# VIKAS

## COLLEGE OF ENGINEERING & TECHNOLOGY

## (Autonomous)

## VCTN R-24

**DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING**

**COURSE STRUCTURE & SYLLABUS M. Tech ECE**

# Embedded System (ES)

| I Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Subject Code** | **Course No** | **Course Name** | **L** | **T** | **P** | **Credits** |
| 1 | M5501 | PC | Embedded System Design | 3 | 0 | 0 | 3 |
| 2 | M5502 | PC | Microcontrollers and Programmable Digital Signal Processors | 3 | 0 | 0 | 3 |
| 3 | M5503<br>M5504<br>M5505 | PE | 1. Digital Signal and Image Processing<br>2. Parallel Processing<br>3. VLSI signal processing | 3 | 0 | 0 | 3 |
| 4 | M5506<br>M5507<br>M5508 | PE | 1. Programming Languages for Embedded Systems<br>2. System Design with Embedded Linux<br>3.CAD of Digital System | 3 | 0 | 0 | 3 |
| 5 | M0109 | | Research methodology and IPR | 2 | 0 | 0 | 2 |
| 6 | M5509 | Lab 1 | Embedded System Design Lab (using Embedded-C) | 0 | 0 | 4 | 2 |
| 7 | M5510 | Lab 2 | Microcontrollers and Programmable Digital Signal Processors Lab | 0 | 0 | 4 | 2 |
| 8 | | Aud 1 | Audit course-1 | 2 | 0 | 0 | 0 |
| | | | | | | Total | 18 |

| II Semester | | | | | | | |
|---|---|---|---|---|---|---|---|
| **S.No** | **Subject Code** | **Course No** | **Course Name** | **L** | **T** | **P** | **Credits** |
| 1 | N5501 | PC | Digital System Design | 3 | 0 | 0 | 3 |
| 2 | N5502 | PC | Real Time Operating Systems | 3 | 0 | 0 | 3 |
| 3 | N5503<br>N5504<br>N5505 | PE | 1. Memory Architectures<br>2. SoC Design<br>3. Sensors &Actuators | 3 | 0 | 0 | 3 |
| 4 | N5506<br>N5507<br>N5508 | PE | 1.Communication Buses and Interfaces<br>2.Network Security and Cryptography<br>3.Physical design automation | 3 | 0 | 0 | 3 |
| 5 | N5509 | Lab 1 | Real Time Operating Systems Lab | 0 | 0 | 4 | 2 |
| 6 | N5510 | Lab 2 | Digital System Design Lab | 0 | 0 | 4 | 2 |
| 7 | N55MP | MP | Mini Project | 0 | 0 | 4 | 2 |
| 8 | | Aud 2 | Audit Course – 2 | 2 | 0 | 0 | 0 |
| | | | Total | | | | 18 |

*Students be encouraged to go to Industrial Training/Internship for at least 2-3 weeks during semester break.

## III Semester*

| S.No | Subject Code | Course No | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|---|
| 1 | P5501<br>P5502<br>P5503 | PE | 1. IOT and its Applications<br>2. Hardware Software co-design<br>3.Artificial Intelligence | 3 | 0 | 0 | 3 |
| 2 | POE01<br>POE02<br>POE03<br>POE04<br>POE05<br>POE07 | OE | 1. Business Analytics<br>2. Industrial Safety<br>3. Operations Research<br>4. Cost Management of Engineering Projects<br>5. Composite Materials<br>6. Waste to Energy | 3 | 0 | 0 | 3 |
| 3 | | Dissertation | Dissertation Phase -I /Industrial Project **(to be continued and evaluated next semester)** | 0 | 0 | 20 | 10# |
| Total | | | | | | | 16 |

#To be Evaluated and Displayed in IV Semester Marks list.

*Students going for Industrial Project/Thesis will complete these courses through MOOCs

## IV Semester

| S.No | Subject Code | Course No | Course Name | L | T | P | Credits |
|---|---|---|---|---|---|---|---|
| 1 | | Dissertation | Project/ Dissertation Phase-II **(continued from III semester)** | 0 | 0 | 32 | 16 |
| Total | | | | | | | 16 |

**Audit Course 1& 2**

1. English for Research Paper Writing
2. Disaster Management
3. Sanskrit for Technical Knowledge
4. Value Education
5. Constitution of India
6. Pedagogy Studies
7. Stress Management by Yoga
8. Personality Development through Life Enlightenment Skills

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code : M5501**

**I Year I Semester**

# EMBEDDED SYSTEM

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**EMBEDDED SYSTEM DESIGN**

**Course Objectives:**

The main objectives of this course are given below:

- To Define an Embedded System and understand the Embedded system design flow.
- To understand Embedded Hardware building blocks and various Embedded Processor architecture models
- To understand the device driver concepts and able to design various device drivers.
- To know the importance of testing an embedded system.
- To understand the use of various ECAD tools in the design of the embedded systems

**UNIT-I:Introduction**

An Embedded System-Definition, Examples, Current Technologies, Integration in system Design, Embedded system design flow, hardware design concepts, software development, processor in an embedded system and other hardware units, introduction to processor based embedded systemdesign concepts.

**UNIT-II:Embedded Hardware**

Embedded hardware building blocks, Embedded Processors – ISA architecture models, Internal processor design, processor performance, Board Memory – ROM, RAM, Auxiliary Memory, Memory Management of External Memory, Board Memory and performance.

Embedded board Input / output – Serial versus Parallel I/O, interfacing the I/O components, I/O components and performance, Board buses – Bus arbitration and timing, Integrating the Bus with other board components, Bus performance.

**UNIT-III:Embedded Software**

Device drivers, Device Drivers for interrupt-Handling, Memory device drivers, On-board bus device drivers, Board I/O drivers, Explanation about above drivers with suitable examples.

Embedded operating systems – Multitasking and process Management, Memory Management, I/O and file system management, OS standards example – POSIX, OS performance guidelines, Board support packages, Middleware and Application Software – Middle ware, Middleware examples, Application layer software examples.

**UNIT-IV:Embedded System Design, Development, Implementation and Testing**

Embedded system design and development lifecycle model, creating an embedded system architecture, introduction to embedded software development process and tools- Host and Target machines, linking and locating software, Getting embedded software into the target system, issues in Hardware-Software design and co-design.

Implementing the design-The main software utility tool, CAD and the hardware, Translation tools, Debugging tools, testing on host machine, simulators, Laboratory tools, System Boot-Up.

**UNIT-V:Embedded System Design-Case Studies**

Case studies- Processor design approach of an embedded system –Power PC Processor based and Micro Blaze Processor based Embedded system design on Xilinx platform-NiosII Processor based Embedded system design on Altera platform-Respective Processor architectures should be taken into consideration while designing an Embedded System.

**Text Books:**


1. Tammy Noergaard "Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers", Elsevier(Singapore) Pvt. Ltd. Publications, 2005.

2. Frank Vahid, Tony D. Givargis, "Embedded system Design: A Unified Hardware/Software Introduction", John Wily & Sons Inc.2002.


**Reference Books:**


1. Peter Marwedel, "Embedded System Design", Science Publishers, 2007.

2. Arnold S Burger, "Embedded System Design", CMP.

3. Rajkamal, "Embedded Systems: Architecture, Programming and Design", TMH Publications, Second Edition, 2008.


**Course Outcomes:**

At the end of this course the student can able to:

- Apply processor based embedded system design concepts to develop an embedded system.
- Analyze and understand the hardware requirement of an embedded system
- Implement a device driver
- Design and Test an embedded system using appropriate software tools and hardware
- Design a processor core based embedded system

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code : M5502**

# EMBEDDED SYSTEM

**I Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

## Microcontrollers and Programmable Digital Signal Processors

**Course Objectives:**

- To understand, compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications.
- To be able to identify and characterize architecture of Programmable DSP Processors
- To develop small applications by utilizing the ARM processor core and DSP processor based platform.

**Unit 1:** ARM Cortex-M3 processor: Applications, Programming model – Registers, Operation modes, Exceptions and Interrupts, Reset Sequence Instruction Set, Unified Assembler Language, Memory Maps, Memory Access Attributes, Permissions, Bit-Band Operations, Unaligned and Exclusive Transfers. Pipeline, Bus Interfaces

**Unit 2:**Exceptions, Types, Priority, Vector Tables, Interrupt Inputs and Pending behavior, Fault Exceptions, Supervisor and Pendable Service Call, Nested Vectored Interrupt Controller, Basic Configuration.

**Unit 3:**LPC 17xx microcontroller- Internal memory, GPIOs, Timers, ADC, UART and other serial interfaces, PWM, RTC, WDT

**Unit 4:** Programmable DSP (P-DSP) Processors: Harvard architecture, Multi port memory, architectural structure of P-DSP- MAC unit, Barrel shifters, Introduction to TI DSP processor family

**Unit 5:**VLIW architecture and TMS320C6000 series, architecture study, data paths, cross paths, Introduction to Instruction level architecture of C6000 family, Assembly Instructions memory addressing, for arithmetic, logical operations. Code Composer Studio for application development for digital signal processing

**Text Books:**

1. Joseph Yiu, “The definitive guide to ARM Cortex-M3”, Elsevier, 2nd Edition
2. Venkatramani B. and Bhaskar M. “Digital Signal Processors: Architecture, Programming and Applications” , TMH , 2nd Edition
3. Sloss Andrew N, Symes Dominic, Wright Chris, “ARM System Developer's Guide: Designing and Optimizing”, Morgan Kaufman Publication

**Reference Books:**

1. Steve furber, “ARM System-on-Chip Architecture”, Pearson Education
2. Frank Vahid and Tony Givargis, “Embedded System Design”, Wiley
3. Technical references and user manuals on www.arm.com.

**Course Outcomes:**

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

- Compare and select ARM processor core based SoC with several features/peripherals based on requirements of embedded applications.
- Identify and characterize architecture of Programmable DSP Processors
- Develop small applications by utilizing the ARM processor core and DSP processor based platform.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code : M5503**

# EMBEDDED SYSTEM

**I Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

## Digital Signal and Image Processing

**(Elective I)**

**UNIT I**

Review of Discrete Time signals and systems, Characterization in time, Z and Fourier domain, Fast Fourier Transform using Decimation In Time (DIT) and Decimation In Frequency (DIF) Algorithms.

**UNIT II**

**IIR Digital Filters:** Introduction, Analog filter approximations – Butter worth and Chebyshev, Design of IIR Digital filters from analog filters using Impulse Invariance, Bilinear Transformation methods.

**FIR Digital Filters:** Introduction, Design of FIR Digital Filters using Window Techniques, Frequency Sampling technique, Comparison of IIR & FIR filters.

**UNIT III**

**Analysis Of Finite Word length Effects:** The Quantization Process and Errors, Quantization of Fixed-Point Numbers, Quantization of Floating-Point Numbers, Analysis of Coefficient Quantization effects.

**Introduction To Digital Image Processing:** Introduction, components in image processing system, Applications of Digital image processing, Image sensing and acquisition, Image sampling, Quantization, Basic Relationships between pixels, Image Transforms: 2D-DFT, DCT, Haar Transform.

**UNIT IV**

**Image Enhancement:** Intensity transformation functions, histogram processing, fundamentals of spatial filtering, smoothing spatial filters, sharpening spatial filters, the basics of filtering in the frequency domain, image smoothing using frequency domain filters, Image Sharpening using frequency domain filters, Selective filtering.

**Image Restoration:** Introduction, restoration in the presence of noise only-Spatial Filtering, Periodic Noise Reduction by frequency domain filtering, Linear, Position –Invariant Degradations, Estimating the degradation function, Inverse filtering, Minimum mean square error (Wiener) filtering.

**Image Segmentation:** Fundamentals, point, line, edge detection, thresholding, region based segmentation.

**UNIT V**

**Image Compression:** Fundamentals, Basic compression methods: Huffman coding, Arithmetic coding, Run-Length coding, Block Transform coding, Predictive coding, Wavelet coding.

**Color Image Processing:** color fundamentals, color models, pseudo color image processing, basics of full color image processing, color transformations, smoothing and sharpening. Image segmentation based on color, noise in color images, color image compression.

**Text Books:**

1. Digital Signal Processing, Principles, Algorithms, and Applications: John G. Proakis, Dimitris G.Manolakis,PearsonEducation/PHI,2007.
2. S. K. Mitra. "Digital Signal Processing – A Computer based Approach", TMH, 3rd Edition,2006
3. Rafael C.Gonzalez and Richard E. Woods, "Digital Image Processing", Pearson Education, 2011.
4. S.Jayaraman, S.Esakkirajan, T.Veerakumar, "Digital Image Processing", Mc Graw Hill Publishers, 2009

**Reference Books:**

1. Digital Signal Processing: Andreas Antoniou, TATA McGraw Hill , 2006
2. Digital Signal Processing: MH Hayes, Schaum"s Outlines, TATA Mc-Graw Hill, 2007.
3. Anil K. Jain, "Fundamentals of Digital Image Processing," Prentice Hall of India, 2012.

**Course Outcomes:**

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

- Analyze discrete-time signals and systems in various domains ( i.e Time, Z and Fourier)
- Design the digital filters (both IIR and FIR) from the given specifications
- Analyze the quantization effects in digital filters and understand the basics of image sampling, quantization and image transforms.
- Understand the concepts of image enhancement, image restoration and image segmentation.
- Know the various methods involved in image compression and fundamentals in color image processing.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code : M5504**

# EMBEDDED SYSTEM

**I Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

## Parallel Processing

**(Elective I)**

**Unit 1:**Overview of Parallel Processing and Pipelining, Performance analysis, Scalability

**Unit 2:**Principles and implementation of Pipelining, Classification of pipelining processors, Advanced pipelining techniques, Software pipelining

**Unit 3:** VLIW processors Case study: Superscalar Architecture- Pentium, Intel Itanium Processor, Ultra SPARC,MIPS on FPGA, Vector and Array Processor, FFT Multiprocessor Architecture

**Unit 4:**Multithreaded Architecture, Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions

**Unit 5:**Parallel Programming Techniques: Message passing program development, Synchronous and asynchronous message passing, Shared Memory Programming, Data Parallel Programming, Parallel Software Issues. Operating systems for multiprocessors systems Customizing applications on parallel processing platforms

**Text Books:**


1. Kai Hwang, Faye A. Briggs, “Computer Architecture and Parallel Processing”, MGH International Edition
2. Kai Hwang, “Advanced Computer Architecture”, TMH
3. V. Rajaraman, L. Sivaram Murthy, “Parallel Computers”, PHI.


**Reference Books:**


1. William Stallings, “Computer Organization and Architecture, Designing for performance”Prentice Hall, Sixth edition
2. Kai Hwang, ZhiweiXu, “Scalable Parallel Computing”, MGH
3. David Harris and Sarah Harris, “Digital Design and Computer Architecture”, Morgan


**Course Outcomes:**

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

- Identify limitations of different architectures of computer
- Analysis quantitatively the performance parameters for different architectures
- Investigate issues related to compilers and instruction set based on type of architectures.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code : M5505**

# EMBEDDED SYSTEM

**I Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

## VLSI Signal Processing

**(Elective I)**

**UNIT -I**

Introduction to DSP: Typical DSP algorithms, DSP algorithms benefits, Representation of DSP algorithms Pipelining and Parallel Processing
Introduction, Pipelining of FIR Digital filters, Parallel Processing, Pipelining and Parallel Processing for Low Power Retiming Introduction, Definitions and Properties, Solving System of Inequalities, Retiming Techniques

**UNIT –II**
Folding and Unfolding: Folding- Introduction, Folding Transform, Register minimization Techniques, Register minimization in folded architectures, folding of Multi rate systems
Unfolding- Introduction, An Algorithm for Unfolding, Properties of Unfolding, critical Path, Unfolding and Retiming, Applications of Unfolding

**UNIT -III**
Systolic Architecture Design: Introduction, Systolic Array Design Methodology, FIR Systolic Arrays, Selection of Scheduling Vector, Matrix Multiplication and 2D Systolic Array Design,Systolic Design for Space Representations contain Delays.

**UNIT -IV**
Fast Convolution: Introduction – Cook-Toom Algorithm – Winogard algorithm – Iterated Convolution – Cyclic Convolution – Design of Fast Convolution algorithm by Inspection

**Unit V:** Digital lattice filter structures, bit level arithmetic, architecture, redundant arithmetic. Numerical strength reduction, synchronous, wave and asynchronous pipe lines, low power design.
Low Power Design:Scaling Vs Power Consumption, Power Analysis, Power Reduction techniques, Power Estimation Approaches

**Text Books:**


1. Keshab K. Parthi[A1] , VLSI Digital signal processing systems, design and implementation[A2] , Wiley, Inter Science, 1999.
2. Mohammad Isamail and Terri Fiez, Analog VLSI signal and information processing, McGraw Hill, 1994
3. S.Y. Kung, H.J. White House, T. Kailath, VLSI and Modern Signal Processing, Prentice Hall, 1985.


**Course Outcomes**
On successful completion of the module, students will be able to:

1. Ability to modify the existing or new DSP architectures suitable for VLSI.
2. Understand the concepts of folding and unfolding algorithms and applications.
3. Ability to implement fast convolution algorithms.
4. Low power design aspects of processors for signal processing and wireless applications.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code: M5506**

**I Year I Semester**

# EMBEDDED SYSTEM

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

## Programming Languages for Embedded Systems
**(Elective II)**

**Unit 1:** Embedded „C‟ Programming Bitwise operations, Dynamic memory allocation, OS services. Linked stack and queue, Sparse matrices, Binary tree. Interrupt handling in C, Code optimization issues. Embedded Software Development Cycle and Methods (Waterfall, Agile)

**Unit 2:**Object Oriented Programming Introduction to procedural, modular, object-oriented and generic programming techniques, Limitations of procedural programming, objects, classes, data members, methods, data encapsulation, data abstraction and information hiding, inheritance, polymorphism

**Unit 3:** CPP Programming: „Cin‟, „Cout‟, formatting and I/O manipulators, new and delete operators, Defining a class, data members and methods, „this‟ pointer, constructors, destructors, friend function, dynamic memory allocation

**Unit 4:** Overloading and Inheritance: Need of operator overloading, overloading the assignment, Overloading using friends, type conversions, single inheritance, base and derived classes, friend Classes, types of inheritance, hybrid inheritance, multiple inheritance, virtual base class, Polymorphism, virtual functions.

**Unit 5:** Templates: Function template and class template, member function templates and template arguments, Exception Handling: syntax for exception handling code: try-catch- throw, Multiple Exceptions.
Scripting Languages:
Overview of Scripting Languages – PERL, CGI, VB Script, Java Script.
PERL: Operators, Statements Pattern Matching etc. Data Structures, Modules, Objects, Tied Variables, Inter process Communication Threads, Compilation & Line Interfacing.

**Text Books:**
1. Michael J. Pont , “Embedded C”, Pearson Education, 2nd Edition, 2008
2. Randal L. Schwartz, “Learning Perl”, O‟Reilly Publications, 6th Edition 2011

**Reference Books:**
1. A. Michael Berman, “Data structures via C++”, Oxford University Press, 2002
2. Robert Sedgewick, “Algorithms in C++”, Addison Wesley Publishing Company, 1999
3. Abraham Silberschatz, Peter B, Greg Gagne, “Operating System Concepts”, John Willey & Sons, 2005Kaufmann.

**Course Outcomes:**
At the end of this course, students will be able to
- Write an embedded C application of moderate complexity.
- Develop and analyze algorithms in C++.
- Differentiate interpreted languages from compiled languages.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code : M5507**

**I Year I Semester**

# EMBEDDED SYSTEM

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

## System Design with Embedded Linux

**(Elective II)**

**Course Objectives:**

- To understand the embedded Linux development model.
- To be able to write and debug applications and drivers in embedded Linux.
- To be able to understand and create Linux BSP for a hardware platform

**Unit 1:**

Embedded Linux , Vendor Independence, Time to Market, Varied Hardware Support, Open Source, Standards (POSIX®) Compliance, Embedded Linux Versus Desktop Linux, Embedded Linux Distributions, BlueCat Linux, Cadenux , Denx, Embedded Debian (Emdebian),ELinOS (SYSGO), Metrowerks ,MontaVista Linux,RTLinuxPro,TimeSys Linux.

**Unit 2:**Embedded Linux Architecture, Real-Time Executive, Monolithic Kernels, Microkernel Kernel Architecture – HAL, Memory manager, Scheduler, File System, I/O and Networking subsystem, IPC, User space, Start-up sequence, Boot Loader Phase, Kernel Start-Up, User Space Initialization.

**Unit 3:** Board Support Package Embedded Storage: MTD, Architecture, Drivers, Embedded File System Embedded Drivers: Serial, Ethernet, $I^2C$, USB, Timer, Kernel Modules.

**Unit 4:** Porting Applications, Architectural Comparison, Application Porting Roadmap, Programming with threads, Operating System Porting Layer (OSPL), Kernel API Driver, Real-Time Linux: Linux and Real time, Programming, Hard Real-time Linux

**Unit 5:** Building and Debugging: Kernel, Building the Kernel, Building Applications, Building the Root File System, Integrated Development Environment, Debugging Virtual Memory Problems , Kernel Debuggers, Root file system Embedded Graphics. Graphics System, Linux Desktop Graphics, Embedded Linux Graphics, Embedded Linux Graphics Driver, Windowing Environments, Toolkits, and Applications, Case study of uClinux

**Text Books:**

1. KarimYaghmour, “Building Embededd Linux Systems”, O'Reilly & Associates
2. P Raghvan, Amol Lad, SriramNeelakandan, “Embedded Linux System Design and Development”, Auerbach Publications

**Reference Books:**

1. Christopher Hallinan, “Embedded Linux Primer: A Practical Real World Approach”,Prentice Hall, 2nd Edition, 2010.
2. Derek Molloy, “Exploring BeagleBone: Tools and Techniques for Building withEmbedded Linux”, Wiley, 1st Edition, 2014.

**Course Outcomes:**

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

- Get the familiarity about embedded Linux development model.
- Write and debug applications and drivers in embedded Linux.
- Understand and create Linux BSP for a hardware platform

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code : M5508**

# EMBEDDED SYSTEM

**I Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**CAD of Digital System**
**(Elective II)**

**Course Objectives:**

- To understand the fundamentals of CAD tools for modeling, design, test and verification of VLSI systems.
- To study various phases of CAD, including simulation, physical design, test and verification.
- To be able to demonstrate the knowledge of computational algorithms and tools for CAD.

**Unit 1:**Introduction to VLSI Methodologies – Design and Fabrication of VLSI Devices, Fabrication Materials, Transistor Fundamentals, Fabrication of VLSI Circuits, Design Rules Layout of Basic Devices, Fabrication Process and its Impact on Physical Design, Scaling Methods , Status of Fabrication Process, Issues related to the Fabrication Process, Future of Fabrication Process , Solutions for Interconnect Issues, Tools for Process Development

**Unit 2:** VLSI design automation tools – Data Structures and Basic Algorithms , Basic Terminology , Complexity Issues and NP-hardness , Basic Algorithms ,Basic Data Structures, graph theory and Computational complexity, tractable and intractable problems.

**Unit 3:**General purpose methods for combinational optimization – **Partitioning-** Problem Formulation, Classification of Partitioning Algorithms, Group Migration Algorithms , Simulated Annealing Simulated Evolution, Other Partitioning Algorithms Performance Driven Partitioning **Floor planning**- Chip planning , Pin Assignment , Integrated Approach, **Placement**- Problem Formulation , Classification of Placement Algorithms, Simulation Based Placement Algorithms , Partitioning Based Placement Algorithms , Performance Driven Placement, **Routing -**Global Routing, , Problem Formulation , Classification of Global Routing Algorithms, Maze RoutingAlgorithms , Line-Probe Algorithms, Shortest Path Based Algorithms. Steiner Tree based Algorithms Integer Programming Based Approach , Performance Driven Routing

**Unit 4:Simulation-** Gate-level Modeling and Simulation , Switch-level Modeling and Simulation, **Logic Synthesis and Verification -** Introduction to Combinational Logic Synthesis , Binary- decision Diagrams , Two-level Logic Synthesis, **High-level Synthesis-** Hardware Models for High level Synthesis , Internal Representation of the Input Algorithm , Allocation, Assignment andScheduling

**Unit 5 :**MCMs-VHDL-Verilog-implementation of simple circuits using VHDL

**Text Books:**

1. N.A. Sherwani, “Algorithms for VLSI Physical Design Automation”.
2. S.H. Gerez, “Algorithms for VLSI Design Automation.

**Course Outcomes:**

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

- Fundamentals of CAD tools for modeling, design, test and verification of VLSI systems.
- Understand various phases of CAD, including simulation, physical design, test and verification.
- Demonstrate knowledge of computational algorithms and tools for CAD.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**Subject Code: M0109**

**I Year I Semester**

# EMBEDDED SYSTEM

| L | P | C |
|---|---|---|
| 2 | 0 | 2 |

## Research Methodology and IPR

**Unit 1:** Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

**Unit 2:** Effective literature studies approaches, analysis Plagiarism, Research ethics. Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee

**Unit 3:** Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

**Unit 4:** Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

**Unit 5:** New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

**Text Books:**


1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science& engineering students'""
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"


**Reference Books:**


1. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
2. Mayall , "Industrial Design", McGraw Hill, 1992.
3. Niebel , "Product Design", McGraw Hill, 1974.
4. Asimov , "Introduction to Design", Prentice Hall, 1962.
5. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New
6. Technological Age", 2016.
7. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

**Course Outcomes:**

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

- Understand research problem formulation.
- Analyze research related information
- Follow research ethics
- Understand that today‟s world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
- Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
- Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

| **I Year I Semester** | **L** | **P** | **C** |
|---|---|---|---|
| **Subject Code:M5509** | **0** | **4** | **2** |

## EMBEDDED SYSTEM DESIGN LAB

**PART-A**

**List of Experiments** by using Embedded C

1. Write a simple program to print " Hello World"
2. Write a simple program to show a delay
3. Write a loop application to copy values from P1 to P2.
4. Write a C program for counting the no of times that a switch is pressed & released.
5. Write a simple program to create a portable hardware delay.
6. Write a C program to test loop time outs.
7. Write a C program to test hardware based timeouts loops.
8. Illustrate the use of port header file (PORT M) using an interface consisting of a keyword and Liquid crystal display.
9. Develop a simple EOS showing traffic light sequencing.
10. Write a program to display elapsed time over RS-232 Link.
11. Write a program to drive SEOS Using Timer 0.
12. Develop software for milk pasteurization system.
13. Develop & implement a program for intruder alarm system

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

| I Year I Semester | L | P | C |
|---|---|---|---|
| Subject Code: M5510 | 0 | 4 | 2 |

## Microcontrollers and Programmable Digital Signal Processors Lab

`

**List of Assignments:**

**Part A)** Experiments to be carried out on Cortex-M3 development boards and using GNU Tool chain

1. Blink an LED with software delay, delay generated using the SysTick timer.
2. System clock real time alteration using the PLL modules.
3. Control intensity of an LED using PWM implemented in software and hardware.
4. Control an LED using switch by polling method, by interrupt method and flash the LED once every five switch presses.
5. UART Echo Test.
6. Take analog readings on rotation of rotary potentiometer connected to an ADC channel.
7. Temperature indication on an RGB LED.
8. Mimic light intensity sensed by the light sensor by varying the blinking rate of an LED.
9. Evaluate the various sleep modes by putting core in sleep and deep sleep modes.
10. System reset using watchdog timer in case something goes wrong.
11. Sample sound using a microphone and display sound levels on LEDs.

**Part B)** Experiments to be carried out on DSP C6713 evaluation kits and using Code Composer Studio (CCS)

1. To develop an assembly code and C code to compute Euclidian distance between any two Points
2. To develop assembly code and study the impact of parallel, serial and mixed execution
3. To develop assembly and C code for implementation of convolution operation
4. To design and implement filters in C to enhance the features of given input sequence/signal

**Course Outcomes:**

At the end of the laboratory work, students will be able to:

- Install, configure and utilize tool sets for developing applications based on ARM processor
- Core SoC and DSP processor.
- Develop prototype codes using commonly available on and off chip peripherals on the
- Cortex M3 and DSP development boards.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:N5501**

**DIGITAL SYSTEM DESIGN**

**Course Objectives:**

The main objectives of this course are given below:

- The basic concepts of K-map, tabular method, QM method are revised.
- Higher order minimization techniques like CAMP algorithm and Cubical operations are explained.
- PLA design techniques and minimization techniques are discussed.
- PLA folding using COMPACT algorithms studied for various cases.
- ASM charts are revised and design techniques of digital circuit realization are explained.
- Digital system design is approached using CPLD,FPGA and ASIC.
- Fault Diagnosis in Combinational Circuits are performed using various techniques like fault detection test, path sensitization method and Boolean difference method.
- Problems in above methods of fault testing are rectified using Kohavi algorithm.
- Fault Diagnosis in sequential circuits is performed using Circuit test approach, Hamming Experiments, synchronizing experiments on different cases.
- Distinguishing and adaptive distinguishing experiments are also performed on various sequential circuits‟ cases.

**UNIT-I: Minimization Procedures and CAMP Algorithm**

Review on minimization of switching functions using tabular methods, k-map, QM algorithm,CAMP-I algorithm, Phase-I: Determination of Adjacencies, DA, CSC, SSMs and EPCs,, CAMP-I algorithm, Phase-II: Passport checking, Determination of SPC, CAMP-II algorithm: Determination of solution cube, Cube based operations, determination of selected cubes are wholly within the givenswitching function or not, Introduction to cube based algorithms.

**UNIT-II: PLA Design, PLA Minimization and Folding Algorithms**

Introduction to PLDs, basic configurations and advantages of PLDs, PLA-Introduction, Block diagram of PLA, size of PLA, PLA design aspects, PLA minimization algorithm(IISc algorithm), PLA folding algorithm(COMPACT algorithm)-Illustration of algorithms with suitable examples.

**UNIT -III: Design of Large Scale Digital Systems**

Algorithmic state machine charts-Introduction, Derivation of SM Charts, Realization of SM Chart, control implementation, control unit design, data processor design, ROM design, PAL design aspects, digital system design approaches using CPLDs, FPGAs and ASICs.

**UNIT-IV: Fault Diagnosis in Combinational Circuits**

Faults classes and models, fault diagnosis and testing, fault detection test, test generation, testing process, obtaining a minimal complete test set, circuit under test methods- Path sensitization method, Boolean difference method, properties of Boolean differences, Kohavi algorithm, faults in PLAs, DFT schemes, built in self-test.

**UNIT-V: Fault Diagnosis in Sequential Circuits**

Fault detection and location in sequential circuits, circuit test approach, initial state identification, Hamming experiments, synchronizing experiments, machine identification, distinguishing experiment, adaptive distinguishing experiments.

**Text Books:**

1. Logic Design Theory-N. N. Biswas, PHI
2. Switching and Finite Automata Theory-Z. Kohavi , 2nd Edition, 2001, TMH
3. Digital system Design using PLDd-Lala

**Reference Books:**

1. Fundamentals of Logic Design – Charles H. Roth, 5th Ed., Cengage Learning.
2. Digital Systems Testing and Testable Design – MironAbramovici, Melvin A. Breuer and Arthur D. Friedman- John Wiley & Sons Inc.

**Course Outcomes:**

At the end of this course the student can able to:

- Understand the basic concepts of a Karnaugh Map ("K-map") for a 2-, 3-, 4-, or 5-variable logic function and to identify the prime implicates, essential prime implicates, and nonessential prime implicates of a function depicted on a K-map.
- Perform the minimization of a Boolean function using tabular method, QM algorithm and CAMP algorithm and determine the Adjacencies, DA, CSC, SSMs, EPCs and SPCs.
- Draw the block diagram of PLA and identify the size of PLA and PLA design aspects.
- Perform the minimization of PLA using IISc algorithm and folding using COMPACT algorithm.
- Can design a digital circuit by steps involving ASM chart.
- Understand the digital system design approaches using CPLDs, FPGAs and ASICs.
- Rectify a single fault and multiple faults in combinational circuits using Path sensitization method, Boolean difference method and Kohavi algorithm.
  Perform fault diagnosis in sequential circuits.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:N5502**

## REAL TIME OPERATING SYSTEMS

**Course Objectives:**

- To Know the Basic Designs using an RTOS.
- To Know the Functions and Types of RTOS for Embedded Systems.
- To Analyze the issues in real time operating systems
- To Study the Programming Concepts of RT Linux.
- To Understand Applications Control by RT Linux System.
- To Analyze the Operating System Software

**UNIT I**

**Introduction to Real-Time Operating Systems -** Defining an RTOS, The scheduler, Kernel Objects and services, Key characteristics of an RTOS

**Task**- Defining a Task, Task States and Scheduling, Typical Task Operations, Typical Task Structure, Synchronization, Communication and Concurrency

**UNIT II**

**Semaphores -** Defining Semaphores, Typical Semaphore Operations, Typical Semaphore Use

**Message Queues -** Defining Message Queues, Message Queue States, Message Queue Content, Message Queue Storage, Typical Message Queue Operations, Typical Message Queue Use, Pipes, Event Registers, Signals and condition Variables

**UNIT III**

**Exceptions and Interrupts -** Exceptions and Interrupts, Applications of Exceptions and Interrupts, Closer look at exceptions and interrupts, processing general Exceptions, Nature of Spurious Interrupts

**Timer and Timer Services -** Real-Time clocks and System Clocks, Programmable Interval Timers, Timer Interrupt Service Routines.

**I/O Subsystems -** I/O concepts, I/O subsystems

**UNIT IV**

**Memory Management -** Dynamic Memory Allocation in Embedded Systems, Fixed-Size Memory management in Embedded Systems, Blocking VS. Non-Blocking Memory Functions, Hardware Memory Management Units

**Modularizing an application for concurrency-** An outside-in approach to decompose Applications, Guidelines and Recommendations for Identifying Concurrency, Schedulability Analysis

**UNIT V**

**Synchronization and Communication -** Synchronization, Communication, Resource Synchronization Methods, Critical section, Common practical design patterns, Specific Solution Design Patterns,

**Common Design Problems -** Resource Classification, Deadlocks, Priority Inversion.

**Text Books**

1. Qing Li, Caroline Yao (2003), "Real-Time Concepts for Embedded Systems", CMP Books.

**Reference Books**

1. Albert Cheng, (2002), "Real-Time Systems: Scheduling, Analysis and Verification", Wiley Interscience.
2. Hermann Kopetz, (1997), "Real-Time Systems: Design Principles for Distributed Embedded Applications", Kluwer.
3. Insup Lee, Joseph Leung, and Sang Son, (2008) "Handbook of Real-Time Systems", Chapman and Hall.Krishna and Kang G Shin, (2001), "Real-Time Systems", McGraw Hill.

**Course Outcomes:**

Upon the completion of the course student will be able to

- Illustrate real time programming concepts.
- Apply RTOS functions to implement embedded applications
- Understand fundamentals of design consideration for embedded applications

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:N5503**

**Memory Architectures**
**(Elective III)**

**Unit 1:**
Random Access Memory Technologies: Static Random Access Memories (SRAMs), SRAM Cell Structures, MOS SRAM Architecture, MOS SRAM Cell and Peripheral Circuit, Bipolar SRAM, Advanced SRAM Architectures, Application Specific SRAMs.

**Unit 2:**
DRAMs, MOS DRAM Cell, BiCMOS DRAM, Error Failures in DRAM, Advanced DRAM Design and Architecture, Application Specific DRAMs. SRAM and DRAM Memory controllers.

**Unit 3:**
Non-Volatile Memories: Masked ROMs, PROMs, Bipolar & CMOS PROM, EEPROMs, Floating Gate EPROM Cell, OTP EPROM, EEPROMs, Non-volatile SRAM, Flash Memories.

**Unit 4:**
Semiconductor Memory Reliability and Radiation Effects: General Reliability Issues, RAM Failure Modes and Mechanism, Nonvolatile Memory, Radiation Effects, SEP, Radiation Hardening Techniques. Process and Design Issues, Radiation Hardened Memory Characteristics, Radiation Hardness Assurance and Testing.

**Unit 5 :**
Advanced Memory Technologies and High-density Memory Packing Technologies: Ferroelectric Random Access Memories (FRAMs), Gallium Arsenide (GaAs) FRAMs, Analog Memories, Magneto Resistive Random Access Memories (MRAMs), Experimental Memory Devices. Memory Hybrids (2D & 3D), Memory Stacks, Memory Testing and Reliability Issues,

**Text Books:**


1. Ashok K Sharma, “Advanced Semiconductor Memories: Architectures, Designs and Applications”, Wiley Interscience
2. KiyooItoh, “VLSI memory chip design”, Springer International Edition


**Reference Books:**


1. Ashok K Sharma,” Semiconductor Memories: Technology, Testing and Reliability , PHI


**Course Outcomes:**
At the end of the course, students will be able to:

- Select architecture and design semiconductor memory circuits and subsystems.
- Identify various fault models, modes and mechanisms in semiconductor memories and their testing procedures.
- Know how the state-of-the-art memory chip design

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:N5504**

**SoC Design**
**(Elective III)**

**Unit 1:**
**ASIC:**Overview of ASIC types, design strategies, CISC, RISC and NISC approaches for SOC architectural issues and its impact on SoC design methodologies, Application Specific Instruction Processor (ASIP) concepts.

**Unit 2:**
**NISC:**NISC Control Words methodology, NISC Applications and Advantages, Architecture Description Languages (ADL) for design and verification of Application Specific Instruction set Processors (ASIP), No-Instruction-Set-computer (NISC)- design flow, modeling NISC architectures and systems, use of Generic Netlist Representation - A formal language for specification, compilation and synthesis of embedded processors.

**Unit 3:**
**Simulation:** Different simulation modes, behavioral, functional, static timing, gate level, switch level, transistor/circuit simulation, design of verification vectors, Low power FPGA, Reconfigurable systems, SoC related modeling of data path design and control logic, Minimization of interconnects impact, clock tree design issues.

**Unit 4:**
**Low power SoC design / Digital system:** Design synergy, Low power system perspective- power gating, clock gating, adaptive voltage scaling (AVS), Static voltage scaling, Dynamic clock frequency and voltage scaling (DCFS), building block optimization, building block memory, power down techniques, power consumption verification.

**Unit 5 :**
**Synthesis:** Role and Concept of graph theory and its relevance to synthesizable constructs, Walks, trails paths, connectivity, components, mapping/visualization, nodal and admittance graph. Technology independent and technology dependent approaches for synthesis, optimization constraints, Synthesis report analysis Single core and Multi core systems, dark silicon issues, HDL coding techniques for minimization of power consumption, Fault tolerant designs

**Text Books:**


1. Hubert Kaeslin, “Digital Integrated Circuit Design: From VLSI Architectures to CMOS
2. Fabrication”, Cambridge University Press, 2008.
3. B. Al Hashimi, “System on chip-Next generation electronics”, The IET, 2006

**Reference Books:**


1. RochitRajsuman, “System-on- a-chip: Design and test”, Advantest America R & D Center,2000
2. P Mishra and N Dutt, “Processor Description Languages”, Morgan Kaufmann, 2008
3. Michael J. Flynn and Wayne Luk, “Computer System Design: System-on-Chip”.


**Course Outcomes:**

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

- Identify and formulate a given problem in the framework of SoC based design approaches Design SoC based system for engineering applications
- Realize impact of SoC on electronic design philosophy and Macro-electronics thereby
- incline towards entrepreneurship & skill development.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

**I Year II Semester**
**Subject Code:N5505**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

## Sensors and Actuators
**(ELECTIVE-III)**

**UNIT-I:**

**Sensors / Transducers:** Principles – Classification – Parameters – Characteristics - Environmental Parameters (EP) – Characterization.

**Mechanical and Electromechanical Sensors:** Introduction – Resistive Potentiometer – Strain Gauge – Resistance Strain Gauge – Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor –Types-Capacitive Sensors:– Electrostatic Transducer– Force/Stress Sensors Using Quartz Resonators – Ultrasonic Sensors.

**UNIT-II:**

**Thermal Sensors:** Introduction – Gas thermometric Sensors – Thermal Expansion Type Thermometric Sensors – Acoustic Temperature Sensor – Dielectric Constant and Refractive Index thermo sensors – Helium Low Temperature Thermometer – Nuclear Thermometer – Magnetic Thermometer – Resistance Change Type Thermometric Sensors –Thermo emf Sensors– Junction Semiconductor Types– Thermal Radiation Sensors –Quartz Crystal Thermoelectric Sensors – NQR Thermometry – Spectroscopic Thermometry – Noise Thermometry – Heat Flux Sensors

**Magnetic sensors:** Introduction – Sensors and the Principles Behind – Magneto-resistive Sensors – Anisotropic Magneto resistive Sensing – Semiconductor Magneto resistors– Hall Effect and Sensors – Inductance and Eddy Current Sensors– Angular/Rotary Movement Transducers – Synchros – Synchro-resolvers - Eddy Current Sensors – Electromagnetic Flow meter – Switching Magnetic Sensors SQUID Sensors

**UNIT-III:**

**Radiation Sensors:** Introduction – Basic Characteristics – Types of Photo sensistors/Photo detectors– X-ray and Nuclear Radiation Sensors– Fiber Optic Sensors.

**Electro analytical Sensors:** Introduction – The Electrochemical Cell – The Cell Potential - Standard Hydrogen Electrode (SHE) – Liquid Junction and Other Potentials – Polarization – Concentration Polarization-– Reference Electrodes - Sensor Electrodes – Electro ceramics in Gas Media .

**UNIT - IV:**

**Smart Sensors:** Introduction – Primary Sensors – Excitation – Amplification – Filters – Converters – Compensation– Information Coding/Processing - Data Communication – Standards for Smart Sensor Interface – The Automation

**Sensors-Applications:** Introduction – On-board Automobile Sensors (Automotive Sensors)– Home Appliance Sensors – Aerospace Sensors — Sensors for Manufacturing –Sensors for environmental Monitoring

**UNIT-V: Actuators**

Pneumatic and Hydraulic Actuation Systems- Actuation systems – Pneumatic and hydraulic systems - Directional Control valves – Presure control valves – Cylinders - Servo and proportional control valves – Process control valves – Rotary actuators

Mechanical Actuation Systems- Types of motion – Kinematic chains – Cams – Gears – Ratchet and pawl – Belt and chain drives – Bearings – Mechanical aspects of motor selection

Electrical Actuation Systems-Electrical systems -Mechanical switches – Solid-state switches Solenoids – D.C. Motors – A.C. motors – Stepper motors

**Text Books:**

1. D. Patranabis – "Sensors and Transducers" –PHI Learning Private Limited.
2. W. Bolton – "Mechatronics" –Pearson Education Limited.

**Reference Books:**

1. Sensors AndActruators – D. Patranabis – 2nd Ed., PHI, 2013.

**Course Outcomes:**

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

- explain fundamental physical and technical base of sensors and actuators
- describe basic laws and phenomena that define behavior of sensors and actuators,
- analyze various premises, approaches, procedures and results related to sensors and actuators,
- create analytical design and development solutions for sensors and actuators,
- conduct experiments and measurements in laboratory and on real components, sensors and actuators
- interpret the acquired data and measured results
  describe development and application of sensors and actuators

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:N5506**

## Communication Busses and Interfaces

**(Elective IV)**

**UNIT I**

Serial Busses- Cables, Serial busses, serial versus parallel, Data and Control Signal- data frame, data rate, features Limitations and applications of RS232, RS485, $I^2C$ , SPI

**UNIT II**

**CAN:** ARCHITECTURE- ISO 11898-2, ISO 11898-3, Data Transmission- ID allocation, Bit timing, Layers- Application layers, Object layer, Transfer layer, Physical layer, Frame formats- Data frame, Remote frame, Error frame, Over load frame, Ack slot, Inter frame spacing, Bit spacing, Applications.

**UNIT III**

**PCIe:** Revision, Configuration space- configuration mechanism, Standardized registers, Bus enumeration, Hardware and Software implementation, Hardware protocols, Applications.

**UNIT IV**

**USB:** Transfer Types- Control transfers, Bulk transfer, Interrupt transfer, Isochronous transfer. Enumeration- Device detection, Default state, Addressed state, Configured state, enumeration sequencing. Descriptor types and contents- Device descriptor, configuration descriptor, Interface descriptor, Endpoint descriptor, String descriptor. Device driver.

**UNIT V**

Data streaming Serial Communication Protocol- Serial Front Panel Data Port(SFPDP) configurations, Flow control, serial FPDP transmission frames, fiber frames and copper cable.

**TEXTBOOKS**


1. A Comprehensive Guide to controller Area Network – Wilfried Voss, Copperhill Media Corporation, 2nd Ed., 2005.
2. Serial Port Complete-COM Ports, USB Virtual Com Portsand Ports for Embedded Systems- Jan Axelson, Lakeview Research, 2nd Ed.,


**REFERENCES**


1. USB Complete – Jan Axelson, Penram Publications.
2. PCI Express Technology – Mike Jackson, Ravi Budruk, Mindshare Press.


**Course Outcomes:**

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

- Select a particular serial bus suitable for a particular application.
- Develop APIs for configuration, reading and writing data onto serial bus.
- Design and develop peripherals that can be interfaced to desired serial bus.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:N5507**

**Network Security and Cryptography**
**(Elective IV)**

**Unit 1:Security & Number Theory**
Need, security services, Attacks, OSI Security Architecture, one time passwords, Model for Network security, Classical Encryption Techniques like substitution ciphers, Transposition ciphers, Cryptanalysis of Classical Encryption Techniques. Introduction, Fermat‟s and Euler‟s Theorem, The Chinese Remainder Theorem, Euclidean Algorithm, Extended Euclidean Algorithm, and Modular Arithmetic.

**Unit 2: Private-Key (Symmetric) Cryptography**
Block Ciphers, Stream Ciphers, RC4 Stream cipher, Data Encryption Standard (DES),Advanced Encryption Standard (AES), Triple DES, RC5, IDEA, Linear and Differential Cryptanalysis.

**Unit 3:Public-Key (Asymmetric) Cryptography**
RSA, Key Distribution and Management, Diffie-Hellman Key Exchange, Elliptic Curve Cryptography, Message Authentication Code, hash functions, message digest algorithms: MD4 MD5, Secure Hash algorithm, RIPEMD-160, HMAC.

**Unit 4:Authentication**
IP and Web Security Digital Signatures, Digital Signature Standards, Authentication Protocols, Kerberos, IP security Architecture, Encapsulating Security Payload, Key Management, Web Security Considerations, Secure Socket Layer and Transport Layer Security, Secure Electronic Transaction.

**Unit 5:System Security**
Intruders, Intrusion Detection, Password Management, Worms, viruses, Trojans, Virus Countermeasures, Firewalls, Firewall Design Principles, Trusted Systems.

**Text Books:**


1. William Stallings, “Cryptography and Network Security, Principles and Practices”, Pearson Education, 3rd Edition.
2. Charlie Kaufman, Radia Perlman and Mike Speciner, “Network Security, Private Communication in a Public World”, Prentice Hall, 2nd Edition

**Reference Books:**


1. Christopher M. King, Ertem Osmanoglu, Curtis Dalton, "Security Architecture, Design Deployment and Operations", RSA Pres,
2. Stephen Northcutt, LenyZeltser, Scott Winters, Karen Kent, and Ronald W. Ritchey, "Inside Network Perimeter Security", Pearson Education, 2nd Edition
3. Richard Bejtlich, "The Practice of Network Security Monitoring: Understanding Incident Detection and Response", William Pollock Publisher, 2013.


**Course Outcomes:**

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

- Identify and utilize different forms of cryptography techniques.
- Incorporate authentication and security in the network applications.
- Distinguish among different types of threats to the system and handle the same.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

| | L | P | C |
|---|---|---|---|
| **I Year II Semester** | | | |
| **Subject Code: N5508** | **3** | **0** | **3** |

## Physical Design Automation

**(Elective IV)**

**UNIT -I**

VLSI design Cycle, Physical Design Cycle, Design Rules, Layout of Basic Devices, and Additional Fabrication, Design styles: full custom, standard cell, gate arrays, field programmable gate arrays, sea of gates and comparison, system packaging styles, multi-chip modules. Design rules, layout of basic devices, fabrication process and its impact on physical design, interconnect delay, noise and cross talk, yield and fabrication cost.

**UNIT -II:**

Factors, Complexity Issues and NP-hard Problems, Basic Algorithms (Graph and Computational Geometry): graph search algorithms, spanning tree algorithms, shortest path algorithms, matching algorithms, min-cut and max-cut algorithms, Steiner tree algorithms

**UNIT -III:**

Basic Data Structures, atomic operations for layout editors, linked list of blocks, bin based methods, neighbour pointers, corner stitching, multi-layer operations.

**UNIT -IV:**

Graph algorithms for physical design: classes of graphs, graphs related to a set of lines, graphs related to set of rectangles, graph problems in physical design, maximum clique and minimum colouring, maximum k-independent set algorithm, algorithms for circle graphs.

**UNIT -V:**

Partitioning algorithms: design style specific partitioning problems, group migrated algorithms, simulated annealing and evolution, and Floor planning and pin assignment, Routing and placement algorithms

**Text Books:**


1. Naveed Shervani, Algorithms for VLSI Physical Design Automation, 3rd Edition, Kluwer Academic, 1999.
2. Charles J Alpert, Dinesh P Mehta, Sachin S Sapatnekar, Handbook of Algorithms for Physical Design Automation, CRC Press, 2008


**Course Outcomes:**

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

- Understand the relationship between design automation algorithms and Various constraints posed by VLSI fabrication and design technology.
- Adapt the design algorithms to meet the critical design parameters.
- Identify layout optimization techniques and map them to the algorithms
- Develop proto-type EDA tool and test its efficacy

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 0 | 4 | 2 |

**Subject Code:N5509**

## Real Time Operating Systems Lab

- The Students are required to write the programs using C-Language according to the Experiment requirements using RTOS Library Functions and macros ARM-926 developer kits and ARM-Cortex.
- The following experiments are required to develop the algorithms, flow diagrams, source code and perform the compilation, execution and implement the same using necessary hardware kits for verification. The programs developed for the implementation should be at the level of an embedded system design.
- The students are required to perform at least SIX experiments from Part-I and TWO experiments from Part-II.

**List of Experiments:**

**Part-I:Experiments using ARM-926 with PERFECT RTOS**

1. Register a new command in CLI.
2. Create a new Task.
3. Interrupt handling.
4. Allocate resource using semaphores.
5. Share resource using MUTEX.
6. Avoid deadlock using BANKER‟S algorithm.
7. Synchronize two identical threads using MONITOR.
8. Reader‟s Writer‟s Problem for concurrent Tasks.

**Part-IIExperiments on ARM-CORTEX processor using any open source RTOS.**

**(Coo-Cox-Software-Platform)**

1. Implement the interfacing of display with the ARM- CORTEX processor.
2. Interface ADC and DAC ports with the Input and Output sensitive devices.
3. Simulate the temperature DATA Logger with the SERIAL communication with PC.
4. Implement the developer board as a modem for data communication using serial port communication between two PC‟s.

**Lab Requirements:**

**Software:**

- Eclipse IDE for C and C++ (YAGARTO Eclipse IDE), Perfect RTOS Library, COO-COX Software Platform, YAGARTO TOOLS, and TFTP SERVER.
- LINUX Environment for the compilation using Eclipse IDE & Java with latest version.

**Hardware:**

- The development kits of ARM-926 Developer Kits and ARM-Cortex Boards.
- Serial Cables, Network Cables and recommended power supply for the board.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

| | L | P | C |
|---|---|---|---|
| **I Year II Semester** | | | |
| **Subject Code:N5510** | **0** | **4** | **2** |

## DESIGN SYSTEMS DESIGN LAB

**Systems Design experiments**:

- The students are required to design the logic to perform the following experiments using necessary Industry standard simulator to verify the logical /functional operation, perform the analysis with appropriate synthesizer and to verify the implemented logic with different hardware modules/kits (CPLD/FPGA kits).
- Consider the suitable switching function and data to implement the required logic if required.

A student has to do at least 10 Experiments.

**List of Experiments:**

1. Determination of EPCs using CAMP-I Algorithm.
2. Determination of SPCs using CAMP-I Algorithm.
3. Determination of SCs using CAMP-II Algorithm.
4. PLA minimization algorithm (IISc algorithm)
5. PLA folding algorithm(COMPACT algorithm)
6. ROM design.
7. Control unit and data processor logic design
8. Digital system design using FPGA.
9. Kohavi algorithm.
10. Hamming experiments.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**I Year II Semester**

# EMBEDDED SYSTEM

| L | P | C |
|---|---|---|
| 0 | 4 | 2 |

**Subject Code:N55MP**

**MINI PROJECT**

**Syllabus Contents**

The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class.

**Course Outcomes**

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

1. Understand of contemporary / emerging technology for various processes and systems.
2. Share knowledge effectively in oral and written form and formulate documents

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**II Year I Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:P5501**

**IOT and its Applications**
**(Elective V)**

**UNIT I:Fundamentals of IoT-** Evolution of Internet of Things, Enabling Technologies, IoT Architectures,oneM2M, IoT World Forum (IoTWF) and Alternative IoT models, Simplified IoT Architecture and Core IoT Functional Stack, Fog, Edge and Cloud in IoT, Functional blocks of an IoT ecosystem, Sensors, Actuators, Smart Objects and Connecting Smart Objects.

IoT Platform overview: Overview of IoT supported Hardware platforms such as: Raspberry pi, ARM Cortex Processors, Arduino and Intel Galileo boards.

**UNIT II: IoT Protocols-** IT Access Technologies: Physical and MAC layers, topology and Security of IEEE 802.15.4, 802.15.4g, 802.15.4e, 1901.2a, 802.11ah and Lora WAN, Network Layer: IP versions, Constrained Nodes and Constrained Networks, Optimizing IP for IoT: From 6LoWPAN to 6Lo, Routing over Low Power and Lossy Networks, Application Transport Methods: Supervisory Control and Data Acquisition, Application Layer Protocols: CoAP and MQTT.

**UNIT III: Design And Development-** Design Methodology, Embedded computing logic, Microcontroller, System on Chips, IoT system building blocks, Arduino, Board details, IDE programming, Raspberry Pi, Interfaces and Raspberry Pi with Python Programming.

**UNIT IV: Data Analytics And Supporting Services-** Structured Vs Unstructured Data and Data in Motion Vs Data in Rest, Role of Machine Learning – No SQL Databases, Hadoop Ecosystem, Apache Kafka, Apache Spark, Edge Streaming Analytics and Network Analytics, Xively Cloud for IoT, Python Web Application Framework, Django, AWS for IoT, System Management with NETCONF-YANG

**UNIT V: Case Studies/Industrial Applications:** IoT applications in home, infrastructures, buildings, security, Industries, Home appliances, other IoT electronic equipments. Use of Big Data and Visualization in IoT, Industry 4.0 concepts.

Sensors and sensor Node and interfacing using any Embedded target boards (Raspberry Pi / Intel Galileo/ARM Cortex/ Arduino)

**Text Books:**

1.IoT Fundamentals: Networking Technologies, Protocols and Use Cases for Internet of Things, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton and Jerome Henry, CiscoPress, 2017

**Reference Books:**

1. Internet of Things – A hands-on approach, ArshdeepBahga, Vijay Madisetti, Universities Press, 2015
2. The Internet of Things – Key applications and Protocols, Olivier Hersent, David Boswarthick, Omar Elloumi and Wiley, 2012 (for Unit 2).
3. "From Machine-to-Machine to the Internet of Things – Introduction to a New Age of Intelligence",Jan Ho¨ ller, VlasiosTsiatsis, Catherine Mulligan, Stamatis, Karnouskos, Stefan Avesand. David Boyle and Elsevier, 2014.
4. Architecting the Internet of Things,Dieter Uckelmann, Mark Harrison, Michahelles and Florian (Eds), Springer, 2011.
5. Recipes to Begin, Expand, and Enhance Your Projects, 2nd Edition,Michael Margolis, Arduino Cookbook and O"Reilly Media, 2011.

**Course Outcomes:**

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

- Apply the Knowledge in IOT Technologies and Data management.
- Determine the values chains Perspective of M2M to IOT.
- Implement the state of the Architecture of an IOT.
- Compare IOT Applications in Industrial & real world.
- Demonstrate knowledge and understanding the security and ethical issues of an IOT.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

**II Year I Semester**
**Subject Code:P**5502

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Hardware Software Co-Design**
**(Elective V)**

**UNIT-I:**
**Co- Design Issues**
Co- Design Models, Architectures, Languages, A Generic Co-design Methodology.
**Co- Synthesis Algorithms**
Hardware software synthesis algorithms: hardware – software partitioning distributed system co-synthesis.

**UNIT-II:**
**Prototyping and Emulation**
Prototyping and emulation techniques, prototyping and emulation environments, future developments in emulation and prototyping architecture specialization techniques, system communication infrastructure
**Target Architectures**
Architecture Specialization techniques, System Communication infrastructure, Target Architecture and Application System classes, Architecture for control dominated systems (8051-Architectures for High performance control), Architecture for Data dominated systems (ADSP21060, TMS320C60), Mixed Systems.

**UNIT-III:**
**Compilation Techniques and Tools for Embedded Processor Architectures**
Modern embedded architectures, embedded software development needs, compilation technologies, practical consideration in a compiler development environment.
**UNIT-IV:**
**Design Specification and Verification**
Design, co-design, the co-design computational model, concurrency coordinating concurrent computations, interfacing components, design verification, implementation verification, verification tools,
Interface verification.

**UNIT-V:**
**Languages for System-Level Specification and Design-I**
System-level specification, design representation for system level synthesis, system level specification languages.
**Languages for System-Level Specification and Design-II**
Heterogeneous specifications and multi language co-simulation, the cosyma system and lycos system.

**Text Books:**

1. Hardware / Software Co- Design Principles and Practice – Jorgen Staunstrup, Wayne Wolf – 2009, Springer.
2. Hardware / Software Co- Design - Giovanni De Micheli, Mariagiovanna Sami, 2002, Kluwer Academic Publishers.

**Reference Books:**

1. A Practical Introduction to Hardware/Software Co-design -Patrick R. Schaumont - 2010 – Springer Publications.

**Course outcomes:**

At the end of the course the student able to

- About the Hardware-Software Code sign Methodology.
- How to select a target architecture and how a prototype is built and how emulation of a prototype is done.
- Brief view about compilation technologies and compiler development environment.
- Understand the importance of system level specification languages and multi-language co-simulation.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

| | L | P | C |
|---|---|---|---|
| **II Year I Semester** | **3** | **0** | **3** |

**Subject Code:P5503**

**Artificial Intelligence**
**(Elective V)**

**Unit 1**
What is AI (Artificial Intelligence)? : The AI Problems, The Underlying Assumption, What are A Techniques, The Level Of The Model, Criteria For Success, Some General References, One Final Word Problems, State Space Search & Heuristic Search Techniques: Defining The Problems As A State Space Search, Production Systems, Production Characteristics, Production System Characteristics, And Issues In The Design Of Search Programs, Additional Problems. Generate-And-Test, Hill Climbing, Best-First Search, Problem Reduction, Constraint Satisfaction, Means-Ends Analysis.

**Unit 2**
Knowledge Representation Issues: Representations And Mappings, Approaches To Knowledge Representation. Using Predicate Logic: Representation Simple Facts In Logic, Representing Instance And Isa Relationships, Computable Functions And Predicates, Resolution. Representing Knowledge Using Rules: Procedural Versus Declarative Knowledge, Logic Programming, Forward Versus Backward Reasoning.

**Unit 3**
Symbolic Reasoning Under Uncertainty: Introduction To No monotonic Reasoning, Logics For Non-monotonic Reasoning. Statistical Reasoning: Probability And Bays‟ Theorem, Certainty Factors And Rule-Base Systems, Bayesian Networks, Dempster Shafer Theory.
Fuzzy Logic. Weak Slot-and-Filler Structures: Semantic Nets, Frames. Strong Slot-and-Filler Structures: Conceptual Dependency, Scripts, CYC

**Unit 4**
Game Playing: Overview, And Example Domain: Overview, Mini-Max, Alpha-Beta Cut-off, Refinements, Iterative deepening, The Blocks World, Components Of A Planning System, Goal Stack Planning, Nonlinear Planning Using Constraint Posting, Hierarchical Planning, Reactive Systems, Other Planning Techniques. Understanding: What is understanding? What makes it hard? As constraint satisfaction

**Unit 5**
Natural Language Processing: Introduction, Syntactic Processing, Semantic Analysis, Semantic Analysis, Discourse And Pragmatic Processing, Spell Checking Connectionist Models: Introduction: Hopfield Network, Learning In Neural Network, Application Of Neural Networks, Recurrent Networks, Distributed Representations, Connectionist AI And Symbolic AI.

**Text Books:**

1. Elaine Rich and Kevin Knight "Artificial Intelligence", 2nd Edition, Tata Mcgraw-Hill, 2005.
2. Stuart Russel and Peter Norvig, "Artificial Intelligence: A Modern Approach", 3rdEdition, Prentice Hall, 2009.

**Course Outcomes:**

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

- Understand the concept of Artificial Intelligence, search techniques and knowledge representation issues
- Understanding reasoning and fuzzy logic for artificial intelligence
- Understanding game playing and natural language processing.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**II Year I Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 0 | 20 | 10 |

**Subject Code:**

**(DISSERTATION) DISSERTATION PHASE – I AND PHASE – II**

**Syllabus Contents:**

The dissertation / project topic should be selected / chosen to ensure the satisfaction of the urgent need to establish a direct link between education, national development and productivity and thus reduce the gap between the world of work and the world of study. The dissertation should have the following

- Relevance to social needs of society
- Relevance to value addition to existing facilities in the institute
- Relevance to industry need
- Problems of national importance
- Research and development in various domain

The student should complete the following:

- Literature survey Problem Definition
- Motivation for study and Objectives
- Preliminary design / feasibility / modular approaches
- Implementation and Verification
- Report and presentation

The dissertation stage II is based on a report prepared by the students on dissertation allotted to them. It may be based on:

- Experimental verification / Proof of concept.
- Design, fabrication, testing of Communication System.
- The viva-voce examination will be based on the above report and work.

**Guidelines for Dissertation Phase – I and II at M. Tech. (Electronics):**

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
- The dissertation may be carried out preferably in-house i.e. department‟s laboratories and centers OR in industry allotted through department‟s T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and

submit the proposal within a month from the date of registration.

- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend repeating the Phase-Iwork.
- During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work

**Course Outcomes:**

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

- Ability to synthesize knowledge and skills previously gained and applied to an in-depth study and execution of new technical problem.
- Capable to select from different methodologies, methods and forms of analysis to produce a suitable research design, and justify their design.
- Ability to present the findings of their technical solution in a written report.
- Presenting the work in International/ National conference or reputed journals.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**II Year I Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:POE01**

**BUSINESS ANALYTICS**
**(Open Elective)**

**Unit1:**
Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organization, competitive advantages of Business Analytics.
Statistical Tools: Statistical Notation, Descriptive Statistical methods,
Review of probability distribution and data modelling, sampling and estimation methods overview.

**Unit 2:**
Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and modelsfor Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology

**Unit 3:**
Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, DataMining,Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization.

**Unit 4:**
Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models.
Monte Carlo Simulation and Risk Analysis: Monte Carle Simulation
Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model.

**Unit 5:**
Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.
Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism

**Reference:**


1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress.
2. Business Analytics by James Evans, personsEducation.

**Course Outcomes:**

- Students will demonstrate knowledge of data analytics.
- Students will demonstrate the ability of think critically in making decisions based on data and deep analytics.
- Students will demonstrate the ability to use technical skills in predicative and prescriptive modeling to support business decision-making.
- Students will demonstrate the ability to translate data into clear, actionable insights

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

**II Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:POE02**

**INDUSTRIAL SAFETY**
**(Open Elective)**

**Unit-1:**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

**Unit-2:**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relationwith replacement economy, Service life of equipment.

**Unit-3:**

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

**Unit-4:**

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment‟s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine,v. Boiler,vi .Electrical motors, Types of faults in machine tools and their generalcauses.

**Unit-5:**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure forperiodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii.Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept andimportance

**Reference:**


1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, McgrewHillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman &HallLondon

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**II Year I Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:POE03**

**OPERATIONS RESEARCH**

**(Open Elective)**

**Unit 1**:

Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models

**Unit 2**

Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming

**Unit 3**:

Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT

**Unit 4**

Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming.

**Unit 5**

Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation

**References**:


1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010


**Course Outcomes:**

**At the end of the course,** the student should be able to

1. Students should able to apply the dynamic programming to solve problems of discreet and continuous variables.
2. Students should able to apply the concept of non-linear programming
3. Students should able to carry out sensitivity analysis
4. Student should able to model the real world problem and simulate it.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

**II Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:POE4**

**COST MANAGEMENT OF ENGINEERING PROJECTS**
**(Open Elective)**

Introduction and Overview of the Strategic Cost Management Process

Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System; Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making.

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non- technical activities.Detailed Engineering activities. Pre project execution main clearances and documents Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning, Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value-Chain Analysis.Budgetary Control; Flexible Budgets;Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing.

Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory.

**References:**


1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

# EMBEDDED SYSTEM

**II Year I Semester**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:POE5**

**COMPOSITE MATERIALS**
**(Open Elective)**

**UNIT–I**:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance.

**UNIT – II**:
REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions.

**UNIT – III:**
Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications.

**UNIT–IV:**
Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications.

**UNIT – V:**
Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations.

**TEXT BOOKS:**


1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,2007.


**References:**


1. Hand Book of CompositeMaterials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L.Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

# VIKAS COLLEGE OF ENGINEERING AND TECHNOLOGY

NUNNA-VIJAYAWADA

**II Year I Semester** **EMBEDDED SYSTEM**

| L | P | C |
|---|---|---|
| 3 | 0 | 3 |

**Subject Code:POE07**

**WASTE TO ENERGY**
**(Open Elective)**

**Unit-I:**

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors

**Unit-II:**
Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications.

**Unit-III:**
Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation

**Unit-IV:**
Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors.

**Unit-V:**
Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India.

**References:**


1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

## AUDIT 1 and 2: ENGLISH FOR RESEARCH PAPER WRITING

| **Course objectives:**<br>Students will be able to:<br>Understand that how to improve your writing skills and level of readability<br>Learn about what to write in each section<br>Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission | | |
|---|---|---|
| **Syllabus** | | |
| **Units** | **CONTENTS** | **Hours** |
| 1 | Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness | 4 |
| 2 | Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction | 4 |
| 3 | Review of the Literature, Methods, Results, Discussion, Conclusions, The Final Check. | 4 |
| 4 | key skills are needed when writing a Title, key skills are needed when writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature, | 4 |
| 5 | skills are needed when writing the Methods, skills needed when writing the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions | 4 |
| 6 | useful phrases, how to ensure paper is as good as it could possibly be the first- time submission | 4 |

**Suggested Studies:**


1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman‟sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

## AUDIT 1 and 2: DISASTER MANAGEMENT

**Course Objectives: -**Students will be able to:

learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.

critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.

develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.

critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in

**Syllabus**

| Units | CONTENTS | Hours |
|---|---|---|
| 1 | **Introduction**<br>Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude. | 4 |
| 2 | **Repercussions Of Disasters And Hazards**: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem.<br>Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts And Famines, Landslides And Avalanches, Man-made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks And Spills, Outbreaks Of Disease And Epidemics, War And Conflicts. | 4 |
| 3 | **Disaster Prone Areas In India**<br>Study Of Seismic Zones; Areas Prone To Floods And Droughts, Landslides And Avalanches; Areas Prone To Cyclonic And Coastal Hazards With Special Reference To Tsunami; Post-Disaster Diseases And Epidemics | 4 |
| 4 | **Disaster Preparedness And Management**<br>Preparedness: Monitoring Of Phenomena Triggering A Disaster Or Hazard; Evaluation Of Risk: Application Of Remote Sensing, Data From Meteorological And Other Agencies, Media Reports: Governmental And Community Preparedness. | 4 |
| 5 | **Risk Assessment**<br>Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global And National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation In Risk Assessment And Warning, People"s Participation In Risk Assessment. Strategies for Survival. | 4 |
| 6 | **Disaster Mitigation**<br>Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India. | 4 |

**Suggested Readings:**

1. R. Nishith, Singh AK, “Disaster Management in India: Perspectives, issues and strategies ““New Royal book Company.
2. Sahni, PardeepEt.Al. (Eds.),” Disaster Mitigation Experiences And Reflections”, Prentice Hall Of India, New Delhi.
3. Goel S. L. , Disaster Administration And Management Text And Case Studies” ,Deep &Deep Publication Pvt. Ltd., New Delhi.

## AUDIT 1 and 2: SANSKRIT FOR TECHNICAL KNOWLEDGE

**Course Objectives**

1. To get a working knowledge in illustrious Sanskrit, the scientific language in the world
2. Learning of Sanskrit to improve brain functioning
3. Learning of Sanskrit to develop the logic in mathematics, science & other subjects enhancing the memory power
4. The engineering scholars equipped with Sanskrit will be able to explore the huge knowledge from ancient literature

**Syllabus**

| Unit | Content | Hours |
|---|---|---|
| 1 | • Alphabets in Sanskrit,<br>• Past/Present/Future Tense,<br>• Simple Sentences | 8 |
| 2 | • Order<br>• Introduction of roots<br>• Technical information about Sanskrit Literature | 8 |
| 3 | • Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics | 8 |

**Suggested reading**


1. "Abhyaspustakam" – Dr.Vishwas, Samskrita-Bharti Publication, New Delhi
2. "Teach Yourself Sanskrit" Prathama Deeksha-Vempati Kutumbshastri, Rashtriya Sanskrit Sansthanam, New Delhi Publication
3. "India"s Glorious Scientific Tradition" Suresh Soni, Ocean books (P) Ltd., New Delhi.


**Course Output**

Students will be able to

1. Understanding basic Sanskrit language
2. Ancient Sanskrit literature about science & technology can be understood
3. Being a logical language will help to develop logic in students

## AUDIT 1 and 2: VALUE EDUCATION

**Course Objectives**

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

**Syllabus**

| Unit | Content | Hours |
|---|---|---|
| 1 | • Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.<br>• Moral and non- moral valuation. Standards and principles.<br>• Value judgements | 4 |
| 2 | • Importance of cultivation of values.<br>• Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.<br>• Honesty, Humanity. Power of faith, National Unity.<br>• Patriotism.Love for nature ,Discipline | 6 |
| 3 | • Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.<br>• Punctuality, Love and Kindness.<br>• Avoid fault Thinking.<br>• Free from anger, Dignity of labour.<br>• Universal brotherhood and religious tolerance.<br>• True friendship.<br>• Happiness Vs suffering, love for truth.<br>• Aware of self-destructive habits.<br>• Association and Cooperation.<br>• Doing best for saving nature | 6 |
| 4 | • Character and Competence –Holy books vs Blind faith.<br>• Self-management and Good health.<br>• Science of reincarnation.<br>• Equality, Nonviolence ,Humility, Role of Women.<br>• All religions and same message.<br>• Mind your Mind, Self-control.<br>• Honesty, Studying effectively | 6 |

**Suggested reading**

1 Chakroborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

**Course outcomes**

Students will be able to 1.Knowledge of self-development

2.Learn the importance of Human values 3.Developing the overall personality

**AUDIT 1 and 2: CONSTITUTION OF INDIA**

**Course Objectives:**
Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals‟ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

**Syllabus**

| Units | Content | Hours |
|---|---|---|
| 1 | **History of Making of the Indian Constitution:**<br>History<br>Drafting Committee, ( Composition & Working) | 4 |
| 2 | **Philosophy of the Indian Constitution:**<br>Preamble Salient Features | 4 |
| 3 | **Contours of Constitutional Rights & Duties:**<br>Fundamental Rights<br>Right to Equality<br>Right to Freedom<br>Right against Exploitation<br>Right to Freedom of Religion<br>Cultural and Educational Rights<br>Right to Constitutional Remedies<br>Directive Principles of State Policy<br>Fundamental Duties. | 4 |

| | | |
|---|---|---|
| **4** | **Organs of Governance:**<br>Parliament<br>Composition<br>Qualifications and Disqualifications<br>Powers and Functions<br>Executive<br>President<br>Governor<br>Council of Ministers<br>Judiciary, Appointment and Transfer of Judges, Qualifications<br>Powers and Functions | 4 |
| **5** | **Local Administration:**<br>District‟s Administration head: Role and Importance,<br>Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation.<br>Pachayati raj: Introduction, PRI: ZilaPachayat.<br>Elected officials and their roles, CEO ZilaPachayat: Position and role.<br>Block level: Organizational Hierarchy (Different departments),<br>Village level: Role of Elected and Appointed officials,<br>Importance of grass root democracy | O<br><br>4 |
| **6** | **Election Commission:**<br>Election Commission: Role and Functioning.<br>Chief Election Commissioner and Election Commissioners.<br>State Election Commission: Role and Functioning.<br>Institute and Bodies for the welfare of SC/ST/OBC and women. | 4 |

**Suggested reading**


1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.


**Course Outcomes:**

Students will be able to:

1. Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
2. Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
3. Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
4. Discuss the passage of the Hindu Code Bill of 1956.

| AUDIT 1 and 2: PEDAGOGY STUDIES | | |
|---|---|---|
| **Course Objectives:**<br>Students will be able to:<br>4. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.<br>5. Identify critical evidence gaps to guide the development. | | |
| **Syllabus** | | |
| **Units** | **Content** | **Hours** |
| **1** | **Introduction and Methodology:**<br>• Aims and rationale, Policy background, Conceptual framework and terminology<br>• Theories of learning, Curriculum, Teacher education.<br>• Conceptual framework, Research questions.<br>• Overview of methodology and Searching. | 4 |
| **2** | • Thematic overview: Pedagogical practices are being used by teachers in formal and informal classrooms in developing countries.<br>• Curriculum, Teacher education. | 2 |
| **3** | • Evidence on the effectiveness of pedagogical practices<br>• Methodology for the in depth stage: quality assessment of included studies.<br>• How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?<br>• Theory of change.<br>• Strength and nature of the body of evidence for effective pedagogical practices.<br>• Pedagogic theory and pedagogical approaches.<br>• Teachers‟ attitudes and beliefs and Pedagogic strategies. | 4 |
| **4** | • Professional development: alignment with classroom practices and follow-up support<br>• Peer support<br>• Support from the head teacher and the community.<br>• Curriculum and assessment<br>• Barriers to learning: limited resources and large class sizes | 4 |
| **5** | **Research gaps and future directions**<br>• Research design<br>• Contexts<br>• Pedagogy<br>• Teacher education<br>• Curriculum and assessment<br>• Dissemination and research impact. | 2 |

**Suggested reading**


1. Ackers J, Hardman F (2001) Classroom interaction in Kenyan primary schools, Compare, 31 (2): 245-261.
2. Agrawal M (2004) Curricular reform in schools: The importance of evaluation, Journal of Curriculum Studies, 36 (3): 361-379.
3. Akyeampong K (2003) Teacher training in Ghana - does it count? Multi-site teacher education research project (MUSTER) country report 1. London: DFID.
4. Akyeampong K, Lussier K, Pryor J, Westbrook J (2013) Improving teaching and learning of basic maths and reading in Africa: Does teacher preparation count? International Journal Educational Development, 33 (3): 272–282.
5. Alexander RJ (2001) Culture and pedagogy: International comparisons in primary education. Oxford and Boston: Blackwell.
6. Chavan M (2003) Read India: A mass scale, rapid, „learning to read" campaign. www.pratham.org/images/resource%20working%20paper%202.pdf.


**Course Outcomes:**

Students will be able to understand:

1. What pedagogical practices are being used by teachers in formal and informal classrooms in developing countries?
2. What is the evidence on the effectiveness of these pedagogical practices, in what conditions, and with what population of learners?
3. How can teacher education (curriculum and practicum) and the school curriculum and guidance materials best support effective pedagogy?

## AUDIT 1 and 2: STRESS MANAGEMENT BY YOGA

**Course Objectives**

1. To achieve overall health of body and mind
2. To overcome stress

**Syllabus**

| Unit | Content | Hours |
|---|---|---|
| 1 | • Definitions of Eight parts of yog. ( Ashtanga ) | 8 |
| 2 | Yam and Niyam. Do`s and Don‟t‟s in life.<br>i) Ahinsa, satya, astheya, bramhacharya and aparigraha<br>ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan | 8 |
| 3 | • Asan and Pranayam<br>1. Various yog poses and their benefits for mind & body<br>2. Regularization of breathing techniques and its effects-Types of pranayam | 8 |

**Suggested reading**

1. „Yogic Asanas for Group Tarining-Part-I" : Janardan Swami YogabhyasiMandal, Nagpur
2. "Rajayoga or conquering the Internal Nature" by Swami Vivekananda, Advaita Ashrama (Publication Department), Kolkata

**Course Outcomes:**

Students will be able to:

1. Develop healthy mind in a healthy body thus improving social health also
2. Improve efficiency

## AUDIT 1 and 2: PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS

**Course Objectives**

1. To learn to achieve the highest goal happily
2. To become a person with stable mind, pleasing personality and determination
3. To awaken wisdom in students

**Syllabus**

| Unit | Content | Hours |
|---|---|---|
| 1 | Neetisatakam-Holistic development of personality<br>• Verses- 19,20,21,22 (wisdom)<br>• Verses- 29,31,32 (pride & heroism)<br>• Verses- 26,28,63,65 (virtue)<br>• Verses- 52,53,59 (dont‟s)<br>• Verses- 71,73,75,78 (do‟s) | 8 |
| 2 | • Approach to day to day work and duties.<br>• Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,<br>• Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,<br>• Chapter 18-Verses 45, 46, 48. | 8 |
| 3 | • Statements of basic knowledge.<br>• Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68<br>• Chapter 12 -Verses 13, 14, 15, 16,17, 18<br>• Personality of Role model. Shrimad Bhagwad Geeta: Chapter2-Verses 17, Chapter 3-Verses 36,37,42,<br>• Chapter 4-Verses 18, 38,39<br>• Chapter18 – Verses 37,38,63 | 8 |

**Suggested reading**

1. "Srimad Bhagavad Gita" by Swami Swarupananda Advaita Ashram (Publication Department), Kolkata
2. Bhartrihari‟s Three Satakam (Niti-sringar-vairagya) by P.Gopinath, Rashtriya Sanskrit Sansthanam, New Delhi.

**Course Outcomes**

Students will be able to

1. Study of Shrimad-Bhagwad-Geeta will help the student in developing his personality and achieve the highest goal in life
2. The person who has studied Geeta will lead the nation and mankind to peace and prosperity
3. Study of Neetishatakam will help in developing versatile personality of students