IK Gujral Punjab Technical University, Kapurthala

Study Scheme 2018 for M.Tech Electronic Product Design & Technology

Semester-1

Sem	Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
1	MTEP-101-18	Programming with Advanced MC &DSP Processors	3	0	0	40	60	100	3
1	MTEP-102-18	Designing with Power Devices	3	0	0	40	60	100	3
1	MTEP-PE1X-18	Program Elective I	3	0	0	40	60	100	3
1	MTEP-PE2Y-18	Program Elective II	3	0	0	40	60	100	3
1	MTEP-111-18	Advance Microcontroller lab	0	0	4	60	40	100	2
1	MTEP-112-18	PLC & Industrial Automation lab	0	0	4	60	40	100	2
1	MTRM-101-18	Research Methodology & IPR	2	0	0	40	60	100	2
1	MTAXX-18	Audit Course I	2	0	0	S/US*	S/US*	100	Non-credit
		Total	14	0	8	320	380	800	18

Semester-2

Sem	Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
2	MTEP-103-18	Industrial Design of Electronics Equipment	3	0	0	40	60	100	3
2	MTEP-104-18	Computer Integrated Manufacturing Systems	3	0	0	40	60	100	3
2	MTEP-PE3X-18	Program Elective III	3	0	0	40	60	100	3
2	MTEP-PE4Y-18	Program Elective IV	3	0	0	40	60	100	3
2	MTEP-113-18	Industrial Design Lab	0	0	4	60	40	100	2
2	MTEP-114-18	Computer Integrated Manufacturing Systems Lab	0	0	4	60	40	100	2
2	MTEP-MP1-18	Mini Project	0	0	4	60	40	100	2
2	MTAXX-18	Audit Course II	2	0	0	S/US*	S/US8	100	Non-credit
		Total	12	0	12	340	360	800	18

Semester-3

Sem	Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
3	MTEP-PE5X-18	Program Elective V	3	0	0	40	60	100	3
3	MTOE-301X-18	Open Elective	3	0	0	40	60	100	3
3	MTEP-DS1-18	Dissertation Phase-I	0	0	20	60	40	100	10
		Total	6	0	20	140	160	300	16

Semester-4

Sem	Course Code	Course Name	L	T	P	Int	Ext	Total	Credits
4	MTEP-DS2-18	Dissertation Phase-II	0	0	32	60	40	100	16
		Total				860	940	2000	68

* S/US - Satisfactory/Unsatisfactory

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Program Electives

Program Elective I	
MTEP-PE1A-18	PLC &Industrial Automation
MTEP-PE1B-18	Microelectronic Technology
MTEP-PE1C-18	Reliability of Electronics
Program Elective II	
MTEP-PE2A-18	Soft Computing Techniques
MTEP-PE2B-18	Advanced Digital Signal Processing
MTEP-PE2C-18	Sensor Data Fusion
Program Elective III	
MTEP-PE3A-18	Electronics System Design
MTEP-PE3B-18	Machine Vision Systems
MTEP-PE3C-18	Embedded System for Wireless & Mobile Communication
Program Elective IV	
MTEP-PE4A-18	Agri electronic and instrumentation
MTEP-PE4B-18	Sensor Technology and MEMS
MTEP-PE4C-18	Advanced Sensors and Actuator
Program Elective V	
MTEP-PE5A-18	Advanced Computer Architecture
MTEP-PE5B-18	Internet of Things & Information Technology Applications
MTEP-PE5C-18	Mechatronic Systems

List of Audit courses I & II

MTA101-18 English for Research Paper Writing
MTA102-18 Disaster Management
MTA103-18 Sanskrit for Technical Knowledge
MTA104-18 Value Education
MTA105-18 Constitution of India
MTA106-18 Pedagogy Studies
MTA107-18 Stress Management by Yoga
MTA108-18 Personality Development through Life Enlightenment Skills

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MTEP-101-18	Credits	L	T	P	Int	Ext
Microcontrollers and Programmable Digital Signal Processors	3	3	0	0	40	60

Course Objective

To introduce ARM processor which is widely used in embedded system and Digital signal processing has become a part of many embedded systems. This subject provides basic knowledge of ARM microcontrollers and DSP.

Course Outcomes

At the end of this course student will demonstrate the ability to:

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

Unit 1: ARM Cortex-M3 Processor

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

Exceptions Types, Priority, Vector Tables, Interrupt Inputs and Pending behavior, Fault Exceptions, Supervisor and Pend able Service Call, Nested Vectored Interrupt Controller, Basic Configuration, SYSTICK Timer, Interrupt Sequences, Exits, Tail Chaining, Interrupt Latency.

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

Unit 6: Code Composer

Studio for application development for digital signal processing, On chip peripherals, Processor benchmarking

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References:

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
4. Steve furber, “ARM System-on-Chip Architecture”, Pearson Education
5. Frank Vahid and Tony Givargis, “Embedded System Design”, Wiley
6. Technical references and user manuals on www.arm.com, NXP Semiconductor www.nxp.com and Texas Instruments www.ti.com

MTEP-102-18	Credits	L	T	P	Int	Ext
Designing with Power Devices	3	3	0	0	40	60

Course Objective

acquire an understanding of the nature of power semiconductor devices and their control and use in switch-mode; understand the arrangement and topology of the circuits in which switch-mode devices.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand basic operation of various power semiconductor devices and switching circuits.
2. Analysis and design Transformers for PWM converters
3. Study principle and operation switch mode power supplies.
4. Study and analyze ups and other power supplies

Unit 1: Power Semiconductor Devices

General characteristics of Power devices such as GTOs, Power BJT, Power MOSFET, IGBT, MCT.

Unit 2: Transformer Design

Fundamentals, Selection of core material, Insulating material and wires, Design Methodology of pulse transformers, High Frequency transformers, Design of Transformers for PWM converter.

Unit 3: Coils

Fundamentals, Selection of core material, Insulating materials and wires, Design of inductors for power frequency, Radio frequency & High frequency.

Unit 4: Switch Mode Power Supplies

Basic regulators, Buck, Boost, Buck Boost, Derived topologies, flyback, forward, Push-pull, half & full bridge converter, Special converters like Cuk‟ converter, PWM control techniques, Study of PWM control

ICs Design of base derive circuits, Design of input section, output section & control section, Thermal design concepts, EMI/EMC considerations, Protection circuit design for power supplies.

Unit 5: UPS and Other Power Supplies

Concept of Uninterrupted power supplies, Inverter preferred (online UPS), Line preferred UPS system (offline UPS system), Line interactive UPS system, Reliability of UPS system, Solar cells as power source devices & their characteristics.

BOOKS RECOMMENDED:

- 1 George Chryssis, *High frequency switching power supplies: theory & design*, McGraw Hill Book Co. 1984 (Text)
- 2 K.Kitsum, *Switch mode power conversion –basic theory and design*, Marcel Deckker Inc 1984.
- 3 N.Radhakrishnan and S.R.Bhat, *Design and technology of low power transformers and inductors*, CEDT, July 1998.

MTEP-PE1-18Program Elective-I

MTEP-PE1A-18	Credits	L	T	P	Int	Ext
PLC and Industrial Automation	3	3	0	0	40	60

Course Objective: To provide knowledge levels needed for PLC programming and operating,to make the students understand various types of PLC registers and apply PLC Timers and Counters for the control of industrial processes

Course Outcomes At the end of this course student will demonstrate the ability to:

1. Ability to gain knowledge on Programmable Logic Controllers
2. Will understand different types of Devices to which PLC input and output modules are connected
3. To provide the knowledge about understand various types of PLC registers
4. Able to create ladder diagrams from process control descriptions.
5. Ability to apply PLC timers and counters for the control of industrial processes
6. Able to use different types PLC functions, Data Handling Function.

Unit 1: Introduction

Introduction to Programmable Logic Controllers (PLCs), history of PLCs, Characteristics, Operation, function, Types of PLC Advantages of PLCs and Comparison of PLC based control systems with computers.

Unit 2: PLC Hardware

Block diagram of PLC, Internal architecture of PLC, The I/O section, Digital and Analog Input output modules of PLCs, special I/O Modules, I/O specifications, CPU, Memory design and human machine interfaces.

Unit 3: PLC Instructions

Number system and codes, fundamental of logic, Bit Logic Instructions, Instruction set: Bit level instructions, Compare, Move/Logical, Math, Program Control Instructions etc

Unit 4: Basics of PLC programming-Ladder

Diagramof logic gates, program files, program scan, PLC programming languages, branch instructions.

Unit 5: PLC Timers and Counter Instruction

Various types of PLC timers with detailed timing diagrams: On delay timer, Off delay timer, Retentive on delay timer, Pulse timer. Various types of PLC counters: Up counter, Down counter, Up-Down counter, Programming of various applications using timers and counters using Ladder diagram only.

Unit 6: PLC communications

Parallel and Serial, communication interface, Simplex, Half duplex, Full duplex, RS 232- DB-25 connector, DB-9 connector, RS 422, EIA 485 interface, Introduction of industrial network, Bus topology, Ring topology, Star topology, Tree topology.

Unit 7: Industrial Automation

Basic Concept, History and Hierarchy of Functions of each level, Advantages and Disadvantages. Architecture of SCADA, Working of SCADA, PLC, DCS and SCADA suitability, Applications: Thermal power plant, Irrigation and Cement factory.

Books Recommended:

- Programmable Logic Controllers by Frank D. Petruzella, McGraw-Hill Education; 4 edition (1 October 2010)
- Programmable Logic Controllers: Principles And Applications, 5Th Edition by Webb/Reis, Pearson India, 2015
- Programmable Logic Controllers by john W. Webb: Principles and Applications (Fifth Edition

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MTEP-PE1B-18	Credits	L	T	P	Int	Ext
MICROELECTRONIC TECHNOLOGY	3	3	0	0	40	60

Course Objective: To familiarize students with the fabrication and the physical concepts behind the operation of microelectronic devices.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. Outline the progress made in the history of microelectronics.
2. Describe the evolution of microelectronics from point-to-point wiring through high element density state-of-the-art microelectronics.
3. List the advantages and disadvantages of point-to-point wiring and high element density state-of the art microelectronics.
4. Identify printed circuit boards, diodes, transistors, and the various types of integrated circuits. Describe the fabrication techniques of these components.

Unit 1: Environment for VLSI Technology: Clean room and safety requirements. Wafer cleaning processes and wet chemical etching techniques.

Unit 2: Impurity incorporation: Solid State diffusion modeling and technology; Ion Implantation modeling, technology and damage annealing; characterization of Impurity profiles.

Unit 3: Oxidation: Kinetics of Silicon dioxide growth both for thick, thin and ultrathin films. Oxidation Technologies in VLSI and ULSI; Characterization of oxide films; High k and low k dielectrics for ULSI.

Unit 4: Lithography: Photolithography, E-beam lithography and newer lithography techniques for VLSI/ULSI;Mask generation. Chemical Vapor

Unit 5: Deposition techniques: CVD techniques for deposition of polysilicon, silicon dioxide, silicon nitride and metal films; Epitaxial growth of silicon; modeling and technology.

Unit 6: Metal film deposition: Evaporation and sputtering techniques. Failure mechanisms in metal Interconnects; Multi-level metallization schemes.

Unit 7: Plasma and Rapid Thermal Processing: PECVD, Plasma etching and RIE techniques; RTP techniques for annealing, growth and deposition of various films for use in ULSI. Process integration for NMOS, CMOS and Bipolar circuits; Advanced MOS technology

Text/References

1. S.M.Sze (Ed), "VLSI Technology", 2nd Edition, McGraw-Hill, 1988.Streetman," VLSI Technology".
2. C.Y. Chang and S.M. Sze (Ed), "ULSI Technology", McGraw-Hill Companies Inc., 1996.

3. S.K.Gandhi, "VLSI fabrication Principles",John Wiley Inc., New York, 1983.
4. VLSI Fabrication Technology, B.Raj& Singh , Laxmi Publications
5. Sorab K. Gandhi, “The Theory and Practice of Microelectronics”, JohnWiley& Sons
6. B.G Streetman, “VLSI Technology” , Prentice Hall, 1990.
7. A.S Grove, “Physics and Technology of semiconductor devices”, John Wiley & Sons

MTEP-PE1C-18	Credits	L	T	P	Int	Ext
Reliability of Electronics & Communication Systems	3	3	0	0	40	60

Course Objective

Course Outcomes: At the end of this course student will demonstrate the ability to:

1. Demonstrate understanding of basic reliability measures such as failure rate, availability, MTTR, etc.
2. Compute and evaluate reliability for redundant, series, and parallel systems
3. Develop fault trees and apply various reliability models to identify and analysis possible faults in machine systems and assess their impact on overall system reliability & maintainability.
4. Use reliability improvement techniques and undertake product testing.

Unit 1: Concept of reliability

Failures of systems and its modes. Measure of Reliability, Reliability function, Hazard rate MTBF and their interrelations.

Unit 2: Reliability Data and Analysis

Data sources, Data collection, use of Reliability Data, Reliability Analysis, Performance Parameters, calculation of failure rate, Application of Weibill distribution.

Unit 3: System Reliability and Modeling

Series systems, Parallel system, series parallel systems. Time dependence, Reliability Determination, stand by systems, r out of n, Configurations, Methods of tie set and cut sets of or reliability evaluation, simulation and Reliability prediction. Monte Carlo method, concepts of network topology. Overall reliability evolution.

Unit 4: Maintainability and Availability

Maintainability and its equation. Factors Affecting maintainability. Measures of Maintainability, Mean Down Time, Availability Intrinsic availability equipment availability & Mission availability. Replacement processes and Policies.

Unit 5: Life

Testing of Equipment's-Non-destructive tests, destruction tests and their Mathematic modeling. Quality and Reliability, Measurement & prediction of Human Reliability, Reliability and safety, safety margins in critical Devices, case studies. 6. Value Engineering Techniques in value Engg; Structure of value Engg. Reliability Management.

Unit 6: Value Engineering

Techniques in value Engg; Structure of value Engg. Reliability Management.

Books Recommended:

- Reliability Engg. By Govil, 1992.
- Reliability Engg. By Dr.A.K.Aggarwal, 1992.
- Related IEEE/IEE publications

MTEP-PE2-18Program Elective-II

MTEP-PE2A-18	Credits	L	T	P	Int	Ext
SOFT COMPUTING	3	3	0	0	40	60

Course Objective1. Artificial Intelligence, Various types of production systems, characteristics of production systems. 2. Neural Networks, architecture, functions and various algorithms involved. 3. Fuzzy Logic, Various fuzzy systems and their functions. 4. Genetic algorithms, its applications and advances.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. Understand importance of soft computing.
2. Understand different soft computing techniques like Genetic Algorithms, Fuzzy Logic, Neural Networks and their combination.
3. Implement algorithms based on soft computing.
4. Apply soft computing techniques to solve engineering or rea life problems.

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Unit 1: Introduction

History of development in neural networks, neural network characteristics, Artificial neural network technology, Model of a neuron, topology, learning, types of learning, supervised, unsupervised and reinforcement learning.

Unit 2: Supervised Learning

Basic hop field model, the perceptron, linear reparability, Basic learning laws, Hebb's rule, Delta rule, Widroff and Huff LMS learning rule, correlation learning rule, In star and out star learning rules. Unsupervised learning, competitive learning, K mean clustering algorithm, Kolwner's feature maps

Unit 3: Radial Basis Function

Basic learning laws in RBF network, recurrent networks, recurrent back propagation, Real time recurrent learning algorithm.

Unit 4: Counter Propagation Networks

Introduction to counter propagation networks, CMAC networks, ART networks, Application of neural networks, pattern recognition, optimization, associative memories, vector quantization, control.

Unit 5: Fuzzy Logic

Basic concepts of fuzzy logic, Fuzzy logic crisp set, Linguistic variable, Membership functions, Operation of fuzzy set, Fuzzy IF-THEN rules, Variable inference techniques, Defuzzification techniques, Basic fuzzy inference algorithm, Application of fuzzy logic, Fuzzy system design, Implementation of fuzzy system, Useful tools supporting design.

Unit 6: Support Vector Machines

Introduction, Support Vector classification, Support Vector regression, applications.

Unit 7: Basics of Genetic Algorithms

Evolution of Genetic and Evolutionary Algorithms, Applications.

BOOKS RECOMMENDED:

- Berkin R and Trubatch, *Fuzzy System Design Principles*, Prentice Hall
- Cristianini N and Taylor JS, *An Introduction to Support Vector Machines (and other Kernel –*
- *based learning methods)*, Cambridge University Press
- Kosko B, *Nueral Networks and Fuzzy Logic*, Prentice Hall
- Haykin S, *Neural Networks*, Pearson Education
- Anderson JA, *An Introduction to Neural Networks*, Prentice Hall
- Sivanandam S and Deepa SN, *Principles of Soft Computing*, Wiley India

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MTEP-PE2B-18	Credits	L	T	P	Int	Ext
ADVANCED DIGITAL SIGNAL PROCESSING	3	3	0	0	40	60

Course Objective To provide an understanding of the principles and concepts digital signal processing, to introduce compressive sensing and its application to automatic target recognition, to provide an understanding of current research in advanced digital signal processing.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. To understand theory of different filters and algorithms
2. To understand theory of multirate DSP, solve numerical problems and write algorithms
3. To understand theory of prediction and solution of normal equations
4. To know applications of DSP at block level.

Unit 1 Overview of DSP

Characterization in time and frequency, FFT Algorithms, Digital filter design and structures: Basic FIR/IIR filter design &structures, design techniques of linear phase FIR filters, IIR filters by impulse invariance, bilinear transformation, FIR/IIR Cascaded lattice structures, and Parallel all pass realization of IIR.

Unit 2 Multi rate DSP

Decimators and Interpolators, Sampling rate conversion, multistage decimator & interpolator, poly phase filters, QMF, digital filter banks, Applications in sub band coding. Unit 3 Linear prediction & optimum linear filters, stationary random process, forward-backward linear prediction filters, solution of normal equations, AR Lattice and ARMA Lattice-Ladder Filters, Wiener Filters for Filtering and Prediction.

Unit 4 Adaptive Filters

Applications, Gradient Adaptive Lattice, Minimum mean square criterion, LMS algorithm, Recursive Least Square algorithm

Unit 5 Estimation of Spectra from Finite-Duration Observations of Signals.

Nonparametric Methods for Power Spectrum Estimation, Parametric Methods for Power Spectrum Estimation, Minimum Variance Spectral Estimation, Eigen analysis Algorithms for Spectrum Estimation. Unit6 Application of DSP & Multi rate DSP, Application to Radar, introduction to wavelets, application to image processing, design of phase shifters, DSP in speech processing & other applications

References:

- J.G.Proakis and D.G.Manolakis"Digital signal processing: Principles, Algorithm and Applications", 4th Edition, Prentice Hall, 2007.
- N. J. Fliege, "Multirate Digital Signal Processing: Multirate Systems -Filter Banks – Wavelets", 1st Edition, John Wiley and Sons Ltd, 1999.
- Bruce W. Suter, "Multirate and Wavelet Signal Processing",1st Edition, Academic Press, 1997.
- M. H. Hayes, "Statistical Digital Signal Processing and Modeling", John Wiley & Sons Inc., 2002.
- S.Haykin, "Adaptive Filter Theory", 4th Edition, Prentice Hall, 2001.

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MTEP-PE2C-18	Credits	L	T	P	Int	Ext
SENSOR DATA FUSION	3	3	0	0	40	60

Course Objective Understand the importance of using data fusion in multi-sensor systems, understand different sensor characteristics and data representations and their importance in data fusion, describe and appreciate different architectures for data fusion, understand simple approaches to data fusion for enhancing sensor reliability.

Course Outcomes At the end of this course student will demonstrate the ability to:Understand the importance and need for data fusion in multi-sensor system.

1. Have an in-depth knowledge and understanding of mathematical concepts for representing uncertainty
2. And combining data. including deriving algorithms from first principles.
3. Have a detailed understanding of data fusion process models and architectures within a system engineering context and be able to critically appraise their applicability to different applications.

Unit 1: Introduction

Sensors and sensor data, Limitations of single sensor, Advantages of multisensory data fusion, Multi sensor data fusion applications, Data fusion models, Generic fusion architectures.

Unit 2: Algorithms for Data Fusion

Taxonomy of algorithms for multi-sensor data fusion. Learning of fusion models: Learning Bayesian classifier, Rule learning from decision three algorithms.

Unit 3: Estimation

Kalman filtering, practical aspects of Kalman filtering, extended Kalmal filters, partical filter, Decision level identify fusion. Knowledge based approaches.

Unit 4: Advanced Filtering

Data information filter, extended information filter. Decentralized and scalable decentralized estimation. Sensor fusion and approximate agreement. Optimal sensor fusion using range trees recursively. Distributed dynamic sensor fusion.

Unit 5: High Performance Data Structures

Tessellated, trees, graphs and function. Representing ranges and uncertainty in data structures. Designing optimal sensor systems within dependability bounds. Implementing data fusion system, Application of multisensor data fusion for mobile robot mapping and
Navigation.

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BOOKS:

- Das SK, “High-level Data Fusion,” Artech House
- Hall DL, “Mathematical techniques in Multisensor data fusion,” Artech House

Reference Books

- Brooks RR and Iyengar SS, “Multi-Sensor Fusion,” Prentice Hall
- Gelb A, “Applied Optimal Estimation,” MIT Press
- Candy JV, “Signal Processing,” McGraw-Hill
- Liggins.II, “Handbook of Multisensor Data Fusion”, Taylor & Francis
- D.G.Manolakis, V.K. Ingle and S.M.Kogon, “Statistical and Adaptive Signal Processing”, McGraw Hill, 2000.

MTEP-111-18	Credits	L	T	P	Int	Ext
Microcontrollers and Programmable Digital Signal Processors Lab	2	0	0	4	40	60

Course Objective To demonstrate programming proficiency using the various addressing modes and data transfer instructions of the ARM microcontroller and to interface the controller to external devices. Design and implement a DSP system using tools like MATLAB.

Course Outcomes At the end of this course student will demonstrate the ability to:

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

List of Assignments:

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

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

MTEP-112-18	Credits	L	T	P	Int	Ext
PLC & Industrial Automation lab	2	0	0	4	60	40

Course Objective

Describe working of various blocks of basic industrial automation system

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Connect the peripherals with the PLC
2. Use various PLC functions and develop small PLC programs
3. Summarize Distributed control system and SCADA system
4. Use various industrial motor drives for the Industrial Automation

List of Assignments:

1. Assemble various modules and component of PLC to make a PLC system
2. Execute/Prepare INPUT-OUTPUT module chart
3. Execute/Prepare ladder diagram of AND, OR, NOT, NAND, NOR, X-OR, X-NOR gate.
4. Execute/Prepare ladder diagram of AND, OR, NOT, NAND, NOR, X-OR, X-NOR gate.
5. Execute/Prepare ladder diagram for logical operations along with truth table.
6. Execute/Prepare ladder diagram for different logical conditions- for Timer
7. Execute/Prepare ladder diagram for different logical conditions- for Counter
8. Execute/Prepare allover ladder diagram for industrial process and control.
9. Develop ladder diagram for a temperature, level, and flow control system.
10. Interface personal computers in network using different topology.
11. Interface RS232-DB-25 connector, DB-9 connector, RS422, EIA 485 interface.
12. Use SCADA system.
13. Identify various levels of distributed control system.

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MTRM-101-18	Credits	L	T	P	Int	Ext
Research Methodology & IPR	3	3	0	0	40	60

Course Objective

Tounderstand some basic concepts of research and its methodologies, identify appropriate research topics, select and define appropriate research problem and parameters. The IPR is to make the students aware of their rights for the protection of their invention done in their project wo

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand research problem formulation.
2. Analyze research related information and follow research ethics
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. 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.
5. 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.

Unit I Overview of Research: Meaning of Research, Objectives of research, Types of research, Research approaches, Significance of research, Criteria of good research. Defining the research problem: research problem, Necessity of defining the problem, Technique involve in defining a problem.

Unit II Research Design: Need for research design, Features of a good design, Basic principles of Experimental design Data Collection: Methods of Data Collection; Primary data and Secondary Data.

Unit III Data preparation: Data preparation process, designing questionnaires and schedules. Descriptive statistics: Measures of central tendency, Mean,Median, Mode etc. Sampling and non-sampling errors, Testing of Hypotheses: Parametric (t, z and F) Chi Square, ANOVA, and non-parametric tests.

Unit IV Overview of Intellectual Property: Introduction and the need for intellectual property right (IPR), Patents, Patent Law, Copyright, Trademarks, Geographical Indications, Industrial Design, Unfair Competition, Protection of IPR, Basic steps to write a research paper/ report writing, Introduction to Latex report writing, Introduction to Plagiarism.

Suggested Readings/ Books:

- Krishnaswami K. N., Sivakumar A. I., Mathirajan M., *Management Research Methodology*, Pearson Education, New Delhi
- Kothari C. R., Research Methodology Methods and Techniques, 2nd Edition, New Age International Publishers
- Halbert, Resisting Intellectual Property, Taylor & Francis Ltd ,2007.
- Niebel, Product Design, McGraw Hill.
- Asimov, Introduction to Design, Prentice Hall.

- Robert P. Merges, Peter S. Menell, Mark A. Lemley, Intellectual Property in New Technological Age.
- T. Ramappa, Intellectual Property Rights Under WT, S. Chand
- J.F.Kaiser, "Richard Hamming-You and Your Research", Transcription of Bell Communications Research Colloquium Seminar, 1986.

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SEMESTER –II

MTEP-103-18	Credits	L	T	P	Int	Ext
Industrial Design of Electronics Equipment	3	3	0	0	40	60

Course Objective This course is intended to prepare students to design products based on product design principles, guidelines and skills. Students will be given experience of designing products through case studies. At the end of the module students will communicate design concepts through sketches, virtual and physical appearance model.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. Design electronic products using user centered design process.
2. Develop sketches, virtual and physical appearance models to communicate proposed designs.
3. Refine product design considering engineering design & manufacturing requirements and constraints.
4. Make mock-up model and working prototype along with design documentation.

Unit I :Introduction to Industrial Design:

General introduction, role of Industrial design in the domain of industry, product innovation, designer's philosophy and role in product design. Product development tools and methods.

Unit 2 :Product Design Methodology:

Electronic product design and development, Methodology, creativity techniques, brain storming, documentation.

Unit 3 :System Reliability Concepts:

Introduction to concepts of reliability, nature of reliability problems in electronic equipment, series configuration, Parallel Configuration, Mixed Configuration, Methods of Solving Complex Systems, Mean Time to Failure (MTTF) and Mean Time between Failure (MTBF) of Systems. Maintainability, Availability Concepts, System Downtime, mean time to Repair (MTTR).

Unit 4: Ergonomics and Aesthetics in Electronic Product Design:

Overview of Electronic Product Design, Top-Down and Bottom-Up Approach, Ergonomic and Aesthetics definition with Example, issues in Designing Electronic Products, Design of Controls and Display w.r.t. Ergonomic and Aesthetics Consideration.

Unit 5 :Control Panel Design:

Types of Controls, Design and Organization of Control Panel, Engineering Considerations, Layout of Components, Selection of Materials, Sheet metals and plastic, Structural Design and Control Cabinets Fabrication.

Unit 6 :Thermal Design:

Conduction, convection, thermal design of electronics equipment's and case studies

Unit 7 :PCB Design:

Design rules for analog circuits, digital circuits, power circuits with connectors, PCB design using CAD packages.

BOOKS:

- Ralph Remsburg, "Advanced Thermal Design of Electronic Equipment", Springer
- V.S.Bagad, "Electronic Product Design", Technical Publications.
- Dave S. Steinberg, "Cooling techniques for electronic equipment", Wiley, 1991
- Ernest Paul DeGarmo, J. T. Black, Ronald A. Kohser "Materials and Processes in Manufacturing",
- John Wiley & Sons.
- Military Handbook, Electronic

REFERENCES

- Ergonomics at work, David J. Oborne, Pub. Wiley (Text)
- SAMEER Notes on Product Design, Thermal Design
- Product Design of Electronic Equipment, SAMEER
- SAMEER Notes on Ergonomics and Human Interface

MTEP-104-18	Credits	L	T	P	Int	Ext
Computer Integrated Manufacturing Systems	3	3	0	0	40	60

Course Objective The student will achieve an understanding of the issues related to computer-integrated manufacturing and the integration of automated processes within a modern manufacturing environment. The focus will be on engineering design, modeling and applications in automation, flow lines, robotics, numerical control, and computer usage in manufacturing.

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Course Outcomes

At the end of this course student will demonstrate the ability to:

1. A knowledge of automated processes in a modern manufacturing environment.
2. An understanding of using engineering design, and modeling techniques towards flow lines, robotics, numerical control and the integration of computer control/usage in manufacturing.
3. An understanding of contemporary manufacturing/production strategies such as agile manufacturing and group technology.

Unit 1: INTRODUCTION

CIM concepts, evolution of CIM, Objectives of a manufacturing system-classifications of manufacturing system, Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

Unit 2: COMPUTER AIDED PLANNING AND CONTROL

Production planning and control-cost planning and control-inventory management-Material requirements planning - (ERP)-shop floor control-Factory data collection system-Automatic identification system-barcode technology automated data collection system.

Unit 3: COMPUTER MONITORING

Types of production monitoring systems-structure model of manufacturing process-process control & strategies direct digital control-supervisory computer control-computer in QC –contact inspection methods non-contact inspection method - computer-aided testing –integration of CAQC with CAD/CAM.

Unit 4: CELLULAR MANUFACTURING

Group Technology(GT), Part Families – Parts Classification and coding –Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell.

Unit 5: INTEGRATED MANUFACTURING SYSTEM

Definition - application - features - types of manufacturing systems-machine tools-materials handling system, computer control system - DNC systems manufacturing cell. Flexible manufacturing systems (FMS) - the FMS concept-transfer systems - head changing FMS – variable mission manufacturing system - CAD/CAM system - human labour in the manufacturing system- computer integrated manufacturing system benefits. Rapid prototyping, Automated Guided Vehicle System (AGVS) – AGVS Application, Concurrent engineering. Rapid proto typing: concept and applications

BOOKS:

1. Groover, M.P., "Automation, Production System and CIM", Prentice-Hall of India, 1998.

REFERENCES:

1. David Bedworth, "Computer Integrated Design and Manufacturing", TMH, New Delhi, 1998.
2. YoremKoren, "Computer Integrated Manufacturing Systems", McGraw Hill, 1983.
3. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice Hall International, 1986.
4. R.W. Yeomamas, A. Choudry and P.J.W. Ten Hagen, "Design rules for a CIM system", North Holland Amsterdam, 1985.
5. W.Bosshart, Design & Fabrication of PCB
6. Computer control of manufacturing systems, Yoram Koren, McGraw Hill Book.

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MTEP-PE3-18Programme Elective-III

MTEP-PE3A-18	Credits	L	T	P	Int	Ext
EMBEDDED SYSTEM FOR WIRELESS & MOBILE COMMUNICATION	3	3	0	0	40	60

Course Objective To make the student understand and apply the theory behind wireless sensor networks.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. Use suitable principles and standards in design and evaluation of sensor networks and wireless communication protocols for small digital transmitters.
2. Demonstrate an ability to read, critically evaluate, analyses and present (verbally or in written form) the content and implications of research articles in the area.
3. Drawing on relevant results from research literature design and implement software and system solutions for wireless embedded systems.

Unit 1: Introduction to wireless technologies

WAP services, Serial and Parallel Communication, Asynchronous and synchronous Communication, FDM, TDM, TFM, Spread spectrum technology.

Unit 2: Introduction to Bluetooth

Specification, Core protocols, Cable replacement protocol Bluetooth Radio: Type of Antenna, Antenna Parameters, Frequency hopping.

Unit 3: Bluetooth Networking

Wireless networking, wireless network types, devices roles and states, adhoc network, scatter net Connection establishment procedure, notable aspects of connection establishment, Mode of connection, Bluetooth security, Security architecture, Security level of services, Profile and usage model: Generic access profile (GAP), SDA, Serial port profile, Secondary bluetooth profile.

Unit 4: Hardware

Bluetooth Implementation, Baseband overview, packet format, Transmission buffers, Protocol Implementation: Link Manager Protocol, Logical Link Control Adaptation Protocol, Host control Interface, Protocol Interaction with layers

Unit 5: Programming with Java

Java Programming, J2ME architecture, Javax. Bluetooth package Interface, classes, exceptions, Javax.

Unit 6: Obex Package

Interfaces, classes bluetooth services registration and search application, bluetooth client and server application.Overview of IrDA, HomeRF, Wireless LANs, JINI

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BOOKS:

- Bluetooth Technology by C.S.R. Prabhu and A.P. Reddi; PHI
- Rappaport. T.S., "Wireless communications", Pearson Education, 2003. Mobile communication by Schiller
- Andreas.F. Molisch, "Wireless Communications", John Wiley – India, 2006.
- Simon Haykin& Michael Moher, "Modern Wireless Communications", Pearson Education, 2007.
- Gordon L. Stuber, "Principles of Mobile Communication", Springer International Ltd., 2001.

MTEP-PE3B-18	Credits	L	T	P	Int	Ext
MACHINE VISION SYSTEMS	3	3	0	0	40	60

Course Objective

The objective is to provide the students with an overview of machine vision systems, their applications, algorithms and modeling

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand machine vision principles.
2. Be able to acquire and process raw image data.
3. Be able to relate image data to 3D scene structures (assessed practical).
4. Know the concepts behind and how to use several model-based object representations, and to critically compare them.
5. Know many of the most popularly used current computer vision techniques.

Unit 1: Introduction Machine Vision

Principles of Machine Vision, Vision and factory automation, Human Vision Vs.Machine Vision, Economic Considerations, Machine Vision – System Overview,Image acquisition – Illumination, Image formation and Focusing, Image Detection –Introduction, Types of Cameras; Image Processing and Presentation.

Unit 2: Image Processing Techniques and Transformations

Fundamental Concepts of Image Processing, Pixel, Pixel Location. Gray Scale,Quantizing Error and Measurement Error and Histograms. Basic Machine Vision Processing Operators – Monadic one Point Transformations: Identity operator, Inverse Operator, Threshold operator and other operators viz: Inverted Threshold operator, Binary Threshold operator, Inverted Binary Threshold Operator, Gray Scale Threshold and Inverted Gray Scale Threshold Operators; Dyadic Two Point Transformations – Image Addition, Image Subtracting, Image Multiplication; Convolution and Spacial Transformations.

Unit 3: Edge Enhancement Techniques and Image Analysis

Introduction, Digital Filters – Low pass and High Pass filters; Edge Engancement Operators – Laplacian, Roberts Gradient, Sobel and other Local operators. Image Analysis: Thresholding, Pattern Matching and Edge Detection, Back-Propagation Algorithm.

BOOKS:

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- Harley R .Myler , Fundamentals of Machine Vision , Prentice - Hall
- Louis J Galbiati , Image Processing Fundamentals, Prentice - Hall
- Ramesh Jain et.al, Machine Vision, McGraw-Hill
- Milan sonka et.al , Image Processing Analysis and Machine Vision,Vikas Publisher
- G.J.Awcock& R. Thomas Applied Image Processing , Macmillan
- Alexander Hornberg , Handbook on Machine Vision , Wiley – VCH , 2008

MTEP-PE3C-18	Credits	L	T	P	Int	Ext
Electronic System Design with HDL	3	3	0	0	40	60

Course Objective The objective of this course is to provide students with opportunities to learn different types of digital systems and to understand and deal with various practical issues related to their design.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. This is an advanced course on digital design techniques.
2. The objective of this course is to provide students with opportunities to learn different types of digital systems and to understand and deal with various practical issues related to their design. The students will be able to appreciate the advantages/disadvantages between the implementations using standard logic (SSI, MSI) and programmable logic (PLDs, PGAs).
3. A great deal of emphasis will be given to Hardware Description language- VHDL and its design styles so that students can describe digital systems using HDL.

Unit 1: Introduction to Digital Design Concepts Review of digital design fundamentals, minimization and design of combinational circuits, sequential machine fundamentals

Unit 2: VHDL Why VHDL? Basic Language Elements, Data objects, classes and data types, operators, overloading, logical operators, VHDL representation of Digital design entity and architectural declarations, introduction to behavioural, dataflow and structural models

Unit 3: Clocked Sequential Finite State Machines State diagram, analysis of synchronous circuits, derivation of state graphs and tables, reduction of state tables, state assignment, design of sequence detectors, serial data code conversion, design of synchronous sequential state machine, design and applications of counters and shift registers .

Unit 4: Multi-input System Controllers Design System controller, controller design principles, timing and frequency considerations, DFD development, controller architecture design, asynchronous input handling, state assignment concepts, flip-flop level implementation using VEM's

Unit 5: Sequential Design using LSI & MSI circuits

Using decoders, multiplexers in sequential circuits, sequential network design using ROMs, PLAs and PALs, Programmable gate Arrays (PGAs)

Unit 6: Asynchronous Sequential Finite State Machines

ntroduction, analysis of asynchronous networks, races and cycles, derivation of primitive flow tables, reduction of primitive flow tables, state assignments, hazards, asynchronous sequential network design

Recommended Books

1. William I Fletcher "An Engineering Approach to Digital Design", PHI, 3rd Indian reprint, (1994)
2. M Morris Mano "Digital Design", Pearson Education, 3rd Edition (2002)
3. Z Navabi "VHDL-Analysis and Modelling of Digital Systems", McGraw Hill, 2nd Edition (1997)
4. Kevin Skahill "VHDL for Programmable Logic", Pearson Education, 1st Indian Reprint (2004)

Programme Elective-IV

MTEP-PE4A-18	Credits	L	T	P	Int	Ext
SENSOR TECHNOLOGY AND MEMS	3	3	0	0	40	60

Course Objective

The objective of this course is to make students to gain basic knowledge on overview of MEMS (Micro electro Mechanical System) and various fabrication techniques. This enables them to design, analysis, fabrication and testing the MEMS based components. And to introduce the student's various opportunities in the emerging field of MEMS

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Design fabrication process plan for development of MEMS
2. Identify characterization and assembly techniques for developed MEMS.
3. Develop physics-based model of MEMS

Unit 1: Introduction

Historical Development of Microelectronics, Evolution of Micro sensors, Evolution of MEMS, Emergence of Micro machines, Sensor Systems, Sensors types and classification, Mechanical Sensors, Acoustic Sensors, Magnetic Sensors, Thermal Sensors, Optical sensors Chemical Sensors, Radiation Sensors and Biosensors. Micro sensors, Sensors based on surface-acoustic wave devices. Review of Fabrication Techniques (Lithography, PVD, CVD, RIE).

Unit 2: Micromachining techniques

Introduction to Bulk Micromachining, Isotropic and Orientation-Dependent Wet Etching, Dry Etching, Buried Oxide Process, Silicon Fusion Bonding, Sacrificial Layer Technology, Surface Micromachining using Plasma Etching, Combined 1C Technology and Anisotropic Wet Etching, Processes Using Both Bulk and Surface Micromachining, Adhesion Problems in Surface Micromachining, Surface Versus Bulk Micromachining

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Unit 3: MICROSYSTEMS DESIGN AND PACKAGING

Design considerations, Mechanical Design, Process design, Realization of MEMS components. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS. Micro system packaging materials - die level - device level - system level - packaging techniques – die preparation – surface bonding - wire bonding - sealing

Unit 4: Smart Sensors and Modeling

Introduction to Smart Sensors, Integrated Smart sensors and smart systems, MEMS and NEMS devices, Elastic structures in MEMS and NEMS, Modeling of Thermal Elastic systems, Electrostatic- elastic systems, magnetically actuated systems, Microfluidics (Membrane Pumps, Nanolithography, Nano jets)

BOOKS:

1. Modeling MEMS and NEMS John A. Pelesko and David H. Bernstein Chapman & Hall/CRC
2. MEMS Fundamental Technology and Applications vikas Choudhary and Krzysztof Iniewski CRC press
3. Micro sensors, MEMS and Smart devices Julian W. Gardner, Vijay K. Varadan John Wiley & Sons, Ltd
4. Smart Sensor Systems Edited by Gerard C.M. Meijer © 2008 John Wiley & Sons, Ltd.
5. Ristic L (ed), "Sensor Technology and Devices", Artech House, London, 1994.
6. Sze S.M. (ed), "Semiconductor Sensors", John Wiley, New York, 1994 Wise
7. K.D. (Guest Editor) "Integrated Sensors, Microp-actuators and micro-systems
8. MEMS, Special Issue of proceedings of IEEE, Vol. 86, No.8, August 1998.
9. MEMS and Microsystems Design and Manufacture" by Tai-Ran Hsu. Tata McGraw-Hill Publishing Company Ltd

MTEP-PE4B-18	Credits	L	T	P	Int	Ext
Agri-Electronic and instrumentation	3	3	0	0	40	60

Course Objective

To provide an understanding of the principles and concepts Electronics and Instrumentation from the Agriculture prospective, to introduce compressive Agri Instrumentation and its application to automatic target recognition, to provide an understanding of current research in Precision Farming and its applications

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. To understand theory of different transducers used in agriculture
2. To enable the student to gain experience in data acquisition and instrument control
3. To understand the Precision Farming and its applications
4. To know applications of DSP at block level.

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Unit 1:Introduction to Agri Instrumentation:

World Agriculture Scenario Information, Interpretation and Instruction Systems Agri Instrumentation: Agri Transducer Measurement, Characteristics of Transducers (Measurand, Electrical, Static Environmental), Review of Conventional Transducers: Silicon Transducers Displacement/Motion Transducers, Temperature Transducers Pressure Transducers Piezoelectric Transducers .

Unit 2:Instrument technology for agriculture:

Instrument for measurement of pH, Electrical conductivity, gas analysis, humidity, leaf area, chlorophyll content, and soil moisture & temperature. Crop monitoring – moisture measurement – capacitive, infrared reflectance and resistance. Monitoring soil and weather – measurement of soil properties and meteorological parameters – irrigation control systems. Crop spraying – selective crop spraying – flow control. Yield monitoring.

Unit 3:Precision Farming:

An introduction to precision farming, Working Philosophy,Need of Precision Agriculture, Subsystems and Components, Status of Precision Agriculture in India, Wireless Sensor Network. GIS/GPS positioning system for precision farming, Yield monitoring and mapping, soil sampling and analysis. Computers and Geographic information systems. Precision farming- Issues and conditions. Role of electronics in farm machinery for precision farming.

Unit 4: Applications in Agriculture Electronics:

Greenhouse: History of modeling and control of Greenhouse, Identification of control and manipulation variables for Greenhouse,Grain Moisture Measurement, Safe Grain Storage System Monitoring, Soil Nutrition Estimation System, Drip Irrigation Instrumentation, Supervisory Control and Data Acquisition System (SCADA). Agriculture & Electronics Governance: Governance products & services in agriculture sector, Role of Electronics Governance in Agricultural sector.

Text Books

1. Curtis Johnson, “Process Control Instrumentation Technology”; 8th Edition, Pearson Education
2. Stuart A. Boyer, SCADA supervisory control and data acquisition, ISA Publication Reference Books

3. De Mess M. N. Fundamental of Geographic Information System. John Willy & sons, New York, Datta S.K.1987.
4. K. Krishna Swamy, "Microprocessor based Agri instrumentation"; PHI publisher
5. Subhas Chandra Mukhopadhyay Smart Sensing Technology for Agriculture and Environmental Monitoring springer 2012
6. K. Krishna Swamy, "Process Control"; New Age International Publishers

MTEP-PE4C-18	Credits	L	T	P	Int	Ext
ADVANCE SENSORS AND ACTUATOR	3	3	0	0	40	60

Course Objective

students are introduced to advanced concepts in sensing and actuation for mechatronic systems, including both traditional sensors and actuators, an introduction to advanced topics in microelectromechanical system (MEMS) sensing, and smart material

Course Outcomes

At the end of this course student will demonstrate the ability to

1. Understand the underlying physical principles of the basic transduction mechanisms of different sensors and actuators.
2. Understand the evolution of emerging sensor and actuator technologies such as micro electromechanical systems (MEMS).
3. Understand the fundamental principles of data acquisition.
4. Demonstrate the ability to apply self-directed learning skills by researching a sensor or actuator not discussed in class.

Unit 1:Measurement Terminology

Input and output, range, accuracy, precision, resolution, sensitivity, linearity, repeatability, reproducibility, calibration and traceability, Testing, quality assurance and safety.

Unit 2: Transducers and sensors

Sensors and transducers: Temperature sensors, resistive sensors, capacitive sensors, electrostatic sensors, piezoelectric sensors, ultrasonic sensors, radiological sensors and MEMS. Optical sensing techniques: Common electromagnetic sensors, IR sensors, passive IR sensors, photo-resistive sensors, photovoltaic sensors, photodiodes, photoelectric detectors, solid state lasers, CCD and CMOS sensors.

Unit 3: Smart Sensors

Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing, Data Communication, Standards for Smart Sensor Interface, The Automation Sensors Applications: On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing, Sensors for environmental Monitoring.

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Unit 4: ACTUATORS

Pneumatic and Hydraulic Actuation Systems, Actuation systems, Pneumatic and hydraulic systems, Directional Control valves, Pressure control valves, Cylinders, Servo and proportional control valves, Process control valves, Rotary actuators Mechanical Actuation Systems. Electrical Actuation Systems, Electrical systems, Solid-state switches Solenoids, D.C. Motors, A.C. motors, Stepper motors.

Unit 5: EMERGING TOPICS

Introduction to sensor networks, sensor fusion, soft and intelligent sensors. System on module, Virtual instrumentation, Intelligent instrumentation, Fault tolerance, Real time systems introduction, reference model, scheduling approaches.

BOOKS:

- Patranabis – "Sensors and Transducers" –PHI Learning Private Limited.
- W. Bolton – "Mechatronics" –Pearson Education Limited.
- Sensors and Actuators – D. Patranabis – 2nd Ed., PHI, 2013.
- Micro sensors, MEMS and Smart devices Julian W. Gardner, Vijay K. Varadan John Wiley & Sons.
- Smart Sensor Systems Edited by Gerard C.M. Meijer © 2008 John Wiley & Sons, Ltd.
- Ristic L (ed), "Sensor Technology and Devices", Artech House, London, 1994.
- Sze S.M. (ed), "Semiconductor Sensors", John Wiley, New York, 1994 Wise
- K.D. (Guest Editor) "Integrated Sensors, Microp-actuators and micro-systems
- MEMS, Special Issue of proceedings of IEEE, Vol. 86, No.8, August 1998

MTEP-113-18	Credits	L	T	P	Int	Ext
Industrial Design Lab	2	0	0	4	60	40

Course Objective This is laboratory course meant to realize various sensors like Ph, temperature, humidity and gas sensors and their interfacing with advanced microcontroller for measurement of real time data in agriculture for innovation in farming.

Course Outcomes: At the **end of this course** student will demonstrate the ability to:

To understand theory of different transducers used in agriculture

To enable the student to gain experience in data acquisition and instrument control

To understand the **Precision Farming** and its applications

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Experiments

1. Program and Interfacing of pH sensor for the measurement of Ph level
2. Program and Interfacing of Electrical conductivity sensor for the measurement of EC level
3. Program and Interfacing of humidity sensor for the measurement of humidity in soil.
4. Program and Interfacing of temperature sensor for the measurement of environment temp.
5. Study of Wireless Sensor Network for agricultural needs
6. Program and Interfacing of GIS/GPS positioning system for precision farming for Yield monitoring and mapping, soil sampling and analysis.
7. Design, modeling and control of Greenhouse, Identification of control and manipulation variables for Greenhouse,
8. Study & Monitoring the Grain Moisture Measurement for Safe Grain Storage System.
9. Study of the Microprocessor based Soil Nutrition Estimation System,
10. Design and study of Drip Irrigation system

MTEP-114-18	Credits	L	T	P	Int	Ext
Computer Integrated Manufacturing Systems Lab	2	0	0	4	60	40

Course Objective

Course Outcomes At the end of this course student will demonstrate the ability to:

- 3D modeling and drafting using 3D features – 20 models
- Assembling and drafting of 2 assemblies
- Surface modeling – 4 exercises
- Types of PCBs & Overview
- PCB Technologies
- About the Base Material
- Component Identification
- Introduction to OrCAD Capture, Entry of Schematic Diagram

- Netlist File Creation, Introduction to OrCAD Layout Plus
- Placement of Components, Manual Routing, Post Processing
- Excursion to an Industry

Note-

1. The term- work will be accessed on the basis of completion of above assignments and submission of report
2. Practical examination: Duration 3 hours, Candidate will carry out one exercise in 2D modeling and one exercise in 3D Modeling, followed by oral examination

Programme Elective-V

MTEP-PE5A-18	Credits	L	T	P	Int	Ext
MECHATRONIC SYSTEMS	3	3	0	0	40	60

Course Objective Knowledge of Automobile engineering is essential for Mechatronic students and the course aims at training students in Mechatronic systems in Automotive Industry.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. Demonstrate technical competence in the field of mechatronics engineering including problem identification and formulation, as well as dynamic and control analysis of mechatronic systems.
2. Demonstrate the practical skills associated with the use of modern modelling and simulation tools.
3. Design electronic and embedded systems for mechatronic applicationsincluding robotic, computer vision and control systems.

Unit 1: Introduction

Definition of Mechatronics, Mechatronics in manufacturing, Products, and design. Comparison between Traditional and Mechatronics approach.

Unit2: Review of fundamentals of electronic

Data conversion devices, sensors, microsensors, transducers, signal processing devices, relays, contactors and timers. Microprocessors controllers and PLCs.

Unit 3: Drives

Stepper motors, servo drives. Ball screws, linear motion bearings, cams, systems controlled by camshafts, electronic cams, indexing mechanisms, tool magazines, transfer systems.

Unit 4: Hydraulic systems

Flow, pressure and direction control valves, actuators, and supporting elements, hydraulic power packs, pumps. Design of hydraulic circuits. Pneumatics: production, distribution and conditioning of compressed air, system components and graphic representations, design of systems. Description.

Unit 5: Controllers

Description of PID controllers, CNC machines and part programming. Industrial Robotics

BOOKS:

HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi, 1988.
G.W. Kurtz, J.K. Schueller, P.W. Claar . II, Machine design for mobile and industrial applications, SAE, 1994.
T.O. Boucher, Computer automation in manufacturing - an Introduction, Chappman and Hall, 1996.
R. Iserman, Mechatronic Systems: Fundamentals, Springer, 1st Edition, 2005
Musa Jouaneh, Fundamentals of Mechatronics, 1st Edition, Cengage Learning, 2012

MTEP-PE5B-18	Credits	L	T	P	Int	Ext
Internet of Things and Applications	3	3	0	0	40	60

Course Objective Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Outcomes At the end of this course student will demonstrate the ability to:

1. Understand the concept of IOT and M2M
2. Study IOT architecture and applications in various fields
3. Study the security and privacy issues in IOT.

Unit 1: - IoT& Web Technology

The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies,

Infrastructure, Networks and Communication, Processes, Data Management, Security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2: - M2M to IoT

A Basic Perspective– Introduction, Some Definitions, M2M Value Chains, IoT Value Chains, An emerging industrial structure for IoT, The international driven global value Model Curriculum of Engineering & Technology PG Courses [Volume -II] [282] chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3: IoT Architecture

State of the Art – Introduction, State of the art, Architecture Reference Model Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4: IoT Applications

IoT Applications for Value Creations Introduction, IoT applications for industry Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT For Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5: Internet of Things Privacy, Security and Governance

Introduction, Overview of Governance, Privacy and Security Issues,

Unit 6: Contribution from FP7 Projects, Security, Privacy and Trust in IoT

Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smartie Approach. Data Aggregation for the IoT in Smart Cities, Security.

References:

- Vijay Madisetti and ArshdeepBahga, “Internet of Things (A Hands-on-Approach)”, 1st Edition, VPT, 2014.
- Francis daCosta, “Rethinking the Internet of Things: A Scalable Approach to Connecting Everything”, 1stEdition, Apress Publications, 2013.
- CunoPfister, “Getting Started with the Internet of Things”, OReilly Media, 2011.

MTEP-PE5C-18	Credits	L	T	P	Int	Ext
Advanced Computer Architecture	3	3	0	0	40	60

Course Objective

An overview of computer architecture, which stresses the underlying design principles and the impact of these principles on computer performance. General topics include design methodology, processor design, control design, memory organization, system organization, and parallel processing.

Course Outcomes

At the end of this course student will demonstrate the ability to:

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1. Understand parallelism and pipelining concepts, the design aspects and challenges.
2. Evaluate the issues in vector and array processors.
3. Study and analyze the high performance scalable multithreaded and multiprocessor systems.

Unit 1: Parallel Processing and Pipelining Processing

Architectural Classification, Applications of parallel processing, Instruction level Parallelism and Thread Level Parallelism, Explicitly Parallel Instruction Computing (EPIC) Architecture

Unit 2: Pipeline Architecture

Principles and implementation of Pipelining, Classification of pipelining processors, Design aspect of Arithmetic and Instruction pipelining, pipelining hazards and resolving techniques, Data buffering techniques, Advanced pipelining techniques, Software pipelining, VLIW (Very Long Instruction Word) processor.

Unit 3: Vector and Array Processor

Issues in Vector Processing, Vector performance modeling, SIMD Computer Organization, Static Vs Dynamic network, Parallel Algorithms for Array Processors: Matrix Multiplication.

Unit 4: Multiprocessor Architecture

Loosely and Tightly coupled multiprocessors, Inter Processor communication network, Time shared bus, Multiport Memory Model, Memory contention and arbitration techniques, Cache coherency and bus snooping, Massively Parallel Processors (MPP).

Unit 5: Multithreaded Architecture

Multithreaded processors, Latency hiding techniques, Principles of multithreading, Issues and solutions, Parallel Programming Techniques: Message passing program development.

Unit 6: Parallel algorithms for multiprocessors

Classification and performance of parallel algorithms, operating systems for multiprocessors systems, Message passing libraries for parallel programming interface, PVM (in distributed memory system), Message Passing Interfaces (MPI).

References:

- Kai Hwang, Faye A. Briggs, “Computer Architecture and Parallel Processing” McGraw Hill Education, 2012.
- Kai Hwang, “Advanced Computer Architecture”, McGraw Hill Education, 1993.
- William Stallings, “Computer Organization and Architecture, Designing for Performance” Prentice Hall, 6th edition, 2006.
- Kai Hwang, “Scalable Parallel Computing”, McGraw Hill Education, 1998.
- Harold S. Stone “High-Performance Computer Architecture”, Addison-Wesley, 1993.

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MTOE-301A-18	Credits	L	T	P	Int	Ext
Open Elective Cost Management of Engineering Projects	3	3	0	0	40	60

Course Objective

This is course deals with strategic cost management for engineering projects and useful quantitative techniques to implement

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand the cost calculation for decision-making about an engineering research project
2. Able to define Role of each member in the project team
3. Manage the project by applying Quantitative techniques for cost management

Unit 1

Introduction and Overview of the Strategic Cost Management Process

Unit 2:

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.

Unit 3:

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 nontechnical 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.

Unit 4:

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

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Recommended Books :

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.

MTOE-301B-18	Credits	L	T	P	Int	Ext
Open Elective Composite Materials	3	3	0	0	40	60

Course Objective

This is course deals with Composite Materials and preparation/manufacturing of Metal Matrix Composites

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand the characteristics of Composite materials and their advantages and applications
2. Get exposure to Manufacturing of Metal Matrix Composites: Knitting, Braiding, Weaving and estimate Strength

Unit 1

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 2:

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 Isostressconditions.

Unit 3:

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 4:

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 5:

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

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

MTOE-301C-18	Credits	L	T	P	Int	Ext
Open Elective Waste to Energy	3	3	0	0	40	60

Course Name

Course Objective

This is course deals with effective and cheap methods to convert waste into useful energy.

Course Outcomes

At the end of this course student will demonstrate the ability to:

1. Understand various methods to convert agro, forest and industrial residue to useful energy
2. Get exposure Biomass Combustion, Biomass Gasification etc.

Unit 1

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

Unit 2:

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

Unit 3:

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 kineticconsideration in gasifier operation.

Unit 4:

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 5:

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.

Recommended Books :

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
3. Publishing Co. Ltd., 1983.
4. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
5. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

MTA101-18	Credits	L	T	P	Int	Ext
ENGLISH FOR RESEA RCH PAPER WRITING	0	2	0	0	S/US	S/US

Course objectives:

Students will be able to:

1. Understand that how to improve your writing skills and level of readability
2. Learn about what to write in each section
3. Understand the skills needed when writing a Title

Ensure the good quality of paper at very first-time submission

Syllabus

Unit1: Planning and Preparation, Word Order, Breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit 2 : Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticising, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit 3: Review of the Literature, Methods, Results, Discussion,Conclusions, The Final Check.

Unit 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,

Unit 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

Unit 6: useful phrases, how to ensure paper is as good as it could possibly
be the first- time submission

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's book .
4. Adrian Wallwork , English for Writing Research Papers, Springer New York Dordrecht Heidelberg London, 2011

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MTA102-18	Credits	L	T	P	Int	Ext
DISASTER MANAGEMENT	0	2	0	0	U/US	U/US

Course Objectives: -Students will be able to:

1. learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
2. critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
3. develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
4. 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

Unit 1: Introduction Disaster: Definition, Factors And Significance; Difference Between Hazard And Disaster; Natural And Manmade Disasters: Difference, Nature, Types And Magnitude.

Unit 2 : Repercussions Of Disasters And Hazards: Economic Damage, Loss Of Human And Animal Life, Destruction Of Ecosystem. 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.

Unit 3 : Disaster Prone Areas In India 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

Unit 4 Disaster Preparedness And Management 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.

Unit 5 Risk Assessment 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.

Unit 6 Disaster Mitigation Meaning, Concept And Strategies Of Disaster Mitigation, Emerging Trends In Mitigation. Structural Mitigation And Non-Structural Mitigation, Programs Of Disaster Mitigation In India.

SUGGESTED READINGS:

1. R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies "'New Royal book Company.
2. Sahni, Pardeep Et.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.

MTA103-18	Credits	L	T	P	Int	Ext
SANSKRIT FOR TECHNICAL KNOWLEDGE	Non-credit	2	0	0	S/US	S/US

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 1

- Alphabets in Sanskrit,
- Past/Present/Future Tense,
- Simple Sentences

Unit 2

- Order
- Introduction of roots
- Technical information about Sanskrit Literature

Unit 3

- Technical concepts of Engineering-Electrical, Mechanical, Architecture, Mathematics

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

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MTA104-18	Credits	L	T	P	Int	Ext
VALUE EDUCATION	Non-credit	2	0	0	S/US	S/US

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

Unit1

- Values and self-development –Social values and individual attitudes. Work ethics, Indian vision of humanism.
- Moral and non- moral valuation. Standards and principles.
- Value judgements

Unit 2

- Importance of cultivation of values.
- Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness.
- Honesty, Humanity. Power of faith, National Unity.
- Patriotism.Love for nature , Discipline

Unit 3

- Personality and Behavior Development - Soul and Scientific attitude. Positive Thinking. Integrity and discipline.
- Punctuality, Love and Kindness.
- Avoid fault Thinking.
- Free from anger, Dignity of labour.
- Universal brotherhood and religious tolerance.
- True friendship.
- Happiness Vs suffering, love for truth.
- Aware of self-destructive habits.
- Association and Cooperation.
- Doing best for saving nature

Unit 4

- Character and Competence –Holy books vs Blind faith.
- Self-management and Good health.
- Science of reincarnation.
- Equality, Nonviolence ,Humility, Role of Women.
- All religions and same message.
- Mind your Mind, Self-control.
- Honesty, Studying effectively

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

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MTA105-18	Credits	L	T	P	Int	Ext
CONSTITUTION OF INDIA	Non-credit	2	0	0	S/US	S/US

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

Unit1

- History of Making of the Indian Constitution:History Drafting Committee, (Composition & Working)

Unit 2

- Philosophy of the Indian Constitution: Preamble, Salient Features

Unit 3

- Contours of Constitutional Rights & Duties:
- Fundamental Rights
- Right to Equality
- Right to Freedom
- Right against Exploitation
- Right to Freedom of Religion
- Cultural and Educational Rights
- Right to Constitutional Remedies
- Directive Principles of State Policy
- Fundamental Duties.

Unit 4

- Organs of Governance:
- Parliament
- Composition
- Qualifications and Disqualifications
- Powers and Functions
- Executive
- President
- Governor
- Council of Ministers
- Judiciary, Appointment and Transfer of Judges, Qualifications
- Powers and Functions

Unit 5

- Local Administration:
- District's Administration head: Role and Importance,

- Municipalities: Introduction, Mayor and role of Elected Representative, CEO
- of Municipal Corporation.
- Pachayati raj: Introduction, PRI: Zila Pachayat.
- Elected officials and their roles, CEO Zila Pachayat: Position and role.
- Block level: Organizational Hierarchy (Different departments),
- Village level: Role of Elected and Appointed officials,
- Importance of grass root democracy

Unit 6

- Election Commission:
- Election Commission: Role and Functioning.
- Chief Election Commissioner and Election Commissioners.
- State Election Commission: Role and Functioning.
- Institute and Bodies for the welfare of SC/ST/OBC and women.

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.

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MTA106-18	Credits	L	T	P	Int	Ext
PEDAGOGY STUDIES	Non-credit	2	0	0	S/US	S/US

Course Objectives:

Students will be able to:

1. Review existing evidence on the review topic to inform programme design and policy making undertaken by the DfID, other agencies and researchers.
2. Identify critical evidence gaps to guide the development.

Syllabus

Unit1

- Introduction and Methodology:
- Aims and rationale, Policy background, Conceptual framework and terminology
- Theories of learning, Curriculum, Teacher education.
- Conceptual framework, Research questions.
- Overview of methodology and Searching.

Unit 2

- Thematic overview: Pedagogical practices are being used by teachers in formal and
- informal classrooms in developing countries.
- Curriculum, Teacher education.

Unit 3

- Evidence on the effectiveness of pedagogical practices
- Methodology for the in depth stage: quality assessment of included studies.
- How can teacher education (curriculum and practicum) and the school curriculum
- and guidance materials best support effective pedagogy?
- Theory of change.
- Strength and nature of the body of evidence for effective pedagogical practices.
- Pedagogic theory and pedagogical approaches.
- Teachers' attitudes and beliefs and Pedagogic strategies.

Unit 4

- Professional development: alignment with classroom practices and follow-up
- support
- Peer support
- Support from the head teacher and the community.
- Curriculum and assessment
- Barriers to learning: limited resources and large class sizes

Unit 5

- Research gaps and future directions
- Research design
- Contexts
- Pedagogy
- Teacher education
- Curriculum and assessment
- Dissemination and research impact.

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.
7. 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?

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MTA107-18	Credits	L	T	P	Int	Ext
STRESS MANAGEMENT BY YOGA	Non-credit	2	0	0	S/US	S/US

Course Objectives

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

Syllabus

Unit 1

- Definitions of Eight parts of yog. (Ashtanga) 8

Unit 2

- Yam and Niyam.

Do`s and Don't's in life.

i) Ahinsa, satya, astheya, bramhacharya and aparigraha

ii) Shaucha, santosh, tapa, swadhyay, ishwarpranidhan

Unit 3

- Asan and Pranayam

i) Various yog poses and their benefits for mind & body

ii) Regularization of breathing techniques and its effects-Types of pranayam

Suggested reading

1. 'Yogic Asanas for Group Tarining-Part-I" : Janardan Swami Yogabhyasi Mandal, 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

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MTA108-18	Credits	L	T	P	Int	Ext
PERSONALITY DEVELOPMENT THROUGH LIFE ENLIGHTENMENT SKILLS	Non-credit	2	0	0	S/US	S/US

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

Unit1 Neetisatakam-Holistic development of personality

- Verses- 19,20,21,22 (wisdom)
- Verses- 29,31,32 (pride & heroism)
- Verses- 26,28,63,65 (virtue)
- Verses- 52,53,59 (dont's)
- Verses- 71,73,75,78 (do's)

Unit 2

- Approach to day to day work and duties.
- Shrimad Bhagwad Geeta : Chapter 2-Verses 41, 47,48,
- Chapter 3-Verses 13, 21, 27, 35, Chapter 6-Verses 5,13,17, 23, 35,
- Chapter 18-Verses 45, 46, 48.

Unit 3

- Statements of basic knowledge.
- Shrimad Bhagwad Geeta: Chapter2-Verses 56, 62, 68
- Chapter 12 -Verses 13, 14, 15, 16,17, 18
- Personality of Role model. Shrimad Bhagwad Geeta:
- Chapter2-Verses 17, Chapter 3-Verses 36,37,42,
- Chapter 4-Verses 18, 38,39
- Chapter18 – Verses 37,38,63

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.