# Dr. Babasaheb Ambedkar Technological University, Lonere.

**Dr. Babasaheb Ambedkar Technological University**
**(Established as a University of Technology in the State of Maharashtra)**
**(under Maharashtra Act No. XXIX of 2014)**
**P.O. Lonere, Dist. Raigad, Pin 402 103, Maharashtra**
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# COURSE STRUCTURE AND SYLLABUS

**For**

## B. Tech. Electronics and Telecommunication Engineering Programme

## With effect from the Academic Year

2017-2018 (First Year), 2018-2019 (Second Year),
2019-2020 (Third Year), 2020-2021 (Final Year).

# Dr. Babasaheb Ambedkar Technological University, Lonere.

## B. Tech (Electronics & Telecommunication Engineering) / B. Tech (Electronics Engineering)

### Curriculum for Semester III [Second Year]

| Sr. No. | Course Code | Course Title | Hours Per Week | | | Evaluation Scheme | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | MSE | CA | ESE | | |
| 1 | BTBSC301 | Engineering Mathematics-III | 3 | 1 | 0 | 20 | 20 | 60 | 100 | 4 |
| 2 | BTEXC302 | Analog Circuits | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | BTEXC303 | Electronic Devices & Circuits | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | BTEXC304 | Network Analysis | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 5 | BTEXC305 | Digital Logic Design | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 6 | BTHM3401 | Basic Human Rights | 2 | 0 | 0 | -- | 50 | -- | 50 | (Audit) |
| 7 | BTEXL307 | Analog Circuits Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 8 | BTEXL308 | Electronic Devices & Circuits Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 9 | BTEXL309 | Network Analysis Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 10 | BTEXL310 | Digital Logic Design Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 11 | BTEXW311 | Electronics Workshop | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 12 | BTES211P | Field Training/ Internship/Industrial Training Evaluation | -- | -- | -- | -- | -- | 50 | 50 | 1 |
| | | **Total** | **13** | **05** | **10** | **100** | **450** | **550** | **1100** | **22** |

## B. Tech (Electronics & Telecommunication Engineering) / B. Tech (Electronics Engineering)

### Curriculum for Semester IV [Second Year]

| Sr. No | Course Code | Course Title | Hours Per Week | | | Evaluation Scheme | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | MSE | CA | ESE | | |
| 1 | BTEXC401 | Electrical Machines and Instruments | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | BTEXC402 | Analog Communication Engineering | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | BTEXC403 | Microprocessor | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | BTEXC404 | Signals and Systems | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 5 | BTID405 | Product Design Engineering | 1 | 0 | 2 | 30 | 30 | 40 | 100 | 2 |
| 6 | BTBSC406 | Numerical Methods and Computer Programming | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 7 | BTEXL407 | Electrical Machines and Instruments Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 8 | BTEXL408 | Analog Communication Engineering Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 9 | BTEXL409 | Microprocessor Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 10 | BTEXL410 | Signals and Systems Lab | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |
| 11 | BTHML411 | Soft-Skill Development | 0 | 0 | 2 | -- | 60 | 40 | 100 | 1 |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 12 | BTEXF412 | Field Training/ Internship/Industrial Training (Minimum 4 weeks which can be completed partially in third semester or fourth semester or in at one time) | -- | -- | -- | -- | -- | -- | -- | 1* (To be evaluated in V$^{th}$ Semester) |
| | | **Total** | **11** | **05** | **12** | **130** | **430** | **540** | **1100** | **22** |

## B. Tech (Electronics & Telecommunication Engineering)

### Proposed Curriculum for Semester V [Third Year]

| Sr. No. | Course Code | Type of Course | Course Title | Hours Per Week | | | Evaluation Scheme | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | MSE | CA | ESE | | |
| 1 | BTEXC501 | Professional Core Course 1 | Electromagnetic Field Theory | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | BTEXC502 | Professional Core Course 2 | Control System Engineering | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | BTETC503 | Professional Core Course 3 | Computer Architecture | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | BTEXC504 | Professional Core Course 4 | Digital Signal Processing | 2 | 1 | 0 | 20 | 20 | 60 | 100 | 3 |
| 5 | BTEXC505 | Professional Core Course 5 | Microcontroller and its Applications | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 6 | BTEXPE506A | Program Elective Course 1 | Probability Theory and Random Processes | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| | BTEXPE506B | | NSQF (Level 7 Course) | | | | | | | | |
| | BTEXPE506C | | Data Structure & Algorithms Using Java Programming | | | | | | | | |
| | BTEXPE506D | | Introduction to MEMS | | | | | | | | |

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| 7 | BTETL507 | Control System Engineering Lab | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 8 | BTETL508 | Digital Signal Processing Lab | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 9 | BTETL509 | Microcontroller and its Applications Lab | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 10 | BTETP510 | Mini Project | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 11 | BTETS511 | Seminar | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 12 | BTEXF412 | Field Training/ Internship/Industrial Training Evaluation | -- | -- | -- | -- | -- | 50 | 50 | 1 |
| | | **Total** | **16** | **02** | **10** | **120** | **270** | **510** | **900** | **24** |

## B. Tech (Electronics & Telecommunication Engineering)

### Proposed Curriculum for Semester VI [Third Year]

| Sr. No. | Course Code | Type of Course | Course Title | Hours Per Week | | | Evaluation Scheme | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | MSE | CA | ESE | | |
| 1 | BTETC601 | Professional Core Course 1 | Antennas and Wave Propagation | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | BTETC602 | Professional Core Course 2 | Computer Network & Cloud Computing | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | BTETC603 | Professional Core Course 3 | Digital Image Processing | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | BTETPE604A | Program Elective Course 2 | CMOS Design | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| | BTETPE604B | | Information Theory and Coding | | | | | | | | |
| | BTETPE604C | | Power Electronics | | | | | | | | |
| | BTETPE604D | | Nano Electronics | | | | | | | | |
| | BTETPE604E | | NSQF (Level 7 Course) | | | | | | | | |
| | BTETPE604F | | Android Programming | | | | | | | | |
| 5 | BTETOE605A | Open Elective Course 1 | Digital System Design | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| | BTETOE605B | | Optimization Techniques | | | | | | | | |
| | BTETOE605C | | Project Management and Operation Research | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | BTETOE605D | | Augmented, Virtual and Mixed Reality | | | | | | | | |
| | BTETOE605E | | Python Programming | | | | | | | | |
| | BTETOE605F | | Web Development and Design | | | | | | | | |
| 6 | BTHM606 | Humanities & Social Science including Management Courses | Employability & Skill Development | 2 | 0 | 0 | 20 | 20 | 60 | 100 | 2 |
| 7 | BTETL607 | Computer Network & Cloud Computing Lab | | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 8 | BTETL608 | Program Elective 2 Lab | | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 9 | BTETL609 | Open Elective 1 Lab | | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 10 | BTETP610 | Mini-project | | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 11 | BTETF611 | Field Training/ Internship/ Industrial Training (Minimum 4 weeks) | | -- | -- | -- | -- | -- | -- | -- | 1* (To be evaluated in VII$^{th}$ Semester) |
| | | | **Total** | **17** | **0** | **8** | **120** | **240** | **440** | **800** | **21** |

| Program Elective 2 | Open Elective 1 |
|---|---|
| (A) CMOS Design | (A) Digital System Design |
| (B) Information Theory and Coding | (B) Optimization Techniques |
| (C) Power Electronics | (C) Project Management and Operation Research |
| (D) Nano Electronics | (D) Augmented, Virtual and Mixed Reality |
| (E) NSQF (Level 7 Course) | (E) Python Programming |
| (F) Android Programming | (F) Web Development and Design |

* To be evaluated in VII$^{th}$ Semester

## B. Tech (Electronics & Telecommunication Engineering)

### Proposed Curriculum for Semester VII [Final Year]

| Sr. No. | Course Code | Type of Course | Course Title | Hours Per Week | | | Evaluation Scheme | | | Total Marks | Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | MSE | CA | ESE | | |
| 1 | BTETC701 | Professional Core Course 1 | Digital Communication | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 2 | BTETPE702 | Program Elective 3 | Group A | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 3 | BTETPE703 | Program Elective 4 | Group B | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 4 | BTETPE704 | Program Elective 5 | Group C | 3 | 0 | 0 | 20 | 20 | 60 | 100 | 3 |
| 5 | BTHM705 | Humanities & Social Science including Management Courses | Financial Management | 2 | 0 | 0 | 20 | 20 | 60 | 100 | 2 |
| 6 | BTETL706 | Program Elective 3 Lab | | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 7 | BTETL707 | Program Elective 4 Lab | | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 8 | BTETL708 | Program Elective 5 Lab | | 0 | 0 | 2 | -- | 30 | 20 | 50 | 1 |
| 9 | BTETP709 | Project Part I | | 0 | 0 | 8 | -- | 50 | 50 | 100 | 4 |
| 10 | BTETF611 | Field Training/ Internship/Industrial Training Evaluation | | -- | -- | -- | -- | -- | 50 | 50 | 1 |
| | | | **Total** | **14** | **0** | **14** | **100** | **240** | **460** | **800** | **22** |

| **Program Elective - 3 (Group A)** | **Program Elective -4 (Group B)** | **Program Elective- 5 (Group C)** |
|---|---|---|
| (A) Microwave Theory & Techniques | (A) Embedded System Design | (A) Consumer Electronics |
| (B) RF Circuit Design | (B) Artificial Intelligence Deep learning | (B) Analog Integrated Circuit Design |
| (C) Satellite Communication | (C) VLSI Design & Technology | (C) Soft Computing |
| (D) Fiber Optic Communication | (D) Data Compression & Encryption | (D) Advance Industrial Automation-1 |
| (E) Wireless Sensor Networks | (E) Big Data Analytics | (E) Mechatronics |
| (F) Mobile Computing | (F) Cyber Security | (F) Electronics in Smart City |

## B. Tech (Electronics & Telecommunication Engineering)

### Course Structure for Semester VIII [Fourth Year] w.e.f. 2020-2021

| Course Code | Type of Course | Course Title | Weekly Teaching Scheme | | | Evaluation Scheme | | | | Credits |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | L | T | P | MSE | CA | ESE | Total | |
| • Introduction to Internet of Things<br>• Computer Vision and Image Processing<br>• Biomedical Signal Processing<br>• Industrial Automation and Control<br>• Cryptography and Network Security<br>• Digital IC Design<br># Student to opt any two subjects from above list | | | 3 | - | -- | 20* | 20* | 60* | 100 | 3 |
| | | | 3 | - | -- | 20* | 20* | 60* | 100 | 3 |
| BTMEP803 | Project Part-II or Internship* | | -- | -- | 30 | -- | -- | 100 | 150 | 15 |
| | | Total | -- | -- | | | | 220 | 350 | 21 |

** Six months of Internship in the industry*

**Students doing project at institute will have to appear for CA/MSE/ESE*

** Student doing project at Industry will give NPTEL examination / Examination conducted by university i.e. CA/MSE/ESE*

*# These subjects are to be studied on self –study mode using SWAYAM/NPTEL/Any other source*

*# Teacher who work as a facilitator for the course should be allotted 3 hrs/week load.*

*# Project Load: 2hrs/week/project.*

## Mapping of Courses with MOOCs Platform SWYAM / NPTEL

| No | Course Name | Duration (Weeks) | Institute Offering Course | Name of Professor |
|---|---|---|---|---|
| 1 | Introduction to internet of things | 12 | IIT Kharagpur | Prof. Sudip Misra |
| 2 | Computer Vision and Image Processing | 12 | IIT Gandhinagar | Prof. M. K. Bhuyan |
| 3 | Biomedical Signal Processing | 12 | IIT Kharagpur | Prof. Sudipta Mukhopadhyay |
| 4 | Industrial Automation and Control | 12 | IIT Kharagpur | Prof. Siddhartha Mukhopadhyay |
| 5 | Cryptography & Network Security | 12 | IIT Kharagpur | Prof. Sourav Mukhopadhyay |
| 6 | Digital IC Design | 12 | IIT Madras | Prof. Janakiraman |

| BTBSC301 | Engineering Mathematics-III | 4 Credits |
|---|---|---|

**Second Year B. Tech Classes (Common to all Branches) Semester: III**

**Prerequisites:** Differential and Integral Calculus, Taylor series and Infinite series, Differential equations of first order and first degree, Fourier series, Vector algebra, Algebra of complex numbers.

**Course Objectives:**

After completion of the course, students will have adequate background, conceptual clarity and knowledge of appropriate solution techniques related to:

1. Linear differential equations of higher order using analytical methods and numerical methods applicable to Control systems and Network analysis.
2. Transforms such as Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Vector differentiation and integration required in Electromagnetics and Wave theory.
4. Complex functions, conformal mappings, contour integration applicable to Electrostatics, Digital filters, Signal and Image processing.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Solve higher order linear differential equation using appropriate techniques for modeling and analyzing electrical circuits.
2. Solve problems related to Fourier transform, Laplace transform and applications to Communication systems and Signal processing.
3. Obtain Interpolating polynomials, numerically differentiate and integrate functions, numerical solutions of differential equations using single step and multi-step iterative methods used in modern scientific computing.
4. Perform vector differentiation and integration, analyze the vector fields and apply to Electromagnetic fields.
5. Analyze conformal mappings, transformations and perform contour integration of complex functions in the study of electrostatics and signal processing.

| UNIT - 1 | 07 Hours |
|---|---|

**Laplace Transform**

Definition – conditions for existence ; Transforms of elementary functions ; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by $t^n$, scale change property, transforms of functions divided by t, transforms of integral of functions, transforms of derivatives ; Evaluation of integrals by using Laplace transform ; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.

| UNIT - 2 | 07 Hours |
|---|---|

**Inverse Laplace Transform**

Introductory remarks ; Inverse transforms of some elementary functions ; General methods of finding inverse transforms ; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms ; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.

| UNIT - 3 | 07 Hours |
|---|---|

**Fourier Transform**

Definitions – integral transforms ; Fourier integral theorem (without proof) ; Fourier sine and cosine integrals ; Complex form of Fourier integrals ; Fourier sine and cosine transforms ; Properties of Fourier transforms ; Parseval's identity for Fourier Transforms.

| UNIT - 4 | 07 Hours |
|---|---|

**Partial Differential Equations and Their Applications**

Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation $\left(\frac{\partial u}{\partial t} = c^2 \frac{^2u}{\partial x^2}\right)$, and two dimensional heat flow equation (i.e. Laplace equation : $\frac{^2u}{\partial x^2} + \frac{^2u}{\partial y^2} = 0$).

| UNIT - 5 | 07 Hours |
|---|---|

**Functions of Complex Variables (Differential calculus)**

Limit and continuity of f(z); Derivative of f(z) ; Analytic functions; Cauchy- Riemann equations in Cartesian and polar forms; Harmonic functions in Cartesian form; Mapping: Translation, magnification and rotation, inversion and reflection , bilinear transformation; Conformal mapping.

| UNIT - 6 | 07 Hours |
|---|---|

**Functions of Complex Variables (Integral calculus)**

Cauchy's integral theorem; Cauchy's integral formula; Residues; Cauchy's residue theorem (All theorems without proofs).

## TEXT BOOKS


1. Higher Engineering Mathematics by B. S. Grewal, Khanna Publishers, New Delhi.
2. Advanced Engineering Mathematics by Erwin Kreyszig, John Wiley & Sons, New York.
3. A Course in Engineering Mathematics (Vol III) by Dr. B. B. Singh, Synergy Knowledge ware, Mumbai.
4. A Text Book of Applied Mathematics (Vol I & II) by P. N. Wartikar and J. N. Wartikar, Pune Vidyarthi Griha Prakashan, Pune.
5. Higher Engineering Mathematics by H. K. Das and Er. Rajnish Verma, S. Chand & CO. Pvt. Ltd., New Delhi.


## REFERENCE BOOKS


1. Higher Engineering Mathematics by B. V. Ramana, Tata McGraw-Hill Publications, New Delhi.
2. A Text Book of Engineering Mathematics by Peter O' Neil, Thomson Asia Pte Ltd., Singapore.
3. Advanced Engineering Mathematics by C. R. Wylie & L. C. Barrett, Tata Mcgraw-Hill Publishing Company Ltd., New Delhi.
4. Integral Transforms and Their Engineering Applications by Dr. B. B. Singh, Synergy . Knowledge ware, Mumbai.

5. Integral Transforms by I. N. Sneddon, Tata McGraw-Hill, New York.

## GENERAL INSTRUCTIONS

1. The tutorial classes in Engineering Mathematics-III are to be conducted batch wise. Each class should be divided into three batches for the purpose.
2. The internal assessment of the students for 20 marks will be done based on assignments, surprise tests, quizzes, innovative approach to problem solving and percentage attendance.
3. The minimum number of assignments should be eight covering all topics.

| BTEXC302 | Analog Circuits | 3 Credits |
|---|---|---|

**Course Objectives:**

- To understand characteristics of IC and Op-Amp and identify the internal structure.
- To introduce various manufacturing techniques.
- To study various op-amp parameters and their significance for Op-Amp.
- To learn frequency response, transient response and frequency compensation techniques for Op-Amp.
- To analyze and identify linear and nonlinear applications of Op-Amp.
- To understand functionalities of PLL.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Understand the characteristics of IC and Op-Amp and identify the internal structure.
2. Understand and identify various manufacturing techniques.
3. Derive and determine various performances based parameters and their significance for Op-Amp.
4. Comply and verify parameters after exciting IC by any stated method.
5. Analyze and identify the closed loop stability considerations and I/O limitations.
6. Analyze and identify linear and nonlinear applications of Op-Amp.
7. Understand and verify results (levels of V & I) with hardware implementation.
8. Implement hardwired circuit to test performance and application for what it is being designed.

9. Understand and apply the functionalities of PLL.

| UNIT - 1 | 06 Hours |
|---|---|

**OP-AMP Basics**

Block diagram of OP-AMP, Differential Amplifier configurations, Differential amplifier analysis for dual-input balanced-output configurations, Need and types of level shifter, current mirror circuits. Feedback topologies: Voltage series and voltage shunt feedback amplifier and its effect on $R_i$, $R_o$, bandwidth and voltage gain.

| UNIT - 2 | 06 Hours |
|---|---|

**Linear Applications of OP-AMP**

Inverting and non-inverting amplifier configurations, voltage follower, summing, averaging scaling amplifier, difference amplifier, integrator, differentiator, and instrumentation amplifiers.

| UNIT - 3 | 06 Hours |
|---|---|

**Non-linear Applications of OP-AMP**

Introduction to comparator, characteristics and applications of comparator, Schmitt trigger, clippers and clampers, voltage limiters, square wave generator, triangular wave generator, Need of precision rectifiers, Half wave and Full wave precision rectifiers.

| UNIT - 4 | 06 Hours |
|---|---|

**Converters using OP-AMP**

V-F, I-V and V-I converter, Digital-to-analog converters (DAC): Weighted resistor, R-2R ladder, resistor string etc. Analog-to-digital converters (ADC): Single slope, dual slope, successive approximation, flash type.

| UNIT - 5 | 06 Hours |
|---|---|

**Oscillators**

Principle of Oscillators, Barkhausen criterion, Oscillator types: RC oscillators (design of phase shift, Wien bridge etc.), LC oscillators (design of Hartley, Colpitts, Clapp etc.), non-sinusoidal oscillators, and voltage controlled oscillators.

| UNIT - 6 | 06 Hours |
|---|---|

**Active filters and PLL**

Design guidelines of Active filters: Low pass, high pass, band pass and band stop filters, block diagram of PLL and its function.

**TEXT/REFERENCE BOOKS**


1. Ramakant A. Gaikwad, "Op Amps and Linear Integrated Circuits", Pearson Education 2000.
2. Salivahanan and Kanchana Bhaskaran, "Linear Integrated Circuits", Tata McGraw Hill, India 2008.
3. George Clayton and Steve Winder, "Operational Amplifiers", 5th Edition Newnes.
4. Sergio Franco, "Design with Operational Amplifiers and Analog Integrated Circuits", Tata McGraw Hill.
5. Bali, "Linear Integrated Circuits", McGraw Hill 2008.
6. Gray, Hurst, Lewise, Meyer, "Analysis & Design of Analog Integrated Circuits", Wiley Publications on Education.


| BTEXC303 | Electronic Devices & Circuits | 3 Credits |
|---|---|---|

**Prerequisites:**

Basic knowledge of Semiconductor Physics.

**Course Objectives:**

1. To introduce semiconductor devices FET and MOSFET, their characteristics, operations, circuits and applications
2. To introduce concepts of both positive and negative feedback in electronic circuits
3. To analyze and interpret FET and MOSFET circuits for small signal at low and high frequencies
4. To simulate electronics circuits using computer simulation software and verify desired results
5. To study the different types of voltage regulators.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Comply and verify parameters after exciting devices by any stated method.
2. Implement circuit and test the performance.

3. Analyze small signal model of FET and MOSFET.
4. Explain behavior of FET at low frequency.
5. Design an adjustable voltage regulator circuits.

| UNIT - 1 | 06 Hours |
|---|---|

**JFET**

Introduction to JFET, Types, Construction, Operation, Static Characteristics, Pinch off voltage, FET Volt-Ampere characteristics, FET Configurations (CS/CD/CG) and their Comparison. Biasing of FET (Self).FET as an amplifier and its analysis (CS) and its frequency response, Small signal model, FET as High Impedance circuits

| UNIT - 2 | 06 Hours |
|---|---|

**MOSFET& its DC Analysis**

Basics of MOS Transistor operation, Construction of n-channel E-MOSFET, E-MOSFET characteristics & parameters, non-ideal voltage current characteristics viz. Finite output resistance, body effect, sub-threshold conduction, breakdown effects and temperature effects. Common source circuit, Load Line & Modes of operation, common MOSFET configurations: DC Analysis, constant current source biasing, MOSFET as switch, diode/active resistor, Current sink and source, current mirror, Voltage references, Basic principle of band gap reference, CMOS Inverter as amplifier: Active load, Current source and Push pull configurations.

| UNIT - 3 | 06 Hours |
|---|---|

**Electronics Amplifiers**

Classification of amplifiers, Fundamentals of Low noise and Power amplifiers. Feedback amplifiers: Feedback concept and topologies, Effect of feedback on terminal characteristics of amplifiers, feedback amplifier analysis, cascade amplifiers, DC Amplifiers.

| UNIT - 4 | 06 Hours |
|---|---|

**Oscillators**

Barkhausen criterion, stability with feedback. Classification of oscillators, RC Oscillators: FET RC Phase Shift oscillator, Wein bridge oscillator, LC Oscillators: Hartley and Colpitts oscillators, Crystal oscillators, UJT Relaxation oscillator.

| UNIT - 5 | 06 Hours |
|---|---|

**Multivibrators**

IC555 Block diagram, Types of Multivibrators: Astable, Monostable and Bistable, Operation of Multivibrators using FETs and IC555. Applications of IC555 in Engineering.

| UNIT - 6 | 06 Hours |
|---|---|

**Voltage Regulator**

Block diagram of an adjustable three terminal positive and negative regulators (317,337) typical connection diagram, current boosting, Low drop out voltage regulators, Introduction to Switch Mode Power supply (SMPS), Block diagram of SMPS, Types of SMPS. Comparison of Linear Power supply and SMPS.

**TEXT/REFERENCE BOOKS**


1. Millman Halkias, "Integrated Electronics-Analog and Digital Circuits and Systems", Tata McGraw Hill, 2000
2. Donald Neaman, "Electronic Circuit Analysis and Design", 3rd Edition, Tata McGraw Hill
3. Brijesh Iyer, S. L. Nalbalwar, R. Dudhe, "Electronics Devices & Circuits", Synergy Knowledgeware Mumbai, 2017. ISBN:9789383352616
4. David A. Bell, "Electronic Devices and Circuits",5th Edition, Oxford Press
5. R. L. Boylstad, L. Nashlesky, "Electronic Devices and circuits Theory", 9thEdition, Prentice Hall of India, 2006.


| BTEXC304 | Network Analysis | 3 Credits |
|---|---|---|

**Course Objectives:**

1. To learn about the basic laws of electric circuits as well as the key fundamentals of the communication channels, namely transmission lines.
2. To understand the need of simplification techniques of complicated circuits
3. To learn about the comprehensive insight into the principle techniques available for characterizing circuits, networks and their implementation in practice.
4. To learn about the use of mathematics, need of different transforms and usefulness of differential equations for analysis of networks.

5. To train the students for handling analog filter design through theory of NA along with practical, this is basic requirement of signal processing field.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Apply knowledge of mathematics to solve numerical based on network simplification and it will be used to analyze the same.
2. Design passive filters and attenuators theoretically and practically. To apply knowledge for design of active filters as well as digital filters and even extend this to advance adaptive filters.
3. Identify issues related to transmission of signals, analyze different RLC networks.
4. Find technology recognition for the benefit of the society.

| UNIT - 1 | 06 Hours |
|---|---|

**Basic Circuit Analysis and Simplification Techniques**

Basic circuit elements, Simplification of networks, Equivalent 'T' and 'Π' networks of any complicated network, Voltage and Current laws (KVL/KCL), Network Analysis: Mesh, Super mesh, Node and Super Node analysis. Principle of duality, Source transformation and source shifting, Network Theorems such as Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.

***Note**: Above circuit analysis, mentioned in this Unit-1, is for AC network only.*

| UNIT - 2 | 06 Hours |
|---|---|

**Frequency Selective Networks**

Significance of Quality factor, Series Resonance: Resonating frequency, Reactance curves, Variation of circuit parameters such as impedance, phase angle, voltage and current with frequency; Bandwidth, Selectivity, Magnification factor, Parallel resonance: Resonant frequency, Variation circuit parameters such as admittance, phase angle, voltage and current with frequency; Bandwidth and selectivity. Analysis of parallel resonating circuit with resistance present in both branches (inductive and capacitive branches) and tank circuit, Effect of generator resistance on BW & Selectivity, Comparison and applications of series and parallel resonant circuits.

| UNIT - 3 | 06 Hours |
|---|---|

**Electrical Network Parameters and Passive Filters**

Classifications: Symmetrical and Asymmetrical networks. Properties of two port Network :(i) Symmetrical Networks (T and Π only): Characteristics impedance and propagation constant in terms of circuit components, open and short circuit parameters (ii) Asymmetrical Networks: Image Impedance and Iterative Impedance. Passive Filters: Filter fundamentals, Introduction to Neper and Decibel, Relation between Neper and Decibel, Constant K-LPF, HPF, BPF and BSF, m-derived LPF and HPF, Terminating half sections, Concept of composite filters. Attenuators: Symmetrical T and Π type attenuators, Ladder attenuator.

| UNIT - 4 | 06 Hours |
|---|---|

**Steady State and Transient Response**

DC and AC response of R-L, R-C and RLC circuits, Analysis of electrical circuits using Laplace Transform.

| UNIT - 5 | 06 Hours |
|---|---|

**Two Port Network Parameters and Functions**

Terminal characteristics of network: Z, Y, h, ABCD Parameters; Reciprocity and Symmetry conditions, Applications of the parameters. Network functions for one port and two port networks, Pole-zeros of network functions and network stability.

| UNIT - 6 | 06 Hours |
|---|---|

**Transmission Line Theory**

Types of Transmission lines, Transmission Line Equation, Equivalent circuits, Primary and Secondary line constants, Terminations of transmission lines, VSWR and Reflection Coefficient, Impedance matching, Transmission line measurements using Smith chart.

## TEXT/REFERENCE BOOKS

1. D Roy Choudary, “Network and Systems” 1st edition, New Age International, 1988
2. John D. Ryder, “Network Lines and Fields” 2nd edition, PHI, 1955
3. C. P. Kuriakose, “Circuit Theory Continuous and Discrete Time System, Elements of Network Synthesis” PHI

4. W.H. Hayt Kemmerly, "Engineering Circuit Analysis", 5th Edition, Tata McGraw Hill Publications, 1993.
5. M. E. Van Valkenburg, "Network Analysis", 3rd Edition, Pearson, 2004. 6. Boylestead, "Introductory Circuit Analysis", 4th edition, Charles & Merrill, 1982. 7. Royal Signal Handbook on Line Communication.

| BTEXC305 | Digital Logic Design | 3 Credits |
|---|---|---|

**Course Objectives:**

1. To acquaint the students with the fundamental principles of two-valued logic and various devices used to implement logical operations on variables.
2. To lay the foundation for further studies in areas such as communication, VHDL, computer.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Use the basic logic gates and various reduction techniques of digital logic circuit in detail.
2. Design combinational and sequential circuits.
3. Design and implement hardware circuit to test performance and application.
4. Understand the architecture and use of VHDL for basic operations and Simulate using simulation software.

| UNIT - 1 | 06 Hours |
|---|---|

**Combinational Logic Design**

Standard representations for logic functions, k map representation of logic functions (SOP and POS forms), minimization of logical functions for min-terms and max-terms (upto 4 variables), don't care conditions, Design Examples: Arithmetic Circuits, BCD - to - 7 segment decoder, Code converters. Adders and their use as subtractor, look ahead carry, ALU, Digital Comparator, Parity generators/checkers, Design of Multiplexers and De-multiplexers, Decoders.

| UNIT - 2 | 06 Hours |
|---|---|

**Sequential Logic Design**

1 Bit Memory Cell, Clocked SR, JK, MS J-K flip flop, D and T flip-flops. Use of preset and clear terminals, Excitation Table for flip flops, Conversion of flip flops. Application of Flip-flops: Registers, Shift registers, Counters (ring counters, twisted ring counters), Sequence Generators, ripple counters, up/down counters, synchronous counters, definitions of lock out, Clock Skew, and Clock jitter.

| UNIT - 3 | 06 Hours |
|---|---|

**State Machines**

Basic design steps- State diagram, State table, State reduction, State assignment, Mealy and Moore machines representation, Implementation, finite state machine implementation, Sequence detector.

| UNIT - 4 | 06 Hours |
|---|---|

**Digital Logic Families**

Classification of logic families, Characteristics of digital ICs-Speed of operation, power dissipation, figure of merit, fan in, fan out, current and voltage parameters, noise immunity, operating temperatures and power supply requirements. TTL logic, Operation of TTL NAND gate, active pull up, wired AND, open collector output, unconnected inputs. Tri-State logic. CMOS logic – CMOS inverter, NAND, NOR gates, unconnected inputs, wired logic, open drain output. Interfacing CMOS and TTL, Comparison table of Characteristics of TTL, CMOS, ECL, RTL, $I^2L$ and DCTL

| UNIT - 5 | 06 Hours |
|---|---|

**Programmable Logic Devices and Semiconductor Memories**

Programmable logic devices: Detail architecture, Study of PROM, PAL, PLA, Designing combinational circuits using PLDs. General Architecture of FPGA and CPLD Semiconductor memories: memory organization and operation, expanding memory size, Classification and characteristics of memories, RAM, ROM, EPROM, EEPROM, NVRAM, SRAM, DRAM.

| UNIT - 6 | 06 Hours |
|---|---|

**Introduction to VHDL**

Behavioral – data flow, and algorithmic and structural description, lexical elements, data objects types, attributes, operators; VHDL coding examples, combinational circuit design examples in VHDL and simulation.

## TEXT/REFERENCE BOOKS


1. R.P. Jain, ―Modern digital electronics‖, 3rd edition, 12threprint Tata McGraw Hill Publication, 2007.
2. M. Morris Mano, ―Digital Logic and Computer Design‖ 4th edition, Prentice Hall of India, 2013.
3. Anand Kumar, ―Fundamentals of digital circuits‖ 1st edition, Prentice Hall of India, 2001.
4. Pedroni V.A., "Digital Circuit Design with VHDL", Prentice Hall India, 2nd 2001 Edition.


| BTHM3401 | Basic Human Rights | Audit |
|---|---|---|

**Course Objectives:**

1. To work for ensuring that basic human rights are respected everywhere.
2. To cooperate to avoid compromising on human rights for economic or political expediency
3. To recognize democratic institutions as a fundamental human right
4. To work towards the sovereignty and self-determination of entities with historical, cultural and ecological identity.
5. To actively engage with the Government of India and other countries to promote human rights education.
6. To bring diplomatic and commercial pressures on regimes that violates human rights, to ensure that they respect the basic rights of their citizens.
7. To keep the interests of disempowered communities foremost in all dealings with countries in which human rights violations occur

8. To develop a more distinctive and effective role for the International Court of Justice in the field of human rights
9. To promote a culture for educating the citizenry that cultivation and promotion of human rights culture is the sine qua non for the smooth functioning of the organs of a democratic State and for the kind of development that results into overall development of the society.
10. To train the young men and women for facing the challenges of the pluralistic society and the rising conflicts and tensions in the name of particularistic loyalties to caste, religion, region and culture
11. To study the effects of draconian laws and unlawful use of State's machinery and force by the enforcement agencies.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Simply put, human rights education is all learning that develops the knowledge, skills, and values of human rights.
2. Strengthen the respect for human rights and fundamental freedoms.
3. Enable all persons to participate effectively in a free society.
4. Learn about human rights principles, such as the universality, indivisibility, and interdependence of human rights.
5. Learn about regional, national, state, and local law that reinforces international human rights law.
6. Learn and know about and being able to use global, regional, national, and local human rights instruments and mechanisms for the protection of human rights.

| UNIT - 1 | 06 Hours |
|---|---|

**The Basic Concepts**

Individual, Group, Civil Society, State, Equality, Justice, Human Values: - Humanity, Virtues, Compassion.

| UNIT - 2 | 06 Hours |
|---|---|

**Human Rights and Human Duties**

Origin, Civil and Political Rights, Contribution of American Bill of Rights, French Revolution, Declaration of Independence, Rights of Citizen, Rights of working and Exploited people, Fundamental Rights and Economic program, India's Charter of freedom

| UNIT - 3 | 06 Hours |
|---|---|

**Society, Religion, Culture, and their Inter-Relationship**

Impact of Social Structure on Human behavior, Roll of Socialization in Human Values, Science and Technology, Modernization, Globalization, and Dehumanization.

| UNIT - 4 | 06 Hours |
|---|---|

**Social Structure and Social Problems**

Social and Communal Conflicts and Social Harmony, Rural Poverty, Unemployment, Bonded Labour, Migrant workers and Human Rights Violations, Human Rights of mentally and physically challenged

| UNIT - 5 | 06 Hours |
|---|---|

**State, Individual Liberty, Freedom and Democracy**

The changing of state with special reference to developing countries, Concept of development under development and Social action, need for Collective action in developing societies and methods of Social action, NGOs and Human Rights in India: - Land, Water, Forest issues.

| UNIT - 6 | 06 Hours |
|---|---|

**Human Rights in Indian Constitution and Law**

The constitution of India:

(i) Preamble

(ii) Fundamental Rights

(iii) Directive principles of state policy

(iv) Fundamental Duties

(v) Some other provisions

Universal declaration of Human Rights and Provisions of India, Constitution and Law, National Human Rights Commission and State Human Rights Commission.

**TEXT/REFERENCE BOOKS**

1. Shastry, T. S. N., India and Human rights: Reflections, Concept Publishing Company India (P Ltd.), 2005.
2. Nirmal, C.J., Human Rights in India: Historical, Social and Political Perspectives (Law in India), Oxford India.

| BTEXC401 | Electrical Machines and Instruments | 3 Credits |
|---|---|---|

**Course Objectives:**

1. Model and Analyze the performance of different types of DC machines
2. Learn the applications of DC generators
3. Analyze the performance of different types of DC motors
4. Analyze the performance of different types of Sensors and Transducers
5. Familiarize with the applications of DC machines
6. To prepare students to perform the analysis of any electromechanical system.
7. To empower students to understand the working of electrical equipment used in everyday life.

**Course Outcomes:**

On completion of the course, students will be able to:

1. The ability to formulate and then analyze the working of any electrical machine using mathematical model under loaded and unloaded conditions.
2. The skill to analyze the response of any electrical machine.
3. The ability to troubleshoot the operation of an electrical machine.
4. The ability to select a suitable measuring instrument for a given application.
5. The ability to estimate and correct deviations in measurements due to the influence of the instrument and due to the accuracy of the instrument.

| UNIT - 1 | 06 Hours |
|---|---|

**DC Machines**

DC machines construction, working principle (motor & generator), EMF equation of DC Machine (motor and generator), Types and its characteristics of DC machines (motor and

generator), back emf, starters of dc machine, Speed control of DC motor Breaking of DC motor, applications of DC machines (motor and generator).

| UNIT - 2 | 06 Hours |
|---|---|

**Induction Motor and Synchronous Motor**

**Induction Motor:** Construction, working principle, types, torque equation, torque slip characteristics, power stages, losses and efficiency, starters speed control, breaking, applications. **Synchronous motor:** Construction, working principle, starting methods, effect of load, hunting, V-curve, synchronous condenser, applications.

| UNIT - 3 | 06 Hours |
|---|---|

**Special Purpose Machines**

Construction, working and application of steeper motor, variable reluctance motor, servo motor, FHP motor, hysteresis, repulsion, linear IM.

| UNIT - 4 | 06 Hours |
|---|---|

**Sensors and Transducers**

Classification selection of transducers strain gauges, LVDT, Temperature transducers, piezoelectric, photosensitive transducers, Hall Effect transducers, proximity devices Digital transducers need of signal conditioning and types, interfacing techniques of transducers with microprocessor and controller.

| UNIT - 5 | 06 Hours |
|---|---|

**Industrial Measurement and Industrial Applications**

Measurement of vibration, electrical telemetry thickness, humidity, thermal conductivity and gas analysis emission computerized tomography, smoke and fire detection, burglar alarm, object counter level measurement, on /off timers, RTC, sound level meter, tachometer, VAW meter.

| UNIT - 6 | 06 Hours |
|---|---|

**I/O Devices**

Recorder X- Y plotters and its applications, optical oscillograph.

## TEXT/REFERENCE BOOKS


1. A course in Electrical and Electronic Measurement and Instrumentation" by A. K. Sawhney (Publisher name: Dhanpat Rai & Co.)
2. Electronics Instrumentation by H.S. Kalsi (Publisher McGraw Hill)
3. Electrical Machines by Ashfaqu Husain, Dhanpatrai and publication
4. Instrumentation Devices System edition C. S. Rajan, G. R. sharma
5. Abhijit Chakrabarti & Sudipta Debnath, "Electrical Machines", Tata McGraw-hill Publication.
6. William H Hayt, Jack E Kimmerly and Steven M. Durbin, "Engineering Circuit Analysis", Tata McGraw Hill.
7. A.E. Fitzgerald, Charles Kingsley & Jr. Stephen D. Umans, "Electrical Machinery", Tata McGraw-hill Publication 6th Edition.
8. I.J Nagarath & D.P Kothari, "Electrical Machines", Tata McGraw-hill Publication 4th Edition.
9. T. J. E. Miller, "Brushless permanent-magnet and reluctance motor drives", Oxford University Press (1989).
10. Ned Mohan, "Electric Machines and Drives": A first course, Wiley.
11. B. L. Theraja, "Electrical technology" volume 2, S. Chand.


| BTEXC402 | Analog Communication Engineering | 3 Credits |
|---|---|---|

**Course Objectives:**

1. To introduce the concepts of analog communication systems.
2. To equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.
3. To understand the concepts of modulation and demodulation techniques of angle modulation (frequency and phase)

**Course Outcomes:**

On completion of the course, students will be able to:

1. Understand and identify the fundamental concepts and various components of analog communication systems.
2. Understand the concepts of modulation and demodulation techniques.
3. Design circuits to generate modulated and demodulated wave.

4. Equip students with various issues related to analog communication such as modulation, demodulation, transmitters and receivers and noise performance.
5. Understand the concepts of modulation and demodulation techniques of angle modulation (frequency and phase).
6. Explain signal to noise ratio, noise figure and noise temperature for single and cascaded stages in a communication system.
7. Develop the ability to compare and contrast the strengths and weaknesses of various communication systems.

| UNIT - 1 | 06 Hours |
|---|---|

**Introduction to Communication System**

Block schematic of communication system, Simplex and duplex systems, Modes of communication: Broadcast and point to point communication, Necessity of modulation, Classification of modulation, sampling theorem and pulse analog modulation, multiplexing: TDM, FDM.

| UNIT - 2 | 06 Hours |
|---|---|

**Amplitude Modulation**

Introduction, Mathematical analysis and expression for AM, Modulation index, Frequency spectrum and bandwidth of AM, Power calculations, Generation of AM using nonlinear property, Low and high level modulation, Balance Modulator.

Types of AM: DSB-FC, DSB-SC, SSB-SC, ISB and VSB, their generation methods and comparison.

| UNIT - 3 | 06 Hours |
|---|---|

**Angle Modulation**

Introduction, Mathematical analysis of FM and PM, Modulation index for FM and PM, Frequency spectrum and bandwidth of FM, Narrow band and wide band FM, Direct and indirect methods of FM generation, Pre emphasis and de-emphasis, Comparison of AM, FM and PM.

| UNIT - 4 | 06 Hours |
|---|---|

**Radio Receivers and Demodulators**

Introduction, Performances characteristic of receivers: Sensitivity, Selectivity, Fidelity, Image frequency and IFRR, Tracking and Double spotting, TRF, Super heterodyne receivers, RF amplifier, Local oscillator and mixer, IF amplifier, AGC.

| UNIT - 5 | 06 Hours |
|---|---|

**AM and FM Detectors**

AM Detectors: Envelop detector and practical diode detector.

FM Detectors: Slope detector, phase discriminator and ratio detector.

| UNIT - 6 | 06 Hours |
|---|---|

**Noise**

Introduction, Sources of noise, Classification of noise, Noise calculations (thermal noise), SNR, Noise figure, Noise Factor, Noise Temperature.

**TEXT/REFERENCE BOOKS**


1. Kennedy, "Electronics Communications Systems", McGraw-Hill New Delhi-1997, 4th Edition.
2. Anokh Singh, "Principles of communication engineering" S.Chand
3. Roddy & Coolen, "Electronic communication" PHI
4. Taub & Schilling "Principles of communication systems" Tata Mc Graw Hill
5. Beasley & Miller, "Modern Electronic Communication", Prentice-Hall India-2006, 8th Edition.
6. Wayne Tomasi, "Electronic Communication Systems", Pearson Education-2005, 5th Edition.
7. R. G. Gupta, "Audio & Video Systems" Tata McGraw-Hill New Delhi-2008.


| BTEXC403 | Microprocessor | 3 Credits |
|---|---|---|

**Course Objectives:**

1. Objective of this course is to introduce to the students the fundamentals of microprocessor.

2. After learning Microprocessor course, students will get advantage to pursue higher studies in Embedded Systems or employment in core industries.
3. The learner can design microprocessor based systems and thus can become successful entrepreneur and meet needs of Indian and multinational industries.
4. The students can design and develop processor which can be used in Robotics, Automobiles, Space and many research areas.
5. The learners will acquaint optimization skills and undergo concepts design metrics for embedded systems.
6. The students will get acquainted with recent trends in microprocessor like pipelining, cache memory etc.
7. To understand the applications of Microprocessors.
8. To learn interfacing of real world input and output devices.
9. To study various hardware and software tools for developing applications.

**Course Outcomes:**

1. Learner gains ability to apply knowledge of engineering in designing different case studies.
2. Students get ability to conduct experiments based on interfacing of devices to or interfacing to real world applications.
3. Students get ability to interface mechanical system to function in multidisciplinary system like in robotics, Automobiles.
4. Students can identify and formulate control and monitoring systems using microprocessors.
5. Students will design cost effective real time system to serve engineering solution for Global, social and economic context.
6. This course understanding will enforce students to acquire knowledge of recent trends like superscalar and pipelining and thus finds recognition of continuous updation.
7. Learn use of hardware and software tools.
8. Develop interfacing to real world devices.

| UNIT - 1 | 07 Hours |
|---|---|

**Fundamentals of Microprocessor**

Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor IC pin outs and signals.

| UNIT - 2 | 07 Hours |
|---|---|

**Programming with 8085**

Assembly Language Programming Basics, Addressing Modes, Instruction set of microprocessor, Instruction timing diagram. Writing, Assembling & Executing Assembly Language Programs.

| UNIT - 3 | 07 Hours |
|---|---|

**Interrupts**

Interrupt structure of 8085 microprocessor, processing of vectored and non-vectored interrupts, latency time and response time; Handling multiple interrupts.

| UNIT - 4 | 07 Hours |
|---|---|

**Interfacing**

Memory Interfacing, Interfacing with 8255 Programmable Peripheral Interface, 8254 Programmable Interval Timer, 8279 Display controller, Interrupt controller 8259.

| UNIT - 5 | 07 Hours |
|---|---|

**Introduction of 8086 Microprocessor**

Detail Architecture of 8086, Addressing Modes, Assembler directives, Co-Processor

## TEXT/REFERENCE BOOKS

1. Microprocessor and interfacing 8085, Douglas V Hall, Tata Mc Gram Hill.
2. Microprocessor-Architecture, programming and application with 8085, gaonkar, penram international.
3. Short K. L., “Microprocessors and Programmed Logic”, 2nd Ed.,Pearson Education, 2008..
4. D V kodavade, S. Narvadkar, 8085-86 microprocessors Architecture progg and interfaces, wiley.

5. Rout 8085 microcontroller-architecture, programming and application, 2nd edi, penram international.

| BTEXC404 | Signals and Systems | 3 Credits |
|---|---|---|

**Course Objectives:**

1. To understand the mathematical description of continuous and discrete time signals and systems.
2. To classify signals into different categories.
3. To analyze Linear Time Invariant (LTI) systems in time and transform domains.
4. To build basics for understanding of courses such as signal processing, control system and communication.
5. To develop basis of probability and random variables.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Understand mathematical description and representation of continuous and discrete time signals and systems.
2. Develop input output relationship for linear shift invariant system and understand the convolution operator for continuous and discrete time system.
3. Understand and resolve the signals in frequency domain using Fourier series and Fourier transforms.
4. Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s- domain.
5. Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

| UNIT - 1 | 06 Hours |
|---|---|

**Introduction to Signals and Systems**

Introduction and Classification of signals: Definition of signal and systems, Continuous time and discrete time signal, Classification of signals as even, odd, periodic and non-periodic, deterministic and non-deterministic, energy and power, elementary signals used for testing: exponential, sine, impulse, step and its properties, ramp, rectangular, triangular, signum, sinc Operations on signals: Amplitude scaling, addition, multiplication, differentiation, integration

(Accumulator for DT), time scaling, time shifting and time folding, Sampling Theorem and reconstruction of sampled signal, Concept of aliasing, examples on under sampled and over sampled signals.

Systems: Definition, Classification: linear and non-linear, time variant and invariant, causal and non-causal, static and dynamic, stable and unstable, invertible.

| UNIT - 2 | 06 Hours |
|---|---|

**Time domain representation of LTI System**

System modeling: Input-output relation, definition of impulse response, convolution sum, convolution integral, computation of convolution integral using graphical method, Computation of convolution sum. Properties of convolution, properties of the system based on impulse response, step response in terms of impulse response.

| UNIT - 3 | 06 Hours |
|---|---|

**Fourier Series**

Fourier series (FS) representation of periodic Continuous Time (CT) signals, Dirichlet condition for existence of Fourier series, FS representation of CT signals using exponential Fourier series, Fourier spectrum representation, properties of Fourier series, Gibbs phenomenon, Discrete Time Fourier Series and its properties.

| UNIT - 4 | 06 Hours |
|---|---|

**Fourier transform**

Fourier Transform (FT) representation of aperiodic CT signals, Dirichlet condition for existence of Fourier transform, evaluation of magnitude and phase response, FT of standard CT signals, FT of standard periodic CT signals, Introduction to Fourier Transform of DT signals, Properties of CTFT and DTFT, Fourier Transform of periodic signals. Concept of sampling and reconstruction in frequency domain, sampling of bandpass signals.

| UNIT - 5 | 06 Hours |
|---|---|

**Laplace and Z-transform**

Definition of Laplace Transform (LT), Limitations of Fourier transform and need of Laplace transform, ROC and its properties, properties of Laplace transform, Laplace transform evaluation using properties, Inverse Laplace transform based on partial fraction expansion, Application of Laplace transforms to the LTI system analysis.

Introduction to Z-transform, and its properties, Inverse Z-transform, different methods of inverse Z-transform, Z-transform for discrete time system LTI analysis.

| UNIT - 6 | 06 Hours |
|---|---|

**Probability and Random Signals**

Probability: Experiment, sample space, event, probability, conditional probability and statistical independence, Bayes theorem, Random variables: Continuous and Discrete random variables, cumulative distributive function, Probability density function, properties of CDF and PDF. Definitions: Statistical averages, mean, moments and expectations, standard deviation and variance, Introduction to Correlation: Autocorrelation, Cross correlation, and their properties.

## TEXT/REFERENCE BOOKS


1. Alan V. *Oppenheim*. Alan S. Willsky and S. Hamid Nawab, "Signals and Systems", PHI
2. Dr. S. L. Nalbalwar, A.M. Kulkarni and S.P. Sheth, "Signals and Systems", 2nd Edition, Synergy Knowledgeware, 2017
3. Simon Haykins and Barry Van Veen, "Signals and Systems", 2nd Edition, Wiley India.
4. Shaila Apte, "Signals and Systems-principles and applications", Cambridge University press, 2016.
5. Mrinal Mandal and Amir Asif, Continuous and Discrete Time Signals and Systems, Cambridge University Press, 2007.
6. Peyton Peebles, "Probability, Random Variable, Random Processes", 4th Edition, Tata McGraw Hill.
7. A. Nagoor Kanni "Signals and Systems", 2nd edition, McGraw Hill.
8. NPTEL video lectures on Signals and Systems.


| BTID405 | Product Design Engineering | 2 Credits |
|---|---|---|

| Teaching Scheme: | Examination Scheme: |
|---|---|
| Lecture-cum-demonstration: 1 hr/week | Continuous Assessment 1: 30 Marks |
| Design Studio: 2 hr/week | Continuous Assessment 2: 30 Marks |
| | Final Assessment: 40 Marks |

- Pre-requisites: Knowledge of Basic Sciences, Mathematics and Engineering Drawing
- Design Studio : 2 hr/week to develop design sketching and practical skills, learning digital tools
- Continuous Assessment: Progress through a product design and documentation of steps in the selected product design
- Final Assessment: Product Design in Studio with final product specifications

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

1. Create simple mechanical or other designs
2. Create design documents for knowledge sharing
3. Manage own work to meet design requirements
4. Work effectively with colleagues.

| UNIT - 1 | 04 Hours |
|---|---|

**Introduction to Engineering Product Design:**

Trigger for Product/ Process/ System, Problem solving approach for Product Design, Disassembling existing Product(s) and understanding relationship of components with each other, Sketching of components, identifying materials and their processing for final product, fitting of components, understanding manufacturing as scale of the components, Reverse engineering concept, case studies of products in markets, (or in each discipline), underlying principles, Case studies of product failures, revival of failed products, Public/Society's perception of products, and its input into product design.

| UNIT - 2 | 04 Hours |
|---|---|

**Ideation:**

Generation of ideas, Funnelling of ideas, Short-listing of ideas for product(s) as an individual or group of individuals, Sketching of products, Market research for need, competitions, scale and cost, Initial specifications of products.

| UNIT - 3 | 04 Hours |
|---|---|

**Conceptualisation:**

Computer operation principles and image editing through a graphical Composition; Computer aided 2D drafting and 3D Modeling through simple exercises.

Designing of components, Drawings of parts and synthesis of a product from its component parts, Rendering the designs for 3-D visualization and to create a photo realistic image, Parametric modelling of product, 3-D Visualization of mechanical products, Detail Engineering drawings of components.

| UNIT - 4 | 04 Hours |
|---|---|

**Detailing:**

Managing assembling, Product specifications- data Sheet, Simple mechanical designs, Workshop safety and health issues, Create documents for knowledge sharing

**Hands-on Activity Charts for Use of Digital Tools**

| | | |
|---|---|---|
| | | |
| Activity 1 | Learn the basic vector sketching tools. | 2 |
| Activity 2 | General understanding of shading for adding depth to objects. Understanding of editing vectors | 2 |
| | | |
| Activity 3 | Begin developing a thought process for using digital sketching. | 3 |
| Activity 4 | Create a basic shape objects sphere, box cylinders | 3 |
| | | |
| Activity 5 | Create Automotive wheel concepts | 3 |
| Activity 6 | Understanding Navigation and Data Panel Interface | 2 |

| | | |
|---|---|---|
| Activity 7 | Solid and Surface modelling, Rendering 3-D models | 4 |
| Activity 8 | Product market and Product Specification Sheet | 3 |
| Activity 9 | Documentation for the product | 2 |

**TEXT/REFERENCE BOOKS**


1. Model Curriculum for "Product Design Engineer – Mechanical", NASSCOM (Ref. ID: SSC/Q4201, Version 1.0, NSQF Level: 7)
2. Eppinger, S., & Ulrich, K.(2015). Product design and development. McGraw - Hill Higher Education.
3. Green, W., & Jordan, P. W. (Eds.). (1999).Human factors in product design: current practice and future trends. CRC Press.
4. Sanders, M. S., & McCormick, E. J. (1993). Human factors in engineering and design McGRAW- HILL book company.
5. Roozenburg, N. F., &Eekels, J. (1995). Product design: fundamentals and methods (Vol. 2). John Wiley & Sons Inc.
6. Lidwell, W., Holden, K., & Butler, J.(2010). Universal principles of designs, revised and updated: 125 ways to enhance usability, influence perception, increase appeal, make better design decisions, and teach through design. Rockport Pub.


**BTBSC406 Numerical Methods and Computer Programming 3 Credits**

**Course Objectives:**

1. To prepare students for successful career in industries, for Post Graduate programmes and to work in research institutes.
2. To understand different numerical techniques used for solving algebraic and transcendental equations.
3. To understand numerical methods to solve a system of linear equations.
4. To understand numerical integration and differentiation techniques.

5. To understand various difference operators and interpolation techniques.
6. To understand object-oriented programming fundamentals and features.
7. To mold students professionally by course contents and sufficient problem solving and programming exercises and to acquaint them with different types of numerical techniques and programming concepts.

**Course Outcomes:**

On completion of the course, students will be able to:

1. Able to solve algebraic and transcendental equations by using numerical techniques and will be able to compare different numerical techniques used for this purpose and also will be able to choose a proper one as per the requirement of the problem.
2. Able to solve a system of linear equations with any number of variables using different direct and iterative numerical techniques.
3. Understand the concept of interpolation, finite difference operators and their relations, and can apply different interpolation techniques on equi-spaced or non equi-spaced data values.
4. Prepare them to write computer programs for the numerical computational techniques.
5. Understand application of the NMCP course in many engineering core subjects like signal processing, digital communication, numerical techniques in electromagnetics etc.
6. Understand procedure-oriented and object oriented programming concepts.
7. Capable of writing C and C++ programs efficiently.

| UNIT - 1 | 06 Hours |
|---|---|

**Introduction to Computational Methods and Errors**

Computational Methods: General principles of computational techniques, Introduction, common ideas and concepts of computational methods, various computational techniques. Errors: Types and sources of errors, Concept in error estimation, Error propagation, Error due to floating point, Representation of errors, Elementary uses of series in calculation of errors.

| UNIT - 2 | 06 Hours |
|---|---|

**Solution of Transcendental / Polynomial Equations and System of Linear Equation**

Solution of Transcendental / Polynomial Equations: Finding root of polynomial equations deploying computational methods such as Bisection, Regula-falsi, Newton-Raphson, Seccant,

Successive approximation. System of linear equation: Solving linear equations deploying computational methods such as Gauss elimination, Gauss Jordan, Partial pivoting, Matrix triangularisation (LU decomposition), Cholesky, Gauss Seidel and Jacobi methods.

| UNIT - 3 | 06 Hours |
|---|---|

**Interpolation and Polynomial Approximation**

Least square approximation, Orthogonal polynomials Chebyshev polynomials, Finite difference operator and their relations, Forward, backward, central and divided difference, Newton's forward divided difference, Backward difference interpolation, Sterling interpolation, Lagrange's interpolation polynomials, Spline interpolation, Least square approximation.

| UNIT - 4 | 06 Hours |
|---|---|

**Numerical Integration and Differentiation**

Numerical Integration: Methods based on interpolation such as Trapezoidal rule, Simsons 1/3 and 3/8 rules. Numerical differentiation: Euler's method, Modified Euler's method, Taylor's series, Runge Kutta $2^{nd}$and $4^{th}$ order, Stability analysis of above methods.

| UNIT - 5 | 06 Hours |
|---|---|

**Object Oriented Programming**

Software Evaluation, Object oriented programming paradigm, Basic concepts of object oriented programming, Benefits of OOP, Object oriented languages, Applications of OOP Beginning with C++: Structure of C++ program, Creating the source file, Compiling & linking, Basic data types, User defined data types, Symbolic constants, Declaration of variables, Dynamic initialization of variables, Reference variables, Operators in C++, Scope resolution operator, Type cast operator. Functions in C++: Function prototyping, Inline functions, Function overloading, Friend and virtual functions. Classes and Objects: Specifying a class, Defining member functions, C++ program with class, Arrays within a class, Memory allocation for objects, Constructors, Multiple constructor in class, Dynamic initialization of objects, Dynamic constructor, Destructors.

| UNIT - 6 | 06 Hours |
|---|---|

**Operator Overloading and Type Conversions**

Defining operator overloading, Overloading unary operators, Overloading binary operators, Manipulation of strings operators, Rules for overloading operators. Inheritance: Extending

Classes: Defining derived classes, Single inheritance, multilevel inheritance, multiple inheritance, Hierarchical inheritance, Hybrid inheritance, Virtual base classes, Abstract classes, Member classes: Nesting of classes Pointers Virtual Functions and Polymorphism: Pointers to objects, Pointers to derived classes, Virtual functions, pure virtual functions Managing Console I/O Operations C++ Streams, C++ Stream Classes, Unformatted I/O Operations, Managing output with manipulators.

## TEXT/REFERENCE BOOKS


1. S. S. Sastry, "Introductory Methods of Numerical Analysis", PHI, 1990, 3rd edition.
2. V. Rajaraman, "Computer Oriented Numerical Methods, PHI, New Delhi", 2000, 3rd Edition.
3. E. V. Krishnamurthy, and Sen S. K., "Numerical Algorithm: Computations in Science and Engg", Affiliated East West, New Delhi, 1996.
4. D. Ravichandran, "Programming with C++", TMH
5. E. Balagurusamy, "Object-Oriented Programming with C++", TMH, New Delhi, 2001,2nd Edition
6. Yeshwant Kanetkar, "Let us C++, BPB Pub.", Delhi, 2002, 4th Edition.
7. Stroupstrup Bjarne, "C++ Programming Language", Addison Wesley, 1997, 3rd Edition.
8. Horton, "Beginning C++: The Complete Language", Shroff Pub., Navi Mumbai, 1998.

| BTEXC501 | Electromagnetic Field Theory | 3 Credits |
|---|---|---|

**Course Objectives:**

- Learners can be able to explore their knowledge in the area of EM Waves and its analysis.
- To learn basic coordinate system, significance of divergence, gradient, curl and its applications to EM Waves.
- To understand the boundary conditions for different materials /surfaces.
- To get insight on finding solution for non-regular geometrical bodies using Finite Element Method, Method of Moments, Finite Difference Time Domain.
- To get the basics of microwave, transmission lines and antenna parameters.
- Students get acquainted with different physical laws and theorems and provide basic platform for upcoming communication technologies.

**Course Outcomes:**

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

1. Understand characteristics and wave propagation on high frequency transmission lines
2. Carryout impedance transformation on TL
3. Use sections of transmission line sections for realizing circuit elements
4. Characterize uniform plane wave
5. Calculate reflection and transmission of waves at media interface
6. Analyze wave propagation on metallic waveguides in modal form
7. Understand principle of radiation and radiation characteristics of an antenna

**UNIT - 1**

**Maxwell's Equations**

Basics of Vectors, Vector calculus, Basic laws of Electromagnetics, Maxwell's Equations, Boundary conditions at Media Interface

**UNIT - 2**

**Uniform Plane Wave**

Uniform plane wave, Propagation of wave, Wave polarization, Poincare's Sphere, Wave propagation in conducting medium, phase and group velocity, Power flow and Poynting vector, Surface current and power loss in a conductor.

## UNIT - 3

**Transmission Lines**

Equations of Voltage and Current on TX line, Propagation constant and characteristic impedance, and reflection coefficient and VSWR, Impedance Transformation on Loss-less and Low loss Transmission line, Power transfer on TX line, Smith Chart, Admittance Smith Chart, Applications of transmission lines: Impedance Matching, use transmission line sections as circuit elements.

## UNIT - 4

**Plane Waves at a Media Interface**

Plane wave in arbitrary direction, Reflection and refraction at dielectric interface, Total internal reflection, wave polarization at media interface, Reflection from a conducting boundary.

## UNIT - 5

**Wave propagation**

Wave propagation in parallel plane waveguide, Analysis of waveguide general approach, Rectangular waveguide, Modal propagation in rectangular waveguide, Surface currents on the waveguide walls, Field visualization, Attenuation in waveguide

## UNIT - 6

**Radiation**

Solution for potential function, Radiation from the Hertz dipole, Power radiated by hertz dipole, Radiation Parameters of antenna, receiving antenna, Monopole and Dipole antenna

## TEXT/REFERENCE BOOKS

1. R.K. Shevgaonkar, Electromagnetic Waves, Tata McGraw Hill India, 2005
2. E.C. Jordan & K.G. Balmain, Electromagnetic waves & Radiating Systems, Prentice Hall, India
3. Narayana Rao, N: Engineering Electromagnetics, 3rd ed., Prentice Hall, 1997.
4. David Cheng, “Electromagnetics”, Prentice Hall.
5. Sadiku, "Elements of Electromagnetics", Oxford.
6. Krauss, "Electromagnetics", McGraw Hill, New York, 4th edition.
7. W. H. Hayt, "Engineering Electromagnetics", McGraw Hill, New Delhi, 1999.

8. Edminister, Schaum series, "Electromagnetics", McGraw Hill, New York, 1993, 2nd edition.
9. Sarvate, "Electromagnetism", Wiley Eastern.

| BTEXC502 | Control System Engineering | 3 Credits |
|---|---|---|

**Course Objectives:**

- To introduce the elements of control system and their modeling using various Techniques.
- To introduce methods for analyzing the time response, the frequency response and the stability of systems.
- To introduce the concept of root locus, Bode plots, Nyquist plots.
- To introduce the state variable analysis method.
- To introduce concepts of PID controllers and digital and control systems.
- To introduce concepts programmable logic controller.

**Course Outcomes:**

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

1. Understand the modeling of linear-time-invariant systems using transfer function and state-space representations.
2. Understand the concept of stability and its assessment for linear-time invariant systems.
3. Design simple feedback controllers.

**UNIT - 1**

**Introduction to control problem**

Industrial Control examples, Mathematical models of physical systems, Control hardware and their models, Transfer function models of linear time-invariant systems.

Feedback Control: Open-Loop and Closed-loop systems. Benefits of Feedback, Block diagram reduction techniques, Signal flow graph analysis.

**UNIT - 2**

**Time Response Analysis**

Standard test signals, Time response of first and second order systems for standard test inputs. Application of initial and final value theorem, Design specifications for second-order systems based on the time-response.

**UNIT - 3**

**Stability Analysis**

Concept of Stability, Routh-Hurwitz Criteria, Relative Stability analysis, Root-Locus technique. Construction of Root-loci, Dominant Poles, Application of Root Locus Diagram,

**UNIT - 4**

**Frequency-response analysis**

Relationship between time and frequency response, Polar plots, Bode plots. Nyquist stability criterion, Relative stability using Nyquist criterion – gain and phase margin. Closed-loop frequency response

**UNIT - 5**

**Introduction to Controller Design**

Stability, steady-state accuracy, transient accuracy, disturbance rejection, insensitivity and robustness of control systems, Application of Proportional, Integral and Derivative Controllers, Designing of Lag and Lead Compensator using Root Locus and Bode Plot.

**UNIT - 6**

**State variable Analysis**

Concepts of state variables, State space model. Diagonalization of State Matrix, Solution of state equations, Eigenvalues and Stability Analysis, Concept of controllability and observability, Pole-placement by state feedback, Discrete-time systems, Difference Equations, State-space models of linear discrete-time systems. Stability of linear discrete-time systems.

**TEXT/REFERENCE BOOKS**

**1.** N. J. Nagrath and M.Gopal, “Control System Engineering”, New Age International Publishers, 5th Edition, 2009.

**2.** Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.

**3.** M. Gopal, "Control System – Principles and Design", Tata McGraw Hill, 4th Edition, 2012.

**4.** Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.

**5.** John J. D'Azzo& Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.

**6.** Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

| **BTETC503** | **Computer Architecture** | **3 Credits** |
|---|---|---|

**Course Objectives:**

- To introduce basic concepts of computer organization and to illustrate the computer organization concepts by Assembly Language programming.
- To understand operating systems and how they work with the computer and students will understand the relationship between hardware and software specifically how machine organization impacts the efficiency of applications written in a high-level language.
- Students will be able to make use of the binary number system to translate values between the binary and decimal number systems, to perform basic arithmetic operations and to construct machine code instructions and students will be able to design and implement solutions for basic programs using assembly language.
- Students will be able to design logical expressions and corresponding integrated logic circuits for a variety of problems including the basic components of a CPU such as adders, multiplexers, the ALU, a register file, and memory cells and to explain the fetch-execute cycle performed by the CPU and how the various components of the data path are used in this process.

**Course Outcomes:**

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

1. learn how computers work
2. know basic principles of computer's working
3. analyze the performance of computers
4. know how computers are designed and built

5. Understand issues affecting modern processors (caches, pipelines etc.).

**UNIT - 1**

**Basics of Computers**

Basic Structure of Computers, Functional units, software, performance issues software, machine instructions and programs, Types of instructions, Instruction sets: Instruction formats, Assembly language, Stacks, Queues, Subroutines.

**UNIT - 2**

**Processor organization**

Processor organization, Information representation, number formats.

**UNIT - 3**

**ALU design**

Multiplication & division, ALU design, Floating Point arithmetic, IEEE 754 floating point formats Control Design, Instruction sequencing, Interpretation, Hard wired control - Design methods, and CPU control unit.

**UNIT - 4**

**Memory organization**

Memory organization, device characteristics, RAMS, ROM, Memory management, Concept of Cache & associative memories, Virtual memory.

**UNIT - 5**

**System organization**

System organization, Input - Output systems, Interrupt, DMA, Standard I/O interfaces.

**UNIT - 6**

**Parallel processing**

Concept of parallel processing, Pipelining, Forms of parallel processing, interconnect network.

**TEXT/REFERENCE BOOKS**

1. V.Carl Hammacher, “Computer Organisation”, Fifth Edition.
2. A.S.Tanenbum, “Structured Computer Organisation”, PHI, Third edition
3. Y.Chu, "Computer Organization and Microprogramming”, II, Englewood Chiffs, N.J.,

4. Prentice Hall Edition
5. M.M.Mano, "Computer System Architecture", Edition
6. C.W.Gear, "Computer Organization and Programming", McGraw Hill, N.V. Edition
7. Hayes J.P, "Computer Architecture and Organization", PHI, Second edition

| BTEXC504 | Digital Signal Processing | 3 Credits |
|---|---|---|

**Course Objectives:**

- To introduce students with transforms for analysis of discrete time signals and systems.
- To understand the digital signal processing, sampling and aliasing.
- To use and understand implementation of digital filters.
- To understand concept of sampling rate conversion and DSP processor architecture.

**Course Outcomes:**

After successfully completing the course students will be able to

1. Understand use of different transforms and analyze the discrete time signals and systems.
2. Realize the use of LTI filters for filtering different real world signals.
3. Capable of calibrating and resolving different frequencies existing in any signal.
4. Design and implement multistage sampling rate converter.
5. Design of different types of digital filters for various applications.

**UNIT - 1**

**DSP Preliminaries**

Discrete time signals: Sequences; representation of signals on orthogonal basis; Sampling and reconstruction of signals, Basic elements of DSP and its requirements, advantages of Digital over Analog signal processing.

**UNIT - 2**

**Discrete Fourier Transform**

DTFT, Definition, Frequency domain sampling, DFT, Properties of DFT, circular convolution, linear convolution, Computation of linear convolution using circular convolution, FFT, decimation in time and decimation in frequency using Radix-2 FFT algorithm

**UNIT - 3**

**Z transform**

Need for transform, relation between Laplace transform and Z transform, between Fourier transform and Z transform, Properties of ROC and properties of Z transform, Relation between pole locations and time domain behavior, causality and stability considerations for LTI systems, Inverse Z transform, Power series method, partial fraction expansion method, Solution of difference equations.

**UNIT - 4**

**IIR Filter Design**

Concept of analog filter design (required for digital filter design), Design of IIR filters from analog filters, IIR filter design by impulse invariance method, Bilinear transformation method. Characteristics of Butterworth filters, Chebyshev filters, Butterworth filter design, IIR filter realization using direct form, cascade form and parallel form, Lowpass, High pass, Bandpass and Bandstop filters design using spectral transformation (Design of all filters using Lowpass filter)

**UNIT - 5**

**FIR Filter Design**

Ideal filter requirements, Gibbs phenomenon, windowing techniques, characteristics and comparison of different window functions, Design of linear phase FIR filter using windows and frequency sampling method. FIR filters realization using direct form, cascade form and lattice form.

**UNIT - 6**

**Introduction to Multirate signal processing**

Concept of Multirate DSP, Introduction to Up sampler, Down sampler and two channel filter bank, Application of Multirate signal processing in communication, Music processing, Image processing and Radar signal processing.

**TEXT/REFERENCE BOOKS**

1. S.K.Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms

And Applications, Prentice Hall, 1997.

4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J.DeFatta, J. G. Lucas andW.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988

| BTEXC505 | Microcontroller and its Applications | 3 Credits |
|---|---|---|

**Course Objectives:**

- Objective of this course is to introduce to the students the fundamentals of microcontroller.
- After learning Microprocessor course, students will get advantage to pursue higher studies in Embedded Systems or employment in core industries.
- The learner can microcontroller design based systems and thus can become successful entrepreneur and meet needs of Indian and multinational industries.
- The students can design and develop processor which can be used in Robotics, Automobiles, Space and many research areas.
- The learners will acquaint optimization skills and undergo concepts design metrics for embedded systems.
- The students will get acquainted with recent trends in microcontroller like pipelining, cache memory etc.
- To understand the applications of Microcontrollers.
- To understand need of microcontrollers in embedded system.
- To understand architecture and features of typical Microcontroller.
- To learn interfacing of real world input and output devices.
- To study various hardware and software tools for developing applications.

**Course Outcomes:**

1. Learner gains ability to apply knowledge of engineering in designing different case studies.
2. Students get ability to conduct experiments based on interfacing of devices to or interfacing to real world applications.
3. Graduates will be able to design real time controllers using microcontroller based system.

4. Students get ability to interface mechanical system to function in multidisciplinary system like in robotics, Automobiles.
5. Students can identify and formulate control and monitoring systems using microcontrollers.
6. Students will design cost effective real time system to serve engineering solution for Global, social and economic context.
7. Learners get acquainted with modern tools like Programmers, Debuggers, cross compilers and current IDE i.e. integrated development environment tools.
8. Learn importance of microcontroller in designing embedded application.
9. Learn use of hardware and software tools.
10. Develop interfacing to real world devices.

**UNIT - 1**

**Fundamentals of Microcontrollers**

Introduction to the general structure of 8 and 16 bit Microcontrollers Harward & Von Neumann architecture, RISC & CISC processors, Role of microcontroller in embedded system, Selection criteria of microcontroller Block diagram and explanation of 8051, Port structure, memory organization, Interrupt structure, timers and its modes, serial communication modes. Overview of Instruction set, Sample programs (assembly): Delay using Timer and interrupt, Programming Timer 0&1, Data transmission and reception using Serial port.

**UNIT - 2**

**Interfacing with 8051 PART I**

Software and Hardware tools for development of microcontroller-based systems such as assemblers, compliers, IDE, Emulators, debuggers, programmers, development board, DSO, Logic Analyzer, Interfacing LED with and without interrupt, Keypads, Seven Segment multiplexed Display, LCD, ADC Interfacing. All Programs in assembly language and C.

**UNIT - 3**

**Interfacing with 8051 PART II**

8051 timer programming, serial port and its programming, interrupt programming, LCD and keyboard interfacing, ADC and DAC interfacing, interfacing to external memory Interfacing of DAC, Temperature sensors, Stepper motor, Motion detectors, Relay, Buzzer, Opto-isolators. All programs in assembly and C

## UNIT - 4

**PIC Microcontroller Architecture**

PIC 10, PIC12, PIC16, PIC18 series comparison, features and selection as per application PIC18FXX architecture, registers, memory Organization and types, stack, oscillator options, BOD, power down modes and configuration bit settings, timer and its programming, Brief summary of Peripheral support, Overview of instruction set, MPLAB IDE & C18 Compiler

## UNIT - 5

**Real World Interfacing Part I**

Port structure with programming, Interrupt Structure (Legacy and priority mode) of PIC18F with SFRS, Interfacing of switch, LED, LCD (4&8 bits), and Key board, Use of timers with interrupts, CCP modes: Capture, Compare and PWM generation, DC Motor speed control with CCP: All programs in embedded C.

## UNIT - 6

**Real World Interfacing Part II**

Basics of Serial Communication Protocol: Study of RS232, RS 485, I2C, SPI, MSSP structure (SPI &I2C), UART, Sensor interfacing using ADC, RTC (DS1306) with I2C and EEPROM with SPI. Design of PIC test Board, Home protection System: All programs in embedded C.

## TEXT/REFERENCE BOOKS


1. Mazidi & Mazidi, The 8085 microcontroller & embedded system, using assembly and C, 2nd edi, pearson edu.
2. Microprocessor and interfacing 8085, Douglas V Hall, Tata Mc Gram Hill.
3. Microprocessor-Architecture, programming and application with 8085, gaonkar, penram international.
4. Crisp, introduction to microprocessor & microcontrollers, 2e Elsevier, 2007.
5. ARM system-on-chip architecture, 2e pearson education.
6. Calcut, 8051 microcontrollers: Applications based introduction, Elsevier.
7. D V kodavade, S. Narvadkar, 8085-86 microprocessors Architecture progg and interfaces, wiley.
8. Udyashankara V., Mallikarjunaswamy, 8051 microcontroller, TMH.
9. Han-way Huang, using The MCS-51 microcontroller, Oxford university press.

10. Ayala, 8051 microcontroller, cengage (Thomson).
11. Rout 8085 microcontroller-architecture, programming and application, 2nd edi, penram international.

| BTEXPE506A | Probability Theory and Random Processes | 3 Credits |
|---|---|---|

**Course Objectives:**

- To develop basic of probability and random variables.
- The primary objective of this course is to provide mathematical background and sufficient experience so that the student can read, write, and understand sentences in the language of probability theory, as well as solve probabilistic problems in engineering and applied science.

**Course Outcomes:**

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

1. Understand representation of random signals
2. Investigate characteristics of random processes
3. Make use of theorems related to random signals
4. To understand propagation of random signals in LTI systems.

**UNIT - 1**

**Introduction to Probability**

Definitions, scope and history; limitation of classical and relative- frequency- based definitions, Sets, fields, sample space and events; axiomatic definition of probability, Combinatorics: Probability on finite sample spaces, Joint and conditional probabilities, independence, total probability; Bayes' rule and applications.

**UNIT - 2**

**Random variables**

Definition of random variables, continuous and discrete random variables, cumulative distribution function (cdf) for discrete and continuous random variables; probability mass function (pmf); probability density functions (pdf) and properties, Jointly distributed random variables, conditional and joint density and distribution functions, independence; Bayes' rule for continuous and mixed random variables, Function of random a variable, pdf of the function of a random variable; Function of two random variables; Sum of two independent random variables, mean, variance and moments of a random variable,

Joint moments, conditional expectation; covariance and correlation, independent, uncorrelated and orthogonal random variables.

**UNIT - 3**

**Random vector and distributions**

Mean vector, covariance matrix and properties, Some special distributions: Uniform, Gaussian and Rayleigh distributions; Binomial, and Poisson distributions; Multivariate Gaussian distribution, Vector- space representation of random variables, linear indepe ndence, inner product, Schwarz Inequality, Elements of estimation theory: linear minimum mean - square error and orthogonality principle in estimation; Moment - generating and characteristic functions and their applications, Bounds and approximations: Chebysev inequality and Chernoff Bound. .

**UNIT - 4**

**Sequence of random variables and convergence**

Almost sure convergence and strong law of large numbers; convergence in mean square sense with examples from parameter estimation; convergence in probability with examples; convergence in distribution, Central limit theorem and its significance.

**UNIT - 5**

**Random process**

Random process: realizations, sample paths, discrete and continuous time processes, examples, Probabilistic structure of a random process; mean, autocorrelation and auto - covariance functions, Stationarity: strict - sense stationary (SSS) and wide- sense stationary (WSS) processes, Autocorrelation function of a real WSS process and its properties, cross- correlation function, Ergodicity and its importance.

**UNIT - 6**

**Spectral representation of a real WSS process**

Power spectral density, properties of power spectral density, cross- power spectral density and properties; auto- correlation function and power spectral density of a WSS random sequence, Line ar time - invariant system with a WSS process as an input: sationarity of the output, auto -correlation and power - spectral density of the output; examples with white - noise as input; linear shift - invariant discrete- time system with a WSS sequence as

input, Spe ctral factorization theorem, Examples of random processes: white noise process and white noise sequence; Gaussian process; Poisson process, Markov Process.

**TEXT/REFERENCE BOOKS**


1. T. Veerrajan, "Probability, Statistics and Random Processes", Third Edition, McGraw Hill.
2. Probability and Random Processes by Geoffrey Grimmett, David Stirzaker
3. Probability, random processes, and estimation theory for engineers by Henry Stark, John William Woods.
4. H. Stark and J. Woods, ``Probability and Random Processes with Applications to Signal Processing," Third Edition, Pearson Education
5. A. Papoulis and S. Unnikrishnan Pillai, "Probability, Random Variables and Stochastic Processes," Fourth Edition, McGraw Hill.
6. K. L. Chung, Introduction to Probability Theory with Stochastic Processes, Springer International
7. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability, UBS Publishers.
8. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Stochastic Processes, UBS Publishers
9. S. Ross, Introduction to Stochastic Models, Harcourt Asia, Academic Press.


**BTEXPE506C Data Structure & Algorithms Using Java Programming 03 Credits**

**Prerequisites:** Basic knowledge of C language is required.

**Course Objectives:**

- To assess how the choice of data structures and algorithm design methods impacts the performance of programs.
- To choose the appropriate data structure and algorithm design method for a specified application.
- To study the systematic way of solving problems, various methods of organizing large amounts of data.

- To solve problems using data structures such as linear lists, stacks, queues, binary trees, binary search trees, and graphs and writing programs for these solutions.
- To employ the different data structures to find the solutions for specific problems

**Course Outcomes:**

On completion of the course, student will be able to:

1. To impart the basic concepts of data structures and algorithms.
2. To understand concepts about searching and sorting techniques
3. Describe how arrays, records, linked structures are represented in memory and use them in algorithms.
4. To understand basic concepts about stacks, queues, lists trees and graphs.
5. To enable them to write algorithms for solving problems with the help of fundamental data structures.

**UNIT - 1**

**Introduction**

Basic Terminologies: Elementary Data Organizations, Data Structure Operations: insertion, deletion, traversal etc.; Analysis of an Algorithm, Asymptotic Notations, Time-Space trade off. Searching: Linear Search and Binary Search Techniques and their complexity analysis

**UNIT - 2**

**Stacks and Queues**

ADT Stack and its operations: Algorithms and their complexity analysis, Applications of Stacks: Expression Conversion and evaluation – corresponding algorithms and complexity analysis. ADT queue, Types of Queue: Simple Queue, Circular Queue, Priority Queue; Operations on each type of Queues: Algorithms and their analysis.

**UNIT - 3**

**Linked Lists**

Singly linked lists: Representation in memory, Algorithms of several operations: Traversing, Searching, Insertion into, Deletion from linked list; Linked representation of Stack and Queue, Header nodes, doubly linked list: operations on it and algorithmic analysis; Circular Linked Lists: all operations their algorithms and the complexity analysis.

## UNIT - 4

**Trees**

Basic Tree Terminologies, Different types of Trees: Binary Tree, Threaded Binary Tree, Binary Search Tree, AVL Tree; Tree operations on each of the trees and their algorithms with complexity analysis. Applications of Binary Trees, B Tree, B+ Tree: definitions, algorithms and analysis.

## UNIT - 5

**Sorting and Hashing**

Objective and properties of different sorting algorithms: Selection Sort, Bubble Sort, Insertion Sort, Quick Sort, Merge Sort, Heap Sort; Performance and Comparison among all the methods, Hashing.

## UNIT - 6

**Graph**

Basic Terminologies and Representations, Graph search and traversal algorithms and complexity analysis.

## TEXT/REFERENCE BOOKS


1. Algorithms, Data Structures, and Problem Solving with C++", Illustrated Edition by Mark Allen Weiss, Addison-Wesley Publishing Company
2. "How to Solve it by Computer", 2nd Impression by R. G. Dromey, Pearson Education.
3. Ellis Horowitz, Sartaj Sahni, "Fundamentals of Data Structures", Galgotia Books Source. ISBN 10: 0716782928.
4. Richard F. Gilberg & Behrouz A. Forouzan, Data Structures: A Pseudocode Approach with C, Cengage Learning, second edition. ISBN-10: 0534390803.
5. Seymour Lipschutz, Data Structure with C, Schaum's Outlines, Tata Mc Graw Hill. ISBN-10: 1259029964.
6. E Balgurusamy - Programming in ANSI C, Tata McGraw-Hill, Third Edition. ISBN-10: 1259004619.
7. Yedidyah Langsam, Moshe J Augenstein, Aaron M Tenenbaum – Data structures using C and C++ - PHI Publications, Second Edition). ISBN 10: 8120311779

| BTEXPE506D | Introduction to MEMS | 3 Credits |
|---|---|---|

**Course Objectives:**

- 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 students various opportunities in the emerging field of MEMS.
- This will enables student to study applications of micro-sensors and micro-actuators, various MEMS fabrication technologies, MEMS-specific design issues and constraints, Dynamics and modeling of microsystems, getting access to fabrication and testing in academia and industry.

**Course Outcomes:**

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

1. Appreciate the underlying working principles of MEMS and NEMS devices.
2. Design and model MEM devices.

## UNIT - 1

**Introduction to MEMS**

Introduction, History, Concepts of MEMS: Principles, application and design, Scaling Properties/Issues, Micromachining Processes: Substrates, lithography, wet/dry etching processes, deposition processes, film stress, exotic processes. Mechanical Transducers: transduction methods, accelerometers, gyroscopes, pressure sensors, MEMS microphones, mechanical structures, actuators.

## UNIT - 2

**Control and Materials of MEMS**

Controls of MEMS: Analog control of MEMS, Sliding mode control of MEMS, Digital control of MEMS, Materials for MEMS: Substrate and wafers, Active substrate material, silicon, Silicon compound, Silicon pezoresisters, Gallium arsenide, Quartz, piezoelectric crystals, Polymers.

## UNIT - 3

**Review of Basic MEMS fabrication modules**:

MEMS fabrication modules, Oxidation, Deposition Techniques, Lithography (LIGA), and Etching

## UNIT - 4

**Micromachining**

Micromachining, Surface Micromachining, sacrificial layer processes, Stiction; Bulk Micromachining, Isotropic Etching and Anisotropic Etching, Wafer Bonding

## UNIT - 5

**Mechanics of solids in MEMS/NEMS**

Mechanics of solids in MEMS/NEMS: Stresses, Strain, Hookes's law, Poisson effect, Linear Thermal Expansion, Bending, Energy methods.

## UNIT - 6

Overview of Finite Element Method, Modeling of Coupled Electromechanical Systems.

## TEXT/REFERENCE BOOKS

1. G. K. Ananthasuresh, K. J. Vinoy, S. Gopalkrishnan K. N. Bhat, V. K. Aatre, Micro and Smart Systems, Wiley India, 2012.
2. S. E.Lyshevski, Nano-and Micro-Electromechanical systems: Fundamentals of Nano-and Microengineering (Vol. 8). CRC press, (2005).
3. S. D. Senturia, Microsystem Design, Kluwer Academic Publishers, 2001.
4. M. Madou, Fundamentals of Microfabrication, CRC Press, 1997.
5. G. Kovacs, Micromachined Transducers Sourcebook, McGraw-Hill, Boston, 1998.
6. M.H. Bao, Micromechanical Transducers: Pressure sensors, accelerometers, and Gyroscopes, Elsevier, New York, 2000.

| BTETC601 | Antennas and Wave Propagation | 3 Credits |
|---|---|---|

**Course Objectives:**

- To understand the applications of electromagnetic engineering.
- To formulate and solve the Helmholtz wave equation and solve it for Uniform Plane Wave.
- To analyze and understand the Uniform plane wave propagation in various media.
- To solve the electric field and magnetic fields for a given wire antenna.

**Course Outcomes:**

After successfully completing the course students will be able to

1. Formulate the wave equation and solve it for uniform plane wave.
2. Analyze the given wire antenna and its radiation characteristics.
3. Identify the suitable antenna for a given communication system.

**UNIT - 1**

**Uniform Plane Waves**

Maxwell Equations in phasor form, Wave Equation, Uniform Plane wave in Homogeneous, free space, dielectric, conducting medium. Polarization: Linear, circular & Elliptical polarization, unpolarized wave. Reflection of plane waves, Normal incidence, oblique incidence, Electromagnetic Power and Poynting theorem and vector.

**UNIT - 2**

**Wave Propagation**

Fundamental equations for free space propagation, Friis Transmission equation, Attenuation over reflecting surface, Effect of earth's curvature. Ground, sky & space wave propagations. Structure of atmosphere. Characteristics of ionized regions. Effects of earth's magnetic field. Virtual height, MUF, Skip distance. Ionospheric abnormalities. Multi-hop propagation. Space link geometry. Characteristics of Wireless Channel: Fading, Multipath delay spread, Coherence Bandwidth, and Coherence Time.

**UNIT - 3**

**Antenna Fundamentals**

Introduction, Types of Antenna, Radiation Mechanism, Antenna Terminology: Radiation pattern, radiation power density, radiation intensity, directivity, gain, antenna efficiency, half power beam width, bandwidth, antenna polarization, input impedance, antenna radiation

efficiency, effective length, effective area, reciprocity. Radiation Integrals: Vector potentials A, J, F, M, Electric and magnetic fields electric and magnetic current sources, solution of inhomogeneous vector potential wave equation, far field radiation.

**UNIT - 4**

**Wire Antennas**

Analysis of Linear and Loop antennas: Infinitesimal dipole, small dipole, and finite length dipole half wave length dipole, small circular loop antenna. Complete Analytical treatment of all these elements.

**UNIT - 5**

**Antenna Arrays**

Antenna Arrays: Two element array, pattern multiplication N-element linear array, uniform amplitude and spacing, broad side and end-fire array, N-element array: Uniform spacing, nonuniform amplitude, array factor, binomial and Dolph Tchebyshev array. Planar Array, Circular Array, Log Periodic Antenna, Yagi Uda Antenna Array.

**UNIT - 6**

**Antennas and Applications**

Structural details, dimensions, radiation pattern, specifications, features and applications of following Antennas: Hertz & Marconi antennas, V- Antenna, Rhombic antenna. TW antennas. Loop antenna, Whip antenna, Biconical, Helical, Horn, Slot, Microstrip, Turnstile, Super turnstile & Lens antennas. Antennas with parabolic reflectors.

**TEXT/REFERENCE BOOKS**

1. C. A. Balanis, “Antenna Theory - Analysis and Design", John Wiley.
2. Mathew N O Sadiku, “Elements of Electromagnetics” 3rd edition, Oxford University Press.
3. John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, 3rd Edition, the McGraw Hill Companies.
4. K. D. Prasad, “Antenna & Wave Propagation”, Satya Prakashan, New Delhi.
5. John D Kraus, “Antenna& Wave Propagation”, 4th Edition, McGraw Hill, 2010.
6. Vijay K Garg, Wireless Communications and Networking, Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008.

| BTETC602 | Computer Network & Cloud Computing | 3 Credits |
|---|---|---|

**Course Objectives:**

- To develop an understanding of modern network architectures from a design and performance perspective.
- To introduce the student to the major concepts involved in wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs).
- To provide an opportunity to do network programming
- To provide a WLAN measurement ideas.

**Course Outcomes:**

1. To master the terminology and concepts of the OSI reference model and the TCP-IP reference model.
2. To master the concepts of protocols, network interfaces, and design/performance issues in local area networks and wide area networks.
3. To be familiar with wireless networking concepts.
4. To be familiar with contemporary issues in networking technologies.
5. To be familiar with network tools and network programming.
6. For a given requirement (small scale) of wide-area networks (WANs), local area networks (LANs) and Wireless LANs (WLANs) design it based on the market available component.
7. For a given problem related TCP/IP protocol developed the network programming.
8. Configure DNS DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls using open source available software and tools.

## UNIT - 1

**Physical Layer**

Data Communications, Networks, Network types, Protocol layering, OSI model, Layers in OSI model, TCP / IP protocol suite, Addressing, Guided and Unguided Transmission media. Switching: Circuit switched networks, Packet Switching, Structure of a switch.

**UNIT - 2**

**Data Link Layer**

Introduction to Data Link Layer, DLC Services, DLL protocols, HDLC, PPP, Media Access Control: Random Access, Controlled Access, Channelization. Wired LAN: Ethernet Protocol, Standard Ethernet, Fast Ethernet, Giagabit Ethernet, 10 Gigabit Ethernet.

**UNIT - 3**

**Wireless LANS & Virtual Circuit Networks**

Introduction, Wireless LANS: IEEE 802.11 project, Bluetooth, Zigbee, Connecting devices and Virtual LANS: Connecting devices, Virtual LANS.

**UNIT - 4**

**Network Layer**

Switching, Logical addressing – IPV4, IPV6; Address mapping – ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

**UNIT - 5**

**Transport Layer**

Process to Process Communication, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), SCTP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

**UNIT - 6**

**Application Layer**

Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls, Basic concepts of Cryptography

**TEXT/REFERENCE BOOKS**

1. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw-Hill.
2. TCP/IP Protocol Suite, 4th Edition, Behrouz A. Forouzan, Tata McGraw-Hill.
3. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
4. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

5. Internetworking with TCP/IP, Volume 1, 6th Edition Douglas Comer, Prentice Hall of India.
6. TCP/IP Illustrated, Volume 1, W. Richard Stevens, Addison-Wesley, United States of America.

| BTETC603 | Digital Image Processing | 3 Credits |
|---|---|---|

**Course Objectives:**

An ability to use current techniques, skills, and tools necessary for computing practice with an understanding of the limitations

**Course Outcomes:**

After completion of this course students will be able to

1. Review the fundamental concepts of digital image processing system.
2. Analyze images in the frequency domain using various transforms.
3. Categories various compression techniques.
4. Interpret image segmentation and representation techniques.

**UNIT - 1**

**Concept of Visual Information**

Introduction, Digital Image definitions, Common Values, Characteristics of Image Operations, Types of Operations, Types of neighborhoods, Video parameters, Tools, 2D convolution, Properties of 2D convolution, 2D Fourier Transforms, Properties of 2D Fourier Transforms, Importance of phase and magnitude, Circularly Symmetric Signals, Examples of 2D Signals and transforms, Statistical Description of Images

**UNIT - 2**

**Image Perception**

Statistical Description of Images, Perception, Brightness Sensitivity, Wavelength Sensitivity, Stimulus Sensitivity, Spatial Frequency Sensitivity, Psychophysics of Color vision, Perceived color, Color metrics, CIE chromaticity coordinates, Spatial effects in color vision, Optical illusions.

## UNIT - 3

**Image Sampling**

Two dimensional Sampling theory, Extensions of sampling theory, Non rectangular Grid sampling, Hexagonal sampling, Optimal sampling, Image Quantization: The optimum Mean Square Lloyd-Max quantiser, Optimum mean square uniform quantiser for non-uniform densities, Analytic Models for practical quantiers, Visual quantization, Vector Quantization

## UNIT - 4

**Image Transforms**

Two dimensional orthogonal and unitary transforms, Separable unitary transforms, Basis images, Dimensionality of Image Transforms, Discrete linear orthogonal, DFT, WHT, KLT, DCT and SVD, Quantisation of Transform coefficients, Transform Coding of Color images

## UNIT - 5

**Image Enhancement**

Contrast and dynamic Range Modification, Histogram-based operations, Smoothing operations, Edge Detection-derivative based operation, Image Interpolation and Motion Estimation, Pseudo coloring

## UNIT - 6

**Image Restoration**

Image Restoration, Degradation Estimation, Reduction of Additive Noise, Reduction of Image Blurring, Simultaneous reduction of noise and blurring, Reduction of Signal dependent noise, Temporal filtering.

## TEXT/REFERENCE BOOKS

1. Rafael C. Gonzalez and Woods, "Digital Image Processing", Addison Wesley, 1998

2. A. K. Jain, "Digital Image Processing", PHI, New Delhi, 1997

3. Pratt W.K., "Digital Image Processing", 2nd Edition, John Wiley, New York, 2001

4. Edward R. Dougherty, "Random Processes for Image and Signal Processing", PHI-2001

| BTETPE604A | CMOS Design | 3 Credits |
|---|---|---|

**Course Objectives:**

- To develop an understanding of design different CMOS circuits using various logic families along with their circuit layout.
- To introduce the student how to use tools for VLSI IC design.

**Course Outcomes:**

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

1. Design different CMOS circuits using various logic families along with their circuit layout.
2. Use tools for VLSI IC design.

**UNIT - 1**

Review of MOS transistor models, Non-ideal behavior of the MOS Transistor, Transistor as a switch. Inverter characteristics

**UNIT - 2**

Integrated Circuit Layout: Design Rules, Parasitics

**UNIT - 3**

Delay: RC Delay model, linear delay model, logical path efforts

**UNIT - 4**

Power, interconnect and Robustness in CMOS circuit layout

**UNIT - 5**

Combinational Circuit Design: CMOS logic families including static, dynamic and dual rail logic

**UNIT - 6**

Sequential Circuit Design: Static circuits. Design of latches and Flip-flops.

**TEXT/REFERENCE BOOKS**

1. N.H.E. Weste and D.M. Harris, CMOS VLSI design: A Circuits and Systems Perspective, 4th Edition, Pearson Education India, 2011.
2. C. Mead and L. Conway, Introduction to VLSI Systems, Addison Wesley, 1979.

3. J. Rabaey, Digital Integrated Circuits: A Design Perspective, Prentice Hall India, 1997.
4. P. Douglas, VHDL: programming by example, McGraw Hill, 2013.
5. L. Glaser and D. Dobberpuhl, The Design and Analysis of VLSI Circuits, Addison Wesley, 1985.

| BTETPE604B | Information Theory and Coding | 3 Credits |
|---|---|---|

**Course Objectives:**

- To provide in-depth understanding of principles and applications of information theory.
- To provide in-depth understanding of how information is measured in terms of probability and entropy and how these are used to calculate the capacity of a communication channel.
- To provide in-depth understanding of different coding techniques for error detection and correction.

**Course Outcomes:**

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

1. Understand the concept of information and entropy
2. Understand Shannon's theorem for coding
3. Calculation of channel capacity
4. Apply coding techniques

**UNIT - 1**

**Theory of Probability and Random Processes**

Concept of probability, random variables, random process, power spectral density of a random process, probability models, statistical averages, central limit theorem, correlation, linear mean square estimation

**UNIT - 2**

**Noise in Communication Systems**

Behavior of analog and digital communication systems in the presence of noise, Sources of noise, Noise representation, Noise filtering, Noise bandwidth, Performance of analog and digital communication systems in the presence of noise.

## UNIT - 3

**Information Theory**

Measure of information, Joint entropy and conditional entropy, Relative entropy and mutual information, Markov sources, Source encoding, Shannon-Fano coding and Huffman coding, Shannon's first and second fundamental theorems, Channel capacity theorem.

## UNIT - 4

**Error Correcting Codes**

Galois fields, Vector spaces and matrices, Block codes, Cyclic codes, Burst-error detecting and correcting codes, Multiple error correcting codes, Convolutional codes, ARQ

## UNIT - 5

**Markov sources**

Shannon's noisy coding theorem and converse for discrete channels; Calculation of channel capacity and bounds for discrete channels; Application to continuous channels

## UNIT - 6

**Speech Coding**

Characteristics of speech signal, Quantization techniques, Frequency domain coding, Vocoders, Linear predictive coders, Codecs for mobile communication, GSM codec, USDC codec, Performance evaluation of speech coders.

## TEXT/REFERENCE BOOKS


1. B. P. Lathi; Modern Digital and Analog Communication Systems; Oxford Publication.
2. Das, Mullick, Chaterjee; Principles of Digital Communication; New Age International.
3. Taub, Schilling, Principles of Communication Engineering ($2^{nd}$ Edition), TMH.
4. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, Wiley Inter science.
5. R.P.Singh, S.D. Sapre; Communication systems: Analog and Digital; TMH.
6. Theodore S. Rappaport; Wireless Communication: Principles and Practice ($2^{nd}$ Edition), Pearson India.
7. N. Abramson, Information and Coding, McGraw Hill, 1963.
8. M. Mansurpur, Introduction to Information Theory, McGraw Hill, 1987.

| BTETPE604C | Power Electronics | 3 Credits |
|---|---|---|

**Course Objectives:**

- To introduce students to different power devices to study their construction, characteristics and turning on circuits.
- To give an exposure to students of working & analysis of controlled rectifiers for different loads, inverters, DC choppers, AC voltage controllers and resonant converters.
- To study the different motor drives, various power electronics applications like UPS, SMPS, etc. and some protection circuits.

**Course Outcomes:**

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

1. Build and test circuits using power devices such as SCR
2. Analyze and design controlled rectifier, DC to DC converters, DC to AC inverters,
3. Learn how to analyze these inverters and some basic applications.
4. Design SMPS.

## UNIT - 1

**Characteristics of Semiconductor Power Devices**

Thyristor, power MOSFET and IGBT- Treatment should consist of structure, Characteristics, operation, ratings, protections and thermal considerations. Brief introduction to power devices viz. TRIAC, MOS controlled thyristor (MCT), Power Integrated Circuit (PIC) (Smart Power), Triggering/Driver, commutation and snubber circuits for thyristor, power MOSFETs and IGBTs (discrete and IC based).Concept of fast recovery and schottky diodes as freewheeling and feedback diode.

## UNIT - 2

**Controlled Rectifiers**

Single phase: Study of semi and full bridge converters for R, RL, RLE and level loads. Analysis of load voltage and input current- Derivations of load form factor and ripple factor, Effect of source impedance, Input current Fourier series analysis of input current to derive input supply power factor, displacement factor and harmonic factor.

**UNIT - 3**

**Choppers**

Quadrant operations of Type A, Type B, Type C, Type D and type E choppers, Control techniques for choppers – TRC and CLC, Detailed analysis of Type A chopper. Step up chopper. Multiphase Chopper.

**UNIT - 4**

**Single-phase inverters**

Principle of operation of full bridge square wave, quasi-square wave, PWM inverters and comparison of their performance. Driver circuits for above inverters and mathematical analysis of output (Fourier series) voltage and harmonic control at output of inverter (Fourier analysis of output voltage). Filters at the output of inverters, Single phase current source inverter.

**UNIT - 5**

**Switching Power Supplies**

Analysis of fly back, forward converters for SMPS, Resonant converters - need, concept of soft switching, switching trajectory and SOAR, Load resonant converter - series loaded half bridge DC-DC converter.

**UNIT - 6**

**Applications**

Power line disturbances, EMI/EMC, power conditioners. Block diagram and configuration of UPS, salient features of UPS, selection of battery and charger ratings, sizing of UPS, Separately excited DC motor drive. P M Stepper motor Drive

**TEXT/REFERENCE BOOKS**

1. Muhammad H. Rashid, “Power electronics” Prentice Hall of India.
2. Ned Mohan, Robbins, “Power electronics”, edition III, John Wiley and sons.
3. P.C. Sen., “Modern Power Electronics”, edition II, Chand& Co.
4. V. R. Moorthi, “Power Electronics”, Oxford University Press.
5. Cyril W., Lander,” Power Electronics”, edition III, McGraw Hill.
6. G K Dubey, S R Doradla,: Thyristorised Power Controllers”, New Age International Publishers. SCR manual from GE, USA.

| BTETPE604D | Nano Electronics | 3 Credits |
|---|---|---|

**Course Objectives:**

- To convey the basic concepts of Nano electronics to engineering students with no background in quantum mechanics and statistical mechanics.
- Main objective of this is to provide the basic platform and deep information of different Nano electronics devices like MOSFET, FINFET, Nano metrology tools used to design the recently developing VLSI applications.
- This subject gives idea about the role and importance of the Nano electronic devices system in engineering world to develop the research ideas in VLSI.
- Recent technology proceeds with MOSFET with 64nm technology, the need Nano electronic Devices and Material subject to achieve transistor size which is less than current technology.
- The content of this course gives platform to the Nano electronics world and innovative ideas to ensure the knowledge of real time applications which helps students to stand them in Indian and multinational industries.

**Course Outcomes:**

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

1. Understand various aspects of nano-technology and the processes involved in making nano components and material.
2. Leverage advantages of the nano-materials and appropriate use in solving practical problems.
3. Understand various aspects of nano-technology and the processes involved in making nano components and material.
4. Leverage advantages of the nano-materials and appropriate use in solving practical problems.

## UNIT - 1

**Overview Nano Technology**

Introduction to nanotechnology, Nano devices, Nano materials, Nano characterization, Definition of Technology node, Basic CMOS Process flow, meso structures.

**UNIT - 2**

**Basics of Quantum Mechanics**

Schrodinger equation, Density of States, Particle in a box Concepts, Degeneracy, Band Theory of Solids, Kronig-Penny Model. Brillouin Zones

**UNIT - 3**

**MOS Scaling theory**

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

**UNIT - 4**

**Nano electronics Semiconductor devices**

Resonant Tunneling Diode, Coulomb dots, Quantum blockade, Single electron transistors, Carbon nanotube electronics, Band structure and transport, devices, applications, 2D semiconductors and electronic devices, Graphene, atomistic simulation

**UNIT - 5**

**Properties of Nano devices**

Vertical transistors, Fin FET and Surround gate FET. Metal source/drain junctions – Properties of schottky functions on Silicon, Germanium and compound semiconductors - Work function pinning.

**UNIT - 6**

**Characterization techniques for Nano materials**

FTIR, XRD, AFM, SEM, TEM, EDAX Applications and interpretation of results, Emerging nano material, nano tubes, Nano rods and other Nano structures, LB technique, Soft lithography Microwave assisted synthesis, Self-assembly.

**TEXT/REFERENCE BOOKS**

1. G.W. Hanson, Fundamentals of Nanoelectronics, Pearson, 2009.
2. W. Ranier, Nanoelectronics and Information Technology (Advanced Electronic Material and Novel Devices), Wiley-VCH, 2003.
3. K.E. Drexler, Nanosystems, Wiley, 1992.
4. J.H. Davies, The Physics of Low-Dimensional Semiconductors, Cambridge University Press, 1998.

5. C.P. Poole, F. J. Owens, Introduction to Nanotechnology, Wiley, 2003.

| BTETPE604F | Android Programming | 3 Credits |
|---|---|---|

**Course Objectives:**

Android Application Development course is designed to quickly get you up to speed with writing apps for Android devices. The student will learn the basics of Android platform and get to understand the application lifecycle

**Course Outcomes:**

At the end of the course, students will demonstrate the ability to write simple GUI applications, use built-in widgets and components, work with the database to store data locally, and much more.

**UNIT - 1**

**Introduction to Mobile Operating Systems and Mobile Application Development**

**Introduction to Mobile OS:**

Palm OS, Windows CE, Embedded Linux, J2ME (Introduction), Symbian (Introduction),

Overview of Android: Devices running android, Why Develop for Android, Features of android, Architecture of Android, Libraries

How to setup Android Development Environment: Android development Framework - Android-SDK, Eclipse, Emulators – What is an Emulator / Android AVD? , Creating & setting up custom Android emulator, Android Project Framework, My first android application.

**UNIT - 2**

**Android Activities, UI Design and Database**

Understanding Intent, Activity, Activity Lifecycle and Manifest, Form widgets, Text Fields, Layouts: Relative Layout ,Table Layout, Frame Layout, Linear Layout, Nested layouts.

UI design: Time and Date, Images and media, Composite, Alert Dialogs & Toast, Popup.

Menu: Option menu, Context menu, Sub menu.

Database: Introducing SQLite, SQLite Open Helper, SQLite Database, Cursor,

Content providers: defining and using content providers, example- Sharing database among two different applications using content providers, Reading and updating Contacts, Reading bookmarks.

**UNIT - 3**

**Preferences, Intents and Notifications**

Preferences: Shared Preferences, Preferences from xml, Intents:Explicit Intents, Implicit intents. Notifications: Broadcast Receivers, Services (Working in background) and notifications, Alarms.

**UNIT - 4**

**Telephony, SMS and Location Based Services**

Telephony: Accessing phone and Network Properties and Status, Monitoring Changes in Phone State, Phone Activity and data Connection.

SMS: Sending SMS and MMS from your Application, sending SMS Manually, Listening for incoming SMS

Location based Services: Using Location Based Services, Working with Google Maps, Geocoder.

**UNIT - 5**

**Accessing Android Hardware**

Networking: An overview of networking, checking the network status, communicating with a server socket, Working with HTTP, Web Services.

Bluetooth: Controlling local Bluetooth device, Discovering and bonding with Bluetooth devices, Managing Bluetooth connections, communicating with Bluetooth

**UNIT - 6**

**Audio Video Handling**

Playing Audio and Video, Recording Audio and Video, Using Camera and Taking Picture

**TEXT/REFERENCE BOOKS**

1. Reto Meier “Professional Android™ Application Development”, Wrox Publications.
2. Lauren Dercy and Shande Conder “Sams teach yourself Android application development” , Sams publishing
3. Hello Android, Introducing Google’s Mobile Development Platform, Ed Burnette, Pragmatic Programmers, ISBN: 978-1-93435-617-3

| BTETOE605A | Digital System Design | 3 Credits |
|---|---|---|

**Course Objectives:**

- The concept and theory of digital Electronics are needed in almost all electronics and telecommunication engineering fields and in many other engineering and scientific disciplines as well.
- The main objective of this course is to lay the foundation for further studies in areas such as communication, VLSI, computer, microprocessor etc. One of the most important reasons for the unprecedented growth of digital electronics is the advent of integrated circuit.
- This course will explore the basic concepts of digital electronics.

**Course outcomes:**

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

1. Design and analyze combinational logic circuits
2. Design & analyze modular combinational circuits with MUX/DEMUX, Decoder, Encoder
3. Design & analyze synchronous sequential logic circuits
4. Use HDL & appropriate EDA tools for digital logic design and simulation.

**UNIT - 1**

**Logic Simplification and Combinational Logic Design**

Review of Boolean algebra and De Morgan's Theorem, SOP & POS forms, Canonical forms, Karnaugh maps up to 6 variables, Binary codes, Code Conversion.

**UNIT - 2**

**MSI devices**

Comparators, Multiplexers, Encoder, Decoder, Driver & Multiplexed Display, Half and Full Adders, Subtractors, Serial and Parallel Adders, BCD Adder, Barrel shifter and ALU

**UNIT - 3**

**Sequential Logic Design**

Building blocks like S-R, JK and Master-Slave JK FF, Edge triggered FF, Ripple and Synchronous counters, Shift registers, Finite state machines, Design of synchronous FSM, Algorithmic State Machines charts. Designing synchronous circuits like Pulse train generator, Pseudo Random Binary Sequence generator, Clock generation

**UNIT - 4**

**Logic Families and Semiconductor Memories**

TTL NAND gate, Specifications, Noise margin, Propagation delay, fan-in, fan-out, Tristate TTL, ECL, CMOS families and their interfacing.

**UNIT - 5**

**Memory Elements**

Concept of Programmable logic devices like FPGA, Logic implementation using Programmable Devices

**UNIT - 6**

**VLSI Design flow**

Design entry: Schematic, FSM & HDL, different modeling styles in VHDL, Data types and objects, Dataflow, Behavioral and Structural Modeling, Synthesis and Simulation VHDL constructs and codes for combinational and sequential circuits.

**TEXT/REFERENCE BOOKS**

1. R.P. Jain, "Modern digital Electronics", Tata McGraw Hill, 4th edition, 2009.
2. Douglas Perry, "VHDL", Tata McGraw Hill, 4th edition, 2002.
3. W.H. Gothmann, "Digital Electronics- An introduction to theory and practice", PHI, 2nd edition, 2006.
4. D.V. Hall, " Digital Circuits and Systems" , Tata McGraw Hill, 1989
5. Charles Roth, "Digital System Design using VHDL", Tata McGraw Hill 2nd edition 2012.

| BTETOE605B | Optimization Techniques | 3 Credits |
|---|---|---|

**Course Objectives:**

- Introduction to optimization techniques using both linear and non-linear programming
- The focus of the course is on convex optimization though some techniques will be covered for non-convex function optimization.

**Course Outcomes:**

1. After completion of this course students will be able to

2. Cast engineering minima/maxima problems into optimization framework
3. Learn efficient computational procedures to solve optimization problems

**UNIT - 1**

**Introduction and Basic Concepts**

Historical Development; Engineering applications of Optimization; Art of Modeling, Objective function; Constraints and Constraint surface; Formulation of design problems as mathematical programming problems, Classification of optimization problems, Optimization techniques – classical and advanced techniques

**UNIT - 2**

**Optimization using Calculus**

Stationary points; Functions of single and two variables; Global Optimum, Convexity and concavity of functions of one and two variables, Optimization of function of one variable and multiple variables; Gradient vectors; Examples, Optimization of function of multiple variables subject to equality constraints; Lagrangian function, Optimization of function of multiple variables subject to equality constraints; Hessian matrix formulation; Eigen values, Kuhn-Tucker Conditions; Examples

**UNIT - 3**

**Linear Programming**

Standard form of linear programming (LP) problem; Canonical form of LP problem; Assumptions in LP Models; Elementary operations, Graphical method for two variable optimization problem; Examples, Motivation of simplex method, Simplex algorithm and construction of simplex tableau; Simplex criterion; Minimization versus maximization problems, Revised simplex method; Duality in LP; Primal-dual relations; Dual Simplex method; Sensitivity or post optimality analysis, Other algorithms for solving LP problems – Karmarkar's projective scaling method

**UNIT - 4**

**Dynamic Programming**

Sequential optimization; Representation of multistage decision process; Types of multistage decision problems; Concept of sub optimization and the principle of optimality, Recursive equations – Forward and backward recursions; Computational procedure in dynamic

programming (DP), Discrete versus continuous dynamic programming; Multiple state variables; curse of dimensionality in DP

**UNIT - 5**

**Integer Programming**

Integer linear programming; Concept of cutting plane method, Mixed integer programming; Solution algorithms; Examples

**UNIT - 6**

**Advanced Topics in Optimization**

Piecewise linear approximation of a nonlinear function, Multi objective optimization – Weighted and constrained methods; Multi level optimization, Direct and indirect search methods, Evolutionary algorithms for optimization and search

**TEXT/REFERENCE BOOKS**

1. S.S. Rao, "Engineering Optimization: Theory and Practice", New Age International, New Delhi, 2000.
2. G. Hadley, "Linear programming", Narosa Publishing House, New Delhi, 1990.
3. H.A. Taha, "Operations Research: An Introduction", 5th Edition, Macmillan, New York, 1992.
4. K. Deb, "Optimization for Engineering Design-Algorithms and Examples", Prentice-Hall of India Pvt. Ltd., New Delhi, 1995.
5. K. Srinivasa Raju and D. Nagesh Kumar, "Multicriterion Analysis in Engineering and Management", PHI Learning Pvt. Ltd., New Delhi, India, ISBN 978-81-203-3976-7, pp.288, 2010.

| BTETOE605C | Project Management and Operation Research | 3 credits |
|---|---|---|

**Course Objectives:**

- To help students understand Evolution of Management Thought, Concepts, basic functions and recent trends managerial concepts and practices for better business decisions.
- To introduce students to framework that are useful for diagnosing problems involving human behavior.
- To enable the students apply mathematical, computational and communication skills needed for the practical utility of Operations Research.

- To teach students about networking, inventory, queuing, decision and replacement models.
- To introduce students to research methods and current trends in Operations Research.

**Course Outcomes:**

Student will be able to

1. Apply operations research techniques like L.P.P, scheduling and sequencing in industrial optimization problems.

2. Solve transportation problems using various OR methods.

3. Illustrate the use of OR tools in a wide range of applications in industries.

4. Analyze various OR models like Inventory, Queing, Replacement, Simulation, Decision etc and apply them for optimization.

5. Gain knowledge on current topics and advanced techniques of Operations Research for industrial solutions.

**UNIT - 1**

Definition, need and importance of organizational behaviour , nature and scope , frame work , organizational behaviour models.

**UNIT - 2**

Organization structure , formation , groups in organizations , influence , group dynamics , emergence of informal leaders and working norms , group decision making techniques , interpersonal relations , communication , control.

**UNIT - 3**

Evolution of Management thoughts, Contribution of Selected Management Thinkers, Various approaches to management, contemporary management practice, Managing in global environment, Managerial functions.

**UNIT - 4**

Importance of planning , Types of planning , decision making process , Approaches to decision making , Decision models , Pay off Matrices , Decision trees , Break Even Analysis.

**UNIT - 5**

Departmentation, Span of Control, Delegation, Centralisation and Decentralisation, Commitees, Line and Staff relationships , Recent trends in organization structures.

**UNIT - 6**

Process of Recruitment, Selection, Induction Training, Motivation, Leading, Leadership styles and qualities, Communication, process and barriers. Managements control systems, techniques, Types of control.

**TEXT/REFERENCE BOOKS**

1. Bateman Snell, Management: Competing in the new era, McGraw,Hill Irwin, 2002.

2. Chandan J.S., Management Concepts and Strategies, Vikas Publishing House, 2002.

3. Hellriegel, Jackson and Slocum, Management: A Competency,Based Approach, South Western, 9th edition, 2002.

4. Koontz, Essentials of Management, Tata McGraw,Hill, 5th Edition, 2001.

5. Stephen P. Robbins and David A. Decenzo, Fundamentals of Management, Pearson Education, Third Edition, 2001.

6. Tim Hannagan, Management Concepts and Practices, Macmillan India Ltd., 1997.

| BTETOE605D | Augmented, Virtual and Mixed Reality | 3 Credits |
|---|---|---|

**Course Objectives:**

An ability to use current techniques, skills, and tools necessary for computing practice with an understanding of the limitations

**Course Outcomes:**

After completion of this course students will be able to

1. To develop 3D virtual environments.
2. To develop 3D interaction techniques and immersive virtual reality applications.

**UNIT - 1**

**Introduction & Geometry of Virtual Worlds**

Course mechanics, Goals and VR definitions, Historical perspective, Birds-eye view

Geometric modeling, Transforming models, Matrix algebra and 2D rotations, 3D rotations and yaw, pitch, and roll, 3D rotations and yaw, pitch, and roll, Axis-angle representations, Quaternions, Converting and multiplying rotations, Homogeneous transforms, The chain of viewing transforms, Eye transforms, Canonical view transform, Viewport transform

**UNIT - 2**

**Light and Optics**

Three interpretations of light, Refraction, Simple lenses, Diopters, Imaging properties of lenses, Lens aberrations, Optical system of eyes

**UNIT - 3**

**Visual Physiology & Visual Perception**

Photoreceptors, Sufficient resolution for VR, light intensity, Eye movements, Eye movements, Eye movement issues for VR, Neuroscience of vision, Depth perception, Depth perception, Motion perception, Frame rates and displays, Frame rates and displays

**UNIT - 4**

**Tracking Systems & Visual Rendering**

Overview, Orientation tracking, Tilt drift correction, Yaw drift correction, Tracking with a camera, Perspective n-point problem, Filtering, Lighthouse approach,Visual Rendering-overview, Shading models, Rasterization, Pixel shading, VR-specific problems, Distortion shading, Post-rendering image warp

**UNIT - 5**

**Audio & Interfaces**

Physics and physiology, auditory perception, Auditory localization, Rendering , Spatialization and display, combining other senses, Interfaces, Locomotion, Manipulation, System control, Social interaction, Evaluation of VR Systems.

**UNIT - 6**

**Augmented Reality**

System Structure of Augmented Reality; Key Technology in AR; General solution for calculating geometric & illumination consistency in the augmented environment

**TEXT/REFERENCE BOOKS**

1. http://msl.cs.uiuc.edu/vr/

2. George Mather, Foundations of Sensation and Perception:Psychology Press; 2 edition, 2009.

3. Peter Shirley, MichaelAshikhmin, and Steve Marschner, Fundamentals of Computer Graphics, A K Peters/CRC Press; 3 edition, 2009.

| BTETOE605E | Python Programming | 3 Credits |
|---|---|---|

**Course Objective:**

- Provide an understanding of the role computation can play in solving problems.
- Help students, including those who do not plan to major in Computer Science and Electrical Engineering, feel confident of their ability to write small programs that allow them to accomplish useful goals.
- Position students so that they can compete for research projects and excel in subjects with programming components.

**Course Outcomes:**

1. Experience with an interpreted Language.
2. To build software for real needs
3. Prior Introduction to testing software

**UNIT - 1**

**Introduction:** History of Python, Need of Python Programming, Applications Basics of Python Programming Using the REPL(Shell), Running Python Scripts, Variables, Assignment, Keywords, Input-Output, Indentation

**UNIT - 2**

**Types, Operators and Expressions: Types** – Integers, Strings, Booleans; Operators- Arithmetic Operators, Comparison (Relational) Operators, Assignment Operators, Logical Operators, Bitwise Operators, Membership Operators, Identity Operators, Expressions and order of evaluations Control Flow- if, if-elif-else, for, while break, continue, pass

**UNIT - 3**

**Data Structures Lists –** Operations, Slicing, Methods; Tuples, Sets, Dictionaries, Sequences, Comprehensions

**UNIT - 4**

**Default Arguments**, Variable-length arguments, Anonymous Functions, Fruitful Functions (Function Returning Values), Scope of the Variables in a Function- Global and Local Variables. Modules: Creating modules, import statement, from. Import statement, name spacing, Python packages, Introduction to PIP, Installing Packages via PIP, Using Python Packages

**UNIT - 5**

**Object-Oriented Programming OOP in Python:** Classes, 'self-variable', Methods, Constructor Method, Inheritance, Overriding Methods, Data hiding, Error, and Exceptions: Difference between an error and Exception, Handling Exception, try except for block, Raising Exceptions, User Defined Exceptions

**UNIT - 6**

**Brief Tour of the Standard Library** – Operating System Interface – String Pattern Matching, Mathematics, Internet Access, Dates and Times, Data Compression, Multithreading, GUI Programming, Turtle Graphics Testing: Why testing is required ?, Basic concepts of testing, Unit testing in Python, Writing Test cases, Running Tests.

**TEXT/REFERENCE BOOKS**


1. Python Programming: A Modern Approach, Vamsi Kurama, Pearson
2. Learning Python, Mark Lutz, Orielly
3. Think Python, Allen Downey, Green Tea Press
4. Core Python Programming, W.Chun, Pearson
5. Introduction to Python, Kenneth A. Lambert, Cengage


| **BTETOE605F** | **Web Development and Design** | **3 Credits** |
|---|---|---|

**Course Objectives:**

- Define the principle of Web page design
- Define the basics in web design
- Visualize the basic concept of HTML.
- Recognize the elements of HTML.
- Introduce basics concept of CSS.

- Develop the concept of web publishing

**Course Outcomes:**

On completion of the course, student will be able to:

1. Develop the skill & knowledge of Web page design
2. Understand the knowhow and can function either as an entrepreneur or can take up jobs in the multimedia and Web site development studio and other information technology sectors.

**UNIT - 1**

Web Design Principles , Basic principles involved in developing a web site , Planning process , Five Golden rules of web designing , Designing navigation bar , Page design, Layout of pages , Design Concept

**UNIT - 2**

Basics in Web Design , Brief History of Internet , What is World Wide Web , Why create a web site , Web Standards , Audience requirement

**UNIT - 3**

Introduction to HTML, HTML Documents, Basic structure of an HTML document, Creating an HTML document, Mark up Tags, Heading, Paragraphs, Line Breaks, HTML Tags

**UNIT - 4**

Elements of HTML, Working with Text, Lists, Tables and Frames, Hyperlinks, Images and Multimedia Working with Forms and controls

**UNIT - 5**

Introduction to Cascading Style Sheets, CSS Properties, CSS Styling (Background, Text Format, Controlling Fonts), Working with block elements and objects, Working with Lists and Tables, CSS Id and Class, Box Model (Introduction, Border properties, Padding Properties, Margin properties) , CSS Advanced (Grouping, Dimension, Display, Positioning, Floating, Align, Pseudo class, Navigation Bar, Image Sprites, Attribute sector) , CSS Color , Creating page Layout and Site Designs

**UNIT - 6**

Introduction to Web Publishing or Hosting , Creating the Web Site ,Saving the site, Working

on the web site, Creating web site structure, Creating Titles for web pages, Themes, Publishing web sites

**TEXT/REFERENCE BOOKS**


1. J. N. Robbins, Learning Web Design, O'Reilly Media, 4th Edition, 2012
2. Steven M. Schafer, HTML, XHTML, and CSS Bible, Wiley India, 5th Edition, 2010
3. John Duckett, Beginning HTML, XHTML, CSS, and JavaScript, Wiley India, 3rd Edition, 2009
4. Hal Stern, David Damstra, Brad Williams, Professional WordPress: Design and Development, Wrox Publication, 3rd Edition, 2015
5. E. Robson, E. Freeman, Head First HTML & CSS, O'Reilly Media, nd Edition, 2012.


| BTHM606 | Employability & Skill Development | 2 Credits |
|---|---|---|

**Course Objectives:**

- To develop analytical abilities.
- To develop communication skills.
- To introduce the students to skills necessary for getting, keeping and being successful in a profession.
- To expose the students to leadership and team-building skills.

**Course Outcomes:**

On completion of the course, student will be able to:

1. Have skills and preparedness for aptitude tests.
2. Be equipped with essential communication skills (writing, verbal and non-verbal)
3. Master the presentation skill and be ready for facing interviews.
4. Build team and lead it for problem solving.

**UNIT - 1**

**Soft Skills & Communication basics**

Soft skills Vs hard skills, Skills to master, Interdisciplinary relevance, Global and national perspectives on soft skills, Resume, Curriculum vitae, How to develop an impressive resume, Different formats of resume – Chronological, Functional, Hybrid, Job application or cover letter, Professional presentation- planning, preparing and delivering presentation, Technical writing.

**UNIT - 2**

**Arithmetic and Mathematical Reasoning**

Aspects of intelligence, Bloom taxonomy, multiple intelligence theory, Number sequence test, mental arithmetic (square and square root, LCM and HCF, speed calculation, reminder theorem).

**UNIT - 3**

**Analytical Reasoning and Quantitative Ability**

Matching, Selection, Arrangement, Verifications (Exercises on each of these types). Verbal aptitude (Synonym, Antonym, Analogy)

**UNIT - 4**

**Grammar and Comprehension**

English sentences and phrases, Analysis of complex sentences, Transformation of sentences, Paragraph writing, Story writing, Reproduction of a story, Letter writing, précis writing, Paraphrasing and e-mail writing

**UNIT - 5**

**Skills for interviews**

Interviews- types of interviews, preparatory steps for job interviews, interview skill tips, Group discussion- importance of group discussion, types of group discussion, difference between group discussion, panel discussion and debate, personality traits evaluated in group discussions, tips for successful participation in group discussion, Listening skills- virtues of listening, fundamentals of good listening, Non-verbal communication-body movement, physical appearance, verbal sounds, closeness, time

**UNIT - 6**

**Problem Solving Techniques**

Problem solving model: 1. Define the problem, 2. Gather information, 3. Identify various solution, 4. Evaluate alternatives, 5. Take actions, 6. Evaluate the actions.

Problem solving skills: 1. Communicate. 2. Brain storming, 3. Learn from mistakes.

**TEXT/REFERENCE BOOKS**

1. R. Gajendra Singh Chauhan, Sangeeta Sharma, “Soft Skills- An integrated approach to maximize personality”, ISBN: 987-81-265-5639-7, First Edition 2016, WileyWren and Martin, "English grammar and Composition", S. Chand publications.

2. R. S. Aggarwal, "A modern approach to verbal reasoning", S. Chand publications.
3. Philip Carter, "The Complete Book of Intelligence Test", John Willey & Sons Ltd.
4. Philip Carter, Ken Russell, "Succeed at IQ test", Kogan Page.
5. Eugene Ehrlich, Daniel Murphy, "Schaum's Outline of English Grammar", McGraw Hills.
6. David F. Beer, David A. Mc Murrey, "A Guide to Writing as an Engineer", ISBN: 978-1-118-30027-5 4th Edition, 2014, Wiley.

| BTETC701 | Digital Communication | 3 Credits |
|---|---|---|

**Course Objectives:**

- To understand the building blocks of digital communication system.
- To prepare mathematical background for communication signal analysis.
- To understand and analyze the signal flow in a digital communication system.
- To analyze error performance of a digital communication system in presence of noise and other interferences.
- To understand concept of spread spectrum communication system.

**Course Outcomes:**

1. Analyze the performance of a baseband and pass band digital communication system in terms of error rate and spectral efficiency.
2. Perform the time and frequency domain analysis of the signals in a digital communication system.
3. Select the blocks in a design of digital communication system.
4. Analyze Performance of spread spectrum communication system.

**UNIT - 1**

**Digital Transmission of Analog Signal**

Introduction to Digital Communication System: Why Digital?, Block Diagram and transformations, Basic Digital Communication Nomenclature. Digital Versus Analog Performance Criteria, Sampling Process, PCM Generation and Reconstruction, Quantization Noise, Non-uniform Quantization and Companding, PCM with noise: Decoding noise, Error

threshold, Delta Modulation, Adaptive Delta Modulation, Delta Sigma Modulation, Differential Pulse Code Modulation, LPC speech synthesis.

**UNIT - 2**

**Baseband Digital Transmission**

Digital Multiplexing: Multiplexers and hierarchies, Data Multiplexers. Data formats and their spectra, synchronization: Bit Synchronization, Scramblers, Frame Synchronization. Inter-symbol interference, Equalization.

**UNIT - 3**

**Random Processes**

Introduction, Mathematical definition of a random process, Stationary processes, Mean, Correlation & Covariance function, Ergodic processes, Transmission of a random process through a LTI filter, Power spectral density, Gaussian process, noise, Narrow band noise, Representation of narrowband noise in terms of in phase & quadrature components.

**UNIT - 4**

**Baseband Receivers**

Detection Theory: MAP, LRT, Minimum Error Test, Error Probability, Signal space representation: Geometric representation of signal, Conversion of continuous AWGN channel to vector channel, Likelihood functions, Coherent Detection of binary signals in presence of noise, Optimum Filter, Matched Filter, Probability of Error of Matched Filter, Correlation receiver.

**UNIT - 5**

**Passband Digital Transmission**

Pass band transmission model, Signal space diagram, Generation and detection, Error Probability derivation and Power spectra of coherent BPSK, BFSK and QPSK. Geometric representation, Generation and detection of - M-ary PSK, M-ary QAM and their error probability, Generation and detection of -Minimum Shift Keying, Gaussian MSK, Non-coherent BFSK, DPSK and DE PSK ,Introduction to OFDM.

## UNIT - 6

**Spread Spectrum Techniques**

Introduction, Pseudo noise sequences, A notion of spread spectrum, Direct sequence spread spectrum with coherent BPSK, Signal space dimensionality & processing gain, Probability of error, Concept of jamming, Frequency hop spread spectrum, Wireless Telephone Systems, Personal Communication System.

## TEXT/REFERENCE BOOKS


1. Simon Haykin, "Digital Communication Systems", John Wiley & Sons, Fourth Edition.
2. A.B Carlson, P B Crully, J C Rutledge, "Communication Systems", Fourth Edition, McGraw Hill Publication.
3. Ha Nguyen, Ed Shwedyk, "A First Course in Digital Communication", Cambridge University Press.
4. B P Lathi, Zhi Ding "Modern Analog and Digital Communication System", Oxford University Press, Fourth Edition.
5. Bernard Sklar, Prabitra Kumar Ray, "Digital Communications Fundamentals and Applications" Second Edition, Pearson Education.
6. Taub, Schilling, "Principles of Communication System", Fourth Edition, McGraw Hill.
7. P Ramkrishna Rao, Digital Communication, Mc Graw Hill Publication.


| BTETPE702A | Microwave Theory and Techniques | 3 Credits |
|---|---|---|

**Course Objectives:**

- To lay the foundation for microwave engineering.
- To understand the applications of microwave engineering.
- Carryout the microwave network analysis.

**Course Outcomes:**

After successfully completing the course students will be able to

1. Formulate the wave equation in wave guide for analysis.
2. Identify the use of microwave components and devices in microwave applications.
3. Understand the working principles of all the microwave tubes.

4. Understand the working principles of all the solid state devices.
5. Choose a suitable microwave tube and solid state device for a particular application.
6. Carry out the microwave network analysis.
7. Choose a suitable microwave measurement instruments and carry out the required measurements.

**UNIT - 1**

**Transmission Lines and Waveguides:**

Introduction to Microwaves engineering: History of Microwaves, Microwave Frequency bands. Applications of Microwave, General solution for TEM, TE and TM waves, Parallel plate waveguide, and rectangular waveguide, Wave guide parameters, Introduction to coaxial line, Rectangular waveguide cavity resonators, Circular waveguide cavity resonators.

**UNIT - 2**

**Microwave Components:**

Multi-port junctions: Construction and operation of E-plane, H-plane, Magic Tee and Directional couplers. Ferrites components: - Ferrite Composition and characteristics, Faraday rotation, Construction and operation of Gyrator, Isolator and Circulator.

Striplines: Structural details and applications of Striplines, Microstrip line, Parallel Strip line, Coplanar Strip line, Shielded Strip Line.

**UNIT - 3**

**Microwave Network Analysis**

Introduction and applications of Impedance and Equivalent voltages and currents, Impedance and Admittance matrices, The Transmission (ABCD) matrix Scattering Matrix:- Significance, formulation and properties. S-Matrix calculations for-2 port network junction, E plane, H-plane and E-H (Magic Tee) Tees, Directional coupler, Isolator and Circulator. Related problems.

**UNIT - 4**

**Microwave Tubes**

Limitations of conventional tubes, O and M type classification of microwave tubes, reentrant cavity, velocity modulation. O type tubes Two cavity Klystron: Construction and

principle of operation, velocity modulation and bunching process Applegate diagram. Reflex Klystron: Construction and principle of operation, velocity modulation and bunching process, Applegate diagram, Oscillating modes, o/p characteristics, efficiency, electronic & mechanical tuning. M-type tubes Magnetron: Construction and Principle of operation of 8 cavity cylindrical travelling wave magnetron, hull cutoff condition, modes of resonance, PI mode operation, o/p characteristics, Applications. Slow wave devices Advantages of slow wave devices, Helix TWT: Construction and principle of operation, Applications.

## UNIT - 5

Microwave bipolar transistor, FET, MESFET, Varactor Diode, PIN Diode, Shottky Barrier Diode, Tunnel Diode, TEDs, Gunn Diodes, IMPATT diode and TRAPATT diode. Structural details, Principle of operation, various modes, specifications, and applications of all these devices.

## UNIT - 6

**Microwave Measurements**

Measurement devices: Slotted line, Tunable detector, VSWR meter, Power Meter, S-parameter measurement, frequency measurements, Power measurement, Attenuation measurement, Phase shift measurement, VSWR measurement, Impedance measurement, Q of cavity resonator measurement.

## TEXT/REFERENCE BOOKS

1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010
2. Microwave Devices and circuits- Liao / Pearson Education
3. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka and Ahmad S Khan, 4thSpecial Indian Edition , McGraw- Hill Education Pvt. Ltd., 2010.
4. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008
5. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015
6. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press, 2007.

| BTETPE702B | RF Circuit Design | 3 Credits |
|---|---|---|

**Course Objectives:**

- To study RF issues related to active and passive components.
- To study circuit design aspects at RF
- To learn design and modeling of circuits at RF.

**Course Outcomes:**

After successfully completion of the course students will be able to

1. Understand behavior of passive components at high frequency and modeling of HF circuit.
2. Design HF amplifiers with gain bandwidth parameters.
3. Understand Mixer types and characteristics.
4. Gain the knowledge about PLLs and Oscillators with respect to their circuit topologies.

## UNIT - 1

**RF Behavior of Passive Components**

HF Resistors, HF Capacitors, HF Inductors, Chip Components. Circuit Board Considerations: Chip Resistors, Chip Capacitors, Surface Mounted Inductors.

## UNIT - 2

**Bandwidth Estimation**

Open Circuit Time Constant Method: Observations & Interpretations, Accuracy of OC τs, Considerations, and Design examples. Short Circuit Time Constant Method: Background, Observations & Interpretations, Considerations. Delay of a system in cascade, Rise time of systems in cascade, Relation between Rise Time and Bandwidth.

## UNIT - 3

**High Frequency Amplifier Design**

Shunt Peaked Amplifier, Shunt Series peak Amplifier, Two port bandwidth enhancement, Design example. Bandwidth enhancement techniques. Tuned Amplifier: Common Source Amplifier with Single Tuned Load, Analysis of Tuned Amplifier. Neutralization and uni lateralization. Characteristics of RF amplifier. Amplifier power relations. Stability considerations, Stabilization methods.

## UNIT - 4

**Low Noise Amplifier Design**

MOSFET two port noise parameters, LNA topologies, Power-constrained noise optimization. Design examples: Single ended LNA, Differential LNA. Linearity and large signal performance. Spurious free dynamic range.

## UNIT - 5

**Oscillators**

Problem with Purely Linear Oscillators, Describing Functions, Describing Function for MOS. Colpitts Oscillator: Describing Function Model and Start-up Model of Colpitts Oscillator. Resonators: Quarter-Wave Resonators, Quartz Crystals. Tuned Oscillators: Basic LC Feedback Oscillators, Crystal Oscillator. Negative Resistance Oscillator.

## UNIT - 6

**Mixers**

Mixer Fundamentals. Significant Characteristics of Mixer: Conversion Gain, Noise Figure, Linearity and Isolation, Spurs. Non Linear Systems as Linear Mixers. Multiplier Based Mixers: Single Balanced Mixer, Linearization techniques of Mixer, Active Double Balanced Mixer. Passive Double Balanced Mixer, Diode Ring Mixers.

## TEXT/REFERENCE BOOKS

1. Reinhold Ludwig, Pavel Bretchko, “RF Circuit Design Theory and Applications”, Pearson Education.
2. Thomas H. Lee, “The Design of CMOS Radio-Frequency Integrated Circuits”, Second Edition, Cambridge Publications.
3. T. Yettrdal, Yunhg Cheng, “Devices modeling for analog and RF COMS circuits design”, John Wiley publication.
4. Calvin Plett, “Radio frequency Integrated Circuits Design”, Artech house.

| BTETPE702C | Satellite Communication | 3 Credits |
|---|---|---|

**Course Objectives**:

- To provide students with good depth of knowledge in radar and Satellite communication.
- Knowledge of theory and practice of advanced communication techniques e.g. TDMA, CDMA, FDMA.
- This will equip the students for further studies and research knowledge of modern applications in radar and Satellite communication.

**Course Outcomes:**

At the end of the course, the students will have:

1. Knowledge of theory and practice related to radar and Satellite communication.
2. Ability to identify, formulate and solve engineering problems related to radar and Satellite communication.
3. The student would be able to analyze the various aspects of establishing a geo-stationary satellite communication link.
4. Acquired knowledge about Satellite Navigation System.
5. Acquired knowledge about Radar and Radar Equations.

## UNIT - 1

**Basic Principles**

General features, frequency allocation for satellite services, properties of satellite communication systems.

**Earth Station:** Introduction, earth station subsystem, different types of earth stations.

## UNIT - 2

**Satellite Orbits**

Introduction, Kepler's laws, orbital dynamics, orbital characteristics, satellite spacing and orbitalcapacity, angle of elevation, eclipses, launching and positioning, satellite drift and station keeping.

## UNIT - 3

**Satellite Construction (Space Segment)**

Introduction; attitude and orbit control system; telemetry, tracking and command; power systems, communication subsystems, antenna subsystem, equipment reliability and space qualification.

## UNIT - 4

**Satellite** L**inks**

Introduction, general link design equation, system noise temperature, uplink design, downlink design, complete link design, effects of rain.

## UNIT - 5

**The Space Segment Access and Utilization**

Introduction, space segment access methods: TDMA, FDMA, CDMA, SDMA, assignment methods.

## UNIT - 6

**The Role and Application of Satellite Communication**

Introduction to Digital Satellite and Mobile Satellite Communication.

## TEXT/REFERENCE BOOKS


1. Timothy Pratt, Charles W. Bostian, Satellite Communications, John Wiley & Sons.
2. Dennis Roddy, Satellite Communications, 3rd Ed., McGraw-Hill International Ed. 2001.
3. W. L. Pritchard, J. A. Sciulli, Satellite Communication Systems Engineering, Prentice-Hall, Inc., NJ.
4. M. O. Kolawole, Satellite Communication Engineering, Marcel Dekker, Inc. NY.
5. Robert Gagliardi , "Satellite Communication" , CBS Publication.
6. Ha, "Digital Satellite Communication", McGraw- Hill.
7. Timothy Pratt and Charles Bostian, "Satellite Communications", John Wiley and Sons.

| BTETPE702D | Fiber Optic Communication | 3 Credits |
|---|---|---|

**Course Objectives**:

- To learn the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To understand the different kind of losses, signal distortion in optical wave guides and other signal degradation factors.
- To learn the various optical source materials, LED structures, quantum efficiency, Laser diodes
- Understand the functionality of each of the components that comprise a fiber-optic communication system: transmitter, fiber, amplifier, and receiver.
- Understand the properties of optical fiber that affect the performance of a communication link.
- Understand basic optical amplifier operation and its effect on signal power and noise in the system.
- Apply concepts listed above to the design of a basic communication link.

**Course Outcomes:**

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

1. Understand the principles fiber-optic communication, the components and the bandwidth advantages.
2. Understand the properties of the optical fibers and optical components.
3. Understand operation of lasers, LEDs, and detectors.
4. Analyze system performance of optical communication systems.
5. Design optical networks and understand non-linear effects in optical fibers

## UNIT - 1

**Introduction**

Introduction to vector nature of light, propagation of light, propagation of light in a cylindrical dielectric rod, Ray model, wave model.

**UNIT - 2**

**Types of optical fibers**

Different types of optical fibers, Modal analysis of a step index fiber, Signal degradation on optical fiber due to dispersion and attenuation. Fabrication of fibers and measurement techniques like OTDR.

**UNIT - 3**

**Optical sources**

LEDs and Lasers, Photo-detectors - pin-diodes, APDs, detector responsivity, noise, optical receivers. Optical link design - BER calculation, quantum limit, power penalties

**UNIT - 4**

**Optical switches**

Coupled mode analysis of directional couplers, electro-optic switches.

**UNIT - 5**

**Optical amplifiers**

EDFA, Raman amplifier, WDM and DWDM systems, Principles of WDM networks.

**UNIT - 6**

**Nonlinear effects in fiber optic links**

Nonlinear effects in fiber optic links, Concept of self-phase modulation, group velocity dispersion and solition based communication.

**TEXT/REFERENCE BOOKS**

1. J. Keiser, Fibre Optic communication, McGraw-Hill, 5th Ed. 2013 (Indian Edition).
2. T. Tamir, Integrated optics, (Topics in Applied Physics Vol.7), Springer-Verlag, 1975.
3. J. Gowar, Optical communication systems, Prentice Hall India, 1987.
4. S.E. Miller and A.G. Chynoweth, eds., Optical fibres telecommunications, Academic Press, 1979.
5. G. Agrawal, Nonlinear fibre optics, Academic Press, 2nd Ed. 1994.
6. G. Agrawal, Fiber optic Communication Systems, John Wiley and sons, New York, 1997

7. F.C. Allard, Fiber Optics Handbook for engineers and scientists, McGraw Hill, New York (1990).

| BTETPE702E | Wireless Sensor Networks | 3 Credits |
|---|---|---|

**Course Objectives:**

- To introduce the emerging research areas in the field of wireless sensor networks
- To understand different protocols and there uses in WSN.

**Course Outcomes:**

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

1. Design wireless sensor networks for a given application
2. Understand emerging research areas in the field of sensor networks
3. Understand MAC protocols used for different communication standards used in WSN
4. Explore new protocols for WSN.

**UNIT - 1**

**Introduction**

Introduction to Sensor Networks, unique constraints and challenges, Advantage of Sensor Networks, Applications of Sensor Networks, Types of wireless sensor networks

**UNIT - 2**

**Networks**

Mobile Ad-hocNetworks (MANETs) and Wireless Sensor Networks, Enabling technologies for Wireless Sensor Networks. Issues and challenges in wireless sensor networks.

**UNIT - 3**

**Protocols**

Routing protocols, MAC protocols: Classification of MAC Protocols, S-MAC Protocol, B-MAC protocol, IEEE 802.15.4 standard and ZigBee.

**UNIT - 4**

**Dissemination protocol**

Dissemination protocol for large sensor network, Data dissemination, data gathering, and data fusion; Quality of a sensor network; Real-time traffic support and security protocols.

**UNIT - 5**

Design Principles for WSNs, Gateway Concepts Need for gateway, WSN to Internet Communication, and Internet to WSN Communication.

**UNIT - 6**

Single-node architecture, Hardware components & design constraints, Operating systems and execution environments.

**TEXT/REFERENCE BOOKS**


1. Waltenegus Dargie , Christian Poellabauer, " Fundamentals Of Wireless Sensor Networks Theory And Practice" , By John Wiley & Sons Publications ,2011
2. Sabrie Soloman, "Sensors Handbook" by McGraw Hill publication. 2009
3. Feng Zhao, Leonidas Guibas, " Wireless Sensor Networks" , Elsevier Publications,2004
4. Kazem Sohrby, Daniel Minoli, "Wireless Sensor Networks": Technology, Protocols and Applications, Wiley-Inter science
5. Philip Levis, And David Gay "Tiny OS Programming" by Cambridge University Press 2009.


| BTETPE702F | Mobile Computing | 3 Credits |
|---|---|---|

**Course Objectives:**

- To provide guidelines, design principles and experience in developing applications for small, mobile devices, including an appreciation of context and location aware services.
- To introduce wireless communication and networking principles, that support connectivity to cellular networks, wireless internet and sensor devices.
- To appreciate the social and ethical issues of mobile computing, including privacy.

**Course Outcomes:**

1. At the end of the course, the student will be able to demonstrate:
2. A working understanding of the characteristics and limitations of mobile hardware devices including their user-interface modalities
3. The ability to develop applications that are mobile-device specific and demonstrate current practice in mobile computing contexts.

4. A comprehension and appreciation of the design and development of context-aware solutions for mobile devices.
5. An awareness of professional and ethical issues, in particular those relating to security and privacy of user data and user behavior.

**UNIT - 1**

Mobile Computing, Mobile Computing vs. wireless Networking, Mobile Computing Applications, Characteristics of Mobile computing, Structure of Mobile Computing Application.

**UNIT - 2**

MAC Protocols, Wireless MAC Issues, Fixed Assignment Schemes, Random Assignment Schemes, Reservation Based Schemes.

**UNIT - 3**

Overview of Mobile IP, Features of Mobile IP, Key Mechanism in Mobile IP, route Optimization. Overview of TCP/IP, Architecture of TCP/IP- Adaptation of TCP Window, Improvement in TCP Performance.

**UNIT - 4**

Global System for Mobile Communication (GSM), General Packet Radio Service (GPRS), Universal Mobile Telecommunication System (UMTS).

**UNIT - 5**

Ad-Hoc Basic Concepts , Characteristics , Applications , Design Issues , Routing , Essential of Traditional Routing Protocols ,Popular Routing Protocols , Vehicular Ad Hoc networks (VANET) , MANET vs. VANET , Security.

**UNIT - 6**

Mobile Device Operating Systems , Special Constrains & Requirements , Commercial Mobile Operating Systems , Software Development Kit: iOS, Android, BlackBerry, Windows Phone , M Commerce , Structure , Pros & Cons , Mobile Payment System , Security Issues.

**TEXT/REFERENCE BOOKS**

1. Principles of Mobile Computing, 2nd Edition, Uwe Hansmann, Lothar Merk, Martin Nicklous, Thomas Stober, Springer

2. Mobile Computing, Tomasz Imielinski, Springer.

| BTETPE703A | Embedded System Design | 3 Credits |
|---|---|---|

**Course Objectives:**

- To understand the embedded system design issues.
- To learn real time operating system concepts.
- To understand the Embedded Linux environment.
- To learn embedded software development and testing process.

**Course Outcomes:**

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

1. Suggest design approach using advanced controllers to real-life situations.
2. Design interfacing of the systems with other data handling / processing systems.
3. Appreciate engineering constraints like energy dissipation, data exchange speeds etc.
4. Get to know the hardware – software co design issues and testing methodology for embedded system.

**UNIT - 1**

**Introduction to Embedded Computing**

The concept of embedded systems design, Characteristics of Embedding Computing Applications, Concept of Real time Systems

**UNIT - 2**

**Design Process**

Requirements, Specifications, Architecture Design, Designing of Components, Embedded microcontroller cores, embedded memories. Examples of embedded systems

**UNIT - 3**

**Technological aspects of embedded systems**

Interfacing between analog and digital blocks, signal conditioning, digital signal processing, subsystem interfacing, interfacing with external systems, user interfacing.

**UNIT - 4**

**Design tradeoffs**

Design tradeoffs due to process compatibility, thermal considerations, etc., Software aspects of embedded systems: real time programming languages and operating systems for embedded systems

**UNIT - 5**

**Operating System**

Basic Features of an Operating System, Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt-driven System, Multi-rate System Processes and Threads, Context Switching: Cooperative Multi-tasking, Pre-emptive Multi- tasking.

**UNIT - 6**

**Scheduling and Inter-process Communication**

Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault-Tolerant Scheduling Signals, Shared Memory Communication, Message-Based Communication

**TEXT/REFERENCE BOOKS**

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

| BTETPE703B | Artificial Intelligence Deep Learning | 3 Credits |
|---|---|---|

**Course Objectives:**

- Apply AI techniques to solve the given problems.
- Implement trivial AI techniques on relatively large system
- Explain uncertainty and Problem solving techniques.
- Compare various learning techniques.

**Course Outcomes:**

This course will enable students to

1. Identify the AI based problems.
2. Apply techniques to solve the AI problems.
3. Define learning and explain various logic inferences.
4. Discuss different learning techniques.

**UNIT - 1**

**Introduction:**

What Is AI? Thinking humanly: The cognitive modeling approach. Thinking rationally: The "laws of thought" approach, Acting rationally: The rational agent approach. The Foundations of Artificial Intelligence, Mathematics, Economics, Neuroscience, Computer engineering, The History of Artificial Intelligence. AI becomes an industry (1980-- present). Agents and Environments, Good Behaviour: The Concept of Rationality. The Nature of Environments. The Structure of Agents.

**UNIT - 2**

**Search Techniques:**

Problem-Solving Agents, Well-defined problems and solutions, Formulating problems, Real-world problems. Uninformed Search Strategies, Breadth-first search, Uniform-cost search, Depth-first search, Depth-limited search, Iterative deepening depth-first search, Bidirectional search, Informed (Heuristic) Search Strategies, Greedy best-first search, A* search: Minimizing the total estimated solution cost, Heuristic Functions. The effect of heuristic accuracy on performance. Beyon Classical Search, Local Search Algorithms and Optimization Problems, Local Search in Continuous Spaces.

**UNIT - 3**

**Game Playing:**

Games, Optimal Decisions in Games, The minimax algorithm, Optimal decisions in multiplayer games, Alpha Beta Pruning, Move ordering, Imperfect Real-Time Decisions, Cutting off search, Forward pruning, Stochastic Games, Evaluation functions for games of chance, Partially Observable Games, Krieg spiel: Partially observable chess, Card games, State-of-the-Art Game Programs, Alternative Approaches.

## UNIT - 4

**Logic and inference:**

Defining Constraint Satisfaction Problems, Constraint Propagation: Inference in CSPs, Backtracking Search for CSPs, Local Search for CSPs, The Structure of Problems, Knowledge-Based Agents, The Wumpus World, Logic , Propositional Logic: A Very Simple Logic, Propositional Theorem Proving, Effective Propositional Model Checking, Agents Based on Propositional Logic. Forward Chaining, Backward Chaining, Definition of Classical Planning. Algorithms for Planning as State-Space Search, Planning Graphs.

## UNIT - 5

**Learning:**

Forms of Learning, Supervised Learning, Learning Decision Trees, Evaluating and Choosing the Best Hypothesis, Model selection: Complexity versus goodness of fit, From error rates to loss, Regularization, The Theory of Learning, Regression and Classification with Linear Models, Artificial Neural Networks, Nonparametric Models, Ensemble Learning, Online Learning, Practical Machine Learning, A Logical Formulation of Learning. Knowledge in Learning. Explanation-Based Learning, Learning Using Relevance Information. Inductive Logic Programming. Statistical Learning. Learning with Complete Data. Learning with Hidden Variables: The EM Algorithm.

## TEXT/REFERENCE BOOKS

1. Stuart Russell and Peter Norvig, Artificial Intelligence: A Modern Approach. III Edition
2. E. Rich, K. Knight & S. B. Nair - Artificial Intelligence, 3/e, McGraw Hill.
3. Dan W. Patterson, Introduction to Artificial Intelligence and Expert Systems, Prentice Hal of India.
4. G. Luger, “Artificial Intelligence: Structures and Strategies for complex problem Solving”, Fourth Edition, Pearson Education, 2002.
5. N.P. Padhy “Artificial Intelligence and Intelligent Systems” , Oxford UniversityPress-2015.

| BTETPE703C | VLSI Design & Technology | 3 Credits |
|---|---|---|

**Course Objectives:**

- To study HDL based design approach.
- To learn digital CMOS logic design.
- To nurture students with CMOS analog circuit designs.
- To realize importance of testability in logic circuit design.
- To overview SoC issues and understand PLD architectures with advanced features.

**Course Outcomes:**

After successfully completing the course, students will be able to

1. Model digital circuit with HDL, simulate, synthesis and prototype in PLDs.
2. Understand chip level issues and need of testability.
3. Design analog & digital CMOS circuits for specified applications

## UNIT - 1

**VHDL Modeling**

Data objects, Data types, Entity, Architecture & types of modeling, Sequential statements, Concurrent statements, Packages, Sub programs, Attributes, VHDL Test bench, Test benches using text files. VHDL modeling of Combinational, Sequential logics & FSM, Meta-stability.

## UNIT - 2

**PLD Architectures**

PROM, PLA, PAL: Architectures and applications. Software Design Flow, CPLD Architecture, Features, Specifications, Applications, FPGA Architecture, Features, Specifications, Applications.

## UNIT - 3

**SoC & Interconnect**

Clock skew, Clock distribution techniques, clock jitter, Supply and ground bounce, power distribution techniques. Power optimization, Interconnect routing techniques; wire parasitic, Signal integrity issues, I/O architecture, pad design, Architectures for low power.

## UNIT - 4

**Digital CMOS Circuits**

MOS Capacitor, MOS Transistor theory, C-V characteristics, Non ideal I-V effects, Technology Scaling. CMOS inverters, DC transfer characteristics, Power components, Power delay product, Transmission gate. CMOS combo logic design, Delays: RC delay model, Effective resistance, Gate and diffusion capacitance, Equivalent RC circuits; Linear delay model, Logical effort, Parasitic delay, Delay in a logic gate, Path logical efforts.

## UNIT -5

**Analog CMOS Design**

Current sink and source, Current mirror, Active load, Current source and Push-pull inverters, Common source, Common drain, Common gate amplifiers. Cascade amplifier, Differential amplifier, Operational amplifier

## UNIT - 6

**Testability**

Types of fault, Need of Design for Testability (DFT), Testability, Fault models, Path sensitizing, Sequential circuit test, BIST, Test pattern generation, JTAG & Boundary scan, TAP Controller.

## TEXT/REFERENCE BOOKS

1. Charles H. Roth, “Digital systems design using VHDL”, PWS.
2. Wyane Wolf, “Modern VLSI Design (System on Chip)”, PHI Publication.
3. Allen Holberg, “Analog CMOS Design”, Oxford University Press.
4. Neil H. E. Weste, David Money Harris, “CMOS VLSI Design: A Circuit & System Perspective”, Pearson Publication.

| BTETPE703D | Data Compression & Encryption | 3 Credits |
|---|---|---|

**Course Objectives:**

- The concept of security, types of attack experienced.
- Encryption and authentication for deal with attacks, what is data compression, need and techniques of data compression.

**Course Outcomes:**

At the end of this course

1. The student will have the knowledge of Plaintext, cipher text, RSA and other cryptographic algorithm.
2. The student will have the knowledge of Key Distribution, Communication Model, Various models for data compression.

**UNIT - 1**

**Data Compression and Encryption:**

Need for data compression, Lossy/lossless compression, symmetrical compression and compression ratio, run length encoding for text and image compression, relative encoding and its applications in facsimile data compression and telemetry, scalar and quantization.

**UNIT - 2**

**Statistical Methods:**

Statistical modeling of information source, coding redundancy, variable size codes, prefix codes, Shannon- Fano coding, Huffman coding, adaptive Huffman coding, arithmetic coding and adaptive arithmetic coding, text compression using PPM method.

**UNIT - 3**

**Dictionary Methods:**

String compression, sliding window compression, LZ77, LZ78 and LZW algorithms and applications in text compression, zip and Gzip, ARC and Redundancy code.

**UNIT - 4**

**Image Compression:**

Lossless techniques of image compression, gray codes, two dimensional image transform ,Discrete cosine transform and its application in lossy image compression, quantization, Zig-Zag coding sequences, JPEG and JPEG-LS compression standards, pulse code modulation

and differential pulse code modulation methods of image compression, video compression and MPEG industry standard.

**UNIT - 5**

**Audio Compression:**

Digital audio, lossy sound compression, M-law and A-law companding, DPCM and ADPCM audio compression, MPEG audio standard, frequency domain coding, format of compressed data.

**UNIT - 6**

**Conventional Encryption:**

Security of information, security attacks, classical techniques, caeser Cipher, block cipher principles, data encryption standard, key generation for DES, block cipher principle, design and modes of operation, S-box design, triple DES with two three keys, introduction to international data encryption algorithm, key distribution.

**TEXT/REFERENCE BOOKS**

1. Data compression- David Solomon Springer Verlag publication.
2. Cryptography and network security- William Stallings Pearson Education Asia Publication.
3. Introduction to data compression-Khalid Sayood Morgan kaufmann publication.
4. The data compression book- Mark Nelson BPB publication.
5. Applied cryptography-Bruce schnecer, John Wiley and sons Inc., publications.

| BTETPE703E | Big Data Analytics | 3 Credits |
|---|---|---|

**Course Objectives:**

- To provide an overview of an exciting growing field of Big Data analytics.
- To discuss the challenges traditional data mining algorithms face when analyzing Big Data.
- To introduce the tools required to manage and analyze big data like Hadoop, NoSql Map Reduce.

- To teach the fundamental techniques and principles in achieving big data analytics with scalability and streaming capability
- To introduce to the students several types of big data like social media, web graphs and data streams
- To enable students to have skills that will help them to solve complex real-world problems in for decision support.

**Course Outcomes:**

At the end of this course, Students will able to:

1. Explain the motivation for big data systems and identify the main sources of Big Data in the real world.
2. Demonstrate an ability to use frameworks like Hadoop, NOSQL to efficiently store retrieve and process Big Data for Analytics.
3. Implement several Data Intensive tasks using the Map Reduce Paradigm
4. Apply several newer algorithms for Clustering Classifying and finding associations in Big Data.

**UNIT - 1**

**Big Data Platforms**

Big Data Platforms for the Internet of Things: network protocol- data dissemination –current state of art- Improving Data and Service Interoperability with Structure, Compliance, Conformance and Context Awareness: interoperability problem in the IoT context- Big Data Management Systems for the Exploitation of Pervasive Environments - Big Data challenges and requirements.

**UNIT - 2**

**YA TRAP** – Necessary and sufficient condition for false authentication prevention - Adaptive Pipelined Neural Network Structure in Self-aware Internet of Things: self-healing systems Role of adaptive neural network- Spatial Dimensions of Big Data: Application of Geographical Concepts and Spatial Technology to the Internet of Things- Applying spatial relationships, functions, and models.

**UNIT - 3**

**Fog Computing**

Fog Computing: A Platform for Internet of Things and Analytics: a massively distributed number of sources - Big Data Metadata Management in Smart Grids: semantic inconsistencies - role of metadata.

**UNIT - 4**

**Web Enhanced Building**

Toward Web Enhanced Building Automation Systems: heterogeneity between existing installations and native IP devices - loosely-coupled Web protocol stack –energy saving in smart building- Intelligent Transportation Systems and Wireless Access in Vehicular Environment Technology for Developing Smart Cities: advantages and achievements.

**UNIT - 5**

**Technologies for Healthcare**

Emerging Technologies in Health Information Systems: Genomics Driven Wellness Tracking and Management System (GO-WELL) – predictive care – personalized medicine.

**UNIT - 6**

**Sustainability Data and Analytics**

Sustainability Data and Analytics in Cloud-Based M2M Systems - potential stakeholders and their complex relationships to data and analytics applications - Social Networking Analysis - Building a useful understanding of a social network - Leveraging Social Media and IoT to Bootstrap Smart Environments: lightweight Cyber Physical Social Systems - citizen actuation.

**TEXT/REFERENCE BOOKS**

1. Stackowiak, R., Licht, A., Mantha, V., Nagode, L.," Big Data and the Internet of Things Enterprise Information Architecture for A New Age", Apress, 2015. 2. Dr. John Bates, "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015.
2. Dr. John Bates, "Thingalytics - Smart Big Data Analytics for the Internet of Things", john Bates, 2015.

| BTETPE703F | Cyber Security | 3 Credits |
|---|---|---|

**Course Objectives:**

- For secured and under control since the information stored and conveyed is ultimately an invaluable resource of the business.
- The growing number of the computer Network(internet/intranet) attacks and sophistication in attack technologies has made this task still more complicated
- To update the knowledge of the personnel manning networks and systems on the network security issues and solutions.

**Course Outcomes:**

Students should be able to understand.

1. The difference between threat, risk, attack and vulnerability.
2. How threats materialize into attacks.
3. Where to find information about threats, vulnerabilities and attacks.
4. Typical threats, attacks and exploits and the motivations behind them.

**UNIT - 1**

**Introduction to Cyber Security**

Overview of Cyber Security, Internet Governance – Challenges and Constraints, Cyber Threats – Cyber Warfare-Cyber Crime-Cyber terrorism-Cyber Espionage, Need for a Comprehensive Cyber Security Policy, Need for a Nodal Authority, Need for an International convention on Cyberspace.

**UNIT - 2**

**Cyber Security Vulnerabilities and Cyber Security Safeguards**

Cyber Security Vulnerabilities-Overview, vulnerabilities in software, System administration, Complex Network Architectures, Open Access to Organizational Data, Weak Authentication, Unprotected Broadband communications, Poor Cyber Security Awareness. Cyber Security Safeguards- Overview, Access control, Audit, Authentication, Biometrics, Cryptography, Deception, Denial of Service Filters, Ethical Hacking, Firewalls, Intrusion Detection Systems, Response, Scanning, Security policy, Threat Management.

**UNIT - 3**

**Securing Web Application, Services and Servers**

Introduction, Basic security for HTTP Applications and Services, Basic Security for SOAP Services, Identity Management and Web Services, Authorization Patterns, Security Considerations, Challenges.

**UNIT - 4**

**Intrusion Detection and Prevention**

Intrusion, Physical Theft, Abuse of Privileges, Unauthorized Access by Outsider, Malware infection, Intrusion detection and Prevention Techniques, Anti-Malware software, Network based Intrusion detection Systems, Network based Intrusion Prevention Systems, Host based Intrusion prevention Systems, Security Information Management, Network Session Analysis, System Integrity Validation.

**UNIT - 5**

**Cryptography and Network Security**

Introduction to Cryptography, Symmetric key Cryptography, Asymmetric key Cryptography, Message Authentication, Digital Signatures, Applications of Cryptography. Overview of Firewalls- Types of Firewalls, User Management, VPN Security Security Protocols: - security at the Application Layer- PGP and S/MIME, Security at Transport Layer- SSL and TLS, Security at Network Layer-IPSec.

**UNIT - 6**

**Cyberspace and the Law, Cyber Forensics**

Introduction, Cyber Security Regulations, Roles of International Law, the state and Private Sector in Cyberspace, Cyber Security Standards. The INDIAN Cyberspace, National Cyber Security Policy 2013 Introduction to Cyber Forensics, Handling Preliminary Investigations, Controlling an Investigation, Conducting disk-based analysis, Investigating Information-hiding, Scrutinizing E-mail, Validating E-mail header information, Tracing Internet access, Tracing memory in real-time.

**TEXT/REFERENCE BOOKS**

1. Charles P. Pfleeger Shari Lawrence Pfleeger Jonathan Margulies, Security in Computing, 5th Edition , Pearson Education , 2015

2. George K.Kostopoulous, Cyber Space and Cyber Security, CRC Press, 2013.
3. Martti Lehto, Pekka Neittaanmäki, Cyber Security: Analytics, Technology and Automation edited, Springer International Publishing Switzerland 2015.
1. Nelson Phillips and Enfinger Steuart, ―Computer Forensics and Investigations‖, Cengage Learning, New Delhi, 2009.

| BTETPE704A | Consumer Electronics | 3 Credits |
|---|---|---|

**Course Objectives:**

- To acquaint students with the practical knowledge of designing and developing consumer electronic systems and products and introduce the latest trends and technologies.

**Course Outcomes:**

Students will be able to:

1. List technical specification of electronics Audio system (microphone and speaker)
2. Trouble shoots consumer electronics products like TV, washing machine and AC.
3. Identify and explain working of various color TV transmission blocks.
4. Adjust various controls of color TV receiver and troubleshoot it.
5. Use various functions of Cam coder and shoot a video and take snapshots and save them in appropriate format.

**UNIT - 1**

**Communication devices**

Mobile handsets, Android technology, 2G, 3G Mobiles, i-phone, EPABX

**UNIT - 2**

**Mass Communication devices**

Color Television, Antenna, HDTV, LCD TV,LED TV, 3D Technology In TV, Interactive TV, DTHTV, Plasma TV, Video Conferencing, FAX Machine, PA System, Dolby Digital Systems, Gesture Technology In TV.

**UNIT - 3**

**Household e1cctronics devices**

Washing Machine, Microwave Oven, Types Applications, Electronics Weighing Balance, Air Conditioner, Vacuum Cleaner.

## UNIT - 4

**Printing and recording devices**

LASER printer, Inkjet Printers, Photocopiers, Scanner, DVD/CD Player, Blue ray DVD Player.

## UNIT - 5

**Special purpose machines**

Electronic Voting Machine, CFL, LED Lamps, Application and Advantages. Solar lamp, Water Purifier, Electronic Calculator, DVD Player, ATM

**Security devices**

Biometric attendance Monitoring System, Working, Biometric Sensors, Home Automation System.

## UNIT - 6

**Compliance:**

Product safety and liability issues, standards related to electrical safety and standards related to fire hazards, e.g., UL and VDE. EM1/EMC requirements and design techniques for compliance, e.g. ESD, RF interference and immunity, line current harmonics and mains voltage surge.

## TEXT/REFERENCE BOOKS


1. Television &Video Engineering-A. M. Dhake, TMH Publication.
2. Monochrome and Color TV - R. R. Gulati, Wiley Eastern publication.
3. Video demystified -Keith Jack, PI publication
4. Audio &Video Systems-R.G.Gupta
5. Audio and Video system - Principles, maintenance and Troubleshooting by R. Gupta
6. Arora C. P., "Refrigeration and Air conditioning", Tata McGraw-Hill, New Delhi, 1994
7. Color TV Theory &Practice -S. P. Bali. TMG Hill Publication.
8. Basic TV &Video Systems-Bernard Grobb.
9. Electronic Communication Systems, Kennedy, TMH.
10. Principles of Communication Engineering- Anokh Singh-TMH.
11. C. M. Wintzer, International Commercial EMC Standards, Interference Control Techno1ologies 1988.

12. P. A. Chatterton and M. A. Houlden, EMC: Electromagnetic Theory to Practical Design. Wiley, 1992.
13. J. A. S. Angus, Electronic Product Design, Chapman and Hall, 1996.
14. Y. J. Wind, Product Policy: Concepts, Methods, and Strategy, Addison-Wesley Pub. Co. 1982.

| BTETPE704B | Analog Integrated Circuit Design | 3 Credits |
|---|---|---|

**Course Objectives:**

- Introduction to Circuit Simulation & EM Simulations.
- Deep Understanding of MOS Device Physics & Modeling.
- Understanding of few transistor circuits like common gate, common source & common drain amplifiers with their frequency response.
- Understanding of Operational Amplifier Design & Trade-offs.
- Advanced Op-Amps and OTAs.
- Temperature Compensated Biasing Schemes.

**Course Outcomes:**

After the successful completion of this course, Students will be able to:

1. Describe the models for active devices in MOS and Bipolar IC technologies.
2. Describe layout considerations for active and passive devices in analog ICs.
3. Analyze and design IC current sources and voltage references.
4. Describe the noise sources and models applicable to ICs.
5. Understand and appreciate the importance of noise and distortion in analog circuits.
6. Analyze integrated circuit noise performance.
7. Analyze and design IC operational amplifiers.

**UNIT - 1**

**Introduction to Simulations**

Introduction to Advanced Design System and Cadence Virtuoso, DC Simulations, AC Simulations, Harmonic Balance, Envelope Simulation, Electromagnetic Simulations- FEM, MOM, FDTD, Circuit Net listing.

**UNIT - 2**

**MOSFET Device Physics & Modeling**

MOSFET Structure, Threshold Voltage, Drain Current Equation, Transfer & Output Characteristics, Weak/Moderate/Strong Inversion, Linear/Triode/Saturation Region of Operation, Device Leakages and Losses, Short Channel Effects, High Frequency Small Signal Model of MOSFET, Cubic, BSIM and Materka Models of MOSFET.

**UNIT - 3**

**Few Transistor Circuits**

Current Mirrors, Common Source/Common Gate/Common Drain Amplifiers, Design and Analysis of CS/CG/CD Amplifiers, Cascode Amplifiers, Differential Gain Stage, Frequency Response & Design Trade-offs, Telescopic Cascode and Wide Swing Cascode Current Mirrors, PTAT, CTAT & Bandgap Bias Circuits.

**UNIT - 4**

**Operational Amplifiers & OTAs**

Design of Classical Op-Amps, Op-Amp Characteristics, Analysis and Trade-offs, Wideband Op-Amps, High Speed Op-Amps, Very High Gain Op-Amps, Operational Transconductance Amplifiers, Ultra Low Power OTAs for Medical Implants, Folded Cascode Op-Amps.

**UNIT - 5**

**Biasing Schemes**

Voltage and Current References, Vt reference bias, PTAT Current Reference, CTAT and Bandgap Voltage References, High Precision Voltage References, Voltage Level Shifters.

**UNIT - 6**

**Non-Linear Circuits**

Single and Balanced Diode Mixers, Translinear Cell, Gilbert Cell Mixers, Power Amplifiers, Even & Odd Order Mixing, In-Modulation (AM, PM Conversions) Distortions, Intermodulation Distortions, Intermodulation Products, ACPR & EVM.

**TEXT/REFERENCE BOOKS**

1. Tony Chan Carusone, David A. Johns, Kenneth W. Martin, “Analog Integrated Circuit

2. Design", John Wiley & Sons
3. Keliu Shu, Edgar Sanchez-Sinencio, "CMOS PLL Synthesizers", Springer
4. Jose Carlos Pedro, Nuno Borges Carvalho, "Intermodulation Distortion in Microwave and Wireless Circuits", Artech House
5. Stephen A. Maas, "Microwave Mixers", Artech House.

| BTETPE704C | Soft Computing | 3 Credits |
|---|---|---|

**Course Objectives:**

- Introduce a relatively new computing paradigm for creating intelligent machines useful for solving complex real world problems.
- Insight into the tools that make up the soft computing technique: fuzzy logic, artificial neural networks and hybrid systems Techniques.
- To create awareness of the application areas of soft computing technique.
- Provide alternative solutions to the conventional problem solving techniques in image/signal processing, pattern recognition/classification, control system.

**Course Outcomes:**

After the successful completion of this course, students will be able to:

1. Use a new tool /tools to solve a wide variety of real world problems.
2. Find an alternate solution, which may offer more adaptability, resilience and optimization.
3. Identify the suitable antenna for a given communication system.
4. Gain knowledge of soft computing domain which opens up a whole new career option.
5. Tackle real world research problems.

**UNIT - 1**

**Artificial Neural Network –I:**

Biological neuron, Artificial neuron model, concept of bias and threshold, McCulloch- Pits Neuron Model, implementation of logical AND, OR, XOR functions Soft Topologies of neural networks, learning paradigms: supervised, unsupervised, reinforcement, Linear neuron model: concept of error energy, gradient descent algorithm and application of linear neuron for linear regression, Activation functions: binary, bipolar (linear, signup, log sigmoid, tan sigmoid)Learning mechanisms: Hebbian, Delta Rule o Perceptron and its limitations Draft.

**UNIT - 2**

**Artificial Neural Network-II:**

Multilayer perceptron (MLP) and back propagation algorithm o Application of MLP for classification and regression o Self- organizing Feature Maps, k- means clustering o Learning vector quantization Radial Basis Function networks: Cover's theorem, mapping functions(Gaussian, Multi-quadrics, Inverse multi quadrics, Application of RBFN for classification and regression o Hopfield network, associative memories.

**UNIT - 3**

**Fuzzy Logic –I:**

Concept of Fuzzy number, fuzzy set theory (continuous, discrete) o Operations on fuzzy sets, Fuzzy membership functions (core, boundary, and support), primary and composite linguistic terms, Concept of fuzzy relation, composition operation (T-norm,T-conorm) o Fuzzy if-then rules.

**UNIT - 4**

**Fuzzy Logic –II:**

Fuzzification, Membership Value Assignment techniques, De-fuzzification (Max membership principle, Centroid method, Weighted average method), Concept of fuzzy inference, Implication rules- Dienes-Rescher Implication, Mamdani Implication, Zadeh Implication, Fuzzy Inference systems -Mamdani fuzzy model, Sugeno fuzzy model , Tsukamoto fuzzy model, Implementation of a simple two-input single output FIS employing Mamdani model Computing.

**UNIT - 5**

**Fuzzy Control Systems:**

Control system design problem 1.5, Control (Decision) Surface, Assumptions in a Fuzzy Control System Design V, Fuzzy Logic Controllers Soft o Comparison with traditional PID control, advantages of FLC, Architecture of a FLC: Mamdani Type, Example Aircraft landing control problem.

**UNIT - 6**

**Adaptive Neuro-Fuzzy Inference Systems (ANFIS):**

ANFIS architecture, Hybrid Learning Algorithm, Advantages and Limitations of ANFIS Application of ANFIS/CANFIS for regression.

**TEXT/REFERENCE BOOKS**


1. Fundamentals of Neural Networks: Architectures, Algorithms and Applications, Laurene Fausett, Pearson Education, Inc, 2008.
2. Fuzzy Logic with Engineering Applications, Third Edition Thomas, Timothy Ross, John Wiley & Sons, 2010.
3. Neuro- Fuzzy and Soft Computing, J.S. Jang, C.T. Sun, E. Mizutani, PHI Learning Private Limited.
4. Principles of Soft Computing, S. N. Sivanandam, S. N. Deepa, John Wiley & Sons, 2007.
5. Introduction to the theory of neural computation, John Hertz, Anders Krogh, Richard Palmer, Addison –Wesley Publishing Company, 1991.
6. Neural Networks A comprehensive foundation,, Simon Haykin, Prentice Hall International Inc-1999.
7. Neural and Adaptive Systems: Fundamentals through Simulations, José C. Principe Neil R. Euliano, W. Curt Lefebvre, John-Wiley & Sons, 2000.
8. Pattern Classification, Peter E. Hart, David G. Stork Richard O. Duda, Second Edition, 2000.
9. Pattern Recognition, Sergios Theodoridis, Konstantinos Koutroumbas, Fourth Edition, Academic Press, 2008.
10. A First Course in Fuzzy Logic, Third Edition, Hung T. Nguyen, Elbert A. Walker, Taylor & Francis Group, LLC, 2008.
11. Introduction to Fuzzy Logic using MATLAB, S. N. Sivanandam, S. Sumathi, S. N. Deepa, Springer Verlag, 2007.


| BTETPE704D | Advance Industrial Automation-1 | 3 Credits |
|---|---|---|

**Course Objectives:**

- To identify potential areas for automation and justify need for automation.
- To select suitable major control components required to automate a process or an activity.

- To translate and simulate a real time activity using modern tools and discuss the benefits of automation.

**Course Outcomes:**

After the successful completion of this course, the student will be able:

1. To identify suitable automation hardware for the given application.
2. To recommend appropriate modeling and simulation tool for the given manufacturing application.

**UNIT - 1**

**Introduction:**

Automation in Production System, Principles and Strategies of Automation, Basic Elements of an Automated System, Advanced Automation Functions, Levels of Automations. Flow lines & Transfer Mechanisms, Fundamentals of Transfer Lines. (SLE: Analysis of Transfer Lines).

**UNIT - 2**

**Material handling and Identification Technologies:**

Overview of Material Handling Systems, Principles and Design Consideration, Material Transport Systems, Storage Systems, Overview of Automatic Identification Methods (SLE: Material Identification Methods).

**UNIT - 3**

**Automated Manufacturing Systems:**

Components, Classification and Overview of Manufacturing Systems, Manufacturing Cells, GT and Cellular Manufacturing, FMS, FMS and its Planning and Implementation, Quality Control Systems: Traditional and Modern Quality Control Methods, SPC Tools, Inspection Principles and Practices, Inspection Technologies. (SLE: Usage of SPC tools using excel or Minitab).

**UNIT - 4**

**Control Technologies in Automation:**

Industrial Control Systems, Process Industries versus Discrete-Manufacturing Industries, Continuous Versus Discrete Control, Computer Process and its Forms, (SLE: Sensors, Actuators and other Control System Components).

**UNIT - 5**

**Computer Based Industrial Control:**

Introduction & Automatic Process Control, Building Blocks of Automation Systems: LAN, Analog & Digital I/O Modules, SCADA Systems& RTU. Distributed Control System: Functional Requirements, Configurations & some popular Distributed Control Systems (SLE: Display Systems in Process Control Environment).

**UNIT - 6**

**Modeling and Simulation for Plant Automation:**

Introduction, need for system Modeling, Building Mathematical Model of a Plant, Modern Tools & Future Perspective. Industrial Control Applications: Cement, Thermal, Water Treatment & Steel Plants. (SLE: Cases Studies minimum one for Cement, Thermal, Water Treatment & Steel Plants applications).

**TEXT/REFERENCE BOOKS**

1. Automation, Production Systems and Computer Integrated Manufacturing- M.P.Groover, Pearson Education.5th edition, 2009.
2. Computer Based Industrial Control- Krishna Kant, EEE-PHI,2nd edition,2010
3. An Introduction to Automated Process Planning Systems- Tiess Chiu Chang & Richard A. Wysk.
4. Performance Modeling of Automated Manufacturing Systems,-Viswanandham, PHI, 1st edition, 2009.

| BTETPE704E | Mechatronics | 3 Credits |
|---|---|---|

**Course Objectives:**

- Understand key elements of Mechatronics system, representation into block diagram.
- Understand concept of transfer function, reduction and analysis.
- Understand principles of sensors, its characteristics, interfacing with DAQ microcontroller.

- Understand the concept of PLC system and its ladder programming, and significance of PLC systems in industrial application.
- Understand the system modelling and analysis in time domain and frequency domain.
- Understand control actions such as Proportional, derivative and integral and study its significance in industrial applications.

**Course Outcomes:**

1. Identification of key elements of mechatronics system and its representation in terms of block diagram.
2. Understanding the concept of signal processing and use of interfacing systems such as ADC, DAC, digital I/O.
3. Interfacing of Sensors, Actuators using appropriate DAQ micro-controller.
4. Time and Frequency domain analysis of system model (for control application).
5. PID control implementation on real time systems.
6. Development of PLC ladder programming and implementation of real life system.

**UNIT - 1**

**Introduction to Sensors & Actuators**

Introduction to Mechatronics, Measurement characteristics: -Static and Dynamic Sensors: Position Sensors: -Potentiometer, LVDT, Encoders; Proximity sensors:-Optical, Inductive, Capacitive; Motion Sensors:-Variable Reluctance; Temperature Sensor: RTD, Thermocouples; Force / Pressure Sensors:-Strain gauges; Flow sensors: -Electromagnetic Actuators: Stepper motor, Servo motor, Solenoids.

**UNIT - 2**

**Block Diagram Representation**

Open and Closed loop control system, identification of key elements of mechatronics systems and represent into block diagram (Electro-Mechanical Systems), Concept of transfer function, Block diagram reduction principles, Applications of mechatronics systems:-Household, Automotive, Shop floor (industrial).

**UNIT - 3**

**Data Acquisition & Microcontroller System**

Interfacing of Sensors / Actuators to DAQ system, Bit width, Sampling theorem, Aliasing, Sample and hold circuit, Sampling frequency, ADC (Successive Approximation), DAC (R-2R), Current and Voltage Amplifier.

**UNIT - 4**

**PLC**

Programming Introduction, Architecture, Ladder Logic programming for different types of logic gates, Latching, Timers, Counter, Practical Examples of Ladder Programming, and Introduction to SCADA system.

**UNIT - 5**

**Modelling and Analysis of Mechatronics System**

System modelling (Mechanical, Thermal and Fluid), Stability Analysis via identification of poles and zeros, Time Domain Analysis of System and estimation of Transient characteristics: % Overshoot, damping factor, damping frequency, Rise time, Frequency Domain Analysis of System and Estimation of frequency domain parameters such as Natural Frequency, Damping Frequency and Damping Factor.

**UNIT - 6**

**Control System**

P, I and D control actions, P, PI, PD and PID control systems, Transient response:-Percentage overshoot, Rise time, Delay time, Steady state error, PID tuning (manual).

**TEXT/REFERENCE BOOKS**

1. K.P. Ramchandran, G.K. Vijyaraghavan, M.S. Balasundaram, Mechatronics: Integrated Mechanical Electronic Systems, Willey Publication, 2008
2. Bolton, Mechatronics -A Multidisciplinary approach, 4th Edition, Prentice Hall, 2009.
3. Alciatore & Histand, Introduction to Mechatronics and Measurement system, 4thEdition, McGraw Hill publication, 2011.
4. Bishop (Editor), Mechatronics –An Introduction, CRC Press, 2006.
5. Mahalik, Mechatronics –Principles, concepts and applications, Tata Mc - Graw Hill publication, New Delhi.

6. C. D. Johnson, Process Control Instrumentation Technology, Prentice Hall, New Delhi.

| BTETPE704F | Electronics in Smart City | 3 Credits |
|---|---|---|

**Course Objectives:**

**Course Outcomes:**

**UNIT - 1**

**Necessity of SMART CITY**

The Smart City Philosophy, Development of Asian Cities, Megacities of India: Current Challenges, The India Story of Smart Cities, Conceptual Basis of a Smart City, Global Smart City Programs, Recommendations for Smart City Framework in GCC.

**UNIT - 2**

**SMART CITY and IOT**

Introduction to Internet of Things, applications in smart city & their distinctive advantages - smart environment, smart street light and smart water & waste management. What is an IOT? Role and scope of IOT in present and future marketplace.

**UNIT - 3**

**SMART Objects**

Smart objects, Wired – Cables, hubs, etc., Wireless – RFID, WiFi, Bluetooth, etc. Different functional building blocks of IOT architecture

**UNIT - 4**

**Smart Cities: Distributed Intelligence and Central Planning**

On the Interplay between Humans and Smart Devices, Theoretical Tools, Intelligence-Artificial Intelligence (Machine Intelligence), Information Dynamics, Synergetic, Information Dynamics and Allometry in Smart Cities.

**UNIT - 5**

**Wireless Protocols for Smart Cities**

IPv6 over Low-Power Wireless Personal Area Network: Features, Addressing, Packet fragmentation, Operation, Security. ZigBee: Architecture Objectives, Wireless Networking

Basics, Wireless Networking Assumptions, Bluetooth Low Energy, Constrained Application Protocol, Message Queue Telemetry Protocol.

**UNIT - 6**

**Leveraging Smart City Projects for Benefitting Citizens: The Role of ICTs**

Smart City and ICT: Using Technologies to Improve the Citizens' Quality of Life, Smart City Goals: The Impact on Citizens' Well-Being and Quality of Life, Critical Dimensions: Urbanization, Local Climate Change, and Energy Poverty, Environmental Issues: The Role of Local and Global Climate Chang.

**TEXT/REFERENCE BOOKS**

# Dr. Babasaheb Ambedkar Technological University, Lonere.

| BTHM705 | Financial Management | 2 Credits |
|---|---|---|

**Course Objectives:**

- To help the students to develop cognizance of the importance of Financial Management in corporate valuation
- To enable students to describe how people analyze the corporate leverage under different conditions and understand why people valuate different corporates in different manner.
- To provide the students to analyze specific characteristics of Supply Chain Industry and their future action for cash flow
- To enable students to synthesize related information and evaluate options for most logical and optimal solution such that they would be able to predict and control Debt Equity incurrence and improve results.

**Course Outcomes:**

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

1. The students would be able to understand and define basic terminology used in finance and accounts
2. The students would be able to prepare& appraise Financial Statements and evaluate a company in the light of different measurement systems.
3. The students would be able to analyze the risk and return of alternative sources of financing.
4. Estimate cash flows from a project, including operating, net working capital, and capital spending.
5. To estimate the required return on projects of differing risk ,to estimate the cash flows from an investment project, calculate the appropriate discount rate, determine the value added from the project, and make a recommendation to accept or reject the project
6. To describe and illustrate the important elements in project finance Using financial calculator and Excel in a variety of problems.

## UNIT - 1

**Introduction to Financial Accounting, Book keeping & Recording:** Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger , Cash book & Trial balance.

## UNIT - 2

**Financial Statement Preparation, analysis & Interpretation:** Preparation of financial statement and Profit & Loss Account, Balance Sheet. , Ratio Analysis - classification of various ratios.

## UNIT - 3

**Introduction To Financial Management:** Concept of business finance, Goals & objectives of financial management, Sources of financing, Long Term financing- shares, debentures, term loans, lease & hire purchase, retained earnings, public deposits, bonds (Types, features & utility). Short Term Financing- bank finance, commercial paper, trade credit

## UNIT - 4

**Working Capital Management:** Concept of working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, financing approaches for working capital, Methods of forecasting working capital requirements, Methods of Forecasting.

## UNIT - 5

**Time Value of Money & Capital Budgeting:** Concept of time value of money, Compounding & discounting; Future value of single amount & annuity, present value of single amount & annuity; Practical application of time value technique. Capital budgeting - Nature and significance, techniques of capital budgeting –Pay Back Method, Accounting rate of return, Internal Rate of Return, DCF, Net Present Value and profitability index.

## UNIT - 6

**Project Financing:** Details of the company, its promoters and project finances required, profitability etc., Loan documentation-Appraisal of terms loans by financial institutions. Basic components of project finance.

## TEXT & REFERENCE BOOKS


1. Financial Management by Khan & Jain, Text, Problem & Cases, Tata McGraw Hill Publication 5th Edition.
2. Tulsian Financial Management by Dr. P.C.Tulsian, S Chand Publication 5th Edition.
3. Taxman's Financial Management by Ravi M. Kishore, Taxmann 2017 Edition.
4. A Textbook of Financial , Cost & Management Accounting by Dr.P.Pariasamy, Himalaya Publishing House
5. Fundamentals of financial Management by Bhabhtosh Banerjee, PHI publication, 2nd Edition.

**BTETPE801A** **Introduction to Internet of Things** **4 Credits**

**PROF. SUDIP MISRA Dept. of Computer Science and Engineering IIT Kharagpur**
**Course Duration: 12 week**

**Course Outline:**
Internet of Things (IoT) is presently a hot technology worldwide. Government, academia, and industry are involved in di-erent aspects of research, implementation, and business with IoT. IoT cuts across di-erent application domain verticals ranging from civilian to defence sectors. These domains include agriculture, space, healthcare, manufacturing, construction, water, and mining, which are presently transitioning their legacy infrastructure to support IoT. Today it is possible to envision pervasive connectivity, storage, and computation, which, in turn, gives rise to building di-erent IoT solutions. IoT-based applications such as innovative shopping system, infrastructure management in both urban and rural areas, remote health monitoring and emergency notication systems, and transportation systems, are gradually relying on IoT based systems. Therefore, it is very important to learn the fundamentals of this emerging technology.

**Course Plan:**
Week 01 : Introduction to IoT, Sensing, Actuation, Basics of Networking.

Week 02 : Basics of Networking, Communication Protocols.

Week 03 : Communication Protocols, Sensor Networks

Week 04 : Sensor Networks, Machine-to-Machine Communications.

Week 05 : Interoperability in IoT, Introduction to Arduino Programming, Integration of Sensors and Actuators with Arduino.

Week 06 : Introduction to Python programming, Introduction to Raspberry.

Week 07 : Implementation of IoT with Raspberry Pi, Introduction to SDN.

Week 08 : SDN for IoT, Data Handling and Analytics, Cloud Computing

Week 09 : Cloud Computing, Sensor-Cloud.

Week 10 : Fog Computing, Smart Cities and Smart Homes

Week 11 : Connected Vehicles, Smart Grid, Industrial IoT

Week 12 : Industrial IoT, Case Study: Agriculture, Healthcare, Activity Monitoring

**BTETPE801B** **Computer Vision and Image Processing** **4 Credits**

**Dr. M. K. Bhuyan**
**Professor, Indian Institute of Technology Guwahati,**
**Course Duration: 12 week**

**Course Outline:**
The course familiarizes students with fundamental concepts and issues related to computer vision and major approaches that address them. The focus of the course is on image acquisition and image formation models, radiometric models of image formation, image formation in the camera, image processing concepts, concept of feature extraction and feature selection for pattern classification/recognition, and advanced concepts like object classification, object tracking, image-based rendering, and image registration. Intended to be a companion to a typical teaching course on computer vision, the course takes a problem-solving approach

**Course Plan:**

**I Image Formation and Image Processing**
Introduction to Computer Vision and Basic Concepts of Image Formation
Introduction and Goals of Computer Vision, Image Formation and Radiometry, Geometric Transformation, Geometric Camera Models, Image Reconstruction from a Series of Projections

Image Processing Concepts
Fundamentals of Image Processing, Image Transforms, Image Filtering, Colour Image Processing, Mathematical Morphology, Image Segmentation

**II Image Features**
Image Descriptors and Features
Texture Descriptors, Colour Features, Edge Detection, Object Boundary and Shape Representations, Interest or Corner Point Detectors, Histogram of Oriented Gradients (HOG), Scale Invariant Feature Transform (SIFT), Speeded up Robust Features (SURF), Saliency

**III Recognition**
Fundamental Pattern Recognition Concepts
Introduction to Pattern Recognition, Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Gaussian Classifier, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Template Matching, Artificial Neural Network (ANN) for Pattern Classification, Convolutional Neural Networks (CNNs), Autoencoder

**IV Applications**
Applications of Computer Vision
Machine Learning Algorithms and their Applications in Medical Image Segmentation, Motion Estimation and Object Tracking, Face and Facial Expression Recognition, Gesture Recognition, Image Fusion, Programming Examples

**BTETPE801C** **Biomedical Signal Processing** **4 Credits**

**Prof. Sudipta Mukhopadhyay ,IIT Kharagpur**
**Course Duration: 12 week**

**Course outline:**
This course is prepared for the engineering students in their final year of undergraduate studies or in their graduate studies. Electrical Engineering students with a good background in Signals and Systems are prepared to take this course. Students in other engineering disciplines, or in computer science, mathematics, geo physics or physics should also be able to follow this course. While a course in Digital Signal Processing would be useful, it is not necessary for a capable student. The course has followed problem solving approach as engineers are known as problem solvers. The entire course is presented in the form of series of problems and solutions.

**Course Plan:**

Week 1: Preliminaries; Biomedical signal origin & dynamics (ECG)

Week 2: Biomedical signal origin & dynamics (EEG, EMG etc.)

Week 3: Filtering for Removal of artifacts Statistical Preliminaries; Time domain filtering (Synchronized Averaging, Moving Average)

Week 4: Filtering for Removal of artifacts contd. Time domain filtering (Moving Average Filter to Integration, Derivative-based operator), Frequency Domain Filtering (Notch Filter)

Week 5: Filtering for Removal of artifacts contd. Optimal Filtering: The Weiner Filter

Week 6: Filtering for Removal of artifacts contd. Adaptive Filtering Selecting Appropriate Filter

Week 7: Event Detection Example events (viz. P, QRS and T wave in ECG) Derivative based Approaches for QRS Detection Pan Tompkins Algorithm for QRS Detection

Week 8: Event Detection contd. Dicrotic Notch Detection Correlation Analysis of EEG Signal

Week 9: Waveform Analysis Illustrations of problem with case studies Morphological Analysis of ECG Correlation coefficient The Minimum phase correspondent and Signal Length

Week 10: Waveform Analysis contd. Envelop Extraction Amplitude demodulation The Envelogram Analysis of activity Root Mean Square value Zero-crossing rate Turns Count, Form factor

Week 11: Frequency-domain Analysis Periodogram

Week 12: Frequency-domain Analysis Averaged Periodogram Blackman-Tukey Spectral Estimator Daniellâ€™s Spectral Estimator Measures derived from PSD

**BTETPE 802A** **Industrial Automation and Control** **4 Credits**

**Prof. S. Mukhopadhyay Department of Electrical Engineering IIT Kharagpur**
**Course Duration: 12 week**

**Course Plan:**

Week 1: Introduction to Industrial Automation and Control , Architecture of Industrial Automation Systems, Introduction to sensors and measurement systems

Week 2: Temperature measurement, Pressure and Force measurements, Displacement and speed measurement, Flow measurement techniques , Measurement of level, humidity, pH etc

Week 3: Signal Conditioning and Processing, Estimation of errors and Calibration

Week 4: Introduction to Process Control, P-- I -- D Control, Controller Tuning.

Week 5: Implementation of PID Controllers, Special Control Structures : Feedforward and Ratio Control. Predictive Control, Control of Systems with Inverse Response, Cascade Control, Overriding Control, Selective Control, Split Range Control

Week 6: Introduction to Sequence Control, PLCs and Relay Ladder Logic Sequence Control : Scan Cycle, RLL Syntax , Structured Design Approach

Week 7: Sequence Control : Advanced RLL Programming ,The Hardware environment

Week 8 : Control of Machine tools : Introduction to CNC Machines , Analysis of a control loop

Week 9 : Introduction to Actuators : Flow Control Valves , Hydraulic Actuator Systems : Principles, Components and Symbols , Pumps and Motors, Proportional and Servo Valves

Week 10 : Pneumatic Control Systems : System Components , Controllers and Integrated Control Systems, Electric Drives : Introduction, Energy Saving with Adjustible Speed Drives , Step motors : Principles, Construction and Drives

Week 11: DC Motor Drives: Introduction, DC--DC Converters, Adjustible Speed Drives , Induction Motor Drives: Introduction, Characteristics, Adjustible Speed Drives ,Synchronous Motor Drives : Motor Principles, Adjustible Speed and Servo Drives

Week 12: Networking of Sensors, Actuators and Controllers : The Fieldbus ,The Fieldbus Communication Protocol , Introduction to Production Control Systems

**BTETPE 802B** **Cryptography and Network Security** **4 Credits**

**Dr. Debdeep Mukhopadhyay IIT Kharagpur**

**Course Duration: 12 week**

**Course Outline**

The course deals with the underlying principles of cryptography and network security. It develops the mathematical tools required to understand the topic of cryptography. Starting from the classical ciphers to modern day ciphers, the course provides an extensive coverage of the techniques and methods needed for the proper functioning of the ciphers. The course deals with the construction and cryptanalysis of block ciphers, stream ciphers and hash functions. The course defines one way functions and trap-door functions and presents the construction and cryptanalysis of public key ciphers, namely RSA. The key exchange problem and solutions using the DiffieHellman algorithm are discussed. Message Authentication Codes (MAC) and signature schemes are also detailed. The course deals with modern trends in asymmetric key cryptography, namely using Elliptic Curves. The course concludes with the design rationale of network protocols for key exchange and attacks on such protocols

**Course Plan:**

**Introduction and Mathematical Foundations**

Introduction, Overview on Modern Cryptography, Number Theory, Probability and Information Theory

**Classical Cryptosystems**

Classical Cryptosystems, Cryptanalysis of Classical Cryptosystems, Shannon's Theory

**Symmetric Key Ciphers**

Symmetric Key, Ciphers Modern Block Ciphers (DES), Modern Block Cipher (AES)

**Cryptanalysis of Symmetric Key Ciphers**

Linear Cryptanalysis, Differential Cryptanalysis, Other Cryptanalytic Techniques, Overview on S-Box Design Principles, Modes of operation of Block Ciphers

**Stream Ciphers and Pseudo-randomness**

Stream Ciphers, Pseudorandom functions

**Hash Functions and MACs**

Hash functions: The Merkle Damgard Construction, Message Authentication Codes (MACs)

**Asymmetric Key Ciphers: Construction and Cryptanalysis**

More Number Theoretic Results ,The RSA Cryptosystem, Primality Testing, Factoring Algorithms , Other attacks on RSA and Semantic Security of RSA ,The Discrete Logarithm Problem (DLP) and the Diffie Hellman Key Exchange algorithm, The ElGamal Encryption Algorithm Cryptanalysis of DLP

**Digital Signatures**

Signature schemes

**Modern Trends in Asymmetric Key Cryptography**

Elliptic curve based cryptography

**Network Security**

Secret Sharing Schemes, A Tutorial on Network Protocols, Kerberos, Pretty Good Privacy (PGP) Secure Socket Layer (SSL), Intruders and Viruses, Firewalls

**BTETPE 802C** **Digital IC Design** **4 credits**

**PROF. JANAKIRAMAN Electrical and Electronics Engineering IIT Madras**

**Course Duration : 12 weeks**

**Course Outline:** This is a most fundamental Digital Circuit Design course for pursing a major in VLSI. We do not deal with any Verilog coding during this course and instead discuss transistor level circuit design concepts in great detail.

Learning objectives of this course are:

• Characterize the key delay quantities of a standard cell

• Evaluate power dissipated in a circuit (dynamic and leakage)

• Design a circuit to perform a certain functionality with specified speed

• Identify the critical path of a combinational circuit

• Convert the combinational block to pipelined circuit

• Calculate the maximum (worst case) operating frequency of the designed circuit

**Course Plan:**

Week 1: The CMOS Inverter construction and Voltage Transfer Characteristics

Week 2: Resistance and Capacitance and transient response.

Week 3: Dynamic, Short Circuit and Leakage power – Stacking Effect

Week 4: Combinational Circuit Design and capacitance

Week 5: Parasitic Delay, Logical Effort and Electrical Effort

Week 6: Gate sizing and Buffering

Week 7: Asymmetric gate, Skewed gates, Ratio'ed logic

Week 8: Dynamic Gates and Domino logic and Static Timing Analysis

Week 9: Sequential circuits and feedback. Various D flip flop circuits – Static and Dynamic

Week 10: Setup and Hold Time measurement. Timing analysis of latch/ flop based systems

Week 11: Adders – Mirror adder, Carry Skip adder, Carry Select adder, Square Root adder

Week 12: Multipliers – Signed and Unsigned arithmetic, Carry Save Multiplier implementation