ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು

(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

ಬುಲ್ ಟೆಂಪಲ್ ರಸ್ತೆ, ಬೆಂಗಳೂರು – ೫೬೦ ೦೧೯

# BMS College of Engineering, Bangalore – 19

**Autonomous College under VTU**

## Department of Electronics & Communication Engineering

**Scheme and Syllabus for III – VIII Semester**

# Batch admitted 2019 & 2020

## INSTITUTE VISION

Promoting Prosperity of mankind by augmenting human resource capital through Quality Technical Education & Training

## INSTITUTE MISSION

Accomplish excellence in the field of Technical Education through Education, Research and Service needs of society

## PROGRAM VISION

To emerge as a Centre of Academic Excellence in Electronics, Communication and related domains through Knowledge acquisition, Knowledge dissemination and Knowledge Generation meeting global needs and standards

## PROGRAM MISSION

Imparting Quality Education through state of the art curriculum, Conducive Learning Environment and Research with scope for continuous improvement leading to overall Professional Success

## PROGRAM EDUCATIONAL OBJECTIVES

PEO 1: Graduates will Professionally Progress in Electronics, Communication and related areas with an inclination towards Continuous Learning

PEO 2: Graduates will work in Diversified Teams of Multidisciplinary Environment

PEO 3: Graduates will exhibit good Inter-personal skills, adapt themselves for changes in Contemporary Technology

## PROGRAM SPECIFIC OUTCOMES

**The students will be able to -**

1. Analyse and design electronic systems for signal processing and communication applications.
2. Demonstrate the Conceptual domain Knowledge with respect to Architecture, Design, Analysis and Engineering deployment in Data communication and Computer networking.
3. Identify and apply domain specific tools for design, analysis, synthesis and validation of VLSI and Communication systems.

# PROGRAM OUTCOMES

Program Outcomes (POs), are attributes acquired by the student at the time of graduation. The POs given in the Table below, ensure that the POs are aligned to the Graduate Attributes (GAs) specified by National Board of Accreditation (NBA). These attributes are measured at the time of Graduation, and hence computed every year for the outgoing Batch. The POs are addressed and attained through the Course Outcomes (COs) of various courses of the curriculum.

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and anengineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineeringproblems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design systemcomponents or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methodsincluding design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineeringand IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal,health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions insocietal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of theengineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverseteams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineeringcommunity and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering andmanagement principles and apply these to one‟s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independentand life-long learning in the broadest context of technological change.

**BMS College of Engineering, Bangalore – 19**
**Autonomous College under VTU**

# SCHEME

**SEMESTER: III**

| Sl No. | Code | Course Title | Type | Credits | | | | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | | CIE | SEE | Total |
| 1 | 19MA3BSEM3 | Engineering Mathematics – III | BS | 3 | 1 | 0 | 4 | 5 | 50 | 50 | 100 |
| 2 | 19ES3CCECA | Electrical Circuit Analysis | PC | 3 | 1 | 0 | 4 | 5 | 50 | 50 | 100 |
| 3 | 19ES3CCAEC | Analog Electronic Circuits | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 4 | 19ES3CCDEC | Digital Electronics Circuits | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 5 | 19ES3GCFTH | Field Theory | PC | 3 | 1 | 0 | 4 | 5 | 50 | 50 | 100 |
| 6 | 19EC3DCMSA | Modern Sensors and its Applications | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 7 | 19EC3PWMP1 | Mini Project I | PW | 0 | 0 | 1 | 1 | 2 | 50 | 50 | 100 |
| 8 | 19IC3HSCPH | Constitution of India, Professional Ethics and Human Rights | HS | 1 | 0 | 0 | 1 | 1 | 50 | 50 | 100 |
| 9 | 19EC3NCPYA | Physical activity | NC | - | - | - | - | 2 | - | - | P/NP |
| | | **Total** | | **19** | **3** | **3** | **25** | **33** | **400** | **400** | **800** |

# SCHEME

**SEMESTER: IV**

| Sl No. | Code | Course Title | Type | Credits | | | | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | L | T | P | Total | | CIE | SEE | Total |
| 1 | 19MA4BSEM4 | Engineering Mathematics –IV | BS | 3 | 1 | 0 | 4 | 5 | 50 | 50 | 100 |
| 2 | 19ES4ESCST | Control Systems | ES | 3 | 1 | 0 | 4 | 5 | 50 | 50 | 100 |
| 3 | 19ES4CCLIC | Linear Integrated Circuits | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 4 | 19ES4CCMCS | Microcontrollers | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 5 | 19ES4CCSAS | Signals and Systems | PC | 3 | 1 | 0 | 4 | 5 | 50 | 50 | 100 |
| 6 | 19EC4PCHDL | HDL Programming | PC | 2 | 1 | 0 | 3 | 4 | 50 | 50 | 100 |
| 7 | 19HS4PCEVS | Environmental studies | HS | 1 | 0 | 0 | 1 | 1 | 50 | 50 | 100 |
| 8 | 20HS4ICSAK / 20HS4ICBAK | Samskruthika Kannada / Balake Kannada | HS | 1 | 0 | 0 | 1 | 1 | 50 | 50 | 100 |
| 9 | 19EC4NCCAS | Media Communication / Sanskrit for Science | NC | - | - | - | - | 2 | - | - | P/NP |
| | | **Total** | | **19** | **4** | **2** | **25** | **33** | **400** | **400** | **800** |

# SCHEME

**SEMESTER: V**

| Sl No. | Code | | Course Title | Type | Credits | | | | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total | | CIE | SEE | Total |
| 1 | 19EC5PCCT1 | | Communication Theory I | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 2 | 19EC5PCFOV | | Fundamentals of VLSI | PC | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 3 | 19EC5PCANT | | Antenna Theory | PC | 3 | 1 | 0 | 4 | 5 | 50 | 50 | 100 |
| 4 | 19ES5CCDSP | | Digital Signal Processing | CC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 5 | 19EC5PE1 (Program Elective –I) | CA | Computer Architecture | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| | | AD | Advanced Digital Logic Design | | 3 | 0 | 0 | | | | | |
| | | PS | Probability and Statistics | | 3 | 0 | 0 | | | | | |
| | | OP | Object Oriented Programming using C++ | | 3 | 0 | 0 | | | | | |
| 6 | 19EC5PE2 (Program Elective –II) | SC | Satellite Communication | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| | | IP | Image Processing | | | | | | | | | |
| | | RB | Robotics | | | | | | | | | |
| | | OS | Operating System | | | | | | | | | |
| 7 | 19EC5PWMP2 | | Mini Project – II | PW | 0 | 0 | 2 | 2 | 4 | 50 | 50 | 100 |
| 8 | 19ES5HSIFE | | Innovation for Entrepreneurship | HS | 2 | 0 | 0 | 2 | 2 | 50 | 50 | 100 |
| 9 | 19EC5NCCMS | | Community service | NC | - | - | - | - | 2 | - | - | P/NP |
| | | | **Total** | | **20** | **1** | **4** | **25** | **32** | **400** | **400** | **800** |

# SCHEME

**SEMESTER: VI**

| SL No. | Code | | Course Title | Type | Credits | | | | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total | | CIE | SEE | Total |
| 1 | 19EC6PCCCN | | Computer Communication Networks | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 2 | 19EC6PCMSD | | Mixed Signal Design | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 3 | 19EC6PCCT2 | | Communication Theory II | PC | 3 | 0 | 1 | 4 | 5 | 50 | 50 | 100 |
| 4 | 19EC6PE3 (Program Elective –III) | AE | Automotive Embedded Systems | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| | | SV | System Verilog & Verification | | | | | | | | | |
| | | DS | Data Structure & Applications | | | | | | | | | |
| | | IT | Internet of Things | | | | | | | | | |
| 5 | 19EC6CE1 (Cluster Elective-I) | ML | Machine Learning | CE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| | | AM | Advanced Microcontroller and Applications | | | | | | | | | |
| | | CV | Computer vision | | | | | | | | | |
| | | PD | Physical Design | | | | | | | | | |
| 6 | 19EC6OE1 (Open Elective-I) | EM | Electronic Engineering Materials | OE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 7 | 19EC6SRTSR | | Technical Seminar on Safety & Standards/Sustainability & Environment/ Engineering & Technology for Society | SR | 0 | 0 | 2 | 2 | 4 | 50 | 50 | 100 |
| 8 | 19GC6HSEEC | | Engineering Economics | HS | 2 | 0 | 0 | 2 | 2 | 50 | 50 | 100 |
| 9 | 19EC6NCPDC | | Personality Development and Communication | NC | - | - | - | - | 2 | - | - | - |
| | | | **Total** | | **20** | **1** | **4** | **25** | **32** | **400** | **400** | **800** |

## SCHEME

**SEMESTER: VII**

| SL. No. | Code | | Course Title | Type | Credits | | | | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total | | CIE | SEE | Total |
| 1 | 19ES7BSBFE | | Biology for Engineers | BS | 2 | 0 | 0 | 2 | 2 | 50 | 50 | 100 |
| 2 | 19EC7PCESD | | Embedded System Design | PC | 3 | 0 | 1 | 4 | 4 | 50 | 50 | 100 |
| 3 | 19EC7PCRFM | | RF & Microwave Engineering | PC | 2 | 0 | 0 | 2 | 2 | 50 | 50 | 100 |
| 5 | 19EC7CE2 (Cluster Elective–II) | WC | Wireless Communication | PE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| | | NC | Network Security & Cryptography | | | | | | | | | |
| | | SC | System On Chip | | | | | | | | | |
| | | EP | Electronics Packaging | | | | | | | | | |
| | | LV | Low Power VLSI | | | | | | | | | |
| | | DL | Deep Learning | | | | | | | | | |
| 6 | 19EC7OE2 (Open Elective-II) | MC | Fundamentals of Mobile Communications | OE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 7 | 19ES7HSPMF | | Project Management & Finance | HS | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| 8 | 19EC7PWMP3 | | Mini Project- III | PW | 0 | 0 | 2 | 2 | 4 | 50 | 50 | 100 |
| 9 | 19EC7NCMCC | | Any MOOC Course with Certification | NC | - | - | - | - | 2 | - | - | P/NP |
| | | | **Total** | | **16** | **0** | **3** | **19** | **23** | **350** | **350** | **700** |

* Mini Project to address Societal needs

## SCHEME

**SEMESTER: VIII**

| SL no. | Code | | Course Title | Type | Credits | | | | Hours | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | L | T | P | Total | | CIE | SEE | Total |
| 1 | 19ES8HSIPL | | Intellectual Property Rights and Cyber Law | HS | 2 | 0 | 0 | 2 | 2 | 50 | 50 | 100 |
| 2 | 19EC8OE3 | ME | Microelectromechanical Systems | OE | 3 | 0 | 0 | 3 | 3 | 50 | 50 | 100 |
| | | AE | Automotive Electronics | | | | | | | | | |
| 3 | 19EC8PWMPW | | Major Project Work | PW | 0 | 0 | 9 | 9 | 18 | 50 | 50 | 100 |
| 4 | 19EC8SRISR | | Seminar on Internship | SR | 0 | 0 | 2 | 2 | 4 | 50 | 50 | 100 |
| 5 | 19EC8NCMEP | | MOOC Course on Engineering Practices | NC | - | - | - | - | 2 | - | - | P/NP |
| | | | **Total** | | **5** | **0** | **11** | **16** | **29** | **200** | **200** | **400** |

## Distribution of Credits among various Curricular Components

| Sem | Humanities andSocial Science Course | Basic Science Course (BS) | Engineering Science course (ES) | Professional Core (PC) | Professional Elective (PE) | Open Elective (OE) | Project Work (PW) | Technical Seminar (SR) | Internship Seminar (ISR) | Non Credit Mandatory Course (NC) | Total Credits |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **I** | | 9 | 11 | | | | | | | NC1 | **20** |
| **II** | | 9 | 11 | | | | | | | NC 2 | **20** |
| **III** | 1 | 4 | | 19 | | | 1 | | | NC 3 | **25** |
| **IV** | 2 | 4 | 4 | 15 | | | | | | NC 4 | **25** |
| **V** | 2 | | | 15 | 6 | | 2 | | | NC 5 | **25** |
| **VI** | 2 | | | 12 | 6 | 3 | | 2 | | NC 6 | **25** |
| **VII** | 3 | 2 | | 6 | 3 | 3 | 2 | | | NC 7 | **19** |
| **VIII** | 2 | | | | | 3 | 9 | | 2 | NC 8 | **16** |
| **Course Total** | **12** | **28** | **26** | **67** | **15** | **9** | **14** | **2** | **2** | | **175** |

# III SEMESTER SYLLABUS

**BMS College of Engineering, Bangalore – 19**
(Autonomous College under VTU)

| Course Title | ENGINEERING MATHEMATICS – III (Common to AS/CV/EEE/ECE/EIE/ML/TCE) | | | | |
|---|---|---|---|---|---|
| Course Code | 19MA3BSEM3 | Credits | 4 | L-T-P | 3:1:0 |

**Course outcomes:**

At the end of the course students will have the ability to:

| | |
|---|---|
| CO 1 | Apply Numerical techniques to solve problems arising in engineering. |
| CO 2 | Demonstrate an understanding of Fourier Series, Fourier Transformsand Z- Transforms. |
| CO 3 | Apply the concepts of calculus to functional. |

## UNIT-1

### MATRICES

Introduction: Elementary row transformations, Echelon form of a matrix, rank of a matrix by elementary row transformations. Consistency of a system of linear equations and solution. Solution of a system of non-homogenous equations: Gauss elimination method, Gauss-Seidel method, LU decomposition method, eigenvalues and eigenvectors of matrices, reduction of a matrix to diagonal form. **9 Hrs(7L + 2T)**

## UNIT-2

### FOURIER SERIES

Introduction: Dirichlet's conditions, Fourier series of periodic functions of period 2*l*, Fourier series of functions having points of discontinuity. Applications: Fourier series of typical waveforms like saw toothed waveform, triangular waveform, square waveform, half-wave rectifier, full wave rectifier and modified saw tooth waveform, exponential Fourier series, practical harmonic analysis. **9 Hrs (7L + 2T)**

## UNIT-3

### FOURIER TRANSFORMS

Infinite Fourier transform: Fourier Sine and Cosine transforms, properties, Inverse transforms. Convolution theorem, Parseval's identities. **9 Hrs(6L + 3T)**

## UNIT-4

### NUMERICAL METHODS

Solution of algebraic and transcendental equations: Newton-Raphson method.

Finite Differences and interpolation: Forward differences, backward differences. Newton-Gregory forward interpolation formula, Newton-Gregory backward interpolation formula, Lagrange's interpolation formula, Lagrange's inverse interpolation. Numerical integration: Simpson's 1/3 rule, Simpson's 3/8th rule, Weddle's rule.
Numerical solution of ordinary differential equations: modified Euler's method, Runge-Kutta method of fourth order**.** **10 Hrs (8L + 2T)**

## UNIT-5

### CALCULUS OF VARIATIONS

Variation of a functional, Euler's equation, variational problems. Applications: Hanging cable problem, Brachistochrone problem.

### Z -TRANSFORMS

Definition, Properties, Transforms of standard functions, Inverse transforms. Solution of difference equations using Z- transforms. **11 Hrs(8L + 3T)**

**Text Books:**

1. Higher Engineering Mathematics, B. S. Grewal, 43rd edition, 2014, Khanna Publishers.
2. Advanced Engineering Mathematics, 4th edition, 2011, Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd.

**Reference Books:**

1. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.
2. Advanced Engineering Mathematics, Erwin Kreyszig, 10th edition Vol.1 and Vol.2, 2014, Wiley- India.

**E books and online course materials:**

1. https://ocw.mit.edu/courses/mechanical-engineering/2-993j-introduction-to-numerical-analysis- for-engineering-13-002j-spring-2005/lecture-notes/
2. https://www.pdfdrive.com/calculus-of-variations-e34313748.html

**Online Courses and Video Lectures:**

1. https://nptel.ac.in/courses/111103021/22 (Fourier series and Transforms, Heat and Wave Equations)
2. https://nptel.ac.in/courses/122104018/2 (Numerical Methods)
3. https://nptel.ac.in/courses/111104025/ (Calculus of variation)

**BMS College of Engineering, Bangalore – 19**
(Autonomous College under VTU)

| Course Title | ELECTRICAL CIRCUIT ANALYSIS | | | | |
|---|---|---|---|---|---|
| Course Code | 19ES3CCECA | Credits | 4 | L-T-P | 3:1:0 |

**Course outcomes:**

At the end of the course students will have the ability to:

| | |
|---|---|
| CO1 | Formulate equations based on physical laws and analyze the steady state behaviour of complex electric networks. |
| CO2 | Apply the knowledge of mathematics and graph theory to the solution of complex electrical networks. |
| CO3 | Apply mathematical and analytical techniques to analyze transient behaviour of networks. |
| CO4 | Analyze networks based on two port networks and Unbalanced three-phase load. |

## UNIT-I

**Basic Concepts:** Practical sources, Source Transformations, Network reduction using Star-Delta transformation, Loop and nodal analysis with linearly dependent and independent sources for DC and AC circuits, coupled circuit, Analysis of networks using concepts of super node, Super mesh. **10 Hrs**

## UNIT-II

**Network Topology:** Graph of a network, Concept of tree and Co-tree, Incidence matrix, tie-set & cut-set schedules, Formulation of equilibrium equations, Principle of duality.

**Resonant Circuits:** Series and parallel resonance, frequency response of series and parallel circuits, Q factor, Bandwidth. **10 Hrs**

## UNIT-III

**Network Theorems:** Superposition, Reciprocity, Millman's, Thevenin's and Norton's theorems, Maximum power transfer theorem. **10 Hrs**

## UNIT-IV

**Transient Behavior and Initial Conditions:**Behavior of circuit elements under switching condition and their representation, Evaluation of Initial and Final conditions in RL, RC and RLC circuits.

**Laplace Transformation & Applications:** Review of Laplace transforms, Waveform Synthesis, Initial and Final value theorems, Step, Ramp and Impulse responses, Convolution theorem, solution of simple R-L, R-C, R-L-C networks for AC and DC excitations using Laplace transforms. **10 Hrs**

## UNIT-V

**Analysis of Two Port Network and its Parameters :**
Definition of Z, Y, T, h parameters, modeling, relationship between parameters sets.

**10 Hrs**

**Text books:**


1. "Network Analysis", M.E.Vanvalkenburg, PHI/ Pearson Education, 3rd Edition. Reprint 2002.
2. "Networks and systems ", Roy Choudhury, 2nd edition, 2006 reprint, New Age International Publications.
3. Theory and Problems of Electric Circuits, Schaum's Series, 2nd Edition McGraw Hill.


**Reference books:**


1. "Engineering Circuit Analysis", Hayt, Kemmerly and Durbin, TMH 6th 2002.
2. "Network analysis and Synthesis", Franklin F. Kuo, Wiley Edition.
3. "Analysis of Linear Systems", David K. Cheng, Narosa Publishing House, 11th reprint, 2002.
4. "Circuits", Bruce Carlson, Thomson learning, 2000. Reprint 2002.
5. "Network analysis and Synthesis", Anand Kumar, PHI Learning, 2019.


**MOOCs:**

1. http://elearning.vtu.ac.in/06ES34.html

2. https://www.coursera.org/course/circuits

**BMS College of Engineering, Bangalore – 19**
(Autonomous College under VTU)

| Course Title | ANALOG ELECTRONIC CIRCUITS | | | | |
|---|---|---|---|---|---|
| Course Code | 19ES3CCAEC | Credits | 4 | L-T-P | 3:0:1 |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO | Course Outcomes |
|---|---|
| CO-1 | Define, understand and explain concepts related to diodes and transistors ( BJTs and MOSFETs) |
| CO-2 | Apply the knowledge of network theorems and device models to solve given analog electronic circuits |
| CO-3 | Analyze a given analog electronic circuits to compute required parameters |
| CO-4 | Design analog electronic circuits for a given specification |
| CO-5 | Conduct experiments to demonstrate the knowledge of design and analysis using circuit simulators/hardware. |

## UNIT-I

**Diode Applications:** Introduction, load line analysis, Series diode configurations, Parallel and series–parallel configurations, clippers, Clampers.
**Bipolar Junction Transistor (BJTs):** DC biasing– Introduction, operating point, voltage divider Bias configuration
**BJT AC Analysis:** Introduction, Application in the AC Domain, BJT Transistor Modeling Transistor model, Voltage Divider Bias **8 Hrs**

## UNIT-II

**BJT Frequency Response:** Introduction, Logarithms, Decibels, Low frequency Response-BJT Amplifier, Miller effect Capacitance, High Frequency response – BJT Amplifier
**Feedback concepts:** Feedback connection types- Voltage series, Voltage-shunt, Current Series and Current Shunt Feedback.
**Practical feedback Circuits:** Voltage series, Current series feedback and voltage Shunt feedback. **8 Hrs**

## UNIT-III

**Power Amplifiers:** Introduction- Definitions and Amplifier Types, Amplifier Efficiency Series-Fed Class A Amplifier: DC Bias Operation, AC operation, Power Consideration, Efficiency.

**Transformer coupled Class A Amplifier:** Operation of Amplifier Stage : DC load line, Quiescent operating point, AC load line , Signal Swing and Output AC power.

**Class B operation:** Class B Amplifier Circuits, Transformer coupled Push-Pull Circuits, Complementary Symmetry Circuits and Amplifier Distortion **8 Hrs**

## UNIT-IV

**MOSFETS:** Introduction ,Device structure and physical operation- Device structure, operation with no gate voltage, creating a channel for current flow, Applying a small VDs, Operation as VDs is increased, Derivation of the id – VDS relationship, The P- Channel MOSFET, Complementary MOS or CMOS, operating the MOS transistor in the sub-threshold region.

**Current voltage Characteristics-**Circuit symbol, $I_D - V_{DS}$ characteristics, characteristics of the P- Channel MOSFET

**MOSFET Circuits at DC The MOSFET as an amplifier and as a switch** - Large – signal operation, Graphical derivation of the transfer characteristic, operation as a switch, operation as a linear amplifier.

**Biasing in MOS amplifier circuits**---Biasing by fixing $V_{GS}$, Biasing by fixing $V_G$ and connecting a resistor in the source , Biasing using a drain to gate feedback resistor, biasing using a current source. **8 Hrs**

## UNIT-V

**Small signal operation and models of MOSFETs:** The DC bias point, the signal current in the drain terminal, the voltage gain, separating dc analysis and the signal analysis, small signal equivalent circuit models, the trans conductance gm, the T equivalent circuit model.

**Single stage MOS amplifiers:** The basic structure, characterizing amplifiers, The CS amplifier, The CS amplifier with a source resistance, Common gate (CG) Amplifier, The common Drain or source follower Amplifier.

**IC Biasing:** Current sources, current mirror and current steering circuits: The basic MOSFET current source, MOS current steering circuits

**Current mirror circuit with improved performance**- The Wilson MOS mirror **8 Hrs**

**Text books:**

1. Electronic Devices and Circuit Theory-Robert L. Boylestad and Louis Nashelsky-10thedition (Pearson Education)

2. Microelectronic Circuits-Theory and applications by Adel S. Sedra and Kenneth C.Smith $5^{th}$ Edition (Oxford International Student Edition)

**Reference Books:**

1. Electronic Devices and Circuits- Millman and Halkias, TMH
2. Electronic Devices and Circuits- David A Bell - PHI 4thedition

**E Books:**

1. ww.pyroelectro.com/edu/analog

2. http://freevideolectures.com/course/3020/circuits-for-Analog-System-Design

**MOOCs:**

1. https://www.mooc-list.com/course/electronic-systems-and-digital-electronics-uninettuno?static=true

2. http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-012-microelectronic-devices-and-circuits-spring-2009/

3. Introductory Analog Electronics Laboratory (Spring 2007) by MIT open courseware Reviews and Ratings

## LABORATORY EXPERIMENT LIST

| Sl.No | Title of the Experiments |
|---|---|
| | **Conduction using Hardware** |
| **1.** | To design and configure BJT as a switch |
| 2. | Design of Bridge rectifier with Capacitor filter |
| 3. | Zener diode characteristics and Zener as regulator |
| 4. | Diode clipping circuits- Single/Double ended |
| 5. | Diode clamping Circuits – Positive clamping/negative clamping |
| 6. | Performance analysis of RC coupled amplifier using BJT |
| 7. | Design and analysis of BJT as RC phase shift oscillator |
| 8. | Design and analysis of Crystal Oscillators |
| 9. | Performance analysis of class – B Power Amplifier |
| 10. | To study voltage series feedback amplifier using BJT |
| | **Conduction using Simulation Tools** |
| 1. | To obtain the characteristics of MOSFET |
| 2. | To design a CS amplifier circuit using MOSFET |

**BMS College of Engineering, Bangalore – 19**
(Autonomous College under VTU)

| Course Title | DIGITAL ELECTRONIC CIRCUITS | | | | |
|---|---|---|---|---|---|
| Course Code | 19ES3CCDEC | Credits | 4 | L-T-P | 3:0:1 |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO | Course Outcomes |
|---|---|
| CO-1 | Understand the fundamental logic functions and Basic Building blocks of Digital Logic design |
| CO-2 | Analyse and Realise logic functions by choosing the suitable logic blocks |
| CO-3 | Optimize the logic circuit with cost effective solution |
| CO-4 | Design a complete digital circuit for given problem statement by applying the digital circuit concepts |
| CO-5 | Conduct experiments using digital ICs to demonstrate a given application/ problem statement. |

## UNIT-I

**Introduction:** Review of Boolean algebra, logic gates.
**Simplification of Boolean functions:** Three Variable, Four Variable and Five Variable K – Maps, The Tabulation Method, Design with Basic gates, NAND gates and NOR gates

**8 Hrs**

## UNIT-II

**Combinational Logic Circuits:** Introduction, Parallel Adders (Carry Look Ahead Adder and Ripple carry adder), Decimal Adder, Code conversion, Magnitude Comparator, Decoders, Multiplexers, Read Only memories (ROM), Programmable Logic Arrays (PLAs).

**8 Hrs**

## UNIT-III

**Sequential Logic Circuits:** The Basic Flip-flop circuit, Clocked Flip-flops, Triggering of Flip-flops: Master Slave Flip-Flops, Edge Triggered Flip-Flops, Characteristic Equations, Conversion of flip-flops, Shift Registers, Ripple Counters, Synchronous Counters **8 Hrs**

## UNIT-IV

**Sequential systems:**
Analysis of Clocked Sequential circuits, State Reduction and Assignment, Design Procedure, Design with State Equations, Sequence detector **8 Hrs**

## UNIT-V

**Logic Families:** Characteristic of Digital ICs, Transistor – Transistor Logic, Complementary MOS (CMOS) Logic, Comparison of TTL and CMOS families. 8 **Hrs**

**Text Books:**

1. Digital Logic and Computer Design- M. Morris Mano, Prentice Hall – Pearson Education
2. Digital Principles and Design- Donald Givone, Tata Mc Graw Hill

**Reference Books:**

1. Fundamental of Logic Design- Charles Roth Jr., Thomas Learning
2. Digital Logic Applications and principles- John Yarbrough, Pearson Education

**E-Books:**
1. http://www.panstanford.com/pdf/9789814364591fm.pdf
2. https://easyengineering.net/digital-logic-and-computer-design-by-morris-mano/
3. https://www.sciencedirect.com/book/9780750645829/digital-logic-design
4. https://easyengineering.net/fundamentals-of-digital-circuits-by-anand-kumar/

**MOOCs:**
1. https://nptel.ac.in/courses/108105113/
2. https://nptel.ac.in/courses/106105185/

## LABORATORY EXPERIMENT LIST

| | Title of the Experiment |
|---|---|
| 1 | Applications of IC 7483 (Adders, Subtractors and Comparators) (Unit-II) |
| 2 | Multiplexers (using Gates and IC) and their applications (Unit-II) |
| 3 | Decoders/DeMultiplexers (using Gates and IC) and their applications (Unit-II) |
| 4 | BCD to Decimal decoder using 7-segment display (Unit-II) |
| 5 | Verification of MSJK Flip-flop (using Gates and IC 7476) (Unit-III) |
| 6 | Asynchronous counters (using ICs 7476,7490,7493) (Unit-III) |
| 7 | Synchronous Counters (using ICs 7476, 74190/74192) (Unit-III) |
| 8 | Shift registers and their applications (using ICs 7476, 7495) (Unit-III) |
| 9 | Verification of few parameters of TTL (Unit-V) |
| 10 | Verification of few parameters of CMOS (Unit-V) |

**BMS College of Engineering, Bangalore – 19**
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| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **FIELD THEORY** | | | | |
| **Course Code** | **19ES3GCFTH** | **Credits** | **4** | **L-T-P** | **3:1:0** |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO Numbers | Course Outcomes | POs |
|---|---|---|
| CO-1 | Apply the laws of static Electric & Magnetic fields to study Time-varying electro-magnetic fields and Waves | PO1 |
| CO-2 | Analyze and solve Electromagnetic problems related to static/time varying fields and also wave propagation in different media | PO2 |
| CO-3 | Self-learning through listening and comprehension of audio / video lectures related to electro-magnetic fields and waves domain | PO12 |

## UNIT-I

**Introduction to Electrostatics:** Introduction to line integral, surface integral, volume integral of vectors, Coulomb's Law (vector form), Electric Field Intensity (vector form), EFI due to different types of charge distributions, Electric Flux Density (EFD), Gauss' Law, Divergence: Electric Flux Density (EFD), Applications of Gauss' Law, Divergence and Divergence Theorem **10 Hrs (7L+3T)**

## UNIT-II

**Energy and Potential:** Energy spent in moving a charge in an Electric field, Definition of Potential and Potential Difference (PD), PD due to Point Charge and System of Charge, Potential gradient, Energy Density

**Current and current density:** Current and Current Density, Continuity of Current, Conductor Properties, and Boundary Conditions **11 Hrs (8L+3T)**

## UNIT-III

**Dielectric:** Dielectric materials, boundary conditions, Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations- solution for Single Variables, Capacitance of different configurations using Laplace's equation. **8 Hrs (6L+2T)**

**UNIT-IV**

**Steady Magnetic Field:**Biot-Savart Law, Ampere's circuital law, curl, Magnetic Flux, Flux Density, Scalar and Vector Magnetic Potentials, Force on a moving charge, Force on differential current element, Inductance and Mutual Inductance Magnetic Boundary Condition. **10 Hrs (8L+2T)**

**UNIT-V**

**Time varying fields and Maxwell's equations:** Faraday's Law, Displacement Current, Maxwell's Equations in Point and Integral Form, Uniform plane waves, Wave equations , solution of wave equation, wave propagation through good dielectric, good conductor, skin depth, Poynting's Theorem. **11 Hrs (9L+2T)**

**Text books:**

1. Engineering Electromagnetics H Hayt, J A Buck, MJaleel Akhtar Tata McGraw-Hill, 8thEdition, 2014.
2. Electromagnetics, Schaum's Outline series Joseph A Ediminister Tata McGraw-Hill, revised secondEdition, 2014.

**Reference books:**

1. Electromagnetics with Applications, John Kraussand Daniel A Fleisch,McGraw-Hill,5thEdition, 1999.
2. "Field and wave electromagnetic", David K Chary, Pearson Education Asia, Second Edition – 1989, Indian Reprint–2001
3. Mathew N. O. Sadiku "Elements of Electromagnetic," Oxford University Publication 2014

**MOOCs:**

1. https://nptel.ac.in/courses/108106073/
2. http://qeee.in/coursepack/generate_books/generated_books/1975/

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| Course Title | MODERN SENSORS AND ITS APPLICATIONS | | | | |
|---|---|---|---|---|---|
| Course Code | 19EC3DCMSA | Credits | 3 | L-T-P | 3:0:0 |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO Numbers | Course Outcomes |
|---|---|
| CO-1 | Understand sensor fabrication and characterization techniques |
| CO-2 | Apply the concepts of physics to understand the principle of sensing physical parameters |
| CO-3 | Analyze the working of analog sensors for engineering applications |

## UNIT-I

**Sensor Characteristics**: Transfer function, span, accuracy, calibration, hysteresis, nonlinearity, saturation, dead band, resolution, special properties, output impedance, excitation, dynamic characteristics, environmental factors, reliability, application characteristics, and uncertainty. **7 Hrs**

## UNIT-II

**Physical Principles of Sensing**: Capacitance, Piezoelectric Effect , pyro-electric effect , Peltier effect and seebeck effect, Hall effect, Thermoelectric effect, Sound waves, Temperature and thermal properties of materials. **8 Hrs**

## UNIT-III

**Force and Strain:** Strain Gauge, Tactile sensors- Membrane switch as a tactile sensor, Active piezoelectric tactile sensor, Piezo electric force sensors.

**Pressure Sensors-** Concepts of Pressure, Units of Pressure, Mercury Pressure Sensor, Vacuum Sensors- Pirani Gauge, Ionization Gauges, Gas Drag Gauge.

**Displacement and Level Sensors:** Inductive and Magnetic sensor- LVDT and RVDT, Hall Effect Sensors.

**Acoustic sensor:** Resistive and Fiber-optic microphones. Humidity and Moisture sensor: Concept of Humidity, Thermal conductivity and Optical Hygrometers. Light Detectors: Photodiode, Photo transistor, Photo resistor **10 Hrs**

## UNIT-IV

**Temperature sensor:** Thermoresistive Sensors-RTD, NTC Thermistors and its Computational Models, Thermoelectric Contact sensors-Thermocouple, Semiconductor PN junction sensor, Optical Temperature sensor. **8 Hrs**

## UNIT-V

**Sensor Materials and Technologies**: Materials (Silicon, Plastics, Metals, Ceramics and Glasses), Surface processing: Thermal evaporation and Chemical vapor deposition, Nanotechnology: Photolithography process **7 Hrs**

**Text Books:**

1. Handbook of Modern Sensors: Physics, Designs, and Applications, Jacob Fraden, Springer Publications, Third Edition.
2. "Foundations of MEMS" Pearson Indian Print- Chang Liu-, 1st Edition -2012
3., "Introduction to Nanotechnology", Charles P. Poole and Frank J. Owens , John Wiley & Sons, 2003.

**References**:

1. Sensors Handbook-SabrieSoloman-Mc Graw Hill publication, Second Edition.
2. A.K.Sawhney, A course in Electrical and Electronic Measurement and Instrumentation– Dhanpat Rai and Sons, New Delhi, 1999.

**MOOCs:**

1. https://nptel.ac.in/courses/112103174/pdf/mod2.pdf
2. https://www.youtube.com/watch?v=1uPTyjxZzyo
3. http://www.nptelvideos.in/2012/11/industrial-instrumentation.html
4. https://www.nap.edu/read/4782/chapter/4

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| **Course Title** | **MINI PROJECT I** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC3PWMP1** | **Credits** | **1** | **L-T-P** | **0:0:1** |

| **CO Numbers** | **Course Outcomes** |
|---|---|
| CO-1 | Analyze, design and develop solutions to real-world problems applying the fundamental concepts of electronics learnt from previous and current semesters |
| CO-2 | Work in a team and Explore the open source tools and resources in solving the problems. |

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| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **CONSTITUTION OF INDIA, PROFESSIONAL ETHICS AND HUMAN RIGHTS** | | | | |
| **Course Code** | **19IC3HSCPH** | **Credits** | **1** | **L-T-P** | **1:0:0** |

**Course outcomes:**

At the end of the course students will have the ability to:

| | |
|---|---|
| CO1 | Understand and explain the significance of Indian Constitution as the Fundamental Law of the Land. |
| CO2 | Analyse the concepts and ideas of Human Rights. |
| CO3 | Apply the practice of ethical responsibilities and duties to protect the welfare and safety of the public. |

## UNIT-I

**Introduction to Indian Constitution:** Historical Background of the Indian Constitution. Framing of the Indian constitution: Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India, Fundamental Rights and its limitations. Fundamental Duties and their significance, Directive Principles of State Policy: Importance and its relevance. Case Studies **3 Hrs**

## UNIT -II

**Union Executive and State Executive:** The Union Executive – The President and The Vice President, The Prime Minister and The Council of Ministers. The Union Parliament – Lok Sabha &Rajya Sabha.

The Supreme Court of India.

**State Executive** – The Governors, The Chief Ministers and The Council of Ministers. The **State Legislature** – Legislative Assembly and Legislative Council. State High Courts.

**2 Hrs**

## UNIT -III

**Election Commission of India, Amendments and Emergency Provisions:** Election Commission of India – Powers & Functions – Electoral Process in India. Methods of Constitutional Amendments and their Limitations.

**Important Constitutional Amendments** – 42$^{nd}$, 44$^{th}$, 61$^{st}$, 74$^{th}$, 76$^{th}$, 77$^{th}$, 86$^{th}$ and 91$^{st}$. Emergency Provisions. Case Studies. **2 Hrs**

## UNIT-IV

**Special Constitutional Provisions/ Human Rights:** Special Constitutional Provisions for Schedule Castes, Schedule Tribes & Other Backward Classes. Women & Children. Case Studies.

Human Rights/values – Meaning and Definitions, Legislative Specific Themes in Human Rights and Functions/ Roles of National Human Rights Commission of India. Human Rights (Amendment Act) 2006 **3 Hrs**

## UNIT-V

**Professional Ethics:** Scope and Aims of Engineering Ethics, Responsibilities of Engineers and impediments to responsibilities. Honesty, Integrity and Reliability; Risks – Safety and Liability in Engineering, Case Studies. **3 Hrs**

**Text Books:**

1. "An Introduction to Constitution of India and Professional Ethics" by Merunandan K.B. and B.R. Venkatesh, Meragu Publications, 3rd edition, 2011.
2. "Constitution of India &Professional Ethics& Human Rights" by Phaneesh K. R., Sudha
   Publications, 10th edition, 2016.

**Reference Books:**

1. "V.N. Shukla's Constitution of India" by Prof (Dr.) Mahendra Pal Singh (Revised), Eastern
   Book Company, Edition: 13th Edition, 2017, Reprint 2019.
2. "Ethics in Engineering" by Martin, W. Mike.,Schinzinger, Roland., McGraw-Hill Education; 4thedition (February 6, 2004).

**E-Book:**

1. https://books.google.co.in/books/about/Constitution_of_India_and_Professional_E.html?id=VcvuVt-d88QC
   Constitution of India and Professional Ethics, by G.B. Reddy and MohdSuhaib, I.K. International Publishing House Pvt. Ltd., 2006.
2. http://www.scribd.com/doc/82372282/Indian-Constitution-M-Raja-Ram-2009#scribd
   Indian Constitution, by M. Raja Ram, New Age International Pvt. Limited, 2009.

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**THIRD SEMESTER B.E COURSE**
(Common to All Branches)

| | | | |
|---|---|---|---|
| **Course Title** | **Additional Mathematics-I** | **Course Code** | **19MA3IMMAT** |
| **Credits** | **00** | **L – T – P** | **3 – 1 – 0** |
| **Contact hours** | **48 hours (36L+12T)** | **III semester Lateral Entry students** | |

**Course outcomes:**
At the end of the course students will have the ability to:

| | |
|---|---|
| CO1 | Understand the basic concepts of differentiation and integration. |
| CO2 | Apply the concepts of polar curves and multivariate calculus. |
| CO3 | Apply analytical techniques to compute solutions of first and higher order ordinary differential equations. |
| CO4 | Apply techniques of vector calculus to engineering problems. |
| CO5 | Comprehend the generalization of vector calculus in curvilinear coordinate system. |

**UNIT-I**

**DIFFERENTIAL AND INTEGRAL CALCULUS**
List of standard derivatives including hyperbolic functions, rules of differentiation. Taylor's and Maclaurin's series expansion for functions of single variable. List of standard integrals, integration by parts. Definite integrals – problems. **9 Hrs** (7L+2T)

**UNIT -II**

**POLAR COORDINATES AND PARTIAL DERIVATIVES**
Polar curves: Polar coordinates, angle between radius vector and tangent, angle between two polar curves. Partial differentiation. Total differentiation-Composite and Implicit functions. Jacobians and their properties (without proof) – Problems. **10 Hrs** (7L+3T)

**UNIT -III**

**VECTOR CALCULUS AND ORTHOGONAL CURVILINEAR COORDINATES**
Recapitulation of scalars, vectors and operation on scalars and vectors. Scalar and vector point functions. Del operator, gradient-directional derivative, divergence, curl and Laplacian operator. Vector identities (without proof). Cylindrical and Spherical polar coordinate

systems. Expressing a vector point function in cylindrical and spherical systems. Expressions for gradient, divergence, curl and Laplacian in orthogonal curvilinear coordinates.

**10 Hrs** (7L+3T)

**UNIT -IV**

**FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS**

Introduction to first order differential equations. Linear equation and its solution. Bernoulli's equation and its solution. Exact differential equation and its solution. Orthogonal Trajectories. **9 Hrs** (7L+2T)

**UNIT -V**

**SECOND AND HIGHER ORDER ORDINARY DIFFERENTIAL EQUATIONS**

Ordinary differential equations with constant coefficients: Homogeneous differential equations, non-homogeneous differential equations – Particular integral for functions of the type $f(x) = e^{ax}$, $\sin(ax)$, $\cos(ax)$, $x^n$, method of variation of parameters, Cauchy's and Legendre linear differential equations. **10 Hrs** (8L+2T)

**Text Book:**

1. Higher Engineering Mathematics, B. S. Grewal, 43rd edition, 2014, Khanna Publishers
2. Advanced Engineering Mathematics, 4th edition, 2011, by Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd.

**Reference Book:**

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Precise Textbook series, Vol. 1 and Vol. 2, 10th edition, 2014, Wiley- India.
2. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.

**E books and online course materials:**

1. Engineering Mathematics, K. A. Stroud, Dexter J. Booth, Industrial Press, 2001
2.http://books.google.co.in/books/about/Engineering_Mathematics.html?id=FZncL-xB8dEC&redir_esc=y.
3. Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.
4. http://ocw.mit.edu/courses/mathematics/ (online course material)

**Online Courses:**

1. https:// www.khanacademy.org/Math
2. https:// www.class-central.com/subject/math (MOOCs)

# IV SEMESTER SYLLABUS

**BMS College of Engineering, Bangalore – 19**
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| **Course Title** | **ENGINEERING MATHEMATICS –IV (Common to AE/CV/EEE/ECE/EIE/ML/TCE)** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19MA4BSEM4** | **Credits** | 4 | **L-T-P** | **3:1:0** |

**Course outcomes:**

At the end of the course students will have the ability to:

| | |
|---|---|
| **CO1** | **Understand** the basic concepts of differentiation and integration. |
| **CO2** | **Apply** the concepts of polar curves and multivariate calculus. |
| **CO3** | **Apply** analytical techniques to compute solutions of first and higher order ordinary differential equations. |
| **CO4** | **Apply** techniques of vector calculus to engineering problems. |
| **CO5** | **Comprehend** the generalization of vector calculus in curvilinear coordinate system. |

## UNIT-I

### STATISTICS AND PROBABILITY

Curve fitting – Principle of least squares, fitting a straight line, fitting of a parabola, fitting of exponential curve of the form $y=ab^x$ . Correlation and regression. Probability distributions: Discrete distribution - Poisson distribution. Continuous distribution- Normal distribution.

**10 Hrs** (8L +2T)

## UNIT-II

### JOINT PROBABILITY AND MARKOV CHAIN

Joint Probability Distributions: Discrete random variables, Mathematical expectations, Covariance and Correlation.

Markov Chain: Markov Chain, Probability vectors, stochastic matrices, fixed point vector, regular stochastic matrices. Higher transition probabilities, stationary distribution of regular Markov chain.

**9 Hrs** (7L + 2T)

## UNIT-III

### NUMERICAL SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS

Finite-Difference formulas to partial derivatives.

Applications: Solution of one-dimensional heat equation using 2-level formula and Schmidt explicit formula and Crank-Nicolson two-level implicit formula. Solution of one-dimensional wave equation using explicit three level formula and implicit scheme. **9 Hrs** (7L +2T)

## UNIT-IV

**COMPLEX ANALYSIS 1:** Function of a complex variable, limits, continuity and differentiability of a complex valued function, Analytic functions, properties of analytic functions, Cauchy-Riemann equations in Cartesian and polar form, construction of analytic functions by Milne-Thomson method, Conformal mapping. Transformation: $w = z^2$ and $w = z + \frac{a^2}{z}(z \neq 0)$. Bilinear Transformations. **10 Hrs** (7L +3T)

## UNIT-V

**COMPLEX ANALYSIS2:** Complex integration: Line integral, Problems on line integral, Cauchy's theorem, Cauchy's integral formula.

**Complex series:** Taylor's, Maclaurin's and Laurent's series (without proof).

Zeros, Poles and Residues: Residue theorem (without proof). **10 Hrs** (7L + 3T)

**Text Books:**

1. Numerical Methods for Engineering, R. P. Kanale and S. C. Chapra, 6th edition, McGraw Hill, Publishers.
2. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.

**Reference Books:**

1. Advanced Modern Engineering Mathematics, Glyn James, 3rd edition, 2004, Pearson Education.
2. Higher Engineering Mathematics, B. S. Grewal, 43rd edition, 2013, Khanna Publishers.

**Ebooks and online course materials:**

1. https://www.coursera.org/learn/basic-statistics
2. http://wiki.stat.ucla.edu/socr/index.php/Probability_and_statistics_EBook
3. https://ocw.mit.edu/courses/mathematics/18-112-functions-of-a-complex-variable-fall-2008/lecture-notes/
4. https://www.math.ubc.ca/~peirce/M257_316_2012_Lecture_8.pdf

**Online Courses and Video Lectures:**

1. https://nptel.ac.in/courses/111105090/ (Probability & statistics-Joint distribution, testing of hypothesis)
2. https://nptel.ac.in/courses/111103070/ (Complex Analysis - Analytic functions, Mobius transformation & Residue theorem)
3. https://nptel.ac.in/courses/111107056/ (Complex Analysis - Complex integration, conformal mapping)

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| Course Title | CONTROL SYSTEMS | | | | |
|---|---|---|---|---|---|
| Course Code | 19ES4ESCST | Credits | 4 | L-T-P | 3:1:0 |

**Course outcomes:**

At the end of the course students will have the ability to:

| CO Numbers | Course Outcomes |
|---|---|
| CO-1 | **Apply** the knowledge of engineering fundamentals to form mathematical model and obtain transfer function/state space representation of a system. |
| CO-2 | **Design** LTI systems for given time/frequency domain specifications using different techniques. |
| CO-3 | **Analyse** the stability of LTI systems in time/frequency domain using different techniques |

## UNIT-I

**Introduction:** Examples of Control Systems, open loop vs Closed loop Systems.
**Mathematical Modeling of Linear Systems:** Transfer functions, Mechanical Systems, Analogous Systems, Block diagram, Signal Flow graph, Transfer Functions of Lag & Lead Compensators. **10Hrs**

## UNIT-II

**Controllers & Time response analysis:** Step response of first order, second order systems, response specification, steady state error and error constants. Effect of PI, PD and PID controllers on the time response of the system. **10Hrs**

## UNIT-III

**Stability Analysis:** Concept of stability, R H criterion, applications of R H criterion with limitations.
**Root locus technique:** Introduction to root locus concepts, Construction rules, Analysis of stability by root locus plot

**10Hrs**

**UNIT-IV**

**Frequency response Analysis:** Nyquist plot, Polar plots, Stability Analysis using Nyquist criterion, Bode plots, GM and PM, Relative stability

**10 Hrs**

**UNIT-V**

**State Variable Analysis:** Concept of state variables, physical variable model, phase variable model, canonical model, obtaining transfer function from state model **10 Hrs**

**Text books:**

1. Control Engineering by Nagrath& Gopal, New Age International Publishers
2. Engineering control systems - Norman S.Nise, John WILEY &sons , 5thEdition

**Reference books:**

1. Modern control Engineering-Ogata, Prentice Hall
2. Automatic Control Systems- B.C Kuo, John Wiley andSons

**E Books:**

1. http://en.wikibooks.org/wiki/Control_Systems
2.http://www.electrical4u.com/control-system-closed-loop-open-loop-control-system/#practical- examples-of-open-loop-control-system
3. http://www.facstaff.bucknell.edu/mastascu/eControlHTML/CourseIndex.html

**MOOCs:**

1. https://swayam.gov.in/explorer
2. https://www.edx.org/course/

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| Course Title | LINEAR INTEGRATEDCIRCUITS | | | | |
|---|---|---|---|---|---|
| Course Code | 19ES4CCLIC | Credits | 4 | L-T-P | 3:0:1 |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO Numbers | Course Outcomes |
|---|---|
| CO-1 | **Define, understand** and explain the DC and AC performance characteristics of op-amp, applications of op-amp, working of 555 timer and voltage regulators. |
| CO-2 | **Apply** the knowledge of KVL and KCL to obtain voltage/current/waveforms at different points in analog electronic circuits such as op-amp amplifiers, rectifiers, filters, waveform generators, PLL, data converters, regulators, comparators,555 timers. |
| CO-3 | **Analyse**analog electronic circuits such as op-amp amplifiers, rectifiers, filters, waveform generators, PLL, data converters, regulators, comparators,555 timers |
| CO-4 | **Design** analog electronic circuits such as op-amp amplifiers, rectifiers, filters, waveform generators, PLL, data converters, regulators, comparators,555 timers |
| CO-5 | **Conduct** experiments using analog electronic components, electronic instruments to function as amplifiers, comparators, rectifiers, filters, astable and monostable circuits using 555 timer, data converters. |
| CO-6 | **Engage** in self-study/independent study to formulate, design, implement, analyse and demonstrate an application using analog electronic components/SIM tools through a mini project |

## UNIT-I

**Operational Amplifier Characteristics:** Introduction, Amplifiers in closed loop configuration, DC Characteristics, AC Characteristics, Frequency compensation.

**Operational Amplifier Applications:** Instrumentation Amplifier, V to I and I to V converter, Op-amp circuits using Diodes – Half wave rectifier, Full wave rectifier, peak detector ,Sample and hold circuit. **8 Hrs**

## UNIT-II

**Comparators and waveform Generators:** Introduction, comparator, Regenerative comparator (Schmitt Trigger), Square wave generator using AstableMultivibrator, MonostableMultivibrator, Triangular wave generator. Sinusoidal oscillators- RC and Wien bridge oscillators. **8 Hrs**

**UNIT-III**

**Voltage Regulators:** Introduction, RC Active Filters, First order low pass filter, second order active filter, Higher order low pass filter, High pass active filter, All pass filter-phase shift lead and lag circuit **8 Hrs**

**UNIT-IV**

**D-A and A-D Converters:** Introduction, Analog and Digital data converter, specifications of D/A and basic DAC techniques-weighed resistor DAC, R-2R ladder DAC,A-D Converters: Specifications of A/D converter, classification of ADCs- The parallel Comparator (Flash)ADC, counter type ADC, Successive Approximation Converter, singles lope type ADC and Dual slope type ADC, Sigma- delta ADC **8 Hrs**

**UNIT-V**

**Timers:** Functional block diagram of 555, Applications-Astable and Monostablemultivibrators, Ramp generator.
**Phase locked loops:** Introduction, Basic principles, phase detector/comparator, voltage controlled oscillator (VCO), PLL in frequency multiplication/Division **8 Hrs**

**Text books:**

1. Linear Integrated Circuits -2e-S. Salivahanan& V. S. KanchanaBhaaskaran (Tata McGraw – Hill Publication)
2. Linear Integrated circuits- D Roy Choudhury &Shail B Jain (New AgePublication)

**Reference books:**

1. Opamps and Linear ICs-David A.Bell (Prentice-Hall Publications) (New age Publication)
2. Op-Amps and Linear Integrated Circuits-Ramakanth A.Gayakwad,4thed,PHI

**E Books:**

1. https://www.analog.com/en/education/education-library/tutorials/analog-electronics.html
2. https://electronicsforu.com/resources/7-free-ebookstutorials-on-op-amp

**MOOCs:**

1. https://swayam.gov.in/nd1_noc19_ee39/preview – op amp practical applications: design, simulation and implementation by Dr.Hardik J. Pandya ,IISc Bangalore
2. Introductory Analog Electronics Laboratory (Spring 2007) by MIT Open Courseware | Reviews and Ratings
3. http://www.pannam.com/blog/free-resources-to-learn-electrical-engineering/

## LABORATORY EXPERIMENT LIST

| Sl. No. | Experiment Name |
|---|---|
| 1 | Inverting and non-inverting amplifier, voltage follower |
| 2 | Inverting and non-inverting summing Amplifier |
| 3 | Precision half wave and full wave rectifier |
| 4 | Zero crossing detector and Schmitt trigger |
| 5 | Wein bridge Oscillator |
| 6 | First order active low passfilter |
| 7 | First order active high pass filter |
| 8 | IC 723 as low voltage and high voltage regulators |
| 9 | D to A converter |
| 10 | A to D converter |
| 11 | 555 as astablemultivibrator |
| 12 | 555 as monostablemultivibrator |

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| **Course Title** | **MICROCONTROLLERS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19ES4CCMCS** | **Credits** | **4** | **L-T-P** | **3:0:1** |

**Course outcomes:**
At the end of the course students will have the ability to:

| **CO Numbers** | **Course Outcomes** |
|---|---|
| CO-1 | Understand and explain architecture of microprocessors and microcontrollers, pipelining, addressing modes, data types in Embedded C, serial communication, timer configuration, interrupt handling of microcontroller, and memory expansion. |
| CO-2 | Apply the knowledge of addressing modes and instructions to develop 8051 assembly programs. |
| CO-3 | Analyse the code in assembly / Embedded C for applications of the timer, serial communication and interrupts of 8051 |
| CO-4 | Design an 8051 system by interfacing 8051 to external memory , I/O, peripheral devices and external devices. |
| CO-5 | Conduct experiments by simulating assembly and Embedded C code using KEIL IDE and interfacing the hardware modules to 8051 platform |

## UNIT-I

Fundamentals of Microprocessors: Block diagram approach for Microprocessor and Microcontroller architecture, Comparison of 8-bit microcontrollers, 16-bit and 32-bit microcontrollers. Definition of embedded system and its characteristics, Role of microcontrollers in embedded Systems.

Overview of the 8051 family: The 8051 Architecture Internal Block Diagram, ,address, data and control bus, working registers, SFRs, Clock and RESET circuits, Stack and Stack Pointer, Program Counter, I/O ports, Memory Structures, Memory architecture-Harvard and Princeton. Data and Program Memory, Timing diagrams and Execution Cycles, Pipelining.

**8 Hrs**

**UNIT-II**

Instruction Set and Assembly Language Programming: Introduction, Instruction syntax, assembler directives, Immediate addressing, Register addressing, Direct addressing, Indirect addressing, Relative addressing, Indexed addressing, bit inherent and bit direct addressing, 8051 Instruction set - Data transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions, Assembly language programs **8 Hrs**

**UNIT-III**

Embedded C Programming: C Data Types, Timer and counter programming, Basics of Serial communication, Programming UART for serial communication, 8051 Interrupt programming **8 Hrs**

**UNIT-IV**

Memory and I/O Interfacing: 8051 interfacing to external memory- memory address decoding, 8051 interfacing with external ROM, 8051 data memory space, accessing external data memory in 8051 C, interfacing with 8255. **8 Hrs**

**UNIT-V**

Interfacing Applications: Interfacing 8051 to LCD, Stepper motor, DC Motor, ADC and DAC, Sensor interfacing for control applications. **8 Hrs**

**Lab Experiments**

**PART A:** The experiments here can be implemented on a simulator using KEIL IDE.

1. Assembly Language Programs to
   (i) Data Transfer Operations
   (ii) Arithmetic, Logical Operations
   (iii) Conditional Operations
   (iv) Bit Manipulations
   (v) Port Functioning
   (vi) Delay operations using Timers
2. Embedded ‘C’ programs for Arithmetic, Logical, Port operations on simulator

**PART B**: Interfacing of hardware modules to microcontrollers such as

(i) Stepper motor
(ii) Key Board
(iii) LCD
(iv) ADC, DAC
(v) Serial Communication

(vi) Temperature sensor interface for monitoring and control

(vii) Sensing of humidity and Co2 for control applications

The experiments may be implemented using KEIL IDE with embedded 'c' programming. The application examples may be modified on similar lines as mentioned in PARTB (vi) and (vii)

**Text Books:**

1. M. A.Mazidi, J. G. Mazidi and R. D. McKinlay, "The8051Microcontroller and Embedded Systems: Using Assembly and C",Pearson Education, 2007.
2. R. S. Gaonkar, ", Microprocessor Architecture: Programming and Applications with the 8085", Penram International Publishing, 1996

**References:**

1. K. J. Ayala, "8051 Microcontroller", Delmar Cengage Learning,2004.
2. R. Kamal, "Embedded System", McGraw Hill Education,2009.
3. D.A. Patterson and J.H. Hennessy, "Computer Organization and Design: The Hardware/Software interface", Morgan Kaufman Publishers, 2013.
4. D. V. Hall, "Microprocessors & Interfacing", McGraw Hill Higher Education, 1991.

**MOOCs:**

1. https://nptel.ac.in/courses/117/104/117104072/

**BMS College of Engineering, Bangalore – 19**
(Autonomous College under VTU)

| Course Title | SIGNALS AND SYSTEMS | | | | |
|---|---|---|---|---|---|
| Course Code | 19ES4CCSAS | Credits | 4 | L-T-P | 3:1:0 |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO Numbers | Course Outcomes |
|---|---|
| CO-1 | Knowledge of mathematical representation of signals and systems in various domains. |
| CO-2 | Apply various properties of transform techniques to solve the continuous and discrete Linear Time Invariant Systems |
| CO-3 | Analyze various methods to categorize the LTI Systems and identify solutions for mathematical representation of systems. |

**UNIT-I**

**INTRODUCTION TO SIGNALS:** Definitions of a signal, elementary signals, classification of signals and basic operations on signals. **11Hrs** (9L+2T)

**UNIT-II**

**INTRODUCTION TO SYSTEMS:** Definitions of a system, properties of systems, systems viewed as Interconnections of operations, Differential and difference equation representations and block diagram representations of LTI systems. **10Hrs** (8L+2T)

**UNIT-III**

**IMPULSE RESPONSE REPRESENTATION OF LTI SYSTEMS:** Introduction to impulse response representation, Convolution Sum and Convolution Integral, relation with system properties, Interconnection of LTI systems (properties of convolution).
**12Hrs** (9L+3T)

**UNIT-IV**

**APPLICATION OF FOURIER ANALYSIS:** Fourier representation for Four classes of signals, properties of Fourier transform (proof excluded), frequency response of LTI systems, solution of difference and differential equations. **7Hrs** (5L+2T)

## UNIT-V

**APPLICATIONS OF Z-TRANSFORMS:** Introduction to bilateral and unilateral Z-transforms, Properties (proof excluded), Analysis of LTI Systems: Transfer function and structures for implementing LTI system, Causality and stability, frequency response, and solution of difference equations. **10Hrs** (7L+3T)

**Text books:**

1. Simon Haykin and Barry Van Veen "Signals and Systems", John Wiley & Sons, 2001.Reprint2002

2. Alan V Oppenheim, Alan S, Willsky and A Hamid Nawab, "Signals and Systems" Pearson Education Asia/PHI, 2nd edition, 1997, Indian Reprint 2002.

**Reference books:**

1. H.P Hsu, R.Ranjan, "Signals and Systems", Scham'soutlines, TMH, 2006
2. B.P.Lathi, "Linear Systems and Signals", Oxford University Press, 2005
3. Ganesh Rao and Satish Tunga, "Signals and Systems", Sanguine Technical Publishers, 2004

**MOOCs:**

1. NPTEL lecture Video on Signalsand Systems by Prof. S.C. Dutt Roy, http://www.satishkashyap.com/2012/04/iit-video-lectures-on-signals-and.html
2. NPTEL lecture Video on Signals and Systems by Prof. T.K. Basu, IIT Kharagpur http://www.nptel.ac.in/courses/108105065/
3. NPTEL on line Course Modules–IIT Bombay –Signals and Systems http://www.cdeep.iitb.ac.in/nptel/Electrical%20&%20Comm%20Engg/Signals%20and%20System/TOC-M1.html

**BMS College of Engineering, Bangalore – 19**
(Autonomous College under VTU)

| Course Title | HDL PROGRAMMING | | | | |
|---|---|---|---|---|---|
| Course Code | 19EC4PCHDL | Credits | 3 | L-T-P | 2-1-0 |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO Numbers | Course Outcomes |
|---|---|
| CO-1 | Apply the knowledge of HDL for modeling and functional verification of Digital circuits. |
| CO-2 | Analyze digital circuits using suitable Verliog HDL modeling |
| CO-3 | Design and synthesize a digital circuit for complex systems using Verilog HDL and state machines |
| CO-4 | Program and synthesize a given application/problem statement using EDA tools |

## UNIT–I

**Introduction:** VLSI design flow, importance of HDLs, Verilog HDL and Design, Methodologies, modules, instances, components of simulation, example, basic concepts.
**Modules and Ports:** Modules, ports, Rules. **10Hrs** (6L+4T)

## UNIT-II

**Gate Level modeling and Data flow modeling:** Gate Types, Gate Delays, Examples, and Continuous assignment, Delays, Expressions, Operators, Operands, Operator Types and Examples. **8 Hrs** (6L+2T)

## UNIT-III

**Behavioural Modeling:** Structured procedure, procedural assignments, timing control, conditional statements, multi way branching, loops, sequential and parallel blocks, generate blocks, Examples.
**Tasks and Functions:** Difference between task and functions, Examples. **08Hrs** (6L+2T)

## UNIT-IV

**Logic Synthesis with Verilog HDL:** Logic synthesis, Verilog HDL Synthesis, Interpretation of Verilog Constructs, Synthesis Design flow, examples, verification of the gate level netlist, modeling tips for logic synthesis **07 Hrs** (5L+2T)

**UNIT-V**

**Synchronous sequential circuits:** Moore and Mealy FSM, Design and implementation of sequence detector, serial adder, code converter.

**FPGA based Systems:** Introduction, basic concepts, Digital design with FPGAs, FPGA based system design. **07Hrs** (5L+2T)

**Text Books:**

1. Sameer Palnitkar, "Verilog HDL-a guide to digital design and synthesis 2nd edition, Pearson Edition 2003.

**ReferenceBooks:**

1. Stephan Brown and ZvonkVranesic, "Fundamentals of digital logic with Verilog design", 2nd edition MGH, 2008

**EBooks:**

1. http://access.ee.ntu.edu.tw/course/dsd_99second/2011_lecture/W2_HDL_
2. Fundamentals_2011-03-02.pdf
3. http://www.ics.uci.edu/~alexv/154/VHDL-Cookbook.pdf
4. http://ece.niu.edu.tw/~chu/download/fpga/verilog.pdf

**MOOCs:**

1. ElectronicDesignAutomationhttp://nptel.ac.in/courses/106105083/

2. DigitalsystemdesignwithPLDsandFPGAshttp://nptel.ac.in/courses/117108040/ Fundamentals of HDL (Lecture #008)

3. https://www.youtube.com/watch?v=rdAPXzxeaxs&index=8&list=PLE3BC3EBC9CE15FB0

**BMS College of Engineering, Bangalore – 19**
(Autonomous College under VTU)

| Course Title | ENVIRONMENTAL STUDIES | | | | |
|---|---|---|---|---|---|
| Course Code | 19HS4PCEVS | Credits | 1 | L-T-P | 1-0-0 |

**Course outcomes:**
At the end of the course students will have the ability to:

| CO Numbers | Course Outcomes |
|---|---|
| CO-1 | Understand the components and impacts of human activities on environment. |
| CO-2 | Apply the environmental concepts for conservation and protection of natural resources. |
| CO-3 | Identify and establish relationship between social, economical and ethical values from environmental perspectives. |

**UNIT–I**

**Introduction to Environment:** Definition about Earth, atmosphere, hydrosphere, lithosphere and biosphere.
Structure of Atmosphere : Troposphere, Stratosphere, Mesosphere,Ionosphere, Exosphere.
Internal structure of the Earth: Crust, Mantle, Core.
Ecosystem, types of Ecosystem: Land, Forest, Water, Desert, Marine.
Effects of Human activities on Environment: Agriculture, Housing, Industries, Mining and Transportation. **06 Hrs**

**UNIT–II**

**Natural Resources:** Water resources: availability, use and consequences of over utlisation, water conflicts. Case studies
Mineral resources: Definition, types, environmental impact of mining
Forest resources: Uses, effects of deforestation, remedial measures
Energy resources: renewable and non-renewable, growing needs, types of energy resources: hydroelectric, wind power, fossil, solar, nuclear and bio gas. Hydrogen as an alternate future source of energy **06 Hrs**

**UNIT–III**

**Environmental pollution:** Introduction, causes, effects and control measures.

Water pollution, land pollution, noise pollution, air pollution and marine pollution-case studies. Environmental management: Solid waste, hazardous waste, e-waste, bio medical waste **06 Hrs**

**UNIT–IV**

**Social issues and Environment:** Population growth.
Climatic changes: Global warming, acid rain, ozone layer depletion.
Water conversation: rain water harvesting and ground water recharging.
Disaster management: floods, earthquakes, landslides-case studies
Environmental Protection Acts: Air, Water, land and Noise (Prevention and Control of pollution), Forest conservation, Wildlife protection. **04 Hrs**

**Text Books:**

1. Environmental studies by - Dr. Geethabalakrishanan (Revised Edition)
2. Ecology by – Subramanyam (Tata McGraw Hill Publication)
3. Environmental studies by – Dr. J.P.Sharma (Third edition)
4. Environmental studies by – SmritiSrivastav

**References:**

1. Environmental studies by – Benny Joseph
2. Environmental studies by – Dr. D.L.Manunath

**Learning Resources:**

1. NPTEL ( Open Sources / power point and visuals )
2. Ecological studies / IITR / Open Sources
3. Ministry of Environment and forest & wildlife.

**MOOCs:**

1. https://www.coursera.org / course / sustain

**BMS College of Engineering, Bangalore – 19**
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**FOURTH SEMESTER B.E COURSE**
(Common to All Branches)

| | | | |
|---|---|---|---|
| **Course Title** | **Additional Mathematics-II** | **Course Code** | **19MA4IMMAT** |
| **Credits** | **00** | **L – T – P** | **3 – 1 – 0** |
| **Contact hours** | **48 hours (36L+12T)** | **IV semester Lateral Entry students** | |

**Course Outcomes:**
At the end of the course, the student will have the ability to:

| | |
|---|---|
| **CO1** | **Describe** the operating principles and characteristics of Transformers and Induction Motors. |
| **CO2** | **Analyze** the operation of Transformers and Induction Motors using phasor diagrams and circuit model of machines |
| **CO3** | **Describe** the methods of testing and estimate performance of Transformers and Inductionmotors |

## UNIT–I

### LAPLACE TRANSFORMS

Laplace transforms of standard functions. Properties and problems. Laplace Transform of Periodic functions with plotting, unit step function and dirac-delta function.

**9 Hrs**(7L+2T)

## UNIT–II

### INVERSE LAPLACE TRANSFORMS

Inverse Laplace transforms of standard functions. Properties and problems. Solution of ODE-Initial and Boundary value Problems. **10 Hrs** (7L+3T)

## UNIT–III

### DOUBLE INTEGRALS

Evaluation of double integral. Change of order of integration. Change of variables to polar coordinates. Application: Area. **11 Hrs** (8L+3T)

## UNIT–IV

### TRIPLE INTEGRALS AND IMPROPER INTEGRALS

Evaluation of triple integral. Application: Volume. Beta and Gamma functions-definition, relation between Beta and Gamma functions, properties and problems. **9 Hrs** (7L+2T)

## UNIT–V

### VECTOR INTEGRATION

Line integral, Green's theorem, Stokes' theorem and Gauss divergence theorem.

**9 Hrs** (7L+2T)

**Text Book:**

1. Higher Engineering Mathematics, B. S. Grewal, 43rd edition, 2014, Khanna Publishers.

2. Higher Engineering Mathematics, B. V. Ramana, 2007, Tata McGraw Hill.

**Reference Book:**

1. Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Precise Textbook series, Vol. 1 and Vol. 2, 10th edition, 2014, Wiley- India.

2. Advanced Engineering Mathematics, 4th edition, 2011, by Dennis G. Zill and Cullen, Jones and Bartlett India Pvt. Ltd

**E books and online course materials**

1. Engineering Mathematics, K. A. Stroud, Dexter J. Booth, Industrial Press, 2001 http://books.google.co.in/books/about/Engineering_Mathematics.html?id=FZncL-xB8dEC&redir_esc=y.

2. Advanced Engineering Mathematics, P. V. O'Neil, 5th Indian reprint, 2009, Cengage learning India Pvt. Ltd.

3. http://ocw.mit.edu/courses/mathematics/ (online course material)

**Online Courses:**

1. https:// www.khanacademy.org/Math
2. https:// www.class-central.com/subject/math (MOOCS)
3. E-learning: www.vtu.ac.in

# V semester

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **COMMUNICATION THEORY I** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PCCT1** | **Credits** | **4** | **L-T-P** | **3-0-1** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**Signals and System

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Apply** various concepts of theorems and Transforms for computing parameters of Communication systems |
| CO-2 | **Analyze** performance of different types of Analog modulation Techniques for a given set of parameters |
| CO-3 | **Design** Analog Communication subsystems for given set of specifications |
| CO-4 | **Simulate and conduct** experiments on different types of Analog communication subsystems |

**Unit-I** **08hrs**

Random process: Random variables, Gaussian distribution, random processes, Stationary, Mean, Correlation and Covariance functions, Transmission of random signals through linear filters.

Amplitude modulation (AM):Time-domain and Frequency domain representation, Generation and Detection.

DSBSC- Time-domain and Frequency domain representation, Generation and Detection. Quadrature carrier multiplexing.

**Unit-II** **08hrs**

Hilbert transform: properties of Hilbert transform, Pre-envelope, Canonical representation of band pass signals

Single side band modulation: Frequency domain description, Generation and Demodulation.

Vestigial side band modultion (VSB): Time and Frequency domain description, Generation and detection. Frequency translation, Frequency division multiplexing.

**Unit-III** **08hrs**

Angle modulation: Basic concepts, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves. Generation of FM waves: Indirect FM, Direct FM. Demodulation of FM waves: Balanced frequency discriminator, Zero-crossing detector, Phase-locked loop, FM stereo multiplexing

**Unit-IV** **08hrs**

Noise in analog modulation: Introduction, shot noise, thermal noise, white noise, Narrow band noise, Representation of noise in terms of In-Phase and Quadrature components, Representation of noise in terms of Envelope and Phase components.
Noise in AM receivers- Signal to Noise Ratios, AM receiver model, SNR in Coherent Reception, Noise in AM receivers using Envelop Detection, FM receiver model, noise in FM reception, FM threshold effect, Pre-emphasis and De-emphasis in FM.

**Unit-V** **07hrs**

Sampling Process: Sampling Theorem, Quadrature Sampling of Band pass signals, Practical aspects of sampling and signal recovery, PAM -TDM .

**Unit Choice: Unit-I and Unit-III**

**Text books:**

1. S.Haykins, An Introduction to Analog and Digial Communications, Wiley, 2003
2. S.Haykins, Communication Systems (4/e), Wiley, 2001
3. S. Haykins, Digital Communication, Wiley 2009

**REFERENCE BOOKS:**

1. John G Proakis, MasoudSalehi, Communication Systems Engineering, (2/e), Person, 2015.
2. K Sam Shanmugam, Digital and Analog Communication Systems, Wiley, 1994 3. http://nptel.ac.in/courses/117102059/1

**E-Books:**

1. S.Haykins, An Introduction to Analog and Digial Communications, Wiley, 2003 https://www.wiley.com/en-us/An+Introduction+to+Analog+and+Digital+Communications%2C+2nd+Edition-p-9780470460870
2. S.Haykins, Communication Systems (4/e), Wiley, 2001

   https://ict.iitk.ac.in/wp-content/uploads/EE320A-Principles-Of-Communication-CommunicationSystems-4ed-Haykin.pdf

3. S. Haykins, Digital Communication, Wiley 2009

https://www.wiley.com/en-in/search?pq=digital%20communication%20haykin%7Crelevance

**MOOCs: https://nptel.ac.in/courses/117/105/117105143/**

## LABORATORY EXPERIMENT LIST

| Sl.No | Title of the Experiments |
|---|---|
| **11.** | Conduction of 2nd order filters. |
| 12. | Conduction of mixer. |
| 13. | Generation and detection of AM, DSBSC waves. |
| 14. | FM wave generation. |
| 15. | Generation and detection of PAM. |
| 16. | TDM and Demultiplexing. |
| 17. | Verification of sampling theorem. |

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **FUNDAMENTALS OF VLSI** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PCFOV** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks (100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Basic concept of MOSFETs

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | To **apply** the knowledge of CMOS technology to construct and analyze array subsystems like memories |
| CO-2 | To comprehend long channel I-V characetristics and short-channel effects of MOSFETs, and thereby **analyze** the DC transfer characteristics CMOS circuits |
| CO-3 | To **design** CMOS based combinational and sequential circuits for given specifications |

**Unit-I** **08hrs**

VLSI design flow: Design Partitioning, Design Verification, Fabrication, Packaging and Testing. MOS Transistor: Introduction, Long Channel I-V characteristics, C-V Characteristics, Simple MOS Capacitance Models, Detailed MOS Gate Capacitance Model, Non ideal I-V Effects.

**Unit-II** **08hrs**

CMOS Processing Technology: CMOS Technologies, Wafer Formation, Photolithography, Well and Channel Formation, Silicon Dioxide (SiO2), Isolation, Gate Oxide, Gate and Source/Drain Formations, Contacts and Metallization, Passivation, Metrology.CMOS Fabrication and Layout: Inverter Cross-Section, Fabrication Process, Layout Design Rules, Gate Layouts, and Stick Diagrams. CMOS Process enhancements – SOI, FINFETS, Carbon nanotube transistor, 3D–IC.

**Unit-III** **08hrs**

DC Transfer Characteristics: Static CMOS Inverter DC Characteristics, Beta Ratio Effect, Noise Margin, Pass Transistor DC Characteristics. Combinational Circuit Design: CMOS

Logic, Inverter, NAND Gate, NOR Gate CMOS, Logic Gates, The Compound Gates, Pass Transistors and Transmission Gates, Tristate buffer, Multiplexers.

**Unit-IV** **08hrs**

Sequential MOS logic circuitry: Behavior of Bistableelement,SR Latch Circuitry, Clocked latch and Flip Flop Circuitry (SR and JK), C-MOS D-Latch and Edge Triggered Flip-Flop. Sequencing Static Circuits: Sequencing Methods, Max-Delay Constraints, Min-Delay Constraints, Time Borrowing, Clock Skew, Characterizing Sequencing Element delays.

**Unit-V** **07hrs**

Array Sub system: SRAM: SRAM Cells, Row Circuitry, Column Circuitry. DRAM: Subarray Architectures, Column Circuitry, Embedded DRAM. Read-Only Memory: Programmable ROMs, NAND ROMs, Flash. Serial Access Memories.

**Choice**: Unit-II and Unit-IV

**Text books:**

1. Neil H. E. Weste, David Harris, "CMOS VLSI Design", Pearson Education, 4th Edition, 2011, ISBN: 0-321-54774-8
2. Sung-Mo Kang, Yusuf Leblebici, "CMOS Digital Integrated Circuits"; Tata McGrawHill, 3rd Edition, ISBN: 0-7923-7246-8

**REFERENCE BOOKS:**

1. Douglas. A. Pucknell, KamaranEshraghian, "Basic VLSI Design", PHI, 3rd Edition, 2010, ISBN: 0-321-26977-2
2. John P. Uyemura, "Introduction to VLSI Circuits & Systems", Wiley India Edition.

**E Books:**

1. http://swarm.cs.pub.ro/~mbarbulescu/SMPA/CMOS-VLSI-design.pdf

**MOOCs:**

1. https://nptel.ac.in/courses/117101058/

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Antenna Theory** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PCANT** | **Credits** | **4** | **L-T-P** | **3:1:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:** Basic knowledge of Electromagnetic Fields and waves, transmission lines

**Course outcomes:** At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | Apply the concepts & properties of Electro-Magnetism to obtain parameters of antennas and Wave Propagation |
| CO-2 | Analyze different types of antennas for various applications |
| CO-3 | Technical documentation and presentation of Case study / Seminar on Advanced topics / Antenna Design as an individual/team |

**Unit- I** **7 Hrs**

Antenna Basics: Introduction, Physical concept of radiation, Patterns, beam area, Power theorem and its application radiation Intensity, beam efficiency, directivity and gain, directivity and resolution, antenna apertures, effective height, radio communication Link, Antenna field zones, polarization, reciprocity, bandwidth, radiation efficiency, antenna temperature and antenna impedance.

**Unit- II** **7 Hrs**

Short electric dipole, fields of a short dipole, radiation resistance of short electric dipole, the thin linear antenna, radiation resistance of half wave dipole, folded dipole antennas, Loop antenna: Introduction, small loop, far field patterns of small loop, far field patterns of circular Loop, radiation resistance and directivity.

**Unit- III** **7 Hrs**

Point Sources &Arrays:Introduction , Array of isotropic point sources- different cases, non-isotropic sources and the principle of pattern multiplication, linear arrays of n elements of equal amplitude and spacing, Null Directions for Arrays of n Isotropic Point Sources of Equal Amplitude and Spacing, Linear broadside arrays with non-uniform amplitude distributions-general condition. Introduction to Phased arrays..

**Unit- IV** **8 Hrs**

Slot Antenna: Slot antenna, Babinet's Principle and complementary antennas. Horn Antennas: Types, Fermat's Principle, Optimum Horns, Design Considerations of Pyramidal Horns, Illustrative Problems. . Microstrip antennas: Introduction, Salient Features & its applications Rectangular Microstrip Antennas, Feed Methods ,Smart Antennas

**Unit- V** **7 Hrs**

Helical antennas: Introduction, Helical Geometry, The Helix Modes, Practical Design Considerations for the Monofilar Axial-Mode Helical Antenna. Reflector Antennas: Introduction, the Parabola-General Properties, the Paraboloidal Reflector, Patterns of Large Circular Apertures with Uniform Illumination, Reflector Types, Feed Methods for Parabolic Reflectors, Antennas for Various Applications MW Radio, Cell Phones Cell Towers, Satellite and Defense Communications

**Choice**: Unit III and Unit IV

**Text books:**

1.John D Kraus R J Marhefka and Ahmed S Khan "ANTENNAS AND WAVE PROPAGATION", Tata McGraw Hiill India, 2006, Fourth Edition

.**REFERENCE BOOKS:**

1.Constantine A Balanis "ANTENNA THEORY" John Wiley & Sons, 2004, Second Edition

2.Simon R Saunders and Alejandro Aragon-Zavala Antennas and Propagation for Wireless Communication systems, Wiley-India, 2nd Edition

3.Antennas and Wave Propagation by A R Harish & M Sachidananda, Oxford University Press 2007, Seventh impression 2011

**E Books:**

1. Introduction to Smart Antennas, Constantine A. Balanis, (https://doi.org/10.2200/S00079ED1V01Y200612ANT005)

2. **Antennas for Satellite Communications - Space Antenna**
   **https://onlinelibrary.wiley.com/doi/10.1002/9781119945147.ch12**

**MOOCs:**

1. https://www.classcentral.com/course/swayam-antennas-7924
2. https://www.coursera.org/lecture/satellite-communications/antennas-BQhQ6
3. https://nptel.ac.in/courses/108/101/108101092/
4. https://www.classcentral.com/course/swayam-transmission-lines-and-electromagnetic-waves-17827

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **DIGITAL SIGNALPROCESSING** | | | | |
|---|---|---|---|---|---|
| **Course Code** | 19ES5CCDSP | **Credits** | **4** | **L-T-P** | **3:0:1** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Linear algebra, Complex-numbers,Fourier-Analysis, Laplace Transform.

Knowledge of Signals and System

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | To apply knowledge of Mathematics and Engineering to understand Sampling and Reconstruction of signals from the given samples. |
| CO-2 | To identify and analyze a signal and its sampling frequency, determine the computing requirements to obtain the DFT and Power Spectral Density of given signals. |
| CO-3 | To implement the processes of FFT to reduce the computational complexity and to increase the speed and thereby perform long data sequence convolution. |
| CO-4 | To Design and implement Filter algorithms and realize real time Digital Signal Processing |
| CO-5 | To understand and formulate algorithms of Multi-rate signal processing using sampling rate conversion for signal analysis/synthesis. |
| CO-6 | To use current techniques and modern tools to carry out the Adaptive filtering as a perquisite to Data science. |

**Unit-I** **08hrs**

Introduction to DSP, Frequency-domain Sampling ,DFT , IDFT, DFT as a Linear Transformation ( Matrix formulation), Properties of DFT: Periodicity, Linearity, Circular Time shifting, Circular Frequency Shifting, Circular Time Reversal, Conjugation and Conjugate Symmetry ( Symmetry properties), Duality, Circular

Convolution (Multiplication of two DFTs),Circular correlation, Multiplication (or Modulation) property, Parseval's Relation.

**Unit-II** **08hrs**

Use of DFT in linear filtering, linear convolution of two finite duration sequences, overlap add and save methods. Relation between DFT and other transforms. Direct computation of DFT. Necessity for efficient computation of DFT. Radix 2 Fast Fourier Transform (FFT) algorithm for DFT computation. Decimation in time algorithm, decimation in frequency algorithms.Radix 2 FFT algorithm for computationof Inverse Discrete Fourier Transform. (IDFT).

**Unit-III** **08Hrs**

Introduction to realization of digital systems, blockdiagramsrepresentation, Realization of

Infinite Impulse Response (IIR)systems:parallel form, cascade form. Introduction to IIRfilters, Pole zero placement method for simple IIR Filters, Impulse invariant& Bilinear Transformations, Design ofanalog Butterworth and Chebyshev filters, Design of Digital Butterworth and Chebyshevfilters.

**Unit-IV** **08hrs**

Realization of Finite Impulse Response (FIR) systems:Direct Form, Linear Phase Form. Introduction to FIR filters, Frequency response of ideal digital low pass filter, high pass filter, Frequency sampling technique of designing FIR filters, Windowing design ofFIR filters using Rectangular, Triangular & Hamming windows.

**Unit-V** **07hrs**

Application of digital filters in noise cancellation; Limitations of Linear filters, Random noise cancellation, Adaptive filters, LMS Algorithm, Applications. Decimation by a factor D, Interpolation by a factor I, Sampling conversion by a Rational factor I/D. Introduction to Multi-rate Digital Signal Processing.

**Unit Choice**: Unit- I and Unit-III

**Text books:**

1. Digital Signal Processing, Principles, Algorithms and Applications, John G.

Proakis, Dimitris K Manolakis, Pearson education/PHI, (4th Edition)
2. Digital Signal Processing, Tarun Kumar Rawat, Oxford University Press (16 December 2014)

**REFERENCE BOOKS:**

`1. Fundamentals of Digital Signal Processing, Lonnie Ludeman, John Wiley &Sons; Wiley International 1st Edition, 1988.

2. Discrete-Time Signal Processing, Alan V. Oppenheim, Ronald W. Schafer, John R. Buck, Prentice-Hall Signal Processing Series, 2nd Edition, 1999

3.Understanding Digital Signal Processing, Richard G. Lyons Prentice Hall, March 25, 2nd Edition 2004

4.Digital Signal Processing: Fundamentals and Applications, Li Tan, Academic Press, 1st edition 2007

5.Schaum's Outline of Digital Signal Processing, Monson Hayes, McGraw- Hill, 1st edition, 1998

**E Books:**

1. https://www.amazon.in/Digital-Signal-Processing-Tarun-Kumar/dp/0198081936

2. https://www.amazon.com/Digital-Signal-Processing-John-Proakis/dp/0131873741

**MOOCs:**

1. https://nptel.ac.in/courses/117/102/117102060/
2. https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-ee05/

LABORATORY EXPERIMENT LIST

| Sl.No | Title of the Experiments |
|---|---|
| **1.** | Display of basic elementary signals |
| 2. | Sampling theorem |
| 3. | Basic operations on sequences (shifting, folding, time scaling and multiplication) |
| 4. | Linear and circular convolution |
| 5. | Cross and auto correlation, |
| 6. | FFT of a Sequence |
| 7. | Linear convolution and correction using FFT algorithm |
| 8. | Design of IIR FILTER-LP,HP |
| 9. | FIR Filter design-LP |
| 10. | FIR filter design using Hamming window for the given order and cut-off frequency |
| 11. | Study of Adaptive filter using LMS Algorithm. Interpolation and Decimation. |

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **COMPUTER ARCHITECTURE** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE1CA** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- Understanding of digital electronics.
- Basic knowledge on microcontroller.
- Basic programming skill.

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Apply** the knowledge of the hardware and software systems of computer to develop efficient coding for sequential and pipeline architectures. |
| CO-2 | **Analyze** various aspects of code optimization, storage technologies and impact of cache memory on the programon modern processors. |
| CO-3 | **Analyze** the exceptional control flow of program and the compilation process to create executable object files. |
| CO-4 | **Communicate** on advanced system engineering trends with effective presentations and report writing skills, following professional ethics. |

**Unit-I** **07hrs**

**Fundamentals of Computer Systems:** Hardware organization of a system, Operating system: processes, threads, virtual memory and file system, Concurrency and parallelism: Instruction level, Data level and Thread level parallelism, Importance of abstractions in a computer system.

**Unit-II** **08hrs**

**Processor Architecture:** Y86 instruction set architecture: instructions, instruction encoding, CISC & RISC instruction set, Y86 exceptions, Y86 programs, Sequential Y86 implementations, General principles of pipelining.

**Unit-III** **09hrs**

**Optimizing Program Performance:**Capabilities and limitations of optimizing compilers, Expressing Program Performance, Eliminating loop inefficiencies and memory references, reducing procedure calls, Loop unrolling, Enhancing parallelism.

**Unit-IV** **08hrs**

**The Memory Hierarchy:** Storage Technologies, Locality, Memory Hierarchy, Cache Memories, Virtual Memory and Virtual Machines, Writing Cache Friendly Code, The impact of Cache on Program Performance.

**Unit-V** **07hrs**

**Running Programs on a System:** Compiler Drivers, Static Linking, Object Files, Loading Executable Object Files.

**Exceptional Control Flow:** Exceptions, Exception handling, Classes of Exceptions.

**Choice**: Unit-III and Unit-IV

**Text books:**

1. Computer Systems: A Programmer's Perspective by Randal E Bryant, David R O' Hallaron, 2nd edition, Prentice Hall.
2. Computer Architecture- A Quantitative Approach by John L Hennessey & David A Patterson, 4th Edition, Elsevier

**REFERENCE BOOKS:**

1. Computer Organization and Architecture, Stallings W, Prentice Hall, 6th edition, 2003.
2. Computer Architecture: From Microprocessors to Super Computers,BehroozParhami, Oxford University press 2010

**E Books:**

1. http://www.freebookcentre.net/CompuScience/Free-Computer-Architecture-Books-Download.html

**MOOCs:**

1. https: //www.mooc-list.com/ course/ computer-architecture-coursera

**NOTE:**
This course content can be supplemented by practical experimentation in a simulator environment for clear understanding.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Advanced Digital Logic Design** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE1AD** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Fundamentals of VLSI, Digital Electronics Circuit Design, HDL Programming

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Apply** the concepts of Digital Design to create digital building blocks using Verilog. |
| CO-2 | **Analyze**the RTL timing reports for violations and synthesize to generate gate level netlist. |
| CO-3 | **Design** of RTL using finite state machines along with design optimizations. |

**Unit-I** **09hrs**

**Logic Design Using Verilog:**Moore's law, Technology Scaling, Die size growth, Frequency, Power dissipation, Power density, Challenges in digital design, Design metrics, and Cost of Integrated circuits, Digital Combinational & Sequential circuits, Modules, Nets, Values, Comments, arrays in Verilog, Delays, parameterized designs, Procedural blocks, Blocking and Non-Blocking Assignment, looping, flow Control, Task, Function, basic test bench generation and Simulation, Verilog modeling of combinational and sequential logic.

**Unit-II** **08hrs**

**Principles of RTL Design:** Verilog Coding Concepts, Verilog coding guide lines: Combinational, Sequential, FSM. General Guidelines, Synthesizable Verilog Constructs, Sensitivity List, Verilog Events, RTL Design Challenges

**Unit-III** **06hrs**

**Introduction to timing concepts:**Setup and hold times. Setup and hold time equalities and inequalities, timing paths. Static timing delay calculation for basic flip flop & sequential circuits, Clock Domain Crossing.

**Unit-IV** **07hrs**

**Synthesis, Libraries and Technology Mapping:**Introduction to synthesis, logical synthesis of basic combinational and sequential circuits, Synthesis Methodologies, Pre and post synthesis mismatch, Translation, mapping and optimization. Overview of Libraries, design constraints, importance of wire load models.

**Unit-V** **09hrs**

**Design and simulation of Finite state machines:** FSM Design – overlapping and non-overlapping Mealy and Moore state machine design.

**Choice**: Unit-I and Unit-V

**Text books:**

1. Digital Design by Morris Mano M, 4th Edition
2. Verilog HDL: A Guide to Digital Design and Synthesis by Samir Palnitkar, 2nd Edition
3. VerilogHDL Synthesis A Practical Primerby J. Bhasker
4. Fundamentals of Digital Circuits by A. Anand Kumar, 2nd Edition
5. Principles of VLSI RTL Design: A Practical Guide by Sanjay Churiwala,SapanGarg,2011

**Reference Websites:**

1. www.asic-world.com
2. www.testbench.in
3. http://www.vlsi-expert.com/2011/03/static-timing-analysis-sta-basic-timing.html

**Online material:**

Seer Academy recordings

**E Books:**
https://www.freebookcentre.net/Electronics/Logic-Design-Books.html

**MOOCs:**
https://nptel.ac.in/courses/117106092/

Note: The Course will be supplemented by hands-on lab sessions using Cadence EDA tools

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **PROBABILITY AND STATISTICS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE1PS** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:** Basic calculus

**Course outcomes:**

At the end of the course, the student will be able to

| | |
|---|---|
| CO-1 | Demonstrate and apply the knowledge of probability, random variables and stochastic processes |
| CO-2 | Understand the tools of statistics and apply them to real life scenarios and data |
| CO-3 | Select an appropriate case study from the domain of electronics and communication engineering and effectively analyze and evaluate its various aspects using the tools learnt in this course. |

**Unit-I** **08hrs**

**Introduction:** Overview of probability theory, continuous type and discrete type random variables, joint distribution, expectation operator, correlation and covariance, Markov chains, numerical examples and engineering applications.

**Unit-II** **07hrs**

**Random Processes:** Introduction and classification, mean and autocorrelation functions, stationarity, strict sense and wide sense stationarity, ergodicity, Gaussian process.

**Unit-III** **08Hrs**

**Statistics:** CurveFitting,PrincipleofLeastSquares,CorrelationandRegression,Confidence Intervals, Descriptive Statistics - Graphical Representation, Measures Of Location and Variability.

**Unit-IV** **08hrs**

**Sampling Theory:** Introduction to Sampling Distributions, Standard Error, Type-I And Type-II Errors, Student's T-Distribution, Chi-Square Distribution as a Test Of Goodness Of Fit, Central Limit Theorem, Law of Large Numbers.

**Unit-V** **08hrs**

**Estimation:** Unbiasedness of Estimator, Hypothesis Testing, Null and Alternate Hypothesis, Maximum Likelihood Estimation, Neyman Pearson Test

**Choice**: Unit-III and Unit-IV

**Text books:**

1. An Introduction to Probability and Statistics by V.K. Rohatgi&Md.E.Saleh.

2. Probability & Statistics for Engineers and Scientists, 8th Edition Walpole, Myers, Myers and Ye, Prentice Hall, Upper Saddle River, NJ 07458, ISBN: 0-13-187711-9

**REFERENCE BOOKS:**

1. Introduction to Probability and Statistics for Engineers and Scientists by S.M. Ross

2. Probability, Random Variables and Stochastic Processes, Papoulis and Pillai, McGraw Hill.

**e-References:**

1. 6.041 Probabilistic Systems Analysis and Applied Probability managed by MIT OCW.
2. Probability and Statistics, conducted by Prof. Somesh K, IIT Kharagpur @ NPTEL

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Object Oriented Programming using C++** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE1OP** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:** Programming in C

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | Understand and apply C++ constructs to solve given problem statements |
| CO-2 | Apply knowledge of object-oriented concepts and realize solutions for given problem statements |
| CO-3 | Design efficient solutionsto real life problems using generic programming concepts and memory efficient strategies |
| CO-4 | Analyse the given to real timeproblem/s and develop complete solution/safter carefully selecting one or more of OOP technique/s |

**Unit-I** **06 hrs**

**Migration to CPP syntax from C** - Tokens, keywords, identifiers and constants, data types-basic types of C and reference variables, enum with their importance, symbolic constants, variables, operators, manipulators, control statements and loops, macros, functions- pass by: value, address and reference, importance of default values in creating applications

**Unit-II** **10 hrs**

**Classes and objects:** Class definition and declaration, member functions, static data members and member functions, Constructors, parameterized constructors, constructors with default values and its importance in applications, multiple constructors in a class and their working, copy constructor, dynamic constructors-realization and relevance, destructors, arrays of objects, pass and return of objects, Function overloading, friend functions

**Unit-III** **10 hrs**

**Operator overloading:** Overloading unary and binary operators, overloading using friend functions and its usage, rules for overloading. Inheritance: Single and multiple inheritances, public, private and protected inheritance. Pointers to objects, this pointer, pointers to derived classes, virtual functions, run-time polymorphism

**Inheritance: U**nderstand the need with real time examples, types: single, multiple, hybrid, hierarchical, modes of inheritance: private, protected and public modes and its significance on data access with real world examples

**Unit-IV** **06 hrs**

**Templates and exceptions:** Need for templates in real life applications, developing container classes with and without template functions, non-member function templates: importance and realization, overloading template functions, member function templates and non-type template arguments. Exception handling: Basics, throwing and catching mechanisms

**Unit-V** **07hrs**

**IO streams:** Managing console I/O operations: C++ streams, C++ stream classes, I/O operations, managing O/P with manipulators to realize solutions to given problems.

**Files:** Need for file systems, classes for file stream operations, opening and closing a file, detecting end of file, more about open():file modes, writing data onto file through any UI

**Choice**: Unit-II and Unit-III

**Text books:**

1. "Object oriented Programming with C++", E Balagurusamy, TMH Publications, 4$^{th}$Edition

2. Object oriented Programming in turbo C++, Robert Lafore, GALGOTIA Publications

**REFERENCE BOOKS:**

1. Let Us C++, Yashvanth P. Kanetkar, BPB Publications

2. Programming With C++-Schaum's series, TMH Publications

3. Video lectures on BMSCE Studio

**E Books:**

1. Object oriented Programming with C++", E Balagurusamy, TMH Publications, 4th Edition
2. Object oriented Programming in turbo C++, Robert Lafore, GALGOTIA Publications Online resources:
3. https://www.w3schools.com/cpp/cpp_oop.asp
4. https://www.geeksforgeeks.org/object-oriented-programming-in-cpp/

**MOOCs:** Object-Oriented Programming (edX) IITBombay X https://www.mooc-list.com/course/object-oriented-programming-edx

**NOTE:** Header files and exception handlers will be developed as a part of course. Also, applications will be developed as services using modular approach to enrich the learning.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **SATELLITE COMMUNICATION** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE2SC** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks (100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Basic concepts of Analog and Digital communication systems

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | Understand the basic dynamics of satellite communication |
| CO-2 | Evaluate the fundamental design of linking Earth station and the satellite |
| CO-3 | Discuss the various electronics subsystems associated with the satellite communication |
| CO-4 | Outline Satellite applications with the focus on communication and national satellite system |

**Unit-I** **08hrs**

Orbital mechanics- Orbital parameters, Kepler's laws, Injection velocity and satellite trajectory, Types of Satellite orbits, Orbital perturbations, Satellite stabilization, Orbital effects on satellite's performance.

**Unit-II** **08hrs**

Satellite Access- Link budget calculations, atmospheric losses, ionospheric effects, rain attenuation, Frequency translation, Error controlling, Multiple access Techniques-FDMA, TDMA, CDMA.

**Unit-III** **08hrs**

Satellite subsystem- Power supply subsystem, Attitude and Orbit control, Tracking, Telemetry and command subsystem, Structural subsystem, Thermal subsystems, Payload subsystems, Equipment reliability and space qualification

**Unit-IV** **07hrs**

Indian satellite scenario-Historical developments of satellite communication, PSLV, GSLV, INSAT, GSAT programs, Chandrayaan, Mangalyaan.

**Unit-V** **08hrs**

Satellite Applications- Global Positioning System, Direct Broadcast satellites, Direct to home broadcast, Digital audio broadcast, World space services, Business TV, Weather Forecasting, Remote Sensing Satellites

**Choice**: Unit-II and Unit-V

**TEXT BOOKS:**

1. Anil K. Maini, VarshaAgrawal: "Satellite Communications", Wiley India Pvt. Ltd., 2015,

ISBN: 978-81-265-2071-8.

2. Dennis Roddy: "Satellite Communications", 4th Edition, McGraw- Hill International

edition,2006.

3. Timothy Pratt, Charles Bostian, JeremyAllnutt: "Satellite Communications", 2nd Edition

**REFERENCE BOOK:**

1. Satellite Communication: Timothy Pratt, Second Edition, John Wiley and sons.

2. Satellite Communications Systems: systems, techniques and technology, 5th edition, by G.

Maral, M. Bousquet, Z. Sun, Publisher: John Wiley and sons

3. The Satellite Communication Applications Handbook, Bruce R. Elbert Artech House, 2004

- Technology & Engineering

**E Books:**

**MOOCs:**

1. https://www.coursera.org/learn/satellite-communications

2. https://www.classcentral.com/course/satellitecommunications-6313

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Image Processing** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE2IP** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:** Basic knowledge of Digital Signal processing

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | Apply enhancement and restoration techniques to 2D-images in spatial and frequency domain for required visualization. |
| CO-2 | Analyze, process and represent an image using various techniques in different domains |
| CO-3 | Interpret image in various data formats by applying imagetransformation/processingtechniquesfordifferent applications. |

**Unit-I** **08hrs**

**Introduction:** Fundamental Steps in Digital Image Processing, Components of an Image Processing System, Sampling and Quantization, Representing Digital Images (Data structure), Some Basic Relationships Between Pixels- Neighbors and Connectivity of pixels in image, Applications of Image Processing: Medical imaging, Robot vision, Character recognition, Remote Sensing.

**Color Image Processing:** Color Fundamentals, Color Models, Pseudocolour Image Processing.

**Unit-II** **08hrs**

**Image Enhancement :**

**Spatial Domain:**Some Basic Gray Level Transformations, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.

**Frequency Domain:**Preliminary Concepts, Filtering in the Frequency Domain, Image Smoothing and Image Sharpening Using Frequency Domain Filters.

**Unit-III** **07hrs**

**Restoration:** Noise models, Restoration in the Presence of Noise Only using Spatial Filtering and Frequency Domain Filtering, Linear, Position-Invariant Degradations, Estimating the Degradation Function, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering

**Unit-IV** **08hrs**

**Morphological Analysis:** Morphological Image Processing: Preliminaries, Erosion and Dilation, Opening and Closing, The Hit-or-Miss Transforms, Some Basic Morphological Algorithms.

**Representation and Description:** Representation, Boundary descriptors.

**Unit-V** **08hrs**

**Image Segmentation:**Introduction, Detection of isolated points, line detection, Edge detection, Edge linking, Region based segmentation- Region growing, split and merge technique, local processing, regional processing, Hough transform, Segmentation using Threshold

**Choice**: Unit-I and Unit-II

**Text books:**

1.Rafael C G., Woods R E. and Eddins S L, Digital Image Processing, Prentice Hall, 3rd

edition, 2008.

**REFERENCE BOOKS:**

1. Milan Sonka,"Image Processing, analysis and Machine Vision", Thomson Press India Ltd, Fourth Edition.
2. Fundamentals of Digital Image Processing- Anil K. Jain, 2nd Edition, Prentice Hall of India.

3. S. Sridhar , Digital Image Processing, Oxford University Press, 2nd Ed, 2016.

**E Books:**

1. https://bookboon.com/en/digital-image-processing-part-one-ebook
2. https://pakuni.info/download/digital-image-processing-by-jayaraman-pdf-book-free-download/

**MOOCs:**

1. https://www.coursera.org/learn/digital
2. https://www.classcentral.com/course/swayam-digital-image-processing-14005

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **ROBOTICS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE2RB** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- Knowledge of basic statics and dynamics.
- Basic programming using C/C$^{++}$.
- Linear Algebra.

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | **Gather** knowledge understand fundamentals of Robotics, components and Systems. |
| CO-2 | **Analyze and Apply** concepts used in Robotics systems. |
| CO-3 | **Design** of a Robotic System meeting the specifications for a particular application. |
| CO-4 | **Demonstrate** with practical experiments important robotics concepts and build a simple robot for an application |

**Unit-I** **08hrs**

**Introduction to Robotics**: History, Robots, Robot Usage, Industrial Robots and Their Applications: Robot Subsystems, Classification of Robots, Industrial Applications -actuators and Grippers: Electric Actuators, Hydraulic Actuators, Pneumatic Actuators, Selection of Motors, GrippersSensors, Vision and Signal Conditioning: Sensor Classification, Internal Sensors, External Sensors, Vision, Signal Conditioning, Sensor Selection

**Unit-II** **09hrs**

**Transformations & Kinematics**: Robot Architecture, Pose of a Rigid Body, Coordinate Transformation, Denavit and Hartenberg (DH) Parameters, A Variant of DH Parameters, DH Parametrization of Euler angles. Forward Position Analysis, Inverse Position Analysis, Velocity Analysis: The Jacobian Matrix, Link Velocities, Jacobian Computation,

JacobianUsing the Decoupled Natural Orthogonal Complement (DeNOC), Forward and Inverse Velocity Analyses, Acceleration Analysis

**Unit-III** **08hrs**

**Dynamics**:

Inertia Properties, Euler–Lagrange Formulation, Newton—Euler Formulation, Recursive Newton—Euler Algorithm, Dynamic Algorithms

**Unit-IV** **07hrs**

**Linear Control**: Control Techniques, Dynamic Systems, Transfer Function and State-Space Representation, A Robotic Joint Performance and Stability of Feedback Control, Proportional-Derivative-Integral (PID) Control of a Moving Block, Selection of PID Controller Gains, State-feedback Control Joint Controllers.

**Unit-V** **07hrs**

**Nonlinear, Force Controls and Motion Planning:** Nonlinear and Force Controls, Control of a Moving Block, Multivariable Robot Control, Joint Space Planning, Cartesian Space Planning, Path Primitives, Cartesian Trajectories, Point-to-Point vs. Continuous Path Planning.

**Text books:**

1. Introduction to Robotics, S K Saha, McGraw Hill Education (India) Private Limited, 2nd Edition, 2014
2. Robotics: Mechanics and Control, K R Guruprasad, PHI Learning Private Limited, 2019

**REFERENCE BOOKS:**

1. Introduction to Robotics: Mechanics and Control, John Craig, Pearson Education Inc, 3rd Edition, 2009.
2. Introduction to Robotics: Analysis Systems and Applications, Saeed B Nikku, PHI Learning Private Limited, New Delhi, 2001.

**E Books:**

1. http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.703.5185&rep=rep1&type=pdf

**MOOCs:**

1. https://www.my-mooc.com/en/categorie/robotics

**NOTE**:
The course will touch upon practical aspects and students are encouraged to execute a project such as on Robotics vehicle, Surveillance Robot, Pick-n-Play Robot etc.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **OPERATING SYSTEM** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC5PE2OS** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- Understanding of microprocessor/microcontroller architecture.
- Understanding of memory and I/O system.
- Basic understanding of system software.

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Apply** the knowledge of different classes and structure of operating system and analyze the requirement of system security and protection. |
| CO-2 | **Analyze** process scheduling, synchronization and memory management functionality of operating system. |
| CO-3 | **Analyze** the device management and engage in writing device drivers for Linux/Windows system as a case study. |

**Unit-I** **08hrs**

**Introduction and overview of operating systems:** Computing environment and nature of computations, Operating System and its Operation, Classes of operating systems: Multi programming systems, Time sharing systems; Different Structures of an operating system, Virtual machine operating systems, Kernel based operating systems.

**Unit-II** **08hrs**

**Process management:** processes and threads: processes and Program, implementing processes: Process States and State transitions, Process Context & Process control Block, Context Save, Scheduling & Dispatching, Threads, POSIX Threads, Case Study: Processes and Threads creation in Linux with Programming.

**Unit-III** **08Hrs**

**Process Synchronization:** Race conditions, Critical sections, Control Synchronization and Indivisible operations, Semaphores, Implementation of Semaphore, Deadlock condition, Case Study: Process Synchronization. **Scheduling:** Scheduling Concepts, Non-preemptive and Preemptive Scheduling Policies, Real Time Scheduling: EDF, RMS, Program Examples.

**Unit-IV** **08hrs**

**Memory management:** Memory allocation to a process, Heap Management: Reuse of Memory, Contiguous memory allocation, Non-contiguous memory allocation, Paging, Segmentation, Virtual Memory concept, Demand Paging & Page Replacement examples

**Unit-V** **07hrs**

**I/O Management:** Interrupt handlers, Device drivers, Device independent I/O software, user space I/O software, Case Study: Device drivers for Linux/Windows.

**Choice**: Unit-II and Unit-III

**Text books:**

1. Operating Systems - A Concept based Approach", D. M. Dhamdhare, TMH,
2. Modern operating systems" , Andrew S Tanenbaum, Herbert Boss 4th edition

**REFERENCE BOOKS:**

1. Operating Systems Concepts, Silberschatz and Galvin, John Wiley, 7th Edition, 2001.
2. Operating System – Internals and Design Systems, Willaim Stalling, Pearson Education, 4th Ed, 2006

**E Books:**

http://www.freebookcentre.net/ComputerScience-Books-Download/Operating-System-Concepts

**MOOCs:**

1. https://www.mooc-list.com/tags/operating-systems
2. https://www.mooc-list.com/course/operating-systems-saylororg

**NOTE:**

This course can have value addition with case study and programming using POSIX APIs for OS services.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **INNOVATION FOR ENTREPRENEURSHIP** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19ES5HSIFE** | **Credits** | **2** | **L-T-P** | **2:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

| | |
|---|---|
| CO-1 | Apply new ideas of design thinking, methods and ways of thinking |
| CO-2 | Able to formulate goals as entrepreneur for a start-up defining your goals as an entrepreneur |
| CO-3 | Able to identify business opportunities by performing market research and choosing target customer |
| CO-4 | Engage with a range of stakeholders to deliver creative and sustainable solutions to specific problems communicate effectively both orally and in writing |
| CO-5 | Work effectively with peers with diverse skills, experiences and be able to critically reflect on own practice |

**Unit 1** **6 hours**

**Ideation and Innovation**

Problems and Pain Points, Ideation and Problem Solving, Design Thinking, Team importance and Leadership, Market Segmentation, Beachhead Market, Building End User Profile, Total Addressable Market (TAM) Size for the Beachhead Market, Profile the Persona, Full Lifecycle Use Case, High-Level Product Specification, Quantify the Value Proposition, Identify Your Next 10 Customers, Define Your Core, Chart Your Competitive Position

**Unit 2** **5 hours**

**Product Acquisition by customer**

Determine the Customer's Decision Making Unit (DMU), Process to Acquire a Paying Customer, Mapping sale process, Total Addressable Market Size for Follow-on Markets

**Unit 3** **5 hours**

**Business from Product**

Design a Business Model, Set your Pricing Framework, Calculate the Lifetime Value (LTV) of an Acquired Customer, Map the Sales Process to Acquire a Customer, Calculate the Cost of Customer Acquisition (COCA)

**Unit 4** **4 hours**

**Designing, building and scaling of the product**

Identify key Assumptions, Test Key Assumptions, Define and build Minimum Viable Product (MVP), Test with Customer, Repeat Cycle to Reach Product Market Fit.

**Unit 5** **6 hours**

**Start-up and Entrepreneurship in India**

Starting company in India, IP landscape, Incubation, Government support, Taxation, Startup culture and leadership, Open innovation, Social Innovation, Intrapreneurship, entrepreneurship abroad.

**Reference Books**

1. Disciplined Entrepreneurship: 24 Steps to a Successful Startup (Wiley, 1st Edition) Bill Aulet, ISBN: 1118692284, 2013
2. The Startup Owner's Manual: The Step-by-Step Guide for Building a great company by Steve Blank K&S Ranch Publishers, K&S Ranch, 2016
3. Innovator's Dilemma: When New Technologies Cause Great Firms to Fail by Christensen, Harvard Business Review Press, 2011

**MOOC:**

1. https://ocw.mit.edu/courses/sloan-school-of-management/15-390-new-enterprises-spring-2013/assignments/assignment-12/
2. https://www.edx.org/course/entrepreneurship-101-who-customer-mitx-15-390x

**Ebook**

https://segera-wisuda.blogspot.in/2016/05/46-ebooks-entrepreneurship-download-free.html

# VI semester

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **COMPUTER COMMUNICATION NETWORKS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | 19EC6PCCCN | **Credits** | **4** | **L-T-P** | **3:0:1** |
| **CIE** | **50 Marks (100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:** Fundamentals of Digital communication and digital signal processing.

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | Understand the concepts of Computer Networks and Networks Models for Data Communication. |
| CO-2 | Apply the knowledge of networking and concepts of TCP/IP protocol stack to deliver packets across Multiple Networks (links). |
| CO-3 | Analyze the issues of routing and congestion mechanism for independent and internetworking networks for wired and wireless link. |
| CO-4 | Design, calculate, and apply subnet masks and routing addresses to fulfil networking requirements. |
| CO-5 | Create Network for given specification and conduct experiments within a simulated networking environment |
| Co-6 | Involve in independent learning on contemporary issues in networking technologies, Communicate effectively and prepare a report. |

**Unit-I** **7Hrs**

Introduction to Data Communication, Network Models, Digital Transmission, Bandwidth Utilization, Transmission Media, Wireless Transmission, Switching,Telephone and Cable TV for data transmission.

**Unit-II** **7Hrs**

Data Link Layer: Data link Control, Error detection and correction.

**Unit-III** **8Hrs**

Medium Access: Medium Access, Wired LANs: Ethernet, Wireless LANs. Connecting devices and Virtual LANS.

**Unit-IV** **8 Hrs**

Network Layer: Logical Addressing, Internet Protocol, Address Mapping, Error Reporting, Delivery, Forwarding and Routing

**Unit-V** **9 Hrs**

Transport layer: Process to process Delivery, Congestion control and Quality of Service

**Text Books:**


1. Data Communication and Networking, B Forouzan, 4th Ed, TMH 2006
2. Computer Networks, Andrew S.Tanenbaum, 4th, EEE
3. J Frauzon "Computer Communication and Networks".
4. W. Stallings, "Data and computer communication", PHI.


**REFERENCE BOOKS:**


1. Computer Networks, James F. Kurose, Keith W. Ross: Pearson education, 2nd Edition, 2003
2. Introduction to Data communication and Networking, Wayne Tomasi: Pearson education 2007
3. S. Keshav, "An Engineering Approach on Computer Networking", Addison Welsey.
4. Wayne Tomasi "Introduction to Data Communications and Networking" Pearson.
5. A.S. Tanenbaum, "Computer Networks", PHI.


**E Books:**

1. https://www.e-booksdirectory.com/details.php?ebook=10361
2. https://www.e-booksdirectory.com/details.php?ebook=7190

MOOCs:

1. http://nptel.ac.in/video.php?subjectId=106105081.
2. http://freevideolectures.com/Course/2278/Data-Communication

LABORATORY EXPERIMENT LIST (using qualnet simulator)

| Sl.No | Title of the Experiments |
|---|---|
| 1 | Analysis and comparison of networks with different topologies |
| 2 | Configuration and Analysis of Ethernet LAN |
| 3 | Analysis & Determination the number of packets dropped in a point to point network |
| 4. | Analysis of Multicast traffic and multicast protocol |
| 5. | Comparison of Multicast and multiple unicast traffic |
| 6. | Simulation and Analysis of wireless ad hoc network |
| 7. | Model a network with two LAN connected by a switch and analysis of the subnet |
| 8. | Analysis of connecting devices, configuration of router used to connect 2 subnets |
| 9 | Comparison and Analysis of routing algorithms( RIP and OSPF) |
| 10. | Simulate and Analyze wireless infrastructure network |
| 11. | Scrutiny of traffic between wired and wireless network |
| 12 | Simulate and analyse working of wireless Ad hoc network with mobility given to the nodes |

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **MIXED SIGNAL DESIGN** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6PCMSD** | **Credits** | **4** | **L-T-P** | **3:0:1** |
| **CIE** | **50 Marks (100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Knowledge of Analog Electronic Circuits, Linear Integrated Circuits and Fundamentals of VLSI

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | To **apply** the knowledge of basic CMOS technology to understand and explain the concepts of analog integrated circuits and mixed signal circuits |
| CO-2 | To **analyze** CMOS based Analog, ADC and DAC circuits |
| CO-3 | To **design**analog CMOS integrated circuits and mixed signal circuits |
| CO-4 | To **conduct** experiments on Analog and mixed signal CMOS circuits using modern EDA tools |

**Unit-I** **08hrs**

Review of MOS Device Models, Single-Stage Amplifiers: Basic Concepts, Common-Source Stage, Source Follower, Common-Gate Stage, Cascode Stage

**Unit-II** **07hrs**

Differential Amplifiers: Basic Differential Pair: Qualitative Analysis, Quantative Analysis, Common-Mode Response, Differential Pair with MOS loads. Basic Current Mirrors, Cascode Current Mirrors.

**Unit-III** **08hrs**

Active Current Mirrors: Large-Signal Analysis, Small-Signal Analysis, Common-Mode Properties. Operational Amplifiers: General Considerations, One-Stage Op Amps, Two-Stage Op Amps, Gain Boosting.

**Unit-IV** **07hrs**

Switched-Capacitor Circuits: General Considerations, Sampling Switches, Switched-Capacitor Amplifiers, Switched-Capacitor Integrator, Switched-Capacitor Common-Mode Feedback.

**Unit-V** **09hrs**

Digital-to-Analog Converter specifications: DNL, INL, Offset, Gain error, Latency, SNR, Dynamic Range. Analog-to-Digital Converter specifications: Quantization error, DNL, INL, Missing codes, Offset, Gain error, Aliasing, SNR, Aperture error, Mixed-Signal layout issues.

DAC Architectures: R-2R ladder DAC, Current Steering DACs, Charge Scaling DACs, Pipeline DAC.

ADC Architectures: Pipeline ADC, Integrating ADCs, Successive Approximation ADC, Oversampling ADCs

**Choice**: Unit-III and Unit-V

**Text books:**

1. Behzad Razavi, "Design of Analog CMOS Integrated Circuits", McGrawHill Edition, 2002, ISBN: 0-07-238032-2
2. R. Jacob Baker, "CMOS Circuit Design, Layout and Simulation", Third Edition, IEEE Press, 2010, ISBN: 978-0-470-88132-3

**REFERENCE BOOKS:**

1. Willy M. C. Sansen, "Analog Design Essentials", Springer, 2006. ISBN-10 0-387-25747-0
2. Gray, Hurst, Lewis and Meyer, "Analysis and Design of Analog Integrated Circuits", Fifth Edition, 2010, John Wiley & Sons.

**E Books:**

1. http://www.designinganalogchips.com/_count/designinganalogchips.pdf

**MOOCs:**

1. https://nptel.ac.in/courses/117106030/
2. https://nptel.ac.in/courses/117106034/

## LABORATORY EXPERIMENT LIST

| Sl.No | Title of the Experiments |
|---|---|
| | **Conduction using Hardware** |
| 1. | Draw the schematic of a CMOS inverter and obtain the DC characteristics. Also perform the transient analysis and determine the delay of the inverter. |
| 2. | Common Source amplifier: Transient, DC and AC analysis |
| 3. | Common Drain amplifier: Transient, DC and AC analysis |
| 4. | Basic (fully) Differential amplifier: Transient, DC and AC analysis. Find the CMRR. |
| 5. | Differential Input, Single-ended output operational amplifier: Transient, DC and AC analysis. Find the CMRR. |
| 6. | OpAmp cascaded with Common-Source amplifier to form 2-stage OpAmp: Transient, DC and AC analysis |
| 7. | Design R-2R ladder DAC using the OpAmp designed above and measure the |

| | |
|---|---|
| | DNL and INL of the DAC |
| 8. | Draw the layout of CMOS inverter and verify DRC, LVS |
| 9. | Draw the layout of Common Source amplifier and verify DRC, LVS. |
| 10. | Draw the layout of Common Drain amplifier and verify DRC, LVS. |
| | **Conduction using Verilog-AMS** |
| 1. | Modeling of Resistors, Capacitors, Ideal diode, Voltage & Current sources |
| 2. | Modeling of SAR ADC |

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **COMMUNICATION THEORY II** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6PCCT2** | **Credits** | **4** | **L-T-P** | **3:0:1** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Knowledge of Digital Signal Processing, Communications Theory I and MATLAB is required

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Apply** the knowledge of various signal processing and coding techniques for efficient and reliable digital communications |
| CO-2 | **Analyze**the performance of givendigital communication techniques |
| CO-3 | **Design** the digital communication system for a given set of specification. |
| CO-4 | **Conduct**hardware experiments and **simulate** experiments to demonstrate design and analysis of concepts. |

**Unit-I** **08hrs**

Introduction to DCS, Block diagram of DCS with basic signal processing operations, Communication channel,

**Pulse code modulation**, Uniform quantization and its SQNR, Robust quantization-companding,Differential PCM TR and RX, Delta modulation and its SQNR, TDM-PCM, T1 and E1 digital Hierarchy.Line codes,

**ISI in band limited channels**, Zero-ISI condition- the Nyquist criterion, Solution for zero ISI-practical raised cosine filters and Duo binary encoding and decoding.

**Unit-II** **08hrs**

**Optimum Receiver** structures forAWGN channel- correlator type receivers, Matched filter type receivers, properties, Power and BW efficiency,

**Digital Modulations**- Generation and detection of ASK , BPSK and BFSK, Signal space constellations, Probability of bit error computation for BPSK, Generation and detection of

QPSK, waveforms and its Signal space constellation, Probability of bit error expression Generation and detection of DPSK, waveforms,Probability of bit error expression,Performance analysis of all the schemes in terms of probability of bit error, BW and Power

.**Unit-III** **07 Hrs**

Introduction to spread spectrum- Need for Spread Spectrum Modulation, PN sequence and its properties, Direct sequence SS system- DS/BPSK Transmitter & Receiver, Processing gain, Jamming margin,Frequency hop SS system- FH-FSK transmitter and Receiver, Fast and slow hop, Application of DS SS and FHSS for multiuser environment –CDMA, Multipath fading

**Introduction to OFDM**- Concept , comparison with FDM, Block diagram of OFDM.

**Unit-IV** **07hrs**

**Introduction to Information theory-** Measurement of Information, Entropy and information rate, Communication channels, Shannon's Channel Capacity theorem and its trade off

**Source coding- definition** Various Properties of source codes, Shannon-Fano encoding algorithm, Huffman's coding algorithm, efficiency and variance computation

**Unit-V** **07hrs**

**Introduction to Channel coding** : Need for channel coding, Shannon's coding theorem.

**Linear Block codes** –rate, encoding procedure.Error detecting andcorrecting capability-Syndrome calculation for error detection.

**Convolutional Encoding**: Convolutional encoder representation, impulse response,transform domain representation, tree, trellis and state representation.

**Choice**: Unit-I and Unit-II

**Text books:**

1. Digital Communications By Simon Haykins –John Wiley 2003

2. Digital communications - Bernard Sklar: Pearson education 2007

**REFERENCE BOOKS:**

1. Modern Analog and Digital communications ,Lathi and Ding , oxford press
2. Concepts of Information theory and coding, P.S. Satyanarayana, DYNARAM 2005

**E Books:**

1. Digital Communication-Authors: **Barry**, John R., **Lee**, Edward A., **Messerschmitt**,David G.
2. Digital Communications By Simon Haykins 4th edition

**MOOCs:**

1. NPTEL lecture series : Prof Bikas Kumar Dey, IITBombay

2. NPTEL lecture Digital Communications-IIT Madras

**LIST OF LABORATORY EXPERIMENT**
**PART A (Hardware experiments)**

1. Flat top sampling using Sample and hold circuit.
2. Generation and detection of BASK for given specifications
3. Generation and detection of BFSK for given specifications
4. Generation and detection of BPSK for given specifications
5. Study and compute directivity, gain of antennas.
6. Study of different modulations and demodulation on SDR platform

**PART B (simulation experiments** on MATLAB Platform**)**

1. Simulation of techniques learnt in Unit 1 –PCM,, DPCM
2. Simulation of techniques learnt in Unit II –Different Modulations
3. Simulation of techniques learnt in Unit III- Spread spectrum
4. Simulation of techniques learnt in Unit IV – source coding
5. Simulation of techniques learnt in Unit V- Channel coding
6. Simulation of end to Communication system with BER plots (in AWGN)

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **AUTOMOTIVE EMBEDDED SYSTEMS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6PE3AE** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- Understanding of sensor principles.
- Knowledge on control systems.
- Knowledge of modeling tool such as: Simulink.

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | **Apply** the knowledge of sensors, control theory, instrumentation and AUTOSAR to develop embedded automotive subsystems. |
| CO-2 | **Analyze** model based design approach in realizing automotive subsystems. |
| CO-3 | **Design** automotive subsystems for specified applications using model based and/or conventional approach. |

**Unit-I** **07hrs**

Automotive Architecture: Need for Electronics in Automotive, Introduction to ECUs, Vehicle Functional Domains and their requirements-General Context, Functional Domains, Standardized Components, Models, and Processes, Intelligent Vehicle Technologies- Road Transport and Its Evolution, New Technologies, Dependability Issues, Fully autonomous car

**Unit-II** **08hrs**

The systems approach to control and instrumentation: Concept of a system, block diagram representation of a system, electronic system performance, instruments, basic measurement system, signal processing, control systems: P,PI, PID controllers. Model Based Design approach: Definition, driving force for MBD, benefits of MBD,contextual requirements of MBD, MBD technology.

**Unit-III** **08hrs**

Case studies of MBD (Block diagram approach only), Electronics engine Control: Motivation for electronic engine control, concept of electronic engine control system, electronic fuel control system: configuration and control sequence, electronic ignition, automatic cruise control, antilock braking system (ABS), electronic suspension system, electronic steering control.

**Unit-IV** **08hrs**

Sensors: Air flow rate sensor, engine crankshaft angular position sensor, magnetic reluctance position sensor, engine speed sensor, hall-effect sensor, throttle angle sensor, typical coolantsensor, exhaust gas oxygen sensor.

**Unit-V** **08hrs**

A Review of Embedded Automotive Protocols: Different Networks for Different Requirements, Event-Triggered versus Time-Triggered, LIN, CAN, MOST, FlexRay, Middleware Layer: Rationale for a Middleware, Main Objectives of AUTOSAR, Layered Software Architecture, BSW and RTE, Virtual function bus, AUTOSAR in Practice:

Demonstration of AUTOSAR- Compliant ECUs.

**Choice**: Unit-III and Unit-V

**Text books:**

1. "Automotive Embedded Systems Handbook", Nicolas Navet, Industrial Information Technology Series, CRC press.
2. Understanding automotive electronics, William B.Ribbens, Elsevier.

**REFERENCE BOOKS:**

1. Automotive Software Architecture- MiroslawStaron, Sringer 2017.

**E Books:**

**1.** https://dl.acm.org/doi/book/10.5555/2414762

**MOOCs:**

**1.** https://www.mooc-list.com/tags/automotive-systems

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **System Verilog & Verification** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6PE3SV** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Digital Design Fundamentals, ASIC Design Flow, HDL Programming

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Understand** the principles of verification, OOPs concepts in System Verilog, layered test bench architecture and its components |
| CO-2 | To **apply** the knowledge of system Verilog to build basic verification environment |
| CO-3 | To **analyze** a given design and come up with suitable test cases to achieve 100% coverage |

**Unit-I** 0**6hrs**

**Verification Concepts**:Concepts of verification, importance of verification, Stimulus vs Verification, functional verification, test bench generation, functional verification approaches, typical verification flow, stimulus generation, direct testing, Coverage: Code and Functional coverage, coverage plan.

**Unit-II** 0**9hrs**

**System Verilog – 1:** System Verilog constructs - Data types: two-state data, four-state data, strings, arrays: queues, dynamic and associative arrays, enumerated types. Program blocks, module, interfaces, clocking blocks, modports

**Unit-III** 0**9hrs**

**System Verilog – 2:**SV Classes: Language evolution, Classes and objects, Class Variables and Methods, Class instantiation, Inheritance, and encapsulation, Polymorphism. Randomization: Directed Vs Random Testing. Randomization: Constraint Driven Randomization, Virtual Interfaces

**Unit-IV** 0**6hrs**

**Assertions:**Assertions: Introduction to Assertion based verification, Immediate and concurrent assertions.

**Unit-V** 0**9hrs**

**Coverage driven verification:**Coverage driven verification: Motivation, Types of coverage, Cover Group, Cover Point, Cross Coverage, Concepts of Binning and event sampling.

Layered testbench architecture

**Choice**: Unit-III and Unit-V

**Text books:**

1. Chris Spear, SystemVerilog for Verification

**REFERENCE BOOKS:**

1. Janick Bergeron, Writing Testbenches Using SystemVerilog
1. Chris Spear, SystemVerilog for Verification
1. Janick Bergeron, Eduard Cerny, Alan Hunter, and Andy Nightingale, VerificationMethodology Manual for SystemVerilog

**Websites:**

1. www.asic-world.com
2. www.testbench.in
3. http://www.vlsi-expert.com/2011/03/static-timing-analysis-sta-basic-timing.html

**Online Materials:**

SeerrAcademyrecordings

**E Books:** SystemVerilog for Verification: A Guide to Learning the Testbench Language Features by Chris Spear

**MOOCs:**

1. http://verificationexcellence.in/online-courses/

Note: The Course will be supplemented by hands-on lab sessions using Cadence EDA tools.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Data Structures & Applications** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6PE3DS** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**C/C++ Programming

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | Understand various methods of realizing data structures. Apply appropriate programming concepts to realize various data structures |
| CO-2 | Analyze the suitability of a given data structure for a given application |
| CO-3 | Develop time and memory efficient data structure/s for given application/s |

**Unit-I** **08 hrs**

**INTRODUCTION:** Revision of OOP concepts: Templates, operator overloading, inheritance, Data Representation methods, Linear lists, Formula-based representation and linked representation, Analysis of different representation methods, Exercises on list manipulation

**Unit-II** **10 hrs**

**ARRAYS AND MATRICS:** Arrays, Overloading operators to add features, Realize 1D, 2D…nD arrays, Inherit classes to add features to existing basic classes Importance of mapping functions, Visualizing n-D matrices, Realization of matrices, perform matrix operations, Special matrices: Diagonal, triangular, tridiagonal, sparse matrices and their importance, space and time implication of realizing special matrices.

**Unit-III** **10 hrs**

**STACKS and QUEUES (linear and circular):** The abstract data type, Formula-based representation, Linked representation, Applications: Parenthesis match, Tower of Hanoi, machine shop scheduling (conversion and evaluation of prefix, postfixexpressions)

**Unit-IV** **06 hrs**

**BINARY TREES:** Representation methods, Properties, Tree operations, Binary tree traversal methods and algorithms, Expression trees.

Binary search trees: Concept of dictionary, BST: representation, insertion and deletion

**Unit-V** **06 hrs**

Heaps – Min and Max heaps: representation, insertion and deletion, Heap sort, Machine scheduling, Huffman codes, AVL trees: representation, insertion and deletion. (All concepts through algorithms)

**Choice**: Unit-II and Unit-III

**Text books:**

1. Data structures, Algorithms, and applications in C++ - SartajSahni, McGraw Hill.2000.

2. Data structures and Algorithm Analysis in C++ Mark Allan Weiss, Pearson, 2013

**REFERENCE BOOK:**

1. Data Structures Using C and C++ by Y. Langsam, M. Augenstein and A. M. Tenenbaum Prentice - Hall Of India Pvt. Ltd. Edition 2 2006

**E Books:**

1. Scilab Textbook Companion for Data Structures Using C And C++ by Y. Langsam, M. Augenstein And A. M. Tenenbaum Created by Dharmesh Majethiya NIT Tiruchirappalli, 2013

**MOOCs:**

**1.** Data Structures and Algorithms https://nptel.ac.in/courses/106/102/106102064/
**2.** Programming data structures and Algorithms https://nptel.ac.in/courses/106/106/106106133/

**NOTE:** Header files and exception handlers will be developed as part of course. Also, applications will be developed as services using modular approach to enrich the learning

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Internet of Things** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6PE3IT** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- knowledge of microprocessor and controller hardware
- knowledge of C and C++, and python (can pick up during the course)
- Networking concepts and technologies

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | Understand the evolution and impact of IoT applications, architectures in real world. |
| CO-2 | Illustrate diverse methods of deploying smart objects and connect them to network. |
| CO-3 | Compare different Application protocols for IoT and Infer the role of Data Analytics and Security in IoT. |
| CO-4 | Identify sensor technologies for sensing real world entities and design smart IoT applications. |

**Unit-I** **7 hrs**

What is IoT, Genesis of IoT, IoT and Digitization, IoT Impact, IoT Challenges, IoT Network Architecture and Design.

**Unit-II** **8hrs**

Smart Objects: The "Things" in IoT, Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies.

**Unit-III** **8hrs**

IP as the IoT Network Layer, The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances, Application Protocols for IoT, The

Transport Layer, IoT Application Transport Methods

**Unit-IV** **8hrs**

Data and Analytics for IoT, An Introduction to Data Analytics for IoT, Machine Learning, Big Data Analytics Tools and Technology, Edge Streaming Analytics, Network Analytics, Securing IoT, Formal Risk Analysis Structures: OCTAVE and FAIR.

**Unit-V** **8hrs**

IoT Physical Devices and Endpoints - Arduino UNO: Introduction to Arduino, ArduinoUNO, Installing the Software, Fundamentals of Arduino Programming. IoT Physical Devices and Endpoints - RaspberryPi: Introduction to RaspberryPi, About the RaspberryPi Board: Hardware Layout, Operating Systems on RaspberryPi, Configuring RaspberryPi, Programming RaspberryPi with Python, Wireless Temperature Monitoring System Using Pi, DS18B20 Temperature Sensor, Connecting Raspberry Pi via SSH, Accessing Temperature from DS18B20 sensors, Remote access to RaspberryPi, Smart and Connected Cities, An IoT Strategy for Smarter Cities, Smart City IoT Architecture. Smart City Security Architecture, Smart City Use-Case Examples.

**Unit Choice: III & IV**

**Text books:**

1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry,"**IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things**", 1st Edition, Pearson Education (Cisco Press Indian Reprint). (ISBN: 978-9386873743)
2. Srinivasa K G, "**Internet of Things**", CENGAGE Leaning India, 2017

**REFERENCE BOOKS:**

1. Vijay Madisetti and ArshdeepBahga, "Internet of Things (A Hands -on- Approach)", 1st Edition, VPT, 2014. (ISBN: 978-8173719547).
2. Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017. (ISBN: 978-9352605224).

**Online Resources:**

1. https://www.youtube.com/watch?v=co2MLqkJVXs
2. https://www.youtube.com/watch?v=9znRbMTimvc

**E Books:**

1. http://alvarestech.com/temp/Industry4.0/2019/Dimitrios%20Serpanos,Marilyn%20Wolf%20(auth.)%20-%20%20Internet-ofThings%20(IoT)%20Systems_%20Architectures,%20Algorithms,%20Methodologies-Springer%20International%20Publishing%20(2018).pdf
2. https://www.oreilly.com/design/free/files/designing-for-the-internet-of-things.pdf

**MOOCs:**

1. https://nptel.ac.in/courses/106/105/106105166/
2. https://www.coursera.org/specializations/internet-of-things

**NOTE:The course will be supplemented by project based learning.**

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **MACHINE LEARNING** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6CE1ML** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- **Knowledge of Linear Algebra**
- **Knowledge of Calculus**
- **Knowledge of Probability & Statistics**
- **Basic knowledge of Programming.**

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | **Apply** the knowledge of mathematics and programming to structure datasets and algorithms to build machine learning models |
| CO-2 | **Analyze**dataset features for different use cases and performance measures to evaluate the models. |
| CO-3 | **Design** and develop application models using supervised and unsupervised machine learning algorithms. |

**Unit-I** **09hrs**

Python for ML: Data types, Understanding and creation of: lists, tuples, dictionaries, writing functions, conditional and looping statements, Python libraries for ML:Data Preparation using Numpy and Pandas functions, parsing and importing data from a text file, data visualization with Matplotlib.

Introduction: Machine Learning (ML) Landscape, Why use ML, Types of ML systems: Supervised, Unsupervised, Semi-supervised and Reinforcement learning, Challenges of ML, Problems ML can solve, Classification and Regression Overview.

**Unit-II** **09hrs**

Classification: kNN algorithm- k-Neighbours classification algorithm flow and concepts, Testing the classifier, improving the classification performance with kNN (handwriting recognition system), Evaluation Metrices: MAE, MSE, RMSE, RAE, RSE, R2-score.

Decision trees: Construction of decision trees, Information gain and entropy, confusion matrix, Precision, Recall and F1score, dataset splitting based on a feature, Matplotlib annotations to visualize a tree, concept of ensembling : Bagging and Boosting, Random Forest.

**Unit-III** **07hrs**

Classifying with probability theory: Naive Bayes and Logistic Regression Algorithms, Training and testing the classifier model, Performance measures: Log loss, Jaccard Index& Accuracy score.

**Unit-IV** **07hrs**

Regression: Simple & Multiple Linear regression for continuous value prediction, Training& Testing the regression model, Cross validation and performance evaluation, evaluating classification Vs Regression for any dataset.

**Unit-V** **07hrs**

Unsupervised Learning: Types of Unsupervised Learning, Challenges in Unsupervised Learning, Pre-processing and Scaling, Applying Data Transformation, K-Means Clustering, Euclidean distance, Manhattan distance and Minkowski distance. Case Study: Recommender system. Introduction to Artificial Neural Networks and Deep Learning.

**Choice**: Unit-I and II

**Text books:**

1. Introduction to Machine Learning, EthemAlpaydin, PHI Learning, 3rd edition 2015.
2. Introduction to Machine Learning with Python: A Guide for Data Scientists, Andreas C Muller & Sarah Guido, O'Reilly Publication, 2019

**REFERENCE BOOKS:**

1. Machine Learning – Tom M. Mitchell, McGraw-Hill Edition1 2013.
2. Machine Learning in Action – Peter Harrington, dreamtech press Indian Edition, 2017.

**E Books:**

1. https://www.pdfdrive.com/machine-learning-with-python-cookbook-practical-solutions-from-preprocessing-to-deep-learning-d176361144.html

**MOOCs:**

1. https://www.simplilearn.com/artificial-intelligence-masters-program-training-course.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **ADVANCED MICROCONTROLLER AND APPLICATIONS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6CE1AM** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- Basic knowledge on 8-bit microcontroller architecture.
- Basic programming skill in assembly and C.
- Knowledge on working with IDEs.

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | **Apply** the acquired knowledge on ARM7 and ARM Cortex m3architecture, their features and instruction set in-programming the ARM processor. |
| CO-2 | **Analyze** the architectural features of ARM7 and Cortex M3,concepts on system software and communication protocol stack design ARM based embedded applications. |
| CO-3 | **Design** and developARM based embedded applications. |

**Unit-I** **08hrs**

Migration from 8-bit to 32-bit cores, RISC design and ARM Design Approach, ARM7TDMIcore dataflow model, Pipeline,Cortex M3 Processor & its applications, Cortex M3 Architecture and Registers,Operation Modes, Nested Vector Interrupt Controller, Debug Support.

**Unit-II** **08hrs**

Thumb2 Technology: Instruction Set Architecture & programming, Exceptions & Interrupts, Stack memory, Memory Map, Bit banding.

**Unit-III** **08Hrs**

Cortex M3 Programming: A typical development flow, Using C, CMSIS, Using Assembly, Interrupt behavior, Exception Programming.

**Unit-IV** **08hrs**

Introduction to Firmware, Boot-loader and Embedded Operating Systems, MMU & Virtual Address Translation**,** Cache Memoryand address mapping.

**Unit-V** **07hrs**

**ARM SoC**: Working with UART, I2C, SPI & USB Protocols.
**Building Applications with ARM Cortex M3**: Robotics & Motion Control, WSN, IoT.

**Choice**:

Unit-II and Unit- III

**Text books:**

1. The Definitive Guide to ARM Cortex M3, 2nd Edition by Joseph Yiu.
2. ARM System Developer's Guide By Andrew N Sloss, Dominic Symes, Chris Wright

**REFERENCE BOOKS:**

1. **ARM System-On-Chip Architecture** By Steve Furber, Addison Wesley, Pearson Education, 2nd edition
2. **Jagger (Ed) ARM architectural reference manual,** Prentice Hall

**E Books:**

1.https://community.arm.com/developer/ip-products/system/f/embedded-forum/2227/ebooks-for-arm

**MOOCs:**

1. https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-i

**NOTE:**This course will be value added with projects based learning. Any cross compiler can be used for running CotrexM3 based assembly programs and developing embedded applications.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **COMPUTER VISION** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC6CE1CV** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**NIL

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | **Apply** various segmentation, feature extraction and representation techniques for a give pattern analysis problem. |
| CO-2 | **Analyze**various pattern recognition and classification schemes to perform a specific computer vision task. |
| CO-3 | **Design** 3D visualization models to process a 3D object for a specific computer vision task. |

**Unit-I** **07 hrs**

Pattern Analysis: Clustering: K-Means, Classification: Discriminant Function, Supervised, Un-supervised, Semi-supervised; Classifiers: Bayes, KNN,ANN-models

**Unit-II** **08 hrs**

Feature extraction: Edges - Canny, LOG, DOG; Line detectors (Hough Transform), Corners - Harris and Hessian Affine, Orientation Histogram, SIFT, SURF,HOG, GLOH

**Unit-III** **08 hrs**

Shape representation and segmentation: Deformable curves and surfaces, Snakes and active contours, Level set representations, Fourier andwaveletdescriptors

**Unit-IV** **07 hrs**

3D Image Visualization: Sources of 3D Data sets, Slicing the Data set, Arbitrary section planes, Volumetric display, Stereo Viewing, Ray tracing, Reflection, Surfaces, Multiply connected surfaces, Image processing in 3D, Measurements on3Dimages.

**Unit-V** **06 hrs**

Modern Trends: Biometrics – fingerprint, face, iris, digital signature; super resolution, Introduction toAugmentedReality

**Choice**: Unit-II and Unit-IV

**Text books:**

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer-Verlag London Limited 2011.

2. Computer Vision: A Modern Approach, D. A. Forsyth, J. Ponce, Pearson Education, 2003.

**REFERENCE BOOKS:**

1. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Second Edition, Cambridge University Press, March 2004

2. K. Fukunaga; Introduction to Statistical Pattern Recognition, Second Edition, Academic Press, Morgan Kaufmann, 1990.

3. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Addison- Wesley, 1992

Mooc: https://www.coursera.org/learn/computer-vision-basics

https://www.edx.org/course/computer-vision-and-image-analysis

EBook: http://freecomputerbooks.com/Programming-Computer-Vision-with-Python.html

http://freecomputerbooks.com/Computer-Vision-Algorithms-and-Applications.htm

# BMS College of Engineering, Bangalore – 19

(Autonomous College under VTU)

| Course Title | Physical Design | | | | |
|---|---|---|---|---|---|
| Course Code | 19EC6CE1PD | Credits | 3 | L-T-P | 3:0:0 |
| CIE | 50 Marks(100% weightage) | SEE | | 100 Marks (50% weightage) | |

**Prerequisites:**

Basic understanding of register-transfer-level design and synthesis in ASIC Flow

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | To **understand** the advanced concepts of modern VLSI system design including standard cells, cell libraries, IPs etc., |
| CO-2 | To **apply** the knowledge of back-end physical design flow, including Floor planning, placement, CTS and Routing |
| CO-3 | To **analyze** the timing reports and fix timing violations in the back end |

**Unit-I** **08hrs**

**Physical design flow :**Libraries and File Formats. Introduction to physical design automation, Physical Design flow, EDA tools, Input files, Libraries: Standard Cells, Transistor Sizing, Input-Output Pads, Library Characterization, Constraints based design, File formats:Library Exchange Format (LEF), Design Exchange Format(DEF), Liberty Timing File (LIB), ESD and its sources, Library characterization, Timing models: Delay model, NLDM, Polynomial Delay model, Current source model.

**Unit-II** **08hrs**

**Partitioning and Floor planning:** Partitioning Techniques, Classification of Partitioning Algorithms, Floor planning, Design Style Specific Issues, macro placement, Floor planning Algorithms

**Unit-III** **08 Hrs**

**Placement :**Design Style Specific Placement Problems, Goals of placement, and Sanity checks before placement. Classification of Placement algorithms, Simulation Based Placement Algorithms: Simulated Annealing, Force Directed Placement, Interconnection Topologies, Estimation of Wire length

**Unit-IV** **07hrs**

**Clock Tree Synthesis and Timing Analysis**
Sanity checks before CTS. Need and goals of CTS. CTS related Terminologies. Clock skew reduction techniques and Topologies.Clock buffering mechanism. Post CTS Optimization. Basic timing related quantities.

**Unit-V** **08hrs**

**Routing and signoff checks :**Goals of Routing, Routing Prerequisites, Routing Constraints, Global Routing, Track Assignment, Detail Routing, Routing algorithms. Design Rule Check (DRC), Layout versus Schematic (LVS), commonly faced LVS issues, IR Drop Analysis: Static IR drop analysis, Dynamic IR drop analysis, Methods to reduce IR drop: ELECTRO MIGRATION (EM): Methods to fix EM

**Choice**: Unit-I and Unit-V

**Text books:**

1. KhosrowGolshan,"Physical Design Essentials-An ASIC Design Implementation Perspective", 2007 Springer Science+Business, Media
2. Sherwani, Naveed A. "Algorithms for VLSI Physical Design Automation"

**Reference books:**

1. Sarafzadeh, C.K. Wong, "An Introduction to VLSI Physical Design", McGraw Hill International Edition 1995.
2. Preas M. Lorenzatti, " Physical Design and Automation of VLSI systems", The Benjamin Cummins Publishers, 1998.

**E Books:** Algorithms for VLSI Physical Design Automation, by **Sherwani**, Naveed A

**MOOCs:**
1. https://www.digimat.in/nptel/courses/video/106105161/L01.html

Note: The Course will be supplemented by hands-on lab sessions using Cadence/ Synopsis EDA tools.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **ELECTRONIC ENGINEERING MATERIALS** | | | | |
| **Course Code** | **19EC6OE1EM** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites: NIL**

**Course Outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | Apply concepts of physics and chemistry to identify the application of materials in various engineering domains |
| CO-2 | Analyze the various material preparation and characterization techniques available and hence infer on the selection of a method to suit requirements |
| CO-3 | Conduct survey on recent application of materials and write a report/survey paper while following professional ethics |

**UNIT 1** **07 hours**

**Introduction** : Classification of engineering materials, levels of structure, structure-property relationships in materials, units, constants and conversion factors, basic thermodynamic functions, statistical nature of entropy, kinetics of thermally activated processes, Novel materials for sensing applications

**UNIT 2** **09 hours**

**Electrical properties of materials :** Electrical conduction, conductivity, conduction in terms of band and atomic bonding models, electron mobility, electrical resistivity of metals, electrical characteristics of commercial alloys, semi conductivity, temp dependence of carrier concentration, factors that affect carrier mobility, Hall effect, dielectric behaviour, types of polarization, frequency dependence of the dielectric constant, Ferro electricity, piezoelectricity

**UNIT 3** **07 hours**

**Optical properties:** Basic concepts, Absorption process, Tauc relation to calculate band gap of materials, Refractive index. Applications of optical properties: photoconductivity, fluorescence and luminescence

**UNIT 4** **07 hours**

**Fabrication methods:** Thermal Evaporation, e-beam evaporation, sputtering spin coating CVD techniques

**Unit 5:** **6 hours**

**Characterization of materials:** XRD, SEM, AFM, TEM, Van der Paul method of resistance measurement

**Text books:**

1. Elementary Solid State Physics: Principles and Applications- Omar Ali – 6th Edition (PEARSON)
2. Material Science and Engineering- A First Course – V. Raghavan -6th edition (PHI)
3. Material Science and Engineering - William D. Callister – 2nd edition (Wiley)

**REFERENCE BOOKS:**

1. Materials Science of thin films – Milton Ohring- 2nd edition (Academic Press)

**E Books:**

1. https://pdfs.semanticscholar.org/fac1/91c1fa2e11ff2dd5367c02b88e65fda25011.pdf
2. https://shodhganga.inflibnet.ac.in/bitstream/10603/60701/8/08_chapter%202.pdf

**NPTEL/MOOCs:**

1. https://nptel.ac.in/courses/113/102/113102080/
2. https://nptel.ac.in/courses/112/105/112105053/

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **ENGINEERING ECONOMICS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19GC6HSEEC** | **Credits** | **2** | **L-T-P** | **2:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Course outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | Acquire the skills to apply the basics of economics in engineering field |
| CO-2 | Perform cost analysis for optimization to engineering products |
| CO-3 | To take economically sound decisions in maintenance of products. |

**UNIT I** **5 Hrs**

**Introduction to Economics**: Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – P/V ratio.

**UNIT II** **5 Hrs**

**Elementary Economic Analysis**: Introduction- Material selection for product, Design selection for a product, Material design – Process planning.

**UNIT III** **6 Hrs**

**Value Engineering:** Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor - Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods.

**UNIT IV** **5 Hrs**

**Cash Flow:** Revenue dominated cash flow diagram, cost dominated cash flow diagram, Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

**UNIT V** **5 Hrs**

**Replacement and Maintenance Analysis:**

**Maintenance** -Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return.

**Depreciation**- Introduction, Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation.

**TEXT BOOKS:**

1. PanneerSelvam, R, “Engineering Economics”, Prentice Hall of India Ltd, New Delhi, 2001.

**REFERENCES:**

1. Chan S.Park, “Contemporary Engineering Economics”, Prentice Hall of India, 2011.
2. Donald.G. Newman, Jerome.P.Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 2010.
3. Degarmo, E.P., Sullivan, W.G and Canada, J.R, “Engineering Economy”, Macmillan, New York, 2011
4. Zahid A khan: Engineering Economy, "Engineering Economy", DorlingKindersley.

**E Books:**

1. https://easyengineering.net/engineering-economics-by-panneerselvam-book/

**MOOCs:**

1. https://www.coursera.org/lecture/faecalsludge/4-7-engineering-economics-KoVa9

**VII semester**

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Biology for Engineers** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19ES7BSBFE** | **Credits** | **2** | **L-T-P** | **2-0-0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites: NIL**

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | Ability to **understand** and **explain** basic concepts of Biology |
| CO-2 | Ability to apply the knowledge of Biology to convey the role of basic building blocks of life. |
| CO-3 | Ability to understand and analyze basics of Radiation and its effects on Human Body |
| CO-4 | Understand role of Biology in organic farming |

**Unit I** **5hrs**

Introduction: Why Engineers Should Study Biology?, What Is life?, The Hierarchy of Life, Evolution, Taxonomy, Interaction of Living Things with the Environment, Brief History of Life, Basic Organic Chemical Structure

**Unit II** **5hrs**

Composition of Living Things: Carbohydrates, Lipids, Proteins, Nucleic Acids, Hybrid and Other Compounds

The Cell: The Common Denominator of Living Things, Prokaryotes and Eukaryotes, The Biological Membrane, Eukaryotic Cell Structure and Function, Cell Reproduction

**Unit III** **5hrs**

Introduction to Radiation: Where does Radiation Come from, Types of Radiation, Types of Ionizing Radiation ,X-rays for Medical Use and Generators, Types of Electromagnetic Waves, Ionization of Radiation - Property of Ionizing Radiation, Types of Radiation and

Biological Effects ,Penetrating Power of Radiation, Penetrating Power of Radiation within the Body,Penetrating Power and Range of Effects on the Human Body

**Unit IV** 6**hrs**

Radiation Effects on Human Body:Types of Effects, Exposure Modes and Effects, Classification of Radiation Effects, Deterministic Effects and Stochastic Effects. Mechanism of Causing Effects on Human Body: Ionization due to Radiation, Damage and Repair of DNA, DNA→Cells→Human Body, Radiation Damage to DNA, Lapse of Time after Exposure and Effects, Deterministic Effects, Radiosensitivity of Organs and Tissues, Stochastic Effects

Cell phone Radiation Hazards: Introduction, Mutation

**Unit V** 5**hrs**

Organic Farming: History and Background, Requirements of Plants for Soil-Derived Nutrients: Effects of Nitrogen, Phosphorous and Potassium on Plant Growth and Quality, Symptoms of Nitrogen, Phosphorous and Potassium Deficiency in Crops

Choice: Unit IIIand Unit IV

**Text Books**

1. Arthur T. Johnson, Biology for Engineers, Second Edition, CRC Press 2019
2. David A. Vaccari, Peter F. Strom and James E. Alleman, Environmental Biology for Engineers and Scientists Wiley Inderscience, 2006
3. Allen V. Barker, Science and Technology of Organic Farming, CRC Press, 2010

**Reference Books:**

1. Suraishkumar, Madhulika Dixit, Biology for Engineers and Non – Biologists, IIT Madras, Oxford University Press
2. Naren, Anubhav E, Vinay C, Mohsen G, 'Electromagnetic Radiation Due to Cellular, Wi-Fi and Bluetooth Technologies: How Safe are we?', IEEE Access Special section on Antenna Propagation for 5G and beyond, pp42980 - 43000, January 2020
3. Sapna E.T., India's Organic Farming Revolution, University of Iowa Press, Iowa City, 2014

**Moocs:**

1. https://nptel.ac.in/courses/121/106/121106008/

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Embedded System Design** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC7PCESD** | **Credits** | 4 | **L-T-P** | **3:0:1** |
| **CIE** | **50 Marks (100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

- **Knowledge of microcontroller hardware features.**
- **Microcontroller basic programming using C/C$^{++}$.**
- **Overall knowledge of computer architecture.**

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Apply** the functioning and features of processors, memory and I/O systems in developing embedded system. |
| CO-2 | **Analyze** the embedded OS functionality and device drivers used in multitasking embedded applications. |
| CO-3 | **Design** embedded applications using given specifications and concepts of communication protocols and modules. |
| CO-4 | **Demonstrate** practical experiments on developing embedded systems. |

**Unit-I** **08hrs**

**Introduction to Embedded System**: Architecture, Computing Core of the Embedded System, Memory, Sensors and Actuators, Communication Interface: Analog & Digital, Timers, Embedded Firmware, Quality Attributes of Embedded Systems.

**Unit-II** **08hrs**

**Embedded I/O & Memory**: Different approaches of I/O operation: Polling, Interrupt, DMA, Interrupt & DMA Controllers, Memory controller, Communication Protocols features & functioning: I2C, SPI, USB, Ethernet,Wi-Fi, Bluetooth.

**Unit-III** **08hrs**

**Embedded Firmware Development**: Embedded Firmware Design Approaches, Programming in Embedded C: Examples with GPIO, PWM, ADC, UART, I2C,SPI

**Unit-IV** **08hrs**

**Real-Time Operating System (RTOS) based Embedded System Design**: Operating System Basics, Types of OS, Tasks, Process and Threads, Multiprocessing and Multitasking, Task Scheduling, Threads, Processes and Scheduling: Task Communication, Task

Synchronization, Writing Device Drivers, How to Choose an RTOS.

**Unit-V** **07hrs**

**The Embedded System Development Environment:** The Integrated Development Environment (IDE), Types of Files Generated on Cross-compilation, Disassembler/Decompiler, Simulators, Emulators and Debugging.

**Choice**: Unit-II and Unit-III

**Text books:**

3. Introduction to Embedded Systems, Shibu K V, Tata McGraw Hill Education Private Limited, 2009
4. Embedded System Design: A Unified Hardware/Software Introduction, Frank Vahid& Tony Givargis, Wiley Publication, 2006

**REFERENCE BOOKS:**

3. Embedded Systems – A contemporary Design Tool, James K Peckol, John Weily, 2008.
4. Computer Organization & Embedded System, Carl Hamacher, NaraigManjikian, McGraw Hill Publication 2014.

**E Books:**

**3.** https://electrovolt.ir/wp-content/uploads/2018/04/Programming-with-Stm32-Getting-Started-with-the-Nucleo.pdf
**4.** http://www.multimedialab.be/doc/erg/2018-2019/Raspberry_Pi/Raspberry_Pi_The_Complete_Manual_8th_Ed_2016.pdf

**MOOCs:**

**2.** https://www.mooc-list.com/tags/embedded-systems
**3.** https://www.edx.org/course/embedded-systems-shape-the-world-microcontroller-i

LABORATORY EXPERIMENT LIST

| Sl.No | Title of the Experiments |
|---|---|
| | **Conduction using Hardware** |
| **1.** | UART programming to display message on Hyper Terminal using LPC 1768. |
| 2. | PWM Programming with interrupt to control DCM speed. |
| 3. | Programming external interrupt through interrupt controller. |
| 4. | Read/Write data through SPI controller using interrupt. |
| 5. | Read analog input at ADC port and display the converted digital data on LCD. |
| 6. | Program to interface the IR sensor to Raspberry Pi and verify the result |
| 7. | Program to interface the DHT sensor to Raspberry Pi and verify the result |
| 8. | Socket programming on R-Pi to establish server-client communication. |

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **RF & Microwave Engineering** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC7PCRFM** | **Credits** | **2** | **L-T-P** | **2:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites**

Knowledge of Network analysis and Analog Communication

**Course outcomes:** At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | To **define, understand** and **explai**n the significance of microwaves and microwave transmissionline |
| CO-2 | To **apply** the knowledge of S-parameter terminology to describe micro wave circuits and multi-Port network |
| CO-3 | To **analyze** the characteristics of microwave circuits.Incorporating hollow, dielectric and planar waveguides, transmission lines, passive components and activedevices.Then compute required parameters |

**Unit I** **6hrs**

Radio Frequency (RF) Waves: RF Spectrum Bands, RF Circuit Design Considerations: Low RF and High RF circuits, RF Electronics Concepts: RF versus DC or Low AC signals, RF Impedance Matching

**Transmission line at RF :**Transmission line equations, Characteristic and input Impedances, reflection and transmission coefficients, standing waves and SWR, Mismatch losses in transmission lines, Smith chart, Application of smith chart.

**Unit-II** **05hrs**

**Microwave network theory:** Scattering Matrix - Significance, Formulation and properties, Symmetrical Z and Y parameters, for reciprocal Networks, S matrix representation of multi-port networks, S – parameters of a Two – port network with mismatched load (Quantitative Analysis).

**Unit-III** **06hrs**.

**Waveguide Components-I:**, Wave guide multiport junctions - E plane and H plane Tees, Magic Tee,2-hole Directional coupler, Wave guide discontinuities - Waveguide Windows, tuning screws and posts, Irises, Transitions, Twists, Bends, Corners and matched loads (Quantitative Analysis).

**Waveguide Components-II:** Ferrites composition and characteristics, Faraday rotation, Ferrite components - Isolator, Circulator (Qualitative analysis only)

**Unit-IV** **05hrs**

**Active Devices:**Schottky diode, PIN diode, Transfer electron devices – GUNN diodes, **Avalanche transit time devices**- IMPATT Diodes, TRAPATT Diodes, BARITT Diodes, Parametric amplifiers (Qualitative analysis Only).

**Unit-V** **04hrs**

**Modern Trends in Microwaves Engineering.**Effect of Microwaves on human body. Medical and Civil applications of microwaves. Electromagnetic interference / Electromagnetic Compatibility (EMI / EMC). Monolithic Microwave IC fabrication. RFMEMS for microwave components. Microwave Imaging

**Choice**: Unit-I and Unit-3

**TEXT BOOKS**:

1. Radio Frequency and Microwave Electronics- Matthew M. Radmanesh, Pearson,2015
2. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2001.
3. Microwave Devices and circuits- S.Y.Liao / Pearson PHI 3rd Ed.

**REFERENCE BOOKS:**

1. Microwave Engineering – David M Pozar, John Wiley, 2e, 2004.

2. Rizzi P.A., "Microwave Engineering, Passive Circuits Hall of India

3.RF Microelectronics- BehzadRazavi, Pearson Education, 2008

**E Books:**

1. RF and Microwave Engineering: Fundamentals of Wireless Communications by Frank Gustrau
2.Handbook of RF and Microwave Power Amplifiers by J. Walker

**MOOCs:**

1. https://nptel.ac.in/courses/108/101/108101112/#
2. https://onlinecourses.nptel.ac.in/noc20_ee04/

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **WIRELESS COMMUNICATION** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC7CE2WC** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Knowledge of Analog and Digital communications

**Course outcomes:**

At the end of the course, the student will have the ability to

| CO | Course Outcomes |
|---|---|
| **1** | **Acquire** the Knowledge of Architecture, Techniques and algorithms in wireless communication systems |
| **2** | **Apply** the knowledge of traffic Engineering, radio wave propagation, receiver characteristics to predict the traffic and coverage of various cellular networks. |
| **3** | **Analyze** the resource allocation strategies, propagation models, diversity techniques, Call flow scenarios applied to various mobile communication networks. |
| **4** | **Use of Modern tools** to analyse a given problem statement in wireless communication |

**Unit-I** **8 hrs**

Introduction to Wireless communication, The Cellular concept: System design fundamentals: Frequency reuse, Channel assignment strategies, Handoff strategies, Interference and system capacity, Trunking and Grade of service, Improving coverage and capacity in cellular system.

**Unit-II** **8 hrs**

**Mobile radio propagation**: Introduction to Radio wave propagation, free-space propagation model, three Basic Propagation mechanism, Propagation models: Okumura Hata, Cost-Hata, Walfisch-Ikegami, Log distance Path loss model, Practical Link budget calculation, Small-scale multipath propagation, Impulse response model of a multipath channel, small scale multipath measurements, Parameters of mobile multipath channels.

**Unit-III** **7 hrs**

**Equalization and Diversity**: Fundamentals of Equalization, Training a generic adaptive equalizer, Equalizers in communication receiver, Linear Equalizer and Nonlinear Equalization, Algorithms for Adaptive Equalization, Diversity techniques; Space Diversity, Time Diversity, Polarization Diversity, Frequency Diversity ,(Qualitative Analysis only)

**Unit-IV** **8 hrs**

**Global System for Mobile communication** ( 2G): System overview- GSM Architecture, GSM MS block description, The air interface, Logical and physical channels, Frame structure, GSM Spectrum ( 900 MHz and 1800 MHz), Call establishment scenarios, GPRS /EDGE architecture, UMTS (3G) Architecture, UMTS Technical features.

**Unit-V** **8 hrs**

**Introduction to Long Term Evolution**(4G)- LTE Architecture, Radio Spectrum, Frame Structure, OFDMA Principle, OFDMA Transmitter, OFDMA Receiver, Physical channels, Signal flow during Cell Search, UL Transmission, DL transmission.

**Choice:** Unit-III and Unit-IV

**Text Books:**

1. Wireless Communication Principles and Practice, Theodore S Rappaport, Pearson, September 2010
2. An Introduction to LTE: LTE, LTE-Advanced, SAE and 4G Mobile Communications ,Christopher Cox, Wiley, March 2012

**REFERENCE BOOKS:**

1. Wireless Communication- Andreas F Molish, Wiley Student, Second Edition

**Ebooks:**

1. https://www.amazon.in/Wireless-Communications-Principles-Practice-2e/dp/8131731863
1. https://www.amazon.in/Introduction-LTE-LTE-Advanced-Mobile-Communications-ebook/dp/B00KBRNO32

**MOOCS:**

1. Wireless communication for everybody. https://www.coursera.org/learn/wireless-communications
2. Introduction to Wireless and Cellular Communications, By Prof. R. David Koilpillai, IIT Madras. https://swayam.gov.in/nd1_noc20_ee61/preview
3. Wireless Communications by Dr.Ranjan Bose, Department of Electrical Engineering, IIT Delhi. (**NPTEL lectures )**

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **Network Security & Cryptography** | | | | |
| **Course Code** | **19EC7CE2NC** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

Knowledge of Computer Communication Networks.

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | Analyse the different types of encipherment techniques along with key exchange mechanisms. |
| CO-2 | Apply the knowledge of encryption and security techniques along with cyber forensics to fulfil the societal needs |
| CO-3 | Submit a report and give a presentation on the impact/growth of network Security tools for societal and sustained development. |

**Unit-I** **07hrs**

Introduction, Services, mechanisms and attacks, The OSI security Architecture, A model for network security, A model for network security, Symmetric Ciphers: Symmetric Cipher model, Symmetric Ciphers: Symmetric Cipher model, Substitution techniques Transposition technique

**Unit-II** **07hrs**

Simplified DES, Simplified DES, Data encryption Standard, mode of Block cipher operation, Principles of public key cryptosystems, Principles of public key cryptosystems, The RSA algorithm, Diffe-Hellman key exchange, Authentication functions, Digital Signatures, Digital Signature standard.

**Unit-III** **07 Hrs**

Electronic Mail Security: Pretty Good Privacy, web security: Web Security Consideration, Secure Electronic Transaction, Intruders, Intruder detection, Password management, Viruses and related threats, Viruses and related threats, Firewalls design principles .

**Unit-IV** **07hrs**

Incident Response and Forensic Analysis:Incident Response Plans: Incident Detection, Incident Response and Containment, Recovery and resumption, Review and improvement. Forensics: Legal Requirements, Evidence Acquisition, Evidence Analysis

**Unit-V** **04 hrs**

Practical Implementations of Cryptography/Security:Cryptographic solutions using Java: Framework, JCA, JCE.Cryptographic solutions using Microsoft.NET framework: Class Model, Programmer's View

**Choice**: Unit-II and Unit-III

**Text Books:**

1. Cryptography and Network Security- Principles and Practice: William Stallings, Third Edition
1. The Complete Reference Network Security by Roberta Bragg, Mark Rhodes-Ousley, Keith
2. Cryptography and Network Security by AtulKahate third Edition Strassberg

**REFERENCE BOOKS:**

1. Cryptography and Network Security, Behrouz A. Forouzan, TMH, 2007.
1. Fundamentals of Network Security-Eric Maiwald, 2009 Edition, Information Security Series
2. Network Security-Private Communication in a public World:Charlie Kaufman, Radia Perlman, Mike Speciner, Second Edition

**E Books:**

1. https://www.e-booksdirectory.com/details.php?ebook=10710
2. https://www.e-booksdirectory.com/details.php?ebook=7010

**MOOC course:**

1. https://nptel.ac.in/courses/106/105/106105031/
2. https://swayam.gov.in/nd1_noc20_cs21/
3. http://www.nptelvideos.in/2012/11/cryptography-and-network-security.html

(Autonomous College under VTU)

| Course Title | SYSTEM ON CHIP | | | | |
|---|---|---|---|---|---|
| Course Code | 19EC7CE2SC | Credits | 3 | L-T-P | 3:0:0 |
| CIE | 50 Marks(100% weightage) | SEE | | 100 Marks (50% weightage) | |

**Prerequisites:**

1.Basics of SoC design and system architecture.
2. Concepts of interconnect architecture and bus architecture of SoC.
3. Principles of memory design and cache architecture.
4. Basic knowledge of ASIC design flow and FPGA design flow.

**Course outcomes:**

At the end of the course, the student will have the ability

| COs | COURSE OUTCOMES |
|---|---|
| CO1 | Understand the System on Chip design ,Architecture and complexity in designing |
| CO2 | Apply the design concepts for Processors and interconnect architecture |
| CO3 | Analyze and Design solutions for issues at system level, and issues of Hardware-Software co design |

**UNIT-I**

**Introduction to the Systems Approach** 8Hrs

System Architecture, Components of the system, Hardware & Software, Processor Architectures, Memory and Addressing. System level interconnection, An approach for SOC Design, System Architecture and Complexity.

**UNIT – II**

**Processors**: 8Hrs

Introduction , Processor Selection for SOC, Basic concepts in Processor Architecture, Basic concepts in Processor Micro Architecture, Basic elements in Instruction handling.

Buffers: Minimizing Pipeline Delays, Branches, More Robust Processors, Vector Processors and Vector Instructions extensions, VLIW Processors, Superscalar Processors, Processor Evolution with examples

**UNIT – III**

**System On Chip Design Process** 8Hrs

A canonical SoC Design, SoC Design flow, waterfall vs spiral, top down vs bottom up, Specification requirement, Types of Specification, System Design Process, System level design issues, Soft IP vs Hard IP, IP verification and Integration.(TB-2)

**UNIT - IV** **7Hrs**

**Hardware-Software co design:**

Design for timing closure, Logic design issues, Verification strategy, On chip buses and interfaces, Low Power, Hardware Accelerators in Soc. (TB-2)

**UNIT-V**

**Interconnect architectures for SoC** **8Hrs**

Bus architecture ,SOC Standard buses, Analytic bus models, Beyond the bus:. Network on Chip (NOC) with switch interconnects, NOC examples, Layered Architecture and NIU, Evaluating Interconnect networks(Chapter-5-TB-1)

Unit Choice : Unit I and II

**Text Books:**

1) Michael J. Flynn and Wayne Luk, “Computer System Design System-on-Chip”, Wiley India Pvt. Ltd

1) Michael Keating, Pierre Bricaud, “Reuse Methodology Manual for System on Chip designs”, Kluwer Academic Publishers, 2nd edition, 2008

**Web Resources:**

1. https://www.xilinx.com/products/silicon-devices/soc/zynq-7000.html

2. https://www.altera.com/products/soc/overview/soc-resourceguide/Introduction.html

3. https://developer.arm.com/products/processors/cortex-a/cortex-a9

**Reference Books**

1. Sudeep Pasricha and Nikil Dutt,"On-Chip Communication Architectures: System on Chip Interconnect”, Morgan Kaufmann Publishers © 2008

2. Rao R. Tummala, Madhavan Swaminathan, “Introduction to system on package sop Miniaturization of the Entire System”, McGraw-Hill, 2008

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **ELECTRONICS PACKAGING** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC7CE2EP** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites:**

No prerequisites are required. Students from electronics, electrical, mechanical and instrumentation background can register for the course. Course is based on process technology centric in the fields of semiconductor and chip packaging.

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | To apply the knowledge of semiconductors for Microelectronics system packaging |
| CO-2 | To design the mathematical equations and tools needed for calculating packaging design parameters |

**Unit-I** **07hrs**

**Introduction to microsystems packaging:** Microsystems, Microsystem Technologies, Microsystems Packaging (MSP), Importance of Microsystems Packaging, System-Level Microsystems Technologies, Expectation of a microsystem engineer, summary and future trends, Inventions of Microsystems and Packaging Technologies.

**Unit-II** **09hrs**

**Role of Packaging in Microelectronics:** Microelectronics, Characteristics of Semiconductors, Microelectronic Devices, Integrated Circuits, IC Packaging, Semiconductor Roadmap, IC Packaging Challenges

**Role of Packaging in Microsystems:** Electronic Product, Anatomy of a Microsystem, Computers and the Internet, Role of Packaging in the Computer Industry, Telecommunication Industry, Automotive Systems, Medical Electronics, Consumer Electronics and Micro-Electro-Mechanical Systems (MEMS) Products.

**Unit-III** **07hrs**

**Electrical package design:** Fundamentals, Electrical anatomy of systems packaging, Signal distribution, Power distribution, Electromagnetic interference, Design process

**Unit-IV** **09hrs**

**Single chip packaging:** Functions of single chip packaging, types, fundamentals, materials, processes, properties and characteristics of single chip packages. Summary and future trends.
**Multichip packaging:** Functionality, Advantages, Modules at system level, Types of multichip module substrates, multichip module design, Multichip module Technology comparisons, Alternatives, Summary and future trends.

**Unit-V** **07hrs**

**Fundamentals of IC Assembly:** Purpose, Requirements of IC assembly, IC Assembly technologies, Wire bonding, Tape Automated bonding.

**Choice**: Unit-II and Unit-IV

**Text books:**


1. Fundamentals of Device and Systems Packaging: Technologies and Applications – Rao R. Tummala – 2nd Edition (McGraw Hill Education).
4. System on Package: Miniaturization of the Entire System- Rao R. Tummala, MadhavanSwaminathan – 1st Edition (McGraw Hill Education).


**REFERENCE BOOKS:**


1. William D. Brown, Advanced Electronic Packaging, IEEE Press, 1999.


**E Books:**


**1.** https://www.ee.ryerson.ca/~courses/coe838/lecture-notes.html
**5.** Kwak, Hocheol&Hubing, Todd, An Overview of Advanced Electronic Packaging Technology – Technical report (2007).


**NPTEL/MOOCs:**


1. https://nptel.ac.in/courses/108/108/108108031/
3. Appello, Davide, Bernardi, Paolo & Grosso, Michelangelo &SonzaReorda, Matteo. (2006). System-in-package testing: Problems and solutions. IEEE Design & Test of Computers **23** (2006) 203 – 211 (https://doi.org/10.1109/MDT.2006.79 )

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| | | | | | |
|---|---|---|---|---|---|
| **Course Title** | **LOW POWER VLSI** | | | | |
| **Course Code** | **19EC7CE2LV** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks (100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Prerequisites**:

Fundamentals of VLSI

**Course Outcomes:**

At the end of the course, the student will have the ability to

| | |
|---|---|
| CO-1 | **Apply** the concept of power analysis in simulators at different levels of design abstraction |
| CO-2 | **Analyze** power dissipation using mathematical and probabilistic approach in digital logic cells and compare the various clock tree synthesis methods |
| CO-3 | **Design** circuits for low power logic cells |

**UNIT-I** **8 Hrs**

CMOS Fabrication Steps, Latch-up and its Prevention, Short-Channel Effects, Emerging Technologies for Low Power, MOS Inverter Configurations, Inverter Ratio in Different Configurations, Switching Characteristics, Delay Parameters, Driving Large Capacitance Loads.

**UNIT-II** **8 Hrs**

MOS Combinational Circuits: Pass-Transistor Logic, Gate Logic, MOS Dynamic Circuits. Sources of Power dissipation: Dynamic Power Dissipation, Short-Circuit Power Dissipation, Switching Power Dissipation, Glitching Power Dissipation, Leakage Power Dissipation.

**UNIT-III** **7 Hrs**

Supply Voltage Scaling for Low Power: Device feature size scaling, Architectural-Level Approaches, Multilevel Voltage Scaling and Challenges, Dynamic Voltage and Frequency Scaling, Adaptive Voltage Scaling, Sub-threshold Logic Circuits

**UNIT-IV** **8 Hrs**

Switched Capacitance Minimization: Bus encoding, Clock Gating, Gated-Clock FSMs, Glitching Power Minimization, Logic Styles for Low Power. Leakage Power minimization Approaches: Fabrication of Multiple Threshold Voltages, VTCMOS Approach, Transistor Stacking, MTCMOS Approach, Power Gating Controller, Power Management, Dual-$V_t$ assignment approach (DTCMOS), Dynamic $V_{th}$ scaling

**UNIT-V** **8 Hrs**

Adiabatic Logic Circuits: Adiabatic Charging, Amplification, Logic Gates, Pulsed Power Supply, Stepwise Charging Circuits. Battery-Aware Systems: Battery-Driven System Design, Energy-Aware Routing, Low-Power Software Approaches: Machine-Independent Software Optimizations.

**Choice:** Unit-IV and Unit-V

**Text Book**:

1. Ajit Pal, “Low-Power VLSI Circuits and Systems”, Springer, 2015. ISBN 978-81-322-1936-1

**Reference Books**:

1. Anantha P. Chandrakasan and Robert W. Brodersen, Low Power Digital CMOS Design, Kluwer Academic Publishers, 1995.
1. Koushik Roy and Sharat C. Prasad, Low-Power CMOS VLSI Circuit Design, John Wiley & Sons Inc., 2000.

**E-book:**

1.http://leda.elfak.ni.ac.rs/education/projektovanjeVLSI/predavanja/10%20Low%20Power%20Design%20in%20VLSI.pdf

**MOOC:**

1. https://nptel.ac.in/courses/106/105/106105034/

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **DEEP LEARNING** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC7CE2DL** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

Prerequisites:

- Knowledge of Linear Algebra
- Knowledge of Calculus
- Knowledge of Probability & Statistics
- Basic knowledge of Programming.

**Course outcomes:**

At the end of the course, the student will have the ability

| **CO** | **Course Outcomes** |
|---|---|
| 1 | **Apply** the knowledge of mathematics and programming to structure datasets and algorithms to build deep learning models. |
| 2 | **Analyze**various activation functions and optimization techniques to feed forward and back propagate in model training. |
| 3 | **Design** and develop application models using deep neural networks, feature engineering and cross validation techniques. |

**Unit-I** **07hrs**

Introduction: A review of Machine Learning, Introduction to Deep Learning, The Math Behind Machine Learning: Linear Algebra, Statistics, Machine Learning Principles: Regression, classification, Clustering, Optimization, Model fitting and evaluation. Introduction to Python Libraries, TensorFlow, Keras.

**Unit-II** **09hrs**

Neural Networks: The Biological Neuron, Perceptron, Multilayer Perceptron, Feed-Forward Networks with Sigmoid Activation, Backpropagation Learning with SGD, Activation Functions: linear, Sigmoid, Tanh, Softmax, ReLu; Loss Functions for Regression & Classification.

**Unit-III** **07hrs**

Optimization Algorithms, Hyperparameters: Learning Rate, Regularization, Momentum, Sparsity, Fully Connected Neural Network, Model Traning& Evaluation, Usecase and Model Building.

**Unit-IV** **09hrs**

Architectures of Deep Networks: Convolutional Neural Network, Architecture Overview: Input layers, Convolutional Layers, Pooling Layers, Fully connected layers, Applications of CNN, Variants of CNN Architecture, Model building using CNN on complex image data.

**Unit-V** **07hrs**

Recurrent Neural Network Architecture, LSTM Networks, Building Blocks: Restricted BolzmanMachines(RBMs), Autoencoders, VariationalAutoencoders, Applications of RNN & LSTM, Use cases & Model building.

**Choice**: Unit-II and Unit-IV

**Text books:**

1. Deep Learning- A Practitioner's Approach, Josh Patterson & Adam Gibson, O'Reilly Publication, 2019
2. Deep Learning with Python: Francois Chollet , Manning Publications, 1st edition.

**REFERENCE BOOKS:**

1. Python Data Science Hand Book – JakeVanderPlas, O'Reilly Publication, 2016-17

**E Books:**

**1.** https://www.pdfdrive.com/machine-learning-with-python-cookbook-practical-solutions-from-preprocessing-to-deep-learning-d176361144.html

**MOOCs:**
https://www.simplilearn.com/artificial-intelligence-masters-program-training-course.

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **FUNDAMENTALS OF MOBILE COMMUNICATIONS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC7OE2MC** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Course outcomes:**

At the end of the course, the student will have the ability to

| CO | Course Outcomes |
|---|---|
| 1 | **Acquire** the knowledge of mobile communications fundamentals and standards and apply in solving traffic problems |
| 2 | **Investigate** on m commerce life cycle, financial services, entertainment services, - content development and distribution and caching, through literature survey and use cases |

**Unit-I** **07hrs**

Introduction to mobile communication, spectrum allocation, services and range of operation. Evolution of Mobile communication from 2G to 4G,WLAN, Bluetooth,Multiple Access Technologies: FDMA, TDMA, CDMA, organizational structure in mobile industry.

**Unit-II** **08 hrs**

Cellular Concepts , Frequency reuse, channel assignment strategies, call establishment, handoff mechanism, trunking concepts, Capacity expansion methods

**Unit-III** **08 hrs**

GSM architecture, frequency allocation, channels in GSM, frame structure, handoff mechanisms, power control mechanism, Call establishment, and security mechanism

**Unit-IV** **08 hrs**

EDGE architecture, UMTS architecture , LTE Architecture, Wireless LAN ( Wi-Fi), Mobile IP architecture, Emerging Wireless systems: Adhoc Wireless networks, Sensor networks, Distributed control network, ultra wideband systems (UWB).

**Unit-V** **08 hrs**

Mcommece-framework, different players, lifecycle, Different Mobile commerce applications and services, content development and distribution, technologies, standard bodies

**Choice:** Unit-III and Unit-IV

**Text Books:**

1. Theodore Rappaport “wireless Communications , Principle and practise” Prentice hall 2005
2. Brian Mennecke, Troy J. Strader, “Mobile Commerce: Technology, Theory and Applications”, IdeaGroupPublishing,

**REFERENCE BOOKS:**

1. Wireless Communication- Andreas F Molish, Wiley Student, Second Edition

**Ebooks:**

**1.** https://www.amazon.in/Wireless-Communications-Principles-Practice-2e/dp/8131731863

**2**. https:// www.amazon.com/Mobile-Commerce-Technology-Theory-Applications/dp/159140044 9

**MOOCS:**

1. Wireles communication for everybody. https://www.coursera.org/learn/wireless-communications
2. Introduction to Wireless and Cellular Communications, By Prof. R. David Koilpillai. IIT Madras. https://swayam.gov.in/nd1_noc20_ee61/preview

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Project Management and Finance** | | | | |
|---|---|---|---|---|---|
| **Course Code** | 19ES7HSPMF | **Credits** | **3** | **L-T-P-S** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Pre-requisites: Personality development course, soft skills**

**Course outcomes:**

At the end of the course, the student will have the ability to

| **CO** | **Course Outcomes** |
|---|---|
| **1** | Apply the Knowledge of project management principles and to study the current market trends |
| **2** | Choose projects .and to implement project management methodologies ethically for successful project completion |
| **3** | To identify the investment opportunities and to formulate the projects. |
| **4** | Ability to choose projects which benefit the society and organization and apply project phases and document them for future reference |

**Unit I** **7hrs**

**Concepts of Project Management** - Project Leadership and Ethics: Introduction to project leadership, ethics in projects, Multicultural and virtual projects

Concepts of project , Categories of project , Project life cycle phases, Project management concepts, Tools and techniques for project management, The project manager, Basic education for a project manager, Roles and responsibilities of project manager ,Project manager as profession, Summary

**Unit II** **8hrs**

**Establishing the Project** - Scope, Time , Cost and performance goals, Feasibility report, Financing Arrangements, Preparation of cost estimates, Finalization of project implementation schedule, Evaluation of the project profitability, Appointing a project manager, Fixing the Zero date, Summary

**Unit III** **8hrs**

**Organizing Human Resources and Contracting** - Delegation , Project managers authority, Project organization , Accountability in Project Execution , Contracts , R's of contracting, Tendering and Selection of Contractors, Team building, Summary

**Unit IV** **8hrs**

**Organizing Systems and Procedures for Project Implementation** -Working of systems, Design of Systems, Project work system design , Work breakdown structure, Project execution plan, Project procedure manual, Project control system, Planning, Scheduling and Monitoring, Monitoring contracts, Project diary , Summary.

**Unit V** **8hrs**

**Financing of Projects -** Capital structure, Menu of financing , Internal accruals , Equity capital, Preference capital , Debentures (or bonds) , Methods of offering term loans , Working capital advances, Miscellaneous sources , Raising venture capital, Project financing structures, Financial closure , Financial institutions ,Summary.

**Choice:** Unit-III and Unit-IV

**Text Books:**

1. Project Management – S Choudary, Tata McGRAW Hill Publishing Company Limited
2. Projects- Planning , Analysis , Selection, Financing ,Implementation and Review –Dr.Prasanna Chandra McGRAW Hill Publishing Company Limited
3. Project Management Institute A Guide to the Project Management Body of Knowledge PMBOK Guide (Sixth Edition), Sept 2017

**Reference books:**

1. Fundamentals of Project Management by Dr.VijayKanabar
2. Project Management – David I Cleland – Mcgraw Hill International edition
3. Project Management – Gopalakrishnan – Mcmillan India Ltd
4. Project Management – harry – Maylor- Peason Publication

**E Books:**

1. https://www.youtube.com/watch?v=5d16JwWwjKo
2. Nptel lecture on Introduction to project management by prof. Arun Kanda https://www.youtube.com/watch?v=5pwc2DYlKQU

**VIII semester**

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **Intellectual PropertyRights and Cyber law** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19ES8HSIPL** | **Credits** | **2** | **L-T-P-S** | **2:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

| **CO-numbers** | **Course Outcomes** | **POs** |
|---|---|---|
| CO-1 | Ability to understand and commit to professional ethics and responsibilities to obtain Intellectual property Rights like Patents, Copyright & Trademarks | 8 |
| CO-2 | Understand the impact of Patents, Copyright & Trademarks and demonstrate the knowledge of Cyber Law for the societal and environmental context | 7 |
| CO-3 | Ability to use IPRs and Cyber Law to access societal, health, safety & Cultural issues | 6 |
| CO-4 | Ability to work in multiple teams to effectively communicate IP & Cyber Law. | 9, 10 |

**Unit I** **5Hrs**

**Basic principles of IP laws &Patents**: Introduction, Concept of property, Constitutional aspects of IP, Evolution of the patent system in UK, US and India, Basis for protection, Origin and meaning of the term patent, Objective of a patent law, principles underlying the patent law in India, the legislative provisions regulating patents, Non–patentable inventions

**Unit II** **6Hrs**

**Procedure for obtaining patent**: Submission of application, Filing provisional and complete specification, Examination of the application, advertisement of the acceptance, opposition, Grant and sealing of patent, Term of the patent, compulsory license.

**Provisional and complete specification**: Definition of Specification, Kinds of specification, provisional specification, complete specification, Claims, Conditions for amendment.

**Rights conferred on a patentee**: Patent rights, Exception and limitations, Duties of a Patentee.

**Transfer of patent**: Forms of transfer of Patent rights, Assignment, kinds of assignment, License, kinds of license, Rights conferred on a licensee, Transmission of patent by operation of law.

**Infringement of patents:**Construction of claims and infringement, patents held to be infringed, patents held to be not infringed.

**Action for Infringement**: Where a suit is to be instituted, procedure followed in the suit, Onus of establishment infringement, Defence by the defendant, The Relief's, Injunction, Damages or account of profits, patent agents.

**Unit III** **6Hrs**

**Copy Right:**Meaning and characteristics of copy right, Indian copy right law, requirement of copy right, Illustrations copy right in literary work, Musical work, Artistic work, work of architecture, Cinematograph film, sound recording.

**Author and Ownership of copy right:**Ownership of copy right, Contract of service, Contract for service, rights conferred by copy right, terms of copy right, license of copy right.

**Infringement of copy right:**Acts which constitute infringement, general principle, direct and indirect evidence of copying, Acts not constituting infringements, Infringements in literary, dramatic and musical works, Remedies against infringement of copy right.

**Trade Marks:** Introduction, Statutory authorities, procedure of registration of trademarks, rights conferred by registration of trademarks, licensing in trade mark, infringement of trade mark and action against infringement

**Unit IV** **5Hrs**

**Cyber Law:** An introduction, Definition, why cyber law in India, Evolving cyber law practices- for corporates, privacy in Indian cyber space. Terrorism & Cyber Crime. Cyber theft and Indian telegraph act, Cyber Stalking

**Unit V** **4Hrs**

**Indian Cyber law**: Protecting Indian children online, Spam, contempt in cyber space, Indian consumers & cyber space, E-courts of India.

**Choice:** Unit II and Unit III

**TextBooks:**

1. Dr.TRamakrishna,"BasicprinciplesandacquisitionofIntellectualProperty Rights",CIPRA,NSLIU-2005.
2. Dr.B.L.Wadehhra,"IntellectualPropertyLawHandbook",UniversalLaw PublishingCo.Ltd.,2002.
3. Cyberlaw-The Indian perspective by PavanDuggal, 2009 Edition.

**Reference books:**

1. Dr.TRamakrishna,"OwnershipandEnforcementofIntellectualProperty
   a. Rights",CIPRA,NSLIU-2005.
2. "IntellectualPropertyLaw(BareActwithshortcomments)",UniversalLaw
   a. PublishingCo.Ltd.2007.
3. "TheTrademarksAct1999(BareActwithshortcomments)",UniversalLaw PublishingCo.Ltd.,2005.

**MOOC course:**

1. https://nptel.ac.in/courses/110/105/110105139/
2. https://nptel.ac.in/courses/109/106/109106137/

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| Course Title | MICROELECTROMECHANICAL SYSTEMS | | | | |
|---|---|---|---|---|---|
| Course Code | 19EC8OE3ME | Credits | 3 | L-T-P | 3:0:0 |
| CIE | 50 Marks(100% weightage) | SEE | | 100 Marks (50% weightage) | |

**Prerequisites: NIL**

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **To understand** the sensing principles of microsystems for real time applications |
| CO-2 | To **design** the microstructure using various micromachining process and tailor the device structure as per the requirement. |
| CO-3 | To **analyse** various MEMS devices using simulation tools. |

**Unit-I** **07hrs**

**Overview of MEMS & Microsystems**: MEMS & Microsystems, Typical MEMS and Microsystem Products, Evolution of Microfabrication, Microsystems and Microelectronics, The Multidisciplinary nature of Microsystem Design and Manufacture, Microsystems and Miniaturization, Applications of Microsystems in the Automotive and other Industries.

**Unit-II** **09hrs**

**Working principles of Microsystems:**

**Micro sensors** — Acoustic Wave, Biomedical and biosensors, Chemical, Optical, Pressure and Thermal Sensors.

**Microactuation:** Actuation using Thermal forces, Shape-Memory Alloys, Piezoelectric crystals & Electrostatic forces.

**UNIT III** **7hrs**

**MEMS with Microactuators:**Microgrippers, Micromotors, Microvalves, Micropumps, Microaccelerometers, Microfluidics.

**Materials for MEMS and Microsystems:** Introduction, Substrates and wafers, Active Substrate materials, Silicon as a substrate material, Silicon compounds, Silicon piezoresistors, Gallium Arsenide, Quartz, Polymers for MEMS, Packaging materials.

**Unit-IV** **09hrs**

**Micromachining Technologies**
**Thin Film Deposition**: Evaporation, Sputtering, Chemical Vapor deposition, Epitaxial growth of Silicon, Thermal Oxidation for Silicon dioxide. Lithography.
**Etching**: Isotropic Etching, Anisotropic Etching, Etch Stops, Dry Etching. Silicon Micromachining, Advanced Process for Microfabrication.

**Unit-V** **07hrs**

**Integration and Packaging:** Microsystems and Microelectronics, Objectives of packaging, Special Issues in packaging, Types of microsystem Packages, Packaging Technologies, Reliability and Key failure mechanisms.

**Choice**: Unit-III and Unit-IV

**Text books:**

1. Tai-Ran Hsu- MEMS and Micro systems: Design, Manufacture and Nano scale Engineering, 2nd Edition (JOHN WILEY & SONS).
2. G.K. Ananthasuresh, K.J.Vinoy, S. Gopalakrishnan, K.N.Bhat, V.K.Aatre, Micro and smart systems 1st edition (WILEY INDIA)

**REFERENCE BOOKS:**

1. NadimMaluf, Kirt Williams - An Introduction to Microelectromechanical Systems Engineering, 2nd Edition (ARTECH HOUSE)

**E Books:**

1. https://www.comsol.co.in/video/how-set-up-run-simulation-comsol-multiphysics
2. http://1.droppdf.com/files/MC684/encyclopedia-of-materials-characterization.pdf
3. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-777j-design-and-fabrication-of-microelectromechanical-devices-spring-2007/lecture-notes/

**MOOCs:**

1. https://nptel.ac.in/courses/117/105/117105082/
2. https://nptel.ac.in/courses/108/108/108108113/

**BMS College of Engineering, Bangalore – 19**

(Autonomous College under VTU)

| **Course Title** | **AUTOMOTIVE ELECTRONICS** | | | | |
|---|---|---|---|---|---|
| **Course Code** | **19EC8OE3AE** | **Credits** | **3** | **L-T-P** | **3:0:0** |
| **CIE** | **50 Marks(100% weightage)** | **SEE** | | **100 Marks (50% weightage)** | |

**Course outcomes:**

At the end of the course, the student will have the ability

| | |
|---|---|
| CO-1 | **Apply** the knowledge of engineering and science to analyze the performance of Automotive Battery Systems, Electronic Engine Control, working of Sensors and Actuators |
| CO-2 | **Analyze** the Vehicle Level Electronic Control for Automotive Subsystems. |
| CO-3 | Gain insight about building future automotive subsystems that contributes to the **safety and health of the society** using block diagram approach |

**Unit-I** **07hrs**

**Automotive Fundamentals Overview**: Four Stroke Cycle, Engine Control, Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Drive Train, Transmission, Brakes, Steering System.

**Unit-II** **07hrs**

**Automotive Batteries and Starting System:** Different types of Batteries – principle, rating, testing, Maintenance and charging, Lithium-ion batteries, Starting system,Ignition switch, Neutral safety switch, Starter relay, Starter solenoid, Battery, Starter motor.

**Unit-III** **07hrs**

**Electronic Engine Control**: Motivation for Electronic Engine Control, Concept of an Electronic Engine Control Engine parameters, variables, Engine Performance terms, Electronic Fuel Control System.

**Unit-IV** **07hrs**

**Automotive Sensors** – Oxygen (O2/EGO) Sensors, Engine Crankshaft Angular Position (CKP) Sensor, Magnetic Reluctance Position Sensor, Engine Speed Sensor, Ignition Timing Sensor, Hall effect Position Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor - Strain gauge, Engine Coolant Temperature (ECT)Sensor, Intake Air Temperature (IAT) Sensor, Knock Sensor, Airflow rate sensor, Throttle angle sensor

**Automotive Actuators** – Fuel Metering Actuator, Fuel Injector, Ignition Actuator and EGR Actuator

**Unit-V** **08hrs**

**Vehicle Motion Control**–Electronic suspension system, Antilock Brake System (ABS), Electronic Steering Control

**Automotive Diagnostics–**Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics.

**Overview Of Automotive Network Protocols-**CAN,LIN,MOST and FlexRay

**Future Automotive Electronic Systems**– Collision Avoidance Radar warning Systems, Low tire pressure warning system, Automatic Driving Control System.

**Choice: Unit-IV and Unit-V**

Text books:

1. William B. Ribbens: Understanding Automotive Electronics, 6th Edition, SAMS/Elsevier Publishing

REFERENCE BOOKS:

1. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and AutomotiveElectronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc., 2007.

E Books:

1. www.engineering108.com/.../Automobile.../Understanding-Automotive-Electronics-e...
2. www.sciencedirect.com/science/book/9780750675994
3. https://warwick.ac.uk/fac/sci/wmg/business/automotive_batteries_101_wmg-apc.pdf
4. http://fmcet.in/AUTO/AT6502_uw.pdf

**MOOCs/NPTEL:**

https://nptel.ac.in/courses/107/106/107106088/

# Guidelines on Internship

The student need to complete a minimum of 12weeks/144 Hrs of Technical internship (1 week internship equated to 12 qualitative hours of participation)

1. The student need to present a seminar on internship during the 8th semester. Internship will be evaluated for 2 credits, where the student need to present the work done during internship. It can be presented as a consolidation of all the internship work carried out after the completion of II semester onwards.

**Note:**

The internships can be taken up in an industry, a government organization, a research organization or an academic institution, either in the country or outside the country, that include activities like:

- Successful completion of Value Added Programs/Training Programs/ workshops organized by academic Institutions and Industries
- Soft skill training (maximum of 4 weeks only will be considered)
- Active association with incubation/ innovation /entrepreneurship cell of the institute
- Participation in Inter-Institute innovation related competitions like Hackathons
- Working for consultancy/ research project within the institutes
- Participation in activities of Institute's Innovation Council, IPR cell, Leadership Talks, Idea/ Design/ Innovation contests
- Internship with industry/ Government organizations/ Micro/ Small/ Medium enterprises
- Development of a prototype/product/business plan/start-up, any other related technical activity apart from Project work.