



BMS College of Engineering, Bangalore

ಬಿ.ಎಂ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ, ಬೆಂಗಳೂರು

(ಸ್ವಾಯತ್ತ ವಿದ್ಯಾ ಸಂಸ್ಥೆ)

ಬುಲ್ ಟೆಂಪಲ್ ರಸ್ತೆ, ಬೆಂಗಳೂರು - 560 019

**Department of Electronics and Telecommunication
Engineering**

(Earlier Telecommunication Engineering)

Scheme: III to VIII Semesters

Syllabus: V to VI Semesters

For Batch Admitted 2021 onwards

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

Department Vision

Our graduates shall be globally competent Engineering professionals

Department Mission

The department will achieve the Vision through:

- Curriculum designed for holistic development
- Effective implementation of the designed curriculum
- Active association with Industry, Academia and Alumni
- Research leading to publications/patent/start-up
- Emphasis on professional ethics, contribution to society and concern for environment

Program Educational Objectives

The Program Educational Objectives (PEOs) describe the professional accomplishments of our graduates about three-five years after having completed the under-graduate program in Telecommunication Engineering. We describe the progress of our graduates through four PEOs. The first PEO reflects their professional career pursued through the knowledge acquired either as employees or as entrepreneurs, the second PEO is focused on their desire to upgrade their technical skills, the third PEO describes their communication skills and team skills, while the fourth PEO describes their attitude through their concern for environment and society.

The PEOs of the program are as under:

| | |
|-------------|---|
| PEO1 | Graduates will compete on a global platform to pursue their professional career in Electronics and Telecommunication Engineering and allied disciplines |
| PEO2 | Graduates will pursue higher education and/or engage in continuous up gradation of their professional skills |
| PEO3 | Graduates will communicate effectively and will demonstrate professional behaviour while working in diverse teams |
| PEO4 | Graduates will demonstrate high regard for human rights, have concern for society and environment |

Program Outcomes (POs)

Program Outcomes (POs), are attributes acquired by the student at the time of graduation. The POs given in the Table below, are identical to the Graduate Attributes (GAs) specified by National Board of Accreditation (NBA), and are common across all branches of engineering. 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, and help in the attainment of the PEOs.

| | |
|-------------|--|
| PO1 | Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems. |
| PO2 | Problem analysis: Identify, formulate, research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences. |
| PO3 | Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations. |
| PO4 | Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions. |
| PO5 | Modern Tool Usage : Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations |
| PO6 | 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. |
| PO7 | Environment and Sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development. |
| PO8 | Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice. |
| PO9 | Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings. |
| PO10 | Communication: Communicate effectively on complex engineering activities with the engineering community 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. |
| PO11 | Project Management and Finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments. |
| PO12 | Life-long learning: Recognise the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change |

Program Specific Outcomes (PSOs)

The Program Specific Outcomes (PSOs), are defined by the stakeholders of the program, and describe the skills in addition to the POs (defined by NBA), expected by the Telecommunication Engineering student at the time of graduation. Similar to the POs, they are addressed through the outcomes of the courses, however, they are exclusive to the branch. The PSOs are developed through the teaching-learning process of various courses of the curriculum. The National Board of Accreditation (www.nbaind.org), recommends having 2-4 PSOs for a program. After series of discussions with the stakeholders of the program, the Department of Telecommunication Engineering has arrived at three PSOs. Through these PSOs, we attempt to develop the ability to: (i) Build Electronic Systems, (ii) Build Communication Systems, (iii) Simulate systems using Engineering Tools and (iv) Holistic Personality.

| At the time of graduation, the Telecommunication Engineers will have the ability to | |
|---|---|
| PSO1 | Build Electronic Systems : formulate the problem, design, implement, analyze and demonstrate a feasible solution to the problem, using suitable electronic components |
| PSO2 | Build Telecommunication Systems : design, implement, analyze and demonstrate the telecommunication system to receive and(or) transmit signals through the specified channel |
| PSO3 | Simulate Systems : Develop, test, analyze and demonstrate algorithms to simulate Electronic systems / Telecommunication systems / Networking protocols using the specified Engineering Tool for services such as voice, data, image, and video transport |
| PSO4 | Holistic Personality : Demonstrate research skill, entrepreneurial skill, written & oral communication skills, interpersonal skills, and negotiation skills together with the right emotional quotient and compliance to professional norms |

**Distribution of credits among various Curricular Components
(Batch Admitted 2021 onwards)**

| Curricular Component/Semester | I | II | III | IV | V | VI | VII | VIII | Total |
|---|-----------|-----------|------------|-----------|-----------|-----------|------------|-------------|--------------|
| Basic science Course(BS) | 8 | 8 | 3 | 3 | | | 1 | | 23 |
| Engineering Science Course(ES) | 10 | 10 | | 4 | | | | | 24 |
| Professional Core Course(PC) | | | 16 | 11 | 15 | 11 | 7 | | 60 |
| Professional Elective Course(PE) | | | | | 3 | 3 | 3 | 3 | 12 |
| Open Elective Course(OE) | | | | | | 3 | 3 | 3 | 9 |
| Project/Mini-Project(PW) | | | | | 2 | 2 | 2 | 6 | 12+4=16 |
| Seminar on Internship(SR) | | | | 1 | | 1 | | 2 | |
| Humanities and Social sciences, Management Course(HS) | 1 | 1 | 2 | 2 | 2 | 2 | | 2 | 12 |
| Ability Enhancement Course/Mandatory Course(AEC) | 1 | 1 | 1 | 1 | | | | | 4 |
| Non-Credit Mandatory Course(NCMC) | - | - | NC | NC | NC | NC | NC | NC | 6 Units |
| Total credits | 20 | 20 | 22 | 22 | 22 | 22 | 16 | 16 | 160 |

III Semester Scheme

| Course Code | Course Title | Type | LT:P | Credits | Hours | CIE | SEE | Total |
|---------------------------|---|------|---------------|---------|-------|-----|-----|-------|
| 22MA3BSTFN | Transform Calculus, Fourier Series and Numerical Techniques | BS | 2:1:0 | 3 | 4 | 50 | 50 | 100 |
| 22ES3PCECA | Electric Circuit Analysis | PC | 3:1:0 | 4 | 5 | 50 | 50 | 100 |
| 22ET3PCSSA | Signals and Systems: Analog | PC | 3:1:0 | 4 | 5 | 50 | 50 | 100 |
| 22ET3PCALC | Analog and Linear Circuits | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ES3PCDCS | Digital Circuits | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22MA3HSUHV | Universal Human Values | HS | 0:1:0 | 1 | 2 | 50 | 50 | 100 |
| 22ET3AEMCP | Mathematics Concepts using python | AE | 0:1:0 | 1 | 2 | 50 | 50 | 100 |
| 22MA3HSSAK/ 22MA3HSBAK | Sanskrutika Kannada / Balake Kannada | HS | 1:0:0 | 1 | 1 | 50 | 50 | 100 |
| 22ET3NCCLA | Cultural Activity | NCMC | | P/NP | - | | | P/NP |
| Total | | | 15:5:2 | 22 | 33 | 22 | 29 | 800 |

IV Semester Scheme

| Course Code | Course Title | Type | L:T:P | Credits | Hours | CIE | SEE | Total |
|--------------|---|------|---------------|-----------|-----------|------------|------------|------------|
| 22MA4BSCPS | Complex Analysis, Probability and Statistical Methods | BS | 2:1:0 | 3 | 4 | 50 | 50 | 100 |
| 22ET4PCSSD | Signal and Systems: Digital | PC | 2:1:0 | 3 | 4 | 50 | 50 | 100 |
| 22ES4ESCST | Control Systems | ES | 3:1:0 | 4 | 5 | 50 | 50 | 100 |
| 22ES4PCAPP | ARM Processor and Programming | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ET4PCCS1 | Communication Systems-1 | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ET4SRIN1 | Seminar- Internship involving Social Activity | INT | 0:0:1 | 1 | 2 | 50 | 50 | 100 |
| 22ET4AEDPY | Data Science using Python | AE | 0:1:0 | 1 | 2 | 50 | 50 | 100 |
| 22CV4HSEVS | Environmental Studies | HS | 1:0:0 | 1 | 1 | 50 | 50 | 100 |
| 22MA4HSCPH | Constitution of India, Professional Ethics and Human Rights | HS | 1:0:0 | 1 | 1 | 50 | 50 | 100 |
| 22ET4NCPYA | Physical Activity | NCMC | - | P/NP | - | | | P/NP |
| Total | | | 15:3:4 | 22 | 29 | 350 | 350 | 800 |

V Semester Scheme

| Course Code | Course Title | Type | L:T:P | Credits | Hours | CIE | SEE | Total |
|--------------|--|-----------------------------|---------------|-----------|-----------|------------|------------|------------|
| 22ET5PCEM1 | Electromagnetics | PC | 3:1:0 | 4 | 5 | 50 | 50 | 100 |
| 22ET5PCSPM | Signal Processing for Multimedia | PC | 2:1:0 | 3 | 4 | 50 | 50 | 100 |
| 22ET5PCCCN | Computer Communication Networks | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ET5PCCS2 | Communications Systems-2 | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ET5PE1 | DD | Digital System Design | PE | 3:0:0 | 3 | 50 | 50 | 100 |
| | OC | Optical Fiber Communication | | | | | | |
| | CA | Computer Architecture | | | | | | |
| | DS | C++ and Data Structures | | | | | | |
| 22ET5PWMP1 | Mini Project-1 | PW | 0:0:2 | 2 | 4 | 50 | 50 | 100 |
| 22ES5HSPMF | <i>Project Management and Finance</i> | HS | 2:0:0 | 2 | 2 | 50 | 50 | 100 |
| 22ET5NCENI | <i>Effective Negotiation with Emotional Intelligence</i> | NCMC | | P/NP | | | | |
| Total | | | 16:2:4 | 22 | 28 | 350 | 350 | 700 |

VI Semester Scheme

| Course Code | Course Title | Type | L:T:P | Credits | Hours | CIE | SEE | Total |
|--------------|---|---------------------------------|---------------|-----------|-----------|------------|------------|------------|
| 22ET6PCVLS | Fundamentals of VLSI | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ET6PCWCN | Wireless and Cellular Networks | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ET6PCTLA | Transmission Lines and Antennas | PC | 2:1:0 | 3 | 4 | 50 | 50 | 100 |
| 22ET6PE2 | ES | Embedded System Design | PE | 3:0:0 | 3 | 50 | 50 | 100 |
| | SC | Satellite Communication | | | | | | |
| | IT | Internet of Things | | | | | | |
| | OS | Operating Systems | | | | | | |
| 22ET6OE1 | CN | Computer Communication Networks | OE | 3:0:0 | 3 | 50 | 50 | 100 |
| | DS | Distributed Systems | | | | | | |
| | OR | Operation Research | | | | | | |
| 22ET6PWMP2 | Mini Project-2 | PW | 0:0:2 | 2 | 4 | 50 | 50 | 100 |
| 22ET6SRIN2 | Internship Based Seminar | INT | 0:0:1 | 1 | 2 | 50 | 50 | 100 |
| 22ES6HSIPL | <i>Intellectual Property Rights and Cyber Law</i> | HS | 2:0:0 | 2 | 2 | 50 | 50 | 100 |
| 22ET6NCPDC | <i>Personality development, Aptitude and Communication Skills</i> | NCCMC | | P/NP | | | | |
| Total | | | 16:1:5 | 22 | 28 | 400 | 400 | 800 |

VII Semester Scheme

| Course Code | Course Title | Type | L:T:P | Credits | Hours | CIE | SEE | Total |
|--------------|---|---------------------------------|---------------|-----------|-----------|------------|------------|------------|
| 22ET7BSBFE | Biology for Engineers | BS | 1:0:0 | 1 | 1 | 50 | 50 | 100 |
| 22ET7PCMWR | Microwaves and Radar | PC | 3:0:1 | 4 | 5 | 50 | 50 | 100 |
| 22ET7PCSTN | Sustainable Telecom Networks | PC | 0:1:0 | 1 | 2 | 50 | 50 | 100 |
| 22ET7PCSIE | Signal Integrity and EMI/EMC | PC | 2:0:0 | 2 | 2 | 50 | 50 | 100 |
| 22ET7PE3 | AD | ASIC Design | PE | 3:0:0 | 3 | 50 | 50 | 100 |
| | CV | Computer Vision | | | | | | |
| | NS | Cryptography & Network Security | | | | | | |
| | DS | Data Science | | | | | | |
| 22ET7OE2 | CY | Cryptography | OE | 3:0:0 | 3 | 50 | 50 | 100 |
| | CH | Communication in Healthcare | | | | | | |
| | LA | Linear Algebra | | | | | | |
| 22ET7PWRER | Project Based on Identified Research Work | PW | 0:0:2 | 2 | 4 | 50 | 50 | 100 |
| 22ET7NCMC1 | MOOCs/ Virtual Lab with certification | NCMC | - | P/NP | | - | - | P/NP |
| Total | | | 12:1:3 | 16 | 25 | 350 | 350 | 700 |

VIII Semester Scheme

| Course Code | Course Title | Type | L:T:P | Credits | Hours | CIE | SEE | Total | |
|--------------|--|--|--------------|-----------|-----------|------------|------------|------------|-----|
| 22ET8PE4 | LV | Low Power VLSI | PE | 3:0:0 | 3 | 3 | 50 | 50 | 100 |
| | SN | Adhoc and Sensor Networks | | | | | | | |
| | BS | Block Chain & Cyber Security | | | | | | | |
| | AL | Artificial Intelligence & Machine Learning | | | | | | | |
| 22ET8PWMPJ | Major Project | PW | 0:0:6 | 6 | 12 | 50 | 50 | 100 | |
| 22ET8OE3 | NS | Network Security | OE | 3:0:0 | 3 | 3 | 50 | 50 | 100 |
| | SC | Principles of Satellite Communication | | | | | | | |
| | NM | Numerical Methods | | | | | | | |
| 22ES8HSIFE | <i>Innovation for Entrepreneurship</i> | HS | 2:0:0 | 2 | 2 | 50 | 50 | 100 | |
| 22ET8SRIN3 | Seminar based on Internship | INT | 0:0:2 | 2 | 4 | 50 | 50 | 100 | |
| 22ET8NCCMC2 | MOOCs/ Virtual Lab with certification | NCCMC | | P/NP | | | | P/NP | |
| | <i>Details of 100 AICTE Activity Points Earned</i> | | | | | | | P/NP | |
| Total | | | 8:0:8 | 16 | 24 | 250 | 250 | 500 | |

Program Electives

| Domain Area | Program Elective-1 (V Sem) | Program Elective-2 (VI Sem) | Program Elective-3 (VII Sem) | Program Elective-4 (VIII Sem) |
|---------------------------|---|---------------------------------------|---|--|
| VLSI | Digital System Design 22ET5PE1DD | Embedded System Design 22ET6PE2ES | ASIC Design 22ET7PE3AD | Low Power VLSI 22ET8PE4LV |
| Communication | Optical Fiber Communication 22ET5PE1OC | Satellite Communication 22ET6PE2SC | Computer Vision 22ET7PE3CV | Adhoc and Sensor Networks 22ET8PE4SN |
| Networking | Computer Architecture 22ET5PE1CA | Internet of Things 22ET6PE2IT | Cryptography & Network Security 22ET7PE3NS | Block Chain & Cyber Security 22ET8PE4BS |
| Programming Skills | C++ and Data Structures 22ET5PE1DS | Operating System 22ET6PE2OS | Introduction to Data Science 22ET7PE3DS | Artificial Intelligence & Machine Learning 22ET8PE4AL |

Open Electives

| Domain Area | Open Elective-1 (VI Sem) | Open Elective-3 (VII Sem) | Open Elective-4 (VIII Sem) |
|-----------------------|---|---|---|
| Cyber Security | Computer Communication Networks 22ET6OE1CN | Cryptography 22ET7OE2CY | Network Security 22ET8OE3NS |
| Communication | Distributed Systems 22ET6OE1DS | Communication in Healthcare 22ET7OE2CH | Principles of Satellite Communication 22ET8OE3SC |
| Mathematical | Operation Research 22ET6OE1OR | Linear Algebra 22ET7OE2LA | Numerical Methods 22ET8OE3NM |

III Semester

| | | | | | |
|--|--|---|----------|--------------|--------------|
| Course Title | Transform Calculus, Fourier Series And Numerical Techniques | | | | |
| Course Code | 22MA3BSTFN | Credits | 3 | L:T:P | 2:1:0 |
| (COMMON TO ALL BRANCHES EXCEPT CS, IS AND AI& ML) | | Pedagogy: 30 Lectures+ 10Tutorial sessions | | | |

COURSE OBJECTIVES: The purpose of the course is to facilitate the learners to:

- Appreciate the importance of Series, Transforms and Numerical Techniques in Engineering Problems.
- Acquire the knowledge of Series, Transforms and Numerical Techniques to apply them in their core domain.
- Improve their Mathematical thinking and acquire skills required for sustained lifelong learning.

TEACHING-LEARNING PROCESS (General Instructions):

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Encourage the students for group learning to improve their creative and analytical skills.

MODULE - I

LAPLACE TRANSFORMS:

Definition and Laplace transforms of elementary functions (statements only). Problems on Laplace transform of $e^{at} f(t)$, $t^n f(t)$, $\frac{f(t)}{t}$. Laplace Transforms of derivatives and integrals, Laplace Transform of periodic functions (statement only) and unit-step function –problems. Inverse Laplace transforms definition and problems, solution of differential equations.

| | |
|---------------------------|--|
| Teaching-Learning Process | Chalk and talk method / Power Point Presentation |
|---------------------------|--|

MODULE - II

FOURIER SERIES:

Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet’s condition. Fourier series of periodic functions with period 2π and arbitrary period. Complex Fourier series. Practical harmonic analysis.

| | |
|---------------------------|--|
| Teaching-Learning Process | Chalk and talk method / Power Point Presentation |
|---------------------------|--|

MODULE - III

FOURIER TRANSFORMS:

Definition and problems on Fourier Transform. Fourier sine and cosine transforms – Problems. Inverse Fourier transform, Inverse Fourier cosine and sine transforms - Problems. Convolution theorem (only statement) – problems.

| | |
|---------------------------|--|
| Teaching-Learning Process | Chalk and talk method / Power Point Presentation |
|---------------------------|--|

MODULE - IV

NUMERICAL SOLUTIONS OF PDE:

Classification of second-order partial differential equations, finite difference approximation of derivatives. Solution of one-dimensional heat equation by Schmidt explicit formula and Crank-Nicholson method. Solution of one-dimensional wave equation using explicit three level formula and implicit scheme.

| | |
|---------------------------|--|
| Teaching-Learning Process | Chalk and talk method / Power Point Presentation |
|---------------------------|--|

MODULE - V

CALCULUS OF VARIATIONS:

[08 hours]

Definition, Variation of a functional, Euler’s equation, variational problems.

Applications: Hanging cable problem, Brachistochrone problem.

Z-TRANSFORMS: Definition, Standard Z-transforms, Damping rule, Shifting rule, Initial value and final value theorems-problems. Inverse Z-transform and applications to solve difference equations.

| | |
|---------------------------|--|
| Teaching-Learning Process | Chalk and talk method / Power Point Presentation |
|---------------------------|--|

Course outcomes (Course Skills Set)

After successfully completing the course, the student will be able to understand the topics:

| Course Code | CO | COURSE OUTCOME (CO) | PO | Strength |
|-------------|------|--|--------|----------|
| 22MA3BSTFN | CO 1 | Apply the concepts of Transform Techniques, optimization and Finite Difference Methods to solve engineering problems. | 1 | 3 |
| | CO 2 | Analyze the solution of differential equations using Transform Techniques, optimization and Finite Difference Methods | 1 | 1 |
| | CO 3 | Demonstrate the importance of Transform Techniques, optimization and Finite Difference Methods in engineering using programming tools. | 5,9,10 | 1 |

Assessment Details (both CIE and SEE)

| Component | Type of assessment | Max. Marks | Total | 50 % Weightage | Total |
|--------------|--------------------|------------|-------|----------------|-------|
| CIE – Theory | Quiz | 10 | 100 | 5 | 50 |
| | AAT | 10 | | 5 | |
| | Test 1 | 40 | | 20 | |
| | Test 2 | 40 | | 20 | |
| | Test 3 | 40 | | 20 | |
| SEE | End Exam | 100 | | 50 | |

Two best scores out of the three tests will be considered for CIE.

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

SEMESTER END EXAMINATION:

- Each unit consists of one full question.
- Five full questions to be answered.
- To set one question each from Units 2, 3 & 4 and two questions each from Unit 1 and Unit 5.

TEXT BOOKS:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCE BOOKS:

1. B.V. Ramana: "Higher Engineering Mathematics", McGraw-Hill Education, 11th Ed.
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics "Oxford University Press, 3rd Reprint, 2016.

3. N. P Bali and Manish Goyal: “A textbook of Engineering Mathematics”, Laxmi Publications.
4. C. Ray Wylie, Louis C. Barrett: “Advanced Engineering Mathematics”, McGraw–Hill Book Co. New York, 6th Edition.
5. Gupta C.B, Sing S. R. and Mukesh Kumar: “Engineering Mathematic for Semester I and II”, Mc- Graw Hill Education (India) Pvt. Ltd 2015.
6. H. K. Dass and Er. Rajnish Verma: “Higher Engineering Mathematics”, S. Chand Publication (2014).
7. James Stewart: “Calculus” Cengage publications, 7th edition, 4th Reprint 2019.

E books and online course materials:

1. [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
2. <http://academicearth.org/>
3. <http://www.bookstreet.in>.
4. VTU e-Shikshana Program
5. VTU EDUSAT Program

| | | | | | |
|---|----------------------------------|----------------|----------|--------------|--------------|
| Course Title | Electric Circuit Analysis | | | | |
| Course Code | 22ES3PCECA | Credits | 4 | L:T:P | 3:1:0 |
| Pedagogy: 40 Lectures+ 10Tutorial sessions | | | | | |
| MODULE - I | | | | | |
| Basic Concepts of Circuits and analysis: | | | | | |
| Practical sources, Source transformations, Loop and node analysis with linearly dependent and independent sources for DC and AC circuits, Analysis of network involving concepts of super node, super mesh. Network reduction using Star to Delta transformation and Delta to Star transformation | | | | | |
| MODULE - II | | | | | |
| Network Topology and Series and Parallel Resonance: | | | | | |
| Graph of a network, Concept of tree and Co-tree, Incidence matrix, tie-set, tie-set schedule & cutset, cut-set schedule, Formulation & solution of equilibrium equations. | | | | | |
| Resonant Circuits: Series and parallel resonance, Frequency response of series and parallel circuits, Q factor, Bandwidth. | | | | | |
| MODULE - III | | | | | |
| Network Theorems: | | | | | |
| Superposition, Reciprocity, Millman's, Thevenin's and Norton's theorems; Maximum power transfer theorem. | | | | | |
| MODULE - IV | | | | | |
| Transient Behaviour and Initial Conditions: | | | | | |
| Behaviour of circuit elements under switching condition and their representation, Evaluation of Initial and final conditions in RL, RC and RLC circuits for DC conditions. | | | | | |
| Review of Laplace transforms, Waveform Synthesis, Initial and Final value theorems, Step, Ramp and Impulse responses, solution of simple R-L, R-C, R-L-C networks for DC excitations using Laplace transforms. | | | | | |
| MODULE - V | | | | | |
| Two Port Network Parameters | | | | | |
| Definition of Z, Y, T and h parameters, symmetric and reciprocity conditions, modelling of two port network parameters, relationship between parameters sets. | | | | | |

TEXT BOOKS:

1. “Network Analysis”, M.E.Vanvalkenburg, PHI/ Pearson Education, 3rd Edition.
Reprint 2002.
2. “ Network 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”, D. Anand Kumar, PHI Learning, 2019.

E Books:

1. nptel.ac.in/courses/108105065- Networks signals and systems by Prof T.K. Basu, IIT Kharagpur.
2. nptel.ac.in/courses/108102042- Circuit Theory by Prof Dutta Roy S.C, IIT Delhi
3. www.electrodiction.com/circuit-theory.

MOOCs:

1. https://swayam.gov.in/nd1_noc19_ee36/preview
2. <http://elearning.vtu.ac.in/06ES34.html>
3. <https://www.coursera.org/course/circuits>

Course Outcomes:

At the end of the course, students will have the

| | | | |
|------------|---|------------------|---------|
| CO1 | Ability to define, understand and explain concepts related to electrical circuits | | |
| CO2 | Ability to apply the knowledge of KVL, KCL, Graph Theory and network theorems to the given electrical circuit to obtain the desired parameter | PO1(3) | PSO3(3) |
| CO3 | Ability to analyze given electrical circuit to arrive at a suitable conclusion | PO2(3) | |
| CO4 | Ability to conduct experiments to demonstrate the specified concept/ application of electrical circuit on the Multisim platform | PO1(3) PO5(3) | |
| CO5 | Ability to analyse the given electrical circuit on the Multisim platform to compute the desired parameter | PO2(2) PO5(2) | |

| | | | | | |
|---|------------------------------------|----------------|----------|--------------|--------------|
| Course Title | Signals and Systems: Analog | | | | |
| Course Code | 22ET3PCSSA | Credits | 4 | L:T:P | 3:1:0 |
| Pedagogy: 40 Lectures+ 10Tutorial sessions | | | | | |

MODULE - I

SIGNALS

Signal definition; signal classification; Elementary signals; Signal transformation of independent and dependent variable; Random Signals; Statistical averages;

SYSTEMS

System definition; system classification; The Linear Time Invariant (LTI) system; Testing a given system for linearity;

MODULE - II

SIGNALS: Time Domain Representation

Impulse response; Properties of impulse response; Measurement techniques for impulse response and step response of practical circuits;

The convolution integral; Methods of evaluating the convolution integral; Correlation; Auto-correlation; Cross-correlation; Hilbert Transform; Representation of signals in terms of a set of orthogonal functions; Orthonormal and Orthogonal signals;

MODULE - III

SIGNALS: Frequency Domain Representation

Fourier Transform of continuous time non-periodic signals; Properties of Fourier Transform; Fourier series of continuous time periodic signals; The Fourier transform of periodic signals; Magnitude Spectrum; Phase Spectrum; Spectrum of sum of signals; Spectrum of product of signals; Spectrum of periodic signals; Energy Spectral Density; Power Spectral Density; Band-pass signals; in-phase and quadrature-phase components; Canonical representation of band pass signals

MODULE - IV

LTI Systems: Representation And Classification

The constant coefficient differential equation; Impulse Response; Relating the Fourier Transform to the Laplace Transform; System Transfer Function; Pole-zero plot; Frequency Response; Block Diagram representation;

MODULE - V

LTI Systems: Design And Analysis

Ideal filters; Butterworth Filters; Butterworth Polynomials; Design of prototype Butterworth filters; Frequency transformation; Practical implementation of Butterworth filters; Filtered output for deterministic signals; Filtered output for random processes;

Tutorial Sessions: Tutorial sessions shall include numerical examples in the classroom; numerical examples implemented in the laboratory using discrete components; using electronic circuit simulation software (Multisim); using Python (an open source programming tool)

Course Outcomes:

At the end of the course, students will have the

| | | | |
|------------|---|---------------------------------------|----------------------------|
| CO1 | Ability to obtain the specified parameter/representation for the given continuous time signal/system using time domain, frequency domain and transform domain representation | PO1 (3) | PSO1(3) PSO3(3) |
| CO2 | Ability to analyse and classify the given signal/system using time domain, frequency domain and transform domain representation | PO2(3) | |
| CO3 | Ability to design analog Butterworth filters to meet given specifications | PO3(2) | |
| CO4 | Ability to conduct investigation through implementation of the experiment, to represent/model the given signal/system | PO4(1) | |
| CO5 | Ability to design, formulate, implement and demonstrate an application of an identified concept(s) of the course, through an Open-Ended experiment using discrete components/ Multisim/ Python | PO5(1) | |
| CO6 | Ability to make an oral presentation of the application concepts of the course for transmission of audio /image/ video/ data signal for benefit of society | PO6(1) PO10(1) PO12(1) | |

TEXT BOOKS:

1. ‘Signals & Systems’, Simon Haykin and Barry Van Veen, John Wiley and Sons
2. ‘Integrated Electronics’, by Jacob Millman and Christos C Halkias, Tata McGraw Hill Edition

REFERENCE BOOKS:

1. H. P Hsu, R. Ranjan, “Signals and Systems”, Scham's outlines, 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

Books:

1. NPTEL lecture Video on Signals and Systems by Prof. S.C.Dutta 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>

MOOCs:

Analog Filters Part A: <https://youtu.be/C7AAYVCAeNU>

Analog Filters Part B: <https://youtu.be/rn2PxSIJ3iI>

Analog Filters Part C: <https://youtu.be/9bFdx7PaYiw>

Analog Filters Part D: https://youtu.be/YeYGyROhN_w

‘Signals and Systems’, VTU-EDUSAT, P10,

<http://117.239.61.113/econtent/courses/ECE/06EC44/index.php>

https://bmsce.ac.in/Content/TE/Butterworth_filters.pdf

https://bmsce.ac.in/Content/TE/Fourier_series_Examples.pdf

https://bmsce.ac.in/Content/TE/Fourier_Transform_Examples_and_Properties.pdf

<https://bmsce.ac.in/home/contentView/Electronics-and-Telecommunication-Engineering/TE/19>

| | | | | | |
|--|-----------------------------------|----------------|----------|--------------|--------------|
| Course Title | Analog and Linear Circuits | | | | |
| Course Code | 22ET3PCALC | Credits | 4 | L:T:P | 3:0:1 |
| Pedagogy: 40 Lectures+ 10 Practical sessions | | | | | |
| MODULE - I | | | | | |
| <p>Diode Applications: clippers, Clampers.</p> <p>Bipolar Junction Transistor (BJTs): DC biasing– Introduction, operating point, voltage divider Bias configuration ,Biasing using a collector to base feedback resistor,</p> <p>BJT AC Analysis: Introduction, Application in the AC Domain, BJT Transistor Modeling, Voltage Divider Bias, BJT Frequency Response.</p> | | | | | |
| MODULE - II | | | | | |
| <p>Feedback concepts: Feedback connection types- Voltage series, Voltage-shunt, Current Series and Current Shunt Feedback.</p> <p>Practical feedback Circuits: Voltage series, Current series feedback and voltage Shunt feedback.</p> <p>Power Amplifiers: Introduction- Definitions and Amplifier Types, Amplifier Efficiency Series-Fed Class A Amplifier: DC Bias Operation, AC operation, Power Consideration, Efficiency.</p> <p>Transformer coupled Class A Amplifier: Operation of Amplifier Stage : DC load line, Quiescent operating point, AC load line , Signal Swing and Output AC power.</p> <p>Class B operation: Class B Amplifier Circuits, Transformer coupled Push-Pull Circuits, Complementary Symmetry Circuits and Amplifier Distortion</p> | | | | | |
| MODULE - III | | | | | |
| <p>MOSFETS: Biasing in MOS amplifier circuits---Biasing by fixing VGS, Biasing by fixing VG and connecting a resistor in the source , Biasing using a drain to gate feedback resistor, biasing using a current source.</p> <p>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</p> | | | | | |
| MODULE - IV | | | | | |
| <p>Introduction to Operational amplifiers: Op-amp AC and DC Amplifiers, concept of negative feedback and virtual short, analysis of simple operational amplifier circuits, Frequency response of amplifiers, instrumentation amplifiers, current and voltage sources, Precision Rectifiers, comparators</p> | | | | | |
| MODULE - V | | | | | |
| <p>DAC-weighted resistor and R-2R ladder, ADC-Successive approximation type applications, Dual slope ADC,Delta-Sigma ADC,Flash ADC. Timers: Functional block diagram of 555, Applications: Astable and Monostable multivibrators, Phase locked loop.</p> | | | | | |
| List of Experiments | | | | | |
| <ol style="list-style-type: none"> 1. Diode clipping circuits- Single/Double ended 2. Diode clamping Circuits – Positive clamping/negative clamping 3. Performance analysis of Transistor as a switch 4. Precision rectifiers: Half wave rectifier 5. Precision rectifiers: Full wave rectifier 6. To design and implement using Op-amp: <ol style="list-style-type: none"> (i)Inverting and non-Inverting ZCD | | | | | |

- (ii) Positive and negative Voltage level detectors
- 7. To design and implement using 555 timers:
 - (i) Astable Multivibrator
 - (ii) Monostable multivibrator
- 8. To design and implement 4-bit R-2R Digital to Analog Converter
- 9. To obtain the characteristics of MOSFET (using simulation tool/hardware)
- 10. To design and implement using Op-amp:Instrumentation amplifier

Course outcomes:

At the end of the course on **Analog and Linear Circuits** , the student will have the ability to

| | | | |
|-----|---|-------------------------------|--------------------|
| CO1 | Ability to define ,understand and explain concepts related to diodes and transistors (BJTs and MOSFETs) | -- | PSO1(3) PSO3(2) |
| CO2 | Ability to apply the knowledge of network theorems to the given analog and linear circuit to obtain the desired parameter | PO1(3) | |
| CO3 | Ability to analyze given analog and linear circuit to arrive at a suitable conclusion | PO2(3) | |
| CO4 | Ability to design analog and linear circuit for given application and specifications | PO3(2) | |
| CO5 | Ability to design and conduct experiment using analog and linear circuit for given application and specifications | PO3(2) PO5(3) | |
| CO6 | Ability to conduct experiments to verify THREE parameters of the datasheet of the given electronic component | PO4(2) PO5(3) | |
| CO7 | Ability to implement a mini-project to implement and demonstrate the given problem using suitable analog and linear circuit | PO2 (2) PO5 (2) PO9 (1) | |

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 5th Edition (Oxford International Student Edition)
3. Linear Integrated circuits- D Roy Choudhury&Shail B Jain (New AgePublication)

REFERENCE BOOKS:

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

E Books:

1. www.pyroelectro.com/edu/analog
2. <http://freevidelectures.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/>

| DIGITAL CIRCUITS | | | | | |
|---|--|---|-------|-------|--|
| 22ES3PCDCS | Credits | 4 | L:T:P | 3:0:1 | |
| Pedagogy: 40 Lectures+ 10 Practical sessions | | | | | |
| MODULE - I | | | | | |
| <p>Introduction: Review of Boolean algebra, logic gates. Simplification of Boolean functions: Three Variable, Four Variable-K– Maps, The Tabulation Method, Design with Basic gates, NAND gates and NOR gates. Introduction to Verilog: Structure of Verilog module, Operators, Data Types, Styles of Description. Introduction to test bench</p> | | | | | |
| MODULE - II | | | | | |
| <p>Arithmetic Circuits: Introduction, Half adder, Half subtractor, Full adder, Full subtractor, Parallel Adders ;Carry Look Ahead Adder and Ripple carry adder, Decimal Adder.Verilog Data flow description: Highlights of Data flow description, Structure of Data flow description.</p> | | | | | |
| MODULE - III | | | | | |
| <p>Combination Logic Circuits: Code conversion, Magnitude Comparator, Decoders, Multiplexers, Read Only memories (ROM), Programmable Logic Arrays (PLAs). Modeling using data flow description.</p> | | | | | |
| MODULE - IV | | | | | |
| <p>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. Verilog Behavioral description: Structure, Variable Assignment Statement, Sequential Statements, Loop Statements, Verilog Behavioral Description of Combinational and Sequential Circuits.</p> | | | | | |
| MODULE - V | | | | | |
| <p>Verilog Structural description: Highlights of Structural description, Organization of structural description, Structural description of Combinational and Sequential Circuits- Shift Registers, Ripple Counters, Synchronous Counters.</p> | | | | | |
| List of Experiments | | | | | |
| Sl.No | Title of Experiment | | | | |
| 1 | Adders, Subtractors and Comparators | | | | |
| 2 | Applications of IC 7483 | | | | |
| 3 | Multiplexers (using Gates and IC) and their applications. | | | | |
| 4 | Decoders/DeMultiplexers (using Gates and IC) and their applications. | | | | |
| 5 | BCD to Decimal decoder using 7-segment display . | | | | |
| 6 | Verification of MSJK Flip-flop (using Gates and IC 7476). | | | | |
| 7 | Asynchronous counters (using ICs 7476,7490,7493). | | | | |
| 8 | Synchronous Counters (using ICs 7476, 74190/74192). | | | | |
| 9 | Shift registers and their applications (using ICs 7476, 7495). | | | | |

TEXT BOOKS:

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

REFERENCE BOOKS:

1. Digital Design : Principles and Practices 4th Edition, John F. Wakerly
2. Fundamental of Logic Design- Charles Roth Jr., Thomas Learning
3. Digital Logic Applications and principles- John Yarbrough, Pearson Education
4. HDL Programming VHDL and Verilog by Nazeih M Botros, 2009 reprint, Dreamtech press.

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/Verilog_fundamentals

| | | | |
|------------------------------|------------------------|-------------|------------|
| Course Code | Universal Human Values | Course Name | 22MA3HSUHV |
| Credits | 01 | L-T-P | 0-1-0 |
| Pedagogy: 15 Lectures | | | |

MODULE - I

Human values for Self-excellence – What is value?, The values for human integration, Golden silence, Peace and non-violence in thought, Word and Deed, Thought culture, individual and group activities.

MODULE - II

Integrating human values into life- Significant spiritual values - Health and Harmony with Nature, Truth and Wisdom, Love and Compassion, Creativity and Appreciation of Beauty, Peace and Justice, National Unity and Global Solidarity, Global Spirituality, Principles of communication -Heartful Communication, Principles of Self-management, individual and group activities.

MODULE - III

Self-transformation – Discover the personality, Heart based living, Healthy Life Style, Peak Performance, Mapping core values with Sustainable Development Goals, individual and group activities.

MODULE - IV

Live light - Character vs. Personality, Dealing with Stress, Time management, The Power of Pause, Empathy vs Sympathy, individual and group activities.

MODULE - V

your destiny - Self-Awareness, Situational Awareness, Transforming Behaviour, Transformation Factors, Thoughts-Habits-Destiny, Science of Belief, Decision Making, individual and group activities.

Course Outcomes:

At the end of the course, students will have the

| | |
|------------|---|
| CO1 | Ability to understand and explain the values and their role in improving the quality of life and become global citizens |
| CO2 | Ability to integrate spiritual values to lead a balanced life |
| CO3 | Ability to apply the values to design their destiny |

Reference Material

1. <https://heartfulness.org/education/training-and-curriculum/>
2. Conscious living content – available at: www.heartfulness.org/cmspublic
3. https://fdp-si.aicte-india.org/5day_onlineUHV.php
4. The 4-Part Nonviolent Communication (NVC) Process Developed by Marshall B. Rosenberg, Ph.D, available at <http://www.nonviolentcommunication.com/aboutnvc/4partprocess.htm>

| | | | | | |
|--|---|---|----------------|--------------|--------------|
| Course Title | MATHEMATICS CONCEPTS USING PYTHON | | | | |
| Course Code | 22ET3AEMCP | Credits | 1 | L:T:P | 0:1:0 |
| Pedagogy: 15 Lectures | | | | | |
| MODULE - I | | | | | |
| Introduction to numpy; matplotlib; Plotting of Functions; The Text Editor for mathematical equations Elementary Functions; Calculus (Integration, Differentiation); Defining Functions; Develop Code for a given equation; Write the equation for a given code | | | | | |
| MODULE - II | | | | | |
| Discrete Probability distribution: Probability and Statistics; Discrete Probability Functions (Binomial, Poisson); Probability Functions; Cumulative distribution functions, covariance, correlation, joint probability distribution, Bayes Theorem. | | | | | |
| MODULE - III | | | | | |
| Continuous Probability distribution: Probability and Statistics; Continuous Probability Functions (Uniform, Normal, Exponential); Cumulative distribution functions, covariance, joint probability distribution, Central limit Theorem. | | | | | |
| MODULE - IV | | | | | |
| Generation of periodic signals from Fourier Series; Fourier Transform of signals (Periodic and Non-periodic) | | | | | |
| MODULE - V | | | | | |
| Differential equation; Pole-zero plot; Magnitude response; Impulse response; Step response; System classification; | | | | | |
| Course Outcomes: | | | | | |
| <i>At the end of the course, students will have the</i> | | | | | |
| CO1 | Ability to develop the Python code for a given mathematical equation, and represent in the specified format | PO1 (3) PO5 (3) | PSO3(3) | | |
| CO2 | Ability to analyse the Python code to obtain the mathematical equation | PO2(3) PO5 (3) | | | |
| CO3 | Ability to develop the code for representing the given mathematical equation in the text editor of Python, using relevant Latex code | PO10(2) PO5 (3) | | | |
| CO4 | Ability to develop the Python code to model and represent the given analog system transfer function and classify the system | PO3(3) PO4(3) PO5(3) | | | |
| Text books: | | | | | |
| 1. Probability and Statistics (Schaum's Outline series) | | | | | |
| References: | | | | | |
| 1. Python Tutorial, Release 3.7.0 by Guido van Rossum and the Python development team, 2018 | | | | | |
| 2. Python Data Analytics, by Fabio Nelli, Apress | | | | | |
| E-books: | | | | | |
| 1. https://colab.research.google.com/drive/1n1Oiz28iErVCNrB0wy3jT_0re0xRACkE?usp=sharing | | | | | |
| 2. https://colab.research.google.com/drive/1LqNaeegWDvO8LPlf4UeodI_jyfU09fQn?usp=sharing | | | | | |

MOOCS:

Essential Mathematics for Machine Learning ; By Prof. Sanjeev Kumar, Prof. S. K. Gupta | IIT Roorkee

| Course Title | CULTURAL ACTIVITY | | | | |
|---|-------------------|---------|---|-------|----|
| Course Code | 22ET3NCCLA | Credits | 0 | L-T-P | -- |
| <p>The college provides opportunity for students to associate with a large number of Cultural activities.</p> | | | | | |
| <p>Sample Affinity groups are listed below:</p> | | | | | |
| <ul style="list-style-type: none"> • Ninaad- Indian Music Team • The Grove House- The Western Music Team • Paramva- The Contemporary DanceTeam • Danz Addix- The Western Dance Team • Panache- The Fashion Team • Pravrutti- The Theatre Team • Photography Club • Chirantana- Kannada Sangha • Fine Arts Club • Inksanity- The Literary Club • Samskrithi Sambhrama – The Folk Dance Club • VAK- The MCEEing Club • Rotaract • Bullz Racing • TEDx BMSCE • Quiz Club | | | | | |
| <p>Students regularly associated with ANY one of the above activities, and certified by the concerned faculty in-charge, shall be awarded a Pass Grade in the Course.</p> | | | | | |
| <p>Students who are not associated with the above affinity groups, shall participate in cultural events organized by the department.</p> | | | | | |

IV Semester

| | | | | | |
|---|--|----------------|----------|--------------|--------------|
| Course Title | Complex Analysis, Probability And Statistical Methods | | | | |
| Course Code For Batch 2018-19 | 22MA4BSCPS | Credits | 3 | L:T:P | 2:1:0 |
| Pedagogy: 30 Lectures+ 10 Tutorial sessions | | | | | |
| Course Objectives: | | | | | |
| <ul style="list-style-type: none"> • Provide insight into applications of complex variables, conformal mapping arising in potential theory, quantum mechanics, heat conduction and field theory. • Special functions familiarize the Power series solution required to analyse the Engineering Problems. • To have insight into Statistical methods, Correlation and regression analysis. • To develop probability distribution of discrete and continuous random variables, Joint probability distribution occurs in digital signal processing, design engineering and microwave engineering. | | | | | |
| Teaching-Learning Process (General Instructions) | | | | | |
| <p>These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.</p> <ul style="list-style-type: none"> • In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills. • State the need for Mathematics with Engineering Studies and Provide real-life examples. • Support and guide the students for self-study. • You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress. • Encourage the students for group learning to improve their creative and analytical skills. • Show short related video lectures in the following ways: <ul style="list-style-type: none"> ✓ As an introduction to new topics (pre-lecture activity). ✓ As a revision of topics (post-lecture activity). ✓ As additional examples (post-lecture activity). ✓ As an additional material of challenging topics (pre-and post-lecture activity). <p>As a model solution for some exercises (post-lecture activity).</p> | | | | | |

MODULE - I

Review of a function of a complex variable, limits, continuity and differentiability. Analytic functions: Cauchy-Riemann equations in Cartesian and polar forms and consequences. Construction of analytic functions by Milne-Thomson method, Problems.

Complex integration: Line integral of a complex function, Cauchy's theorem and Cauchy's integral formula and problems.

Self-Study: Conformal transformations: Discussion of transformations: $w = z^2$, $w = e^z$, $w = z + 1/z$ ($z \neq 0$). Bilinear transformations- Problems (RBT Levels: L1, L2 and L3) Pedagogy: Chalk and Board, Problem based learning

MODULE - II

SPECIAL FUNCTIONS:

Series solution of Bessel's differential equation leading to $J_n(x)$ Bessel's function of the first kind, Properties, Orthogonality of Bessel's functions. Series solution of Legendre's differential equation leading to $P_n(x)$ Legendre polynomials. Rodrigue's formula (without proof), problems.

Self Study: Recurrence Relations.

(RBT Levels: L1, L2 and L3) Pedagogy: Chalk and Board, Problem based learning

MODULE - III

STATISTICAL METHODS:

Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation, problems. Regression analysis, lines of regression, problems. Curve Fitting: Curve fitting by the method of least squares, fitting the curves of the forms $y = ax + b$, $y = ax^b$ and $y = ax^2 + bx + c$.

Self-study: Angle between two regression lines, problems

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and Board, Problem based learning

MODULE - IV

PROBABILITY DISTRIBUTIONS:

Review of basic probability theory. Random variables (discrete and continuous), probability mass and density functions. Mathematical expectation, mean and variance. Binomial, Poisson and normal distributions- problems (derivations for mean and standard deviation for Binomial and Poisson distributions only)-Illustrative examples.

Joint probability distribution: Joint Probability distribution for two discrete random variables, expectation, covariance and correlation.

Self Study: Hiper Geometric Distribution, Exponential Distribution,

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and Board, Problem based learning

MODULE - V

STATISTICAL INFERENCE:

Sampling Theory: Introduction to sampling distributions, standard error, Type-I and Type-II errors. Test of hypothesis for means, student's t-distribution, Chi-square distribution as a test of goodness of fit.

Self Study: Paired t -test, F-test for ratio of variance.

(RBT Levels: L1, L2 and L3)

Pedagogy: Chalk and Board, Problem based learning

TEXT BOOKS:

- Higher Engineering Mathematics, B. S. Grewal Khanna Publishers 44th Edition, 2017.
- Advanced Engineering Mathematics, E. Kreyszig: John Wiley & Sons, 10th Ed. (Reprint), 2016.

REFERENCES:

- Advanced Engineering Mathematics C. Ray Wylie, Louis C.Barrett McGraw-Hill 6th Edition 1995.
- Higher Engineering Mathematics B. V. Ramana McGraw-Hill 11th Edition,2010.
- A Text-Book of Engineering Mathematics N. P. Bali and Manish Goyal Laxmi Publications 2014.
- Advanced Engineering Mathematics Chandrika Prasad and Reena Garg Khanna Publishing, 2018.

E books and online course materials

- <http://nptel.ac.in/courses.php?disciplineID=111>
- [http://www.class-central.com/subject/math\(MOOCs\)](http://www.class-central.com/subject/math(MOOCs))
- <http://academicearth.org/>
- <http://www.bookstreet.in>.
- VTU EDUSAT PROGRAMME – 20
- VTU e-Shikshana Program

| | | | | | |
|---|------------------------------------|----------------|----------|--------------|--------------|
| Course Title | Signal and Systems: Digital | | | | |
| Course Code | 22ET4PCSSD | Credits | 3 | L:T:P | 2:1:0 |
| Pedagogy: 30 Lectures+ 10 Tutorial sessions | | | | | |
| MODULE - I | | | | | |
| DIGITAL SIGNALS AND SYSTEMS | | | | | |
| Digitals Signals; definition and classification; Elementary signals; Signal transformation of independent and dependent variable; Random Signals; Pseudo Random Binary Sequence (PRBS); System definition; system classification; The Linear Time Invariant (LTI) system; Testing a given system for linearity; | | | | | |
| SAMPLING THEOREM | | | | | |
| Sampling Theorem; statement and proof; converting a given analog signal to a digital signal; ideal sampling; natural sampling; sampling of band-pass signals; | | | | | |
| MODULE - II | | | | | |
| SIGNALS: TIME DOMAIN REPRESENTATION | | | | | |
| Impulse response; Properties of impulse response; Impulse response of a given difference equation; The convolution sum; Methods of evaluating the convolution sum; Linear Convolution; Circular Convolution; properties of convolution sum; Correlation; Auto- correlation; Cross-correlation; Representation of signals in terms of a set of orthogonal functions; Orthonormal and Orthogonal signals; Gold Sequence | | | | | |
| MODULE - III | | | | | |
| SIGNALS: FREQUENCY DOMAIN REPRESENTATION | | | | | |
| The Discrete Time Fourier Transform (DTFT); Discrete Fourier Transform (DFT); Properties of DFT; Methods of evaluating the DFT – overlap-add; overlap-save; The Fast Fourier Transform; Decimation in Time – Fast Fourier Transform; Decimation in Frequency – Fast Fourier Transform; Spectrum of analog signal; Spectrum of sampled signal; aliasing; up-sampling; down-sampling; | | | | | |
| MODULE - IV | | | | | |
| LTI SYSTEMS: REPRESENTATION and CLASSIFICATION | | | | | |
| The constant coefficient difference equation; Impulse Response; Relating the Discrete Time Fourier Transform to the Z Transform; System Transfer Function; Pole-zero plot; Power Spectral Density; Frequency Response | | | | | |
| LTI SYSTEMS: DESIGN and ANALYSIS | | | | | |
| Ideal Filters; Finite Impulse Response (FIR) Filters; Design of FIR Filters using the Window Method; Design of FIR Filters using the Frequency Sampling Method; Implementation structure for FIR Filters | | | | | |

– Linear Phase structure; Frequency Sampling Structure;

FIR filters for One-dimensional signals (data, bio - signals, audio signals); Spectrum of the signal; Filter specifications for desired output; design filter to meet specifications; obtain the filtered output; Rate conversion of an audio signal;

MODULE - V

LTI SYSTEMS: APPLICATIONS

Infinite Impulse Response (IIR) Filters; Design of IIR Butterworth Filters using Impulse Invariant method; Design of IIR Butterworth Filters using the Bilinear Transform; Implementation structure for IIR Filters- Direct Form-I and Direct Form-II;

Introduction to wavelet transforms; wavelet transforms for data compression; de-noising;

IIR filters for One-dimensional signals (data, bio - signals, audio signals); Spectrum of the signal; Filter specifications for desired output; design filter to meet specifications; obtain the filtered output; Rate conversion of an audio signal;

Two-dimensional signal; Image; Spectrum of the image; Low-pass filtered image; high-pass filtered image; compression of an image; de-noising an image;

Course Outcomes:

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

| | | | |
|------------|---|---------------------------------------|----------------------------|
| CO1 | Ability to obtain the specified parameter/representation for the given discrete time signal/system using time domain, frequency domain and transform domain representation | PO1 (3) | PSO1(3) PSO3(3) |
| CO2 | Ability to analyse and classify the given signal/system using time domain, frequency domain and transform domain representation | PO2(3) | |
| CO3 | Ability to design digital filters to meet given specifications, and use the filter for 1-dimensional signals, audio and 2-dimensional images | PO3(3) | |
| CO4 | Ability to conduct investigation through implementation of the experiment, to represent/model the given signal/system | PO4(1) PO5(2) | |
| CO5 | Ability to design, formulate, implement and demonstrate an application of signal processing identified during the seminar of the earlier Course on ‘Signals and Systems: Analog’, through a Mini-project using Python | PO5(2) | |
| CO6 | Ability to make an oral presentation of the application digital Signal Processing for representation/ transmission of audio /image/ video/ data signal for benefit of society | PO6(1) PO10(1) PO12(1) | |

Text books:

1. **Theory and application of Digital signal processing**, Lawrence R Rabiner and Bernard Gold, Prentice Hall, Easter Economy Edition
2. **Digital Signal Processing Concepts using Python**, B Kanmani, ISTE-WPLP, (*Book proposal accepted, work-in-progress*)

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. Schaffer, 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. The scientist and engineers guide to DSP by Steven smith
2. <http://www.dspguide.com/pdfbook.htm>

MOOCS:

Sampling Theorem Part A: <https://youtu.be/zJ-e3UxXSeo>

Sampling Theorem Part B: <https://youtu.be/Rbu7laRN6dM>

Sampling Theorem Part C: <https://youtu.be/sHCuHoibQAs>

Sampling Theorem Part D: <https://youtu.be/mtRwC1HPIno>

<https://bmsce.ac.in/home/contentView/Electronics-and-Telecommunication-Engineering/TE/83>

Laboratory Sessions: *Laboratory sessions shall include time-domain, frequency domain representation of signals; design and analysis of FIR and IIR Filters; use of the designed filter to pass a given input and obtain the corresponding output; Signals of both one-dimensional and two-dimensional shall be considered. The programming tool shall be Python (an open source programming tool)*

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|--|--|----------------|----------|--------------|--------------|
| Course Title | Control Systems | | | | |
| Course Code | 22ES4ESCST | Credits | 4 | L:T:P | 3:1:0 |
| Pedagogy: 40 Lectures+ 10 Tutorial sessions | | | | | |
| MODULE I | | | | | |
| <p>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.</p> | | | | | |
| MODULE II | | | | | |
| <p>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.</p> | | | | | |
| MODULE III | | | | | |
| <p>Stability Analysis: Concept of stability, RH criterion, applications of RH criterion with limitations. Root locus technique: Introduction to root locus concepts, Construction rules, Analysis of stability by root locus plot</p> | | | | | |
| MODULE IV | | | | | |
| <p>Frequency Response Analysis: Frequency domain specification, Polar plots, Nyquist plot, Stability Analysis using Nyquist criterion, Bode plots, GM and PM, Relative stability</p> | | | | | |
| MODULE V | | | | | |
| <p>State Variable Analysis: Concept of state variables, physical variable model, phase variable model, canonical model, obtaining transfer function from state model.</p> | | | | | |
| <p>List of experiments:</p> <ul style="list-style-type: none"> • Determine the overall transfer function of the a control system • Determine rise time, peak time, peak overshoot and settling time for the given transfer function. • To obtain and plot the Unit step, Unit ramp response of a closed loop control system. • To obtain Nyquist diagram for given transfer function. • Determine the root locus of the given characteristic equation for the given control system. • Determine gain margin, phase margin, gain crossover frequency and phase crossover frequency for the given control system. | | | | | |
| Design and analysis of controllers | | | | | |
| Course Outcomes: | | | | | |
| <i>At the end of the course, students will have the ability to</i> | | | | | |
| CO1 | Ability to define, understand and explain concepts related to linear control systems | | -- | | |
| CO2 | Ability to apply the concepts of control systems and signal processing to obtain the specified parameter/ system function | | PO1(3) | | PSO3(3) |
| CO3 | Ability to analyze the given linear control system and arrive at a suitable conclusion | | PO2(2) | | |

| | | | |
|-----|--|------------------|--|
| CO4 | Ability to conduct experiments to demonstrate concepts related to linear control systems using the engineering tool: Matlab/ Simulink | PO1(3) PO5(3) | |
| CO5 | Ability to design controllers to meet given specifications | PO3(2) PO5(2) | |

TEXT BOOKS:

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

REFERENCE BOOKS:

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

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>
<https://www.edx.org/course/>

| | | | | | |
|--|--------------------------------------|----------------|----------|--------------|--------------|
| Course Title | ARM Processor and Programming | | | | |
| Course Code | 22ES4PCAPP | Credits | 4 | L:T:P | 3:0:1 |
| Pedagogy: 40 Lectures+ 10 Practical sessions | | | | | |
| MODULE I | | | | | |
| Overview of computing systems: Basic structure of computers- function units of a computer, bus structure, performance of the processor, memory location and addresses, memory and I/O systems , basic processing unit, pipelining, computer peripherals | | | | | |
| MODULE II | | | | | |
| ARM Processor fundamentals -RISC and ARM Design philosophy, ARM core Dataflow model, programming model, processor states and operating modes, exceptions and interrupts, ARM pipeline, ARM instruction set, Assembler rules and Directives, load/store architecture, ARM-THUMB interworking, programming | | | | | |
| MODULE III | | | | | |
| Embedded C codes- overview of C compiler and optimization, Basic C data types, Local variable types, C looping and structures, Registrar allocation, function calls, pointer aliasing, Writing and optimizing assembly codes, mixing C and Assembly, programming, instruction scheduling | | | | | |
| MODULE IV | | | | | |
| Subroutines and stacks-introduction, stack, subroutines, passing parameters to Subroutines, Exception and interrupt handling- Vector Table, Exception priorities, link register offsets, interrupts. Interrupt handling schemes | | | | | |
| MODULE V | | | | | |
| Application of ARM controller LPC 2148: Memory map, memory and I/O mapped peripherals- ADC, DAC and UART, firmware and boot loader, introduction to Embedded Operating System | | | | | |
| List of Experiments: | | | | | |
| 1. Divide an 8-bit variable into two 4 bit nibbles and store one nibble in each byte of a 16 bit variable. Store the disassembled byte in memory location (pointed by result) 2. Compare 2 values stored in memory location and store the higher value in a memory location (pointed by result) 3. Write a program to add two 64-bit numbers and store the result in a memory location. 4. Add a series of 16-bit numbers stored in sequential location in memory (called Table)and store the result in memory 5. Find the factorial of a given number 6. Write an assembly language program using the ARM instruction set to find the largest in a series of numbers stored in memory. Store the largest number in a memory location 7. ALP to multiply two 16 bit binary numbers. 8. ALP to find the sum of first 10 integer numbers. 9. Write a program in C for the ARM processor to read data from the 8-bit on board DIP switch and display the value on the 8 LEDs 10. Write a program in C for the ARM processor to use the built in DAC to generate the following waveforms - square, ramp, triangle and sine 11. Write a program in C for the ARM processor to rotate the stepper motor in both directions. 12. Establish serial communication between the ARM kit and the PC and do the following: Send a character from the ARM kit to the serial terminal on the PC Send a character from the PC to the ARM Kit and display it on the LED, Send a character from the PC to the ARM Kit. The program on the ARM processor should add 2 to it and send it back to the PC | | | | | |

TEXT BOOKS:

1. Computer Organization and Architecture, Carl Hamacher, Zvonko Vranesic, McGraw-Hill,2001
2. ARM System Developer's Guide, Sloss, Symes, WrightMorgan Kaufmann Publishers, Elsevier,2005
3. ARM Assembly Language- Fundamentals and Techniques, William Hohl, CRC press, Taylor and Francis,2009

REFERENCE BOOKS:

- 1.Computer Organisation & Architecture , William Stallings, PHI , 2010
- 2.ARM System –on-Chip Architecture , Steve Furber, Second Edition, Pearson, 2010

E- books:

<https://www.pdfdrive.com/embedded-systems-introduction-to-arm-cortexm-m-microcontrollers-e176014882.html>

MOOCS:

1. https://onlinecourses.nptel.ac.in/noc20_cs15
2. <https://nptel.ac.in/courses/117106111>

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|--|---|----------------|----------|--------------|----------------|
| Course Title | Communication Systems-1 | | | | |
| Course Code | 22ET4PCCS1 | Credits | 4 | L:T:P | 3:0:1 |
| Pedagogy: 40 Lectures+ 10 Practical sessions | | | | | |
| MODULE I | | | | | |
| AMPLITUDE MODULATION: Introduction, AM: Time-Domain description, Frequency – Domain description. Generation of AM wave: square law modulator, switching modulator. Detection of AM waves: square law detector, envelop detector. Double side band suppressed carrier modulation (DSBSC): Time-Domain description, Frequency Domain representation, Generation of DSBSC waves: balanced modulator, ring modulator. Coherent detection of DSBSC modulated waves. | | | | | |
| MODULE II | | | | | |
| SINGLE SIDE-BAND MODULATION (SSB): Quadrature carrier multiplexing, Single side-band modulation, Frequency-Domain description of SSB wave. Phase discrimination method for generating an SSB modulated wave. Demodulation of SSB waves, VESTIGIAL SIDE-BAND MODULATION (VSB): Frequency – Domain description, Generation of VSB modulated wave, Time – Domain Canonical representation of VSB, Frequency translation, FDM: Frequency division multiplexing | | | | | |
| MODULE III | | | | | |
| ANGLE MODULATION (FM): Basic definitions, FM, narrow band FM, wide band FM, transmission bandwidth of FM waves, generation of FM waves: indirect FM and direct FM. Demodulation of FM waves, FM stereo multiplexing, Phase-locked loop Noise in FM receivers, FM threshold effect, Pre-emphasis and De-emphasis in FM. Figure of merit of FM . | | | | | |
| MODULE IV | | | | | |
| Block Diagram of Digital Communication System, TDM,Pulse-Digital Modulation: Elements of PCM, Noise in PCM systems, Quantization, Companding, T1 digital Hierarchy. Base-band Data transmission: Elements of binary PAM, Baseband shaping, Optimum transmitting and receiving filters, Correlative coding, Eye pattern, Examples: Line coding | | | | | |
| MODULE V | | | | | |
| Gram-Schmidt orthogonalization procedure, Matched filters, Properties of matched filters.Band-pass data transmission: Time and frequency domain representation of ASK, FSK,PSK;generation and detection; Performance analysis: power and bandwidth, bit error rate. | | | | | |
| <i>At the end of the course, the student will have the ability to,</i> | | | | | |
| CO1 | Ability to define, understand and explain concepts of modulation, demodulation, time and frequency domain representation of analog and digital communication systems. | | | | |
| CO2 | Ability to apply the knowledge of signal processing to obtain the time and frequency domain representation communication systems. | PO1 (3) | | | PSO2(1) |
| CO3 | Ability to analyze the concepts and related to analog and digital communication. | PO2(2) | | | |
| CO4 | Ability to conduct experiments to demonstrate concepts related to analog and digital communication using suitable electronic | PO5(3) | | | |

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|------------|---|---------------------------------|--|
| | components/Engineering Tool (Matlab). | | |
| CO5 | Ability to make an effective oral presentation on broadcast standards, contribution to society, impact on health, effect on environment. | PO10 (1) | |
| CO6 | Ability to perform in a team to build an AM/FM receiver using discrete components and demonstrate the live reception | PO4(1) PO5 (1) | |

LAB Experiments Part A: Using discrete components

- Analog filters;
- Generation and demodulation of AM, DSB-SC,
- Generation FM, pre-emphasis and de-emphasis
- Generation of SSB (using Multisim)
- Sampling Theorem verification
- Generation of PAM, PWM, PPM, PAM-TDM
- Generation of ASK, PSK
- Demodulation of ASK, FSK, PSK

TEXT BOOKS:

1. An Introduction to Analog and Digital Communication, Simon Haykins, John Wiley, 2003
2. Digital Communications By Simon Haykins –John Wiley 2003

REFERENCE BOOKS:

1. Modern digital and analog Communication systems B. P. Lathi, 3rd ed 2005 Oxford University press.
2. Communication Systems, Harold P.E, Stern Samy and A Mahmond, Pearson Edn, 2004.
3. Communication Systems: Singh and Sapre: Analog and digital TMH 2nd , Ed 2007
4. Analog and Digital communications by Simon Haykins –John Wiley

MOOCs:https://swayam.gov.in/nd1_noc19_ee46/preview

| Course Title | SEMINAR-INTERNSHIP INVOLVING SOCIAL ACTIVITY | | | | |
|--|---|---------|---|-------|---|
| Course Code | 22ET4SRIN1 | Credits | 1 | L:T:P | 0:0:1 |
| During semester breaks, students are encouraged to engage in community service, through an NGO or as an individual. The duration of the activity shall be of 4 to 6 week duration. The work carried out in the semester break is assessed through an oral seminar accompanied by a written report. It is expected that this association will motivate the student to develop simple Electronic (or other) products to make their life comfortable, through suitable projects in later semesters. | | | | | |
| <i>At the end of the course, the student will have the ability to,</i> | | | | | |
| CO1 | Engage in community service | | | | PO6 (2) |
| CO2 | Prepare the project report, three minute video and the poster of the work | | | | PO10 (3) |
| CO3 | Identify and specify an engineering product that can make their life comfortable | | | | PO2 (1) |
| CO4 | Prepare a business plan for a commercial venture of the proposed product, together with complying to relevant norms | | | | PO7 (2) PO8 (3) PO11 (2) |
| CO5 | Identify the community that shall benefit from the product | | | | PO6 (2) |

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|---|--|---|----------------|--------------|--------------|
| Course Title | Data Science using Python | | | | |
| Course Code | 22ET4AEDPY | Credits | 1 | L:T:P | 0:1:0 |
| Pedagogy: 15 Lectures | | | | | |
| MODULE I | | | | | |
| Introduction to Data Types in Python; Numpy; Matplotlib; Pandas; Functions; Probability and Statistics. | | | | | |
| MODULE II | | | | | |
| Introduction to Machine learning concepts – Bias/variance, over-fitting and train/test splits. Types of Machine learning – Supervised, Unsupervised, Semi-supervised, Classification and Regression algorithms, | | | | | |
| MODULE III | | | | | |
| Regression algorithms, Linear Regression, Logistic Regression algorithms, the concept, and implementation using Python. | | | | | |
| MODULE IV | | | | | |
| The Naïve Bayes Classifier for Discrete and Continuous Input; Decision Trees (for Discrete and Continuous Input and Output); the concept, and implementation using Python. | | | | | |
| MODULE V | | | | | |
| Kmeans Clustering; Regularization; Introduction to Neural Networks; | | | | | |
| Course Outcomes: | | | | | |
| <i>At the end of the course, students will have the</i> | | | | | |
| CO1 | Ability to develop the Python code for a given Probability Distribution, and compute statistical averages for given data | PO1 (3) PO5 (3) | PSO3(3) | | |
| CO2 | Ability to analyse the Python code to obtain the mathematical equation | PO2(3) PO5 (3) | | | |
| CO3 | Ability to develop the code for representing the given mathematical equation in the text editor of Python, using relevant Latex code | PO10(2) PO5 (3) | | | |
| CO4 | Ability to develop the Python code for the Data Science concept from the mathematical equation and verify the result using available built-in functions | PO3(3) PO4(3) PO5(3) | | | |
| TEXT BOOKS: 1. Data science from scratch (first principles with python) by Joel Grus, Oreilly, April 2015, 1 st edition. | | | | | |
| REFERENCE BOOKS: Doing data science (straight talk from the front line) by Rachel Schutt and Cathy O Neil, Oreily, October 2013, 1 st edition. | | | | | |
| E-books: Python Data Science Handbook By Jake VanderPlas; https://jakevdp.github.io/PythonDataScienceHandbook/ | | | | | |
| MOOCS: Python for Data Science , By Prof. Ragunathan Rengasamy , IIT Madras, nptel https://onlinecourses.nptel.ac.in/noc22_cs32/preview | | | | | |

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|----------------|------------------------------|--------------------|---------------------|------------------------|-------------|
| Course | Environmental studies | Course Code | 22CV3/4HSEVS | SEE QP Duration | 1Hr 30 Mins |
| Credits | 01 | L:T:P | 1: 0 : 0 | SEE marks | 50 |

COURSE OBJECTIVE: The students will be able to develop a sense of responsibility about the environment, natural resources, their conservation and Understand the concept, structure and function of different ecosystems and the ill effects of environmental pollution and other environmental issues like population growth, Acid rain, global warming etc.,

COURSE OUTCOME : Student can an ability to

CO1: Discuss the components and impacts of human activities on environment.

CO2: Apply the environmental concepts for conservation and protection of natural resources.

CO3: Identify and establish relationship between social, economic and ethical values from environmental perspectives.

UNIT I

Introduction to Environment

- Definition, about the Earth, Earth's Structure i.e. Atmosphere and its parts, Hydrosphere, Lithosphere and Biosphere.
- Ecology & Ecosystem, Balanced ecosystem, types of Ecosystem.

03 Hrs

UNIT II

Human Activities on Environment

- Human activities - Food, Shelter, Economic and Social Security.
- Effects of Human activities on Environment:
 - i) Agriculture,
 - ii) Housing,
 - iii) Industries,
 - iv) Mining and
 - v) Transportation activities.
- Environmental Impact Assessment (E I A)
- Sustainable development

03 Hrs

Unit-III**Natural Resources**

- Definition, Renewable and Non-Renewable sources.
- Major Natural Resources are -
 - Water resources, its availability, quality, water borne & water induced diseases,
 - Mineral resources, classification, uses in various Industries as byproducts.
 - Forest resources – causes & consequences of deforestation, various afforestation programs.
- Conventional and Non-conventional energy resources -
 - Hydroelectric, Wind power, Solar, Biogas, geothermal energy.
 - Fossil fuel based energy resources – Coal, Oil & Gas, Nuclear power
 - Hydrogen as an alternate future sources of energy.

03 Hrs

UNIT IV

Introduction, following are few types of pollutions to study -

- Water pollution - definition, types, sources, effects and control of water pollution.
- Land pollution - definition, types, sources, effects, Solid waste management.
- Noise pollution - definition, sources, effects & control of noise pollution.
- Air pollution - definition, sources, effects & control of air pollution.

03 Hrs

UNIT V**Current Environmental Issues & Importance**

- Population growth, effects & Control, Climatic changes,
- Global warming, Acid rain, Ozone layer depletion and its effects.
- Environmental protection – initiatives by Government and non-Govt. Organizations (NGO's), Role of Legal aspects.
- Environmental Education, Women education.

03 Hrs

Total contact hours = 15 (Weekly 1 Hr.)

C I E Marks: Conduct 3 Tests, considering best of 2. The pattern of Test paper consists of two parts. Part-A consists of 20 MCQs for 1 mark each; Part-B consists of 3 descriptive questions, 10 marks each. Student should answer 2 full questions from part-B. Two quizzes, each quiz is for 5 marks covering full syllabus.

TOTAL C I E MARKS: 20+20+10=50 MARKS

| | | | |
|--|-------------------|--------------------|--|
| Course Code | 22MA4HSCPH | Course Name | Constitution of India, Professional Ethics and Human Rights |
| Credits | 01 | L-T-P-S | 1-0-0-0 |
| Pedagogy: 15 Lectures | | | |
| MODULE I | | | |
| Introduction to 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 | | | |
| MODULE 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. | | | |
| MODULE 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. | | | |
| MODULE IV | | | |
| Human Rights | | | |
| Human Rights – Meaning and significance, Types Human Rights, Powers and Functions of National and State Human Rights Commission of India. Human rights in constitution of India | | | |
| MODULE 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. | | | |

Course Outcomes:

Students will:

1. Recognize the significance of the Indian Constitution as the supreme legal authority.
2. Analyse human rights theories and concepts.
3. Apply the principles of moral obligations and duties to safeguard the public's welfare and safety.

Course Outcomes:

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

| | | | |
|------------|--|--------------------|------------------|
| CO1 | Recognize the significance of the Indian Constitution as the supreme legal authority. | Remember | PO6, PO12 |
| CO2 | Analyse human rights theories and concepts. | Analyse | PO6, PO12 |
| CO3 | Apply the principles of moral obligations and duties to safeguard the public's welfare and safety. | Application | PO8, PO12 |

TEXT BOOKS:

1. "An Introduction to Constitution of India and Professional Ethics" by Merunandan a. 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.
- 3.

REFERENCE BOOKS:

1. "V.N. Shukla's Constitution of India" by Prof (Dr.) Mahendra Pal Singh (Revised), EasternBook 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 Books:

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 Mohd Suhaib, 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.

| | | | | | |
|---|--------------------------|----------------|----------|--------------|-----------|
| Course Title | Physical Activity | | | | |
| Course Code | 22ET4NCPYA | Credits | 0 | L-T-P | -- |
| <p>The college provides opportunity for students to associate with a large number of physical activities.</p> <p>Sample activities are listed below:</p> <ul style="list-style-type: none"> • Civil Defense/ Self-defense through Karate • NCC • Sports for Beginners Badminton/ Kho-Kho/ Chess/ Net Ball/ Football/ Table Tennis/ Handball/ Cricket/ Hockey/ Volleyball/ Kabaddi/ Basket Ball/Throw Ball • Sports for Regular Players: Tennis / Athletics / Ball Badminton / Baseball / Billiards & Snookers / Body Building / Roller Skating / Rugby / Softball / Swimming / Yachting / Gymnastic / Archery / Cycling / Equestrian / Fencing / Golf / Karate / Kayaking & Canoeing / Power-lifting / Rowing / Shooting / Squash / Weight Lifting / Boxing / Wrestling / Judo <p>Students regularly associated with ANY one of the above activities, and certified by the concerned faculty in-charge, shall be awarded a Pass Grade in the Course.</p> <p>Students who are not associated with the above affinity groups, shall participate in the events organized by the department:</p> <ul style="list-style-type: none"> • Yoga for Beginners • Full/Half-Marathon | | | | | |

V Semester

| Course Title | ELECTROMAGNETICS | | | | |
|--|------------------|---------|---|------------------------|-------|
| Course Code | 22ET5PCEM1 | Credits | 4 | L:T:P | 3:1:0 |
| <p>Prerequisites: The knowledge of following subjects is essential to understand this subject:</p> <ol style="list-style-type: none"> 1. Calculus-Based Physics in Electricity and Magnetism. 2. Analytic Geometry and Calculus II including Vector Analysis and Vector Calculus. 3. Differential Equations; Calculus III including Partial Derivatives, Double and Triple Integrals, Vector Fields, Stoke's Theorem and Linear Algebra. <p>Objectives: The purpose of the course is to facilitate the learners to:</p> <ul style="list-style-type: none"> • Appreciate the importance of vectors, vector calculus, and orthogonal coordinate systems in Engineering Problems. • Acquire the knowledge of Coulomb's law, Gauss' law, Maxwell's equations, electric field boundary conditions, and electrostatic potential, in basic electric field and potential calculations, BiotSavart's and Ampere's laws, magnetic field boundary conditions and vector magnetic potential. • Improve their Mathematical thinking and acquire skills required for Electromagnetics | | | | | |
| MODULE I | | | | [8Hr L + 2Hr T] | |
| 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), Gauss' Law, Application, Divergence and Divergence Theorem | | | | | |
| MODULE II | | | | [8Hr L + 2Hr T] | |
| Energy and Potential: Energy spent in moving charge, Definition of Potential Difference (PD), PD due to Point Charge and System of Charge, Energy Density, Current and Current Density, Continuity of Current | | | | | |
| MODULE III | | | | [8Hr L + 2Hr T] | |
| Conductor and Dielectric properties, Boundary conditions, Poisson's and Laplace's equations: Derivations of Poisson's and Laplace's Equations, solution of Poisson's and Laplace for Single Variables, Capacitance of different configurations using Laplace's equation. | | | | | |
| MODULE IV | | | | [8Hr L + 2Hr T] | |
| 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 different current element, Inductance and Mutual Inductance Magnetic Boundary Condition. | | | | | |
| MODULE V | | | | [8Hr L + 2Hr T] | |
| 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 Theorem.

MODULE Choice: MODULE-I and MODULE-V

TEXT BOOKS:

1. Engineering Electromagnetics H Hayt, J A Buck, MJaleelAkhtar Tata McGraw-Hill, 8th Edition, 2014.
2. Electromagnetics, Schaum's Outline series Joseph A Ediminister Tata McGraw-Hill, revised second Edition, 2014.

REFERENCE BOOKS:

1. Electromagnetics with Applications, John Krauss and Daniel A Fleisch, McGraw-Hill, 5th Edition, 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 Electromagnetics,” Oxford University Publication 2014.

E-References:

1. <https://open.umn.edu/opentextbooks/textbooks/532>

e-Learnings:

1. https://onlinecourses.nptel.ac.in/noc21_ee83/preview
2. https://onlinecourses.nptel.ac.in/noc21_ph05/preview

Course Outcomes: At the end of the course on **Electromagnetics**, the student will have the

| | | | |
|-----|--|------------------------------|---------|
| CO1 | Ability to define, understand, and explain concepts of static and time varying Electric and Magnetic Fields, Maxwell’s equations, wave propagation in different media | -- | PSO3(1) |
| CO2 | Ability to apply various properties/ laws/theorems of Electric and Magnetic Fields to obtain the specified parameter | PO1(3) | |
| CO3 | Ability to analyze the given static and time varying Electric and Magnetic Fields to arrive at a suitable solution | PO2(3) | |
| CO4 | Ability to develop the code in any programming language to demonstrate specified concept (s) of static and time varying Electric and Magnetic Fields | PO3(1) PO5(1) PO12(1) | |
| CO5 | Ability to engage in independent study and make an oral presentation on the applications/ hazards of Electromagnetic radiation | PO6(1) PO10(1) PO12(1) | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | | | | | | | | | | | | | - |
| CO2 | 3 | | | | | | | | | | | | 3 |
| CO3 | | 3 | | | | | | | | | | | 3 |
| CO4 | | | 1 | | 1 | | | | | | | 1 | 1 |
| CO5 | | | | | | 1 | | | | 1 | | 1 | 1 |

| | | | | | |
|--|---|----------------|----------------------------|--------------|--------------|
| Course Title | SIGNAL PROCESSING FOR MULTIMEDIA | | | | |
| Course Code | 22ET5PCSPM | Credits | 3 | L:T:P | 2:1:0 |
| Prerequisites: Signals and Systems: Analog, Signals and Systems: Digital | | | | | |
| Objectives: The purpose of the course is to facilitate the learners to: <ul style="list-style-type: none"> • Gain fundamental knowledge in understanding the basics of different multimedia networks and applications. • Understand digitization principle techniques required to analyse different media types. • Analyse processing and compression techniques required to compress text and image. • Analyse processing and compression techniques required to compress audio and video. | | | | | |
| MODULE - I | | | [5 Hr. L + 2 Hr. T] | | |
| Fundamentals of Multimedia Communication: Introduction, multimedia information representation, multimedia networks: telephone networks, data networks, broadcast television networks, ISDNs, broadband multiservice networks, multimedia applications: interpersonal communications, interactive applications over internet, entertainment applications. Multimedia Information Representation: Media types, communication modes, network types, multipoint conferencing: centralized, decentralized and hybrid modes. | | | | | |
| MODULE - II | | | [6 Hr. L + 2 Hr. T] | | |
| Text Representation and Compression: Text representation, unformatted text, formatted text, Hypertext, Code word generation of unformatted text, Text compression principles, Entropy encoding, Source encoding, Transform encoding, Text compression principles: Adaptive Huffman coding, Arithmetic coding, LZW coding. | | | | | |
| MODULE - III | | | [5 Hr. L + 2 Hr. T] | | |
| Image Representation and Compression: Image representation, Graphics, Digitized documents, Digitized Pictures, Raster scan principles, three color image capture methods, Path length calculations, JPEG: Image Preparation, Block Preparation, DCT, Quantization, Entropy encoding, Frame builder, Basics of JPEG decoder, Introduction to Graphics Interchange Format, TIFF and JPEG 2000. | | | | | |
| MODULE - IV | | | [5 Hr. L + 2 Hr. T] | | |
| Audio Processing and Compression: PCM Speech, CD quality audio, Synthesized audio, MIDI, MIDI versus Digital Audio, Adding sound to multimedia projects, Music CDs, Adaptive predictive coding, Linear predictive coding, Prediction error calculation for LPC, Dolby Audio coders. | | | | | |
| MODULE - V | | | [5 Hr. L + 2 Hr. T] | | |
| Video Processing: Introduction to Video compression: Broadcast TV, Color signals, Luminance and Chrominance, Signal bandwidth, digital video: 4:2:2 format, 4:2:0 format, HDTV format, Video compression techniques: Video Compression principles: Frame Types, Introduction to MPEG. | | | | | |

Animation: Pixels: Graph paper, Simple shapes, Grayscale color, RGB Color, Color Transparency. Creating **synthetic videos** using Midjourney (an introduction)

Processing: The Processing Application, Sketchbook, Coding, The First Sketch.

MODULE Choice: MODULE-II and MODULE-IV

TEXT BOOKS:

1. **Multimedia Communications: Applications, Networks, Protocols, and Standards** – Fred Halsall, Pearson Education, Fourth Impression 2009.
2. Learning Processing – Daniel Shiffman, Elsevier, Second Edition, 2015.

REFERENCE BOOKS:

1. Data Compression: The Complete Reference – David Salomon, Springer, Fourth Edition, 2007.
2. Multimedia in Practice: Technology and Applications – Judith Jeffcoate, Pearson Education, Fifth Impression 2011.

Course Outcomes: At the end of the course on **SIGNAL PROCESSING FOR MULTIMEDIA**, the student will have the

| | | | |
|-----|--|------------------|---------|
| CO1 | Ability to understand and explain concepts of multimedia communication. | -- | PSO3(3) |
| CO2 | Ability to apply knowledge of analog and digital communication to various multimedia data, networks and applications. | PO1(3) | |
| CO3 | Ability to analyze various communication networks, audio / speech/ video frames. derive text encoding, evaluate different image compression schemes. | PO2(3) | |
| CO4 | Ability to function effectively as an individual and as a team member to conduct experiments using modern engineering tool MATLAB / LabVIEW for a given multimedia application/problem statement. | PO5(1) PO9(1) | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | | | | | | | | | | | | | - |
| CO2 | 3 | | | | | | | | | | | | 3 |
| CO3 | | 3 | | | | | | | | | | | 3 |
| CO4 | | | | | 1 | | | | 1 | | | | 1 |

| | | | | | |
|--|--|----------------|----------|--------------|--------------|
| Course Title | COMPUTER COMMUNICATION NETWORKS | | | | |
| Course Code | 22ET5PCCCN | Credits | 4 | L-T-P | 3:0:1 |
| Prerequisites: Basics of Communication | | | | | |
| Objectives: Introduction to analysis and design of computer and communication networks through understanding the network layered architecture and the protocol stack and by conducting hands-on programming and lab activities. | | | | | |
| MODULE-I | | | | 8 Hr. | |
| Introduction: Data communication, Networks, Network Models: The OSI Model, Layers in the OSI model, TCP/IP Protocol Suite, addressing; Physical Layer and media: Transmission media – Guided media, switching – Introduction, Circuit Switched networks, Datagram Networks, Virtual Circuit Networks. | | | | | |
| MODULE-II | | | | 8Hr. | |
| Data Link Layer :Data Link Control (DLC): Framing, Flow and Error control, Protocols, Noisy Channels; Multiple Access: Random Access, Controlled Access ; WireLANs: Ethernet – IEEE Standards, Standard Ethernet; Wireless LANs - IEEE802.11, Bluetooth. | | | | | |
| MODULE-III | | | | 8 Hr. | |
| Data Link Layer: Connecting LANs, Backbone networks and Virtual LANs: Connecting Devices, Backbone Networks, Virtual LANs Network layer: Logical Addressing: IPv4 addresses, IPv6 Addresses; Internet Protocol: Internetworking, IPv4, IPv6, Transition from IPv4 to IPv6; Address Mapping, ICMP | | | | | |
| MODULE-IV | | | | 8 Hr. | |
| Network Layer: Delivery, Forwarding, Unicast Routing Protocols, Multicast Routing Protocol(without application) Transport layer: Process to process delivery, User Datagram Protocol(UDP),TCP, SCTP. | | | | | |
| MODULE-V | | | | 8 Hr. | |
| Congestion control & QoS: Data traffic, Congestion, Congestion control, Quality of Service, Techniques to improve QoS | | | | | |
| Application layer: Domain Name system: Name space, Domain Name space, Distribution of name space, DNS in the internet, Resolution ; Remote logging, Electronics mail and File transfer: Electronic mail, File transfer ; WWW and HTTP: Architecture, web documents , HTTP | | | | | |
| Lab Experiments: | | | | | |
| Study of different types of Network cables and Practically implement the cross-wired cable and | | | | | |

| |
|---|
| straight through cable using clamping tool |
| Study of Network Devices in Detail |
| Configure network with the following topologies and analyze i) BUS ii) RING iii) Fully connected mesh topology, disable a node in each of the topologies and find the changes. i) Total unicast message sent ii) Total unicast message received iii) UDP: broadcast throughput at transport layer |
| Study of network IP |
| Connect the computers in Local Area Network |
| Study of basic network command and Network configuration commands. |
| Configure a Network topology using software |
| Performing an Initial Switch Configuration |
| Performing an Initial Router Configuration |
| Simulate Ethernet LAN with 4 nodes , apply relevant TCP and UDP applications and determine i) The number of data packets sent by UDP and TCP ii) Number of periodic updates sent by the routing algorithm iii) Number of ACK packets sent iv) Average jitter of UDP and TCP |
| Module Choice: Module II and Module III |
| Text books: 1. Data Communication and Networking, Behrouz Forouzan, 4 th Edition, Tata Mcgraw Hill |
| Reference books: 1.Computer Networks, Andrew S Tanenbaum, 3 rd Edition, PHI 2.J.F. Kurose and K. W. Ross, “Computer Networking – A top down approach featuring the Internet”, Pearson Education, 5th Edition |
| e-Learning : 1. https://onlinecourses.nptel.ac.in/noc22_ee61/ 2. https://ocw.mit.edu/courses/6-263j-data-communication-networks-fall-2002/ |

Course Outcomes: At the end of the course on **Computer Communication networks**, the student will have the

| | | | |
|-----|--|---|---------|
| CO1 | Explain the concepts of computer communication networks | - | PSO3(2) |
| CO2 | Apply the concepts of communication fundamentals to obtain the solution for specified parameters | PO1(3) | |
| CO3 | Analyse the given network systems parameters and arrive at suitable conclusions | PO2(2) | |
| CO4 | Design an network system to demonstrate networking concepts using the hardware and software engineering tool: Qualnet / Matlab/packet tracer | PO3(1) PO5(2) PO9(1) | |
| CO5 | Demonstrate and Implement network concepts using suitable computer communication network parameters | PO5(2) PO8 (1) PO10(1) PO12(1) | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | 1 | - | 2 | - | - | - | 1 | - | - | - | 2 |
| CO5 | - | - | - | - | 2 | - | - | 1 | - | 1 | - | 1 | 2 |

| | | | | | |
|---|--------------------------------|----------------|----------|--------------|--------------|
| Course Title | COMMUNICATION SYSTEMS-2 | | | | |
| Course Code | 22ET5PCCS2 | Credits | 4 | L-T-P | 3:0:1 |
| Prerequisites: Communication Systems-1 | | | | | |
| Objectives: | | | | | |
| <ul style="list-style-type: none"> The course aims at introducing information theory and the practical aspects of data compression and error-control coding. The theoretical concepts are illustrated using practical examples related to the effective storage and transmission of digital and analog data. Recent developments in the field of channel coding are also discussed (Turbo-codes). The goal of the course is to introduce the basic techniques for reasoning under uncertainty as well as the computational and graphical tools which are broadly used in this area. The theoretical course is complemented by a series of laboratories, in which the students can simulate using various software tools for data compression, error-correction | | | | | |
| MODULE-I | | | | 8 Hr. | |
| Introduction, Measure of information, (Entropy) Average information content of symbols in long independent sequences, Joint Entropy and conditional entropy, Mutual information, Relationship between entropy and mutual information, Mark-off statistical model for information source, Entropy and information rate of mark-off source. Problems | | | | | |
| MODULE-II | | | | 8Hr. | |
| Encoding of the source output, Kraft inequality, Noiseless coding Theorem, Shannon's encoding algorithm, Shannon's Fano encoding algorithm, Huffman coding, problems. | | | | | |
| Discrete communication channels: Representation of channels Channel Capacity, Shannon's Theorem on channel capacity, Channel efficiency, symmetric channel Binary symmetric channel Binary Erasure channel, Cascaded channel, problems | | | | | |
| MODULE-III | | | | 8 Hr. | |
| Introduction, Types of errors, Types of codes : Linear Block Codes: Matrix description, Encoding and syndrome circuits, Syndrome calculation circuit, Hamming weight, Hamming distance, Design of an hamming code, Error detection and correction, Standard arrays and look up table for decoding, Decoding circuit for Linear block codes, problems | | | | | |
| Binary Cyclic Codes: Algebraic structures of cyclic codes, properties, Systematic and non-systematic Encoding using an (n-k) bit shift register, Syndrome calculation circuit, Problems | | | | | |
| MODULE-IV | | | | 8 Hr. | |
| Introduction to Convolution Codes, Encoder for Convolution Codes using Time domain approach, Transform domain approach, State Diagram and code trees, Trellis structure, Viterbi Decoding, Introduction to Turbo Codes | | | | | |

| MODULE-V | 8 Hr. |
|---|-------|
| <p>Band-pass data transmission: Time and frequency domain representation of DPSK, QPSK; generation and detection; Performance analysis: power and bandwidth, bit error rate. Introduction to OFDM, MSK, GMSK, Need for Spread Spectrum Modulation. PN sequence and its properties, Direct sequence SS system- DS/BPSK Transmitter & Receiver, Frequency hopping, Processing gain, Jamming margin, CDMA</p> | |
| <p>Lab Experiments:</p> <p>Basics of Matrix</p> <ul style="list-style-type: none"> • Polynomial multiplication and division • Encoding using different encoding algorithms • Channel capacity of different communication channels • CRC implementation • Error detection and correction in Linear Block Code • Generation of QPSK signals • Generation of OFDM symbols | |
| <p>Module Choice: MODULE-II and MODULE-III</p> | |
| <p>Text books:</p> <ol style="list-style-type: none"> 1. Digital and Analog Communication Systems – K. Sam Shanmugam, John Wiley, 1996. 2. Digital Communication – Simon Haykin, John Wiley, 2003 | |
| <p>Reference books:</p> <ol style="list-style-type: none"> 1. Concepts of Information Theory and Coding – Dr.P.S.Satyanarayana, Dynaram, 2005. 2. Elements of information theory – Thomas M. Cover, John Wiley, 2006 | |
| <p>E- References:</p> <ol style="list-style-type: none"> 1.https://archive.nptel.ac.in/content/storage2/courses/117108097/Learning%20Material%20-%20ITC.pdf 2.http://www.rejinpaul.com/2013/06/anna-university-IT2302-Information-Theory-andCoding-ITC-Notes.html | |
| <p>e-Learning :</p> <ol style="list-style-type: none"> 1.http://nptel.ac.in/courses/117101053/1 2.https://www.youtube.com/watch?v=nvmo9voRiSs | |

Course Outcomes

At the end of the course on **Communication Systems-2**, the student will have the ability to

| | | |
|-----|---|------------------------------|
| CO1 | Ability to define, understand and explain concepts related to information theory and coding | |
| CO2 | Ability to apply the knowledge of mathematics and probability and source encoding algorithms to obtain the information of discrete message sources | PO1(3) |
| CO3 | Ability to analyze Convolution coder | PO2(1) |
| CO4 | Ability to design the Block and Convolution codes for a given channel | PO3(3) |
| CO5 | Ability to conduct experiments to demonstrate concepts related to digital communication and information theory and coding | PO5(3) |
| CO6 | Ability to design, implement and demonstrate the specific application of digital communication and coding theory as a member of the team using LabVIEW/ Matlab/ any other | PO5(1) PO11(1) PO12(1) |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 1 | - | - | - | - | - | - | - | - | - | - | 1 |
| CO4 | - | - | 3 | - | - | - | - | - | - | - | - | - | 3 |
| CO5 | - | - | - | - | 3 | - | - | - | - | - | - | - | 3 |
| CO6 | - | - | - | - | 1 | | | - | - | - | 1 | 1 | 1 |

| | | | | | |
|--|------------------------------|----------------|----------|---------------|--------------|
| Course Title | DIGITAL SYSTEM DESIGN | | | | |
| Course Code | 22ET5PE1DD | Credits | 3 | L:T:P | 3:0:0 |
| Prerequisites: Basic concepts in Digital Circuit design and Verilog HDL | | | | | |
| Objectives: To design Digital Systems through Verilog HDL, Simulate the Designs using CAD tools and Implementation using PLDs. | | | | | |
| MODULE I | | | | [7Hr] | |
| Review of Verilog concepts: Structure of the Verilog Module, Styles (Types) of Description (Data flow modeling, Behavioral modeling, Structural modeling) ports, operators and datatypes, Synchronous sequential circuits: Moore and Mealy FSM, Design and Implementation of FSM | | | | | |
| MODULE II | | | | [7Hr] | |
| Switch level modeling: Switch modeling elements, MOS Switches, CMOS Switches, Bidirectional Switches, Power and Ground, Resistive switches Logic Synthesis with Verilog HDL: What is logic synthesis? Impact of Logic synthesis, Verilog HDL synthesis, Synthesis design Flow, Synthesis examples | | | | | |
| MODULE III | | | | [7Hr] | |
| Introduction to Programmable Logic Devices : Brief Overview of Programmable Logic Devices, Simple Programmable Logic Devices (SPLDs), Complex Programmable Logic Devices (CPLDs), Field-Programmable Gate Arrays (FPGAs) | | | | | |
| MODULE IV | | | | [7Hr] | |
| Design of Arithmetic Circuits: BCD to 7-Segment Display Decoder, A BCD Adder, 32-Bit Adders, Traffic Light Controller , State Graphs for Control Circuits, Binary Multipliers, Binary Dividers | | | | | |
| MODULE V | | | | [7Hr] | |
| SM Charts and Microprogramming: State Machine Charts, Derivation of SM Charts, Realization of SM Charts, Implementation of the Dice Game, Microprogramming, Linked State Machines | | | | | |
| Module Choice: MODULE- I and MODULE- IV | | | | | |
| Text Book: | | | | | |
| <ol style="list-style-type: none"> 1. Digital Design: with an introduction to Verilog HDL by M. Morris Mano and Michael D.Ciletti, 5th Edition, Pearson Education, 2013 2. Digital system design using Verilog by Roth, John and Lee, 1st edition, Cengage learning, 2016. 3. Samir Palnitkar, "Verilog HDL: A Guide to Digital Design and Synthesis", Pearson Education, Second Edition. | | | | | |
| Reference Books: | | | | | |
| <ol style="list-style-type: none"> 1. Advanced Digital Design with the Verilog HDL by Michael D Ciletti, 2nd edition, Pearson education, 2017. 2. Fundamentals of Logic Design by Roth and Kinney. 7th edition, Cengage learning, 2014 3. Stephen Brown and Zvonko Vranesic, "Fundamentals of Digital logic with Verilog Design", McGraw Hill publications | | | | | |
| E- References: | | | | | |
| <ol style="list-style-type: none"> 1. https://www.pdfdrive.com/embedded-systems-introduction-to-arm-cortexm-m-microcontrollers-e176014882.html 2. https://www.pdfdrive.com/arm-microprocessor-systems-cortex-m-architecture-programming-and-interfacing-e157100364.html | | | | | |

e-Learning :

1. https://onlinecourses.nptel.ac.in/noc22_cs94/
2. https://onlinecourses.nptel.ac.in/noc21_ee97

Course Outcomes

At the end of the course on **Digital System Design**, the student will have the ability to

| | |
|---|--------------------------|
| CO1: Ability to apply the knowledge of Digital Electronics and HDL to describe behaviour of a digital circuits using data flow, Behavioral and structural modelling | PO 1 |
| CO2: Ability to analyse the given specifications for a digital circuit to describe the behaviour in HDL | PO 2 |
| CO3: Ability to design a digital circuit through HDL for given specifications | PO3 |
| CO4: Ability to design and conduct experiments using modern engineering CAD tool to: (i) perform simulation (ii) perform synthesis | PO5 PO9 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | - | 2 | - | - | - | - | - | - | - | - | - | - |
| CO3 | - | - | 2 | - | - | - | - | - | - | - | - | - |
| CO4 | - | - | - | - | 2 | - | - | - | 2 | - | - | - |

| | | | | | |
|--|------------------------------------|----------------|----------|--------------|--------------|
| Course Title | OPTICAL FIBER COMMUNICATION | | | | |
| Course Code | 22ET5PE10C | Credits | 3 | L-T-P | 3:0:0 |
| MODULE-I | | | | 8 Hrs | |
| Optical Fiber Waveguides: Introduction, General system, Advantages of Optical fiber Communication, Ray Theory Transmission, Electromagnetic mode theory for optical propagation, Cylindrical Fiber, Cut-off wavelength, mode field diameter, phase velocity, group velocity, group delay, Single mode fibers. | | | | | |
| MODULE-II | | | | 8Hrs | |
| Optical Transmitters and Receivers: Introduction, LASER diodes, LEDs, Photodetectors: Device Types, Principles, Absorption co-efficient, Quantum Efficiency, Responsivity, Photodiodes without internal gain, Avalanche Photodiodes. | | | | | |
| MODULE-III | | | | 8 Hrs | |
| Fiber Couplers and Connectors: Introduction, Fibre Alignment and joint loss, single mode fibre joints, fibre splices, fibre connectors and fibre couplers. | | | | | |
| MODULE-IV | | | | 8 Hrs | |
| Fundamental concepts in Optical communications: Optical receiver : Introduction, Optical Receiver operation, Digital signal transmission, error sources ,Analog Receiver sensitivity. Analog and Digital Links: Analog Links-Introduction, Overview of analog links, CNR, multichannel transmission techniques, Digital Links-Introduction, point-point links, System Considerations, link and rise time power budget analysis. | | | | | |
| MODULE-V | | | | 8 Hrs | |
| Introduction to optical networks: Operational principles of WDM,2x2 fiber coupler and connector, Optical Amplifiers, Erbium -Doped fiber amplifier, SONET/SDH, Optical Interfaces. | | | | | |
| Module Choice: Module II and Module IV | | | | | |
| Text books: | | | | | |
| 1.Optical Fiber Communications: Gerd Keiser, III edition,Tata McGraw Hill | | | | | |
| 2.Optical Fiber Communications: Principles and Practice – 3 rd Edition, by John.M.Senior, Publisher: PHI | | | | | |

Reference books:

1. **Fiber optic Communication Systems:** G.P. Agrawal, John Wiley and sons, Fourth Edition, 2011
2. **Optical Fiber Communication Systems with MATLAB and Simulink Models,** 2e, Le Nguyen Binh, Huawei Technologies Co., Ltd, CRC Press, Inc., 2015
3. **Harold Kolimbris-** Fiber Optics Communication, 2nd Ed., 2004, PEI

E- References:

1. Fiber Optics Communication by SL Kakani (CBS PUBLISHERS AND DISTRIBUTORS PVT LTD; First Edition) <https://www.amazon.in/Fiber-Optics-Communication-SL-Kakani-ebook/dp/B07TJXKPBN>

MOOCs

1. Fiber Optics By Prof. Vipul Rastogi IIT Roorkee https://onlinecourses.nptel.ac.in/noc20_ph07/preview
2. Fiber-Optic Communication Systems and Techniques, IIT Kanpur, Dr. Pradeep Kumar K <https://nptel.ac.in/courses/108104113>
3. <https://nanohub.org/courses/FOC>

Course Outcomes

At the end of the course on **OPTICAL FIBER COMMUNICATION** , the student will have the ability to

| | | |
|-----|---|---------|
| CO1 | Ability to define, understand and explain the concepts of Optical Fiber communication system | |
| CO2 | Ability to apply the knowledge of physics, electronics and communication theory to study the components of Optical Fiber communication system, ray theory and EM theory of wave propagation and optical networks | PO1(3) |
| CO3 | Ability to analyse analog and digital links using link design and rise time budget analysis for a given Optical Fiber communication link | PO2(2) |
| CO4 | Ability to make an oral presentation of the application and developments in Optical fibre communication with respect to standards, applications, challenges and impacts | PO10(1) |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | - | - | - | - | - | - | - | 1 | - | - | 1 |

| Course Title | COMPUTER ARCHITECTURE | | | | |
|---|-----------------------|---------|---|-------------|-------|
| Course Code | 22ET5PE1CA | Credits | 3 | L-T-P | 3:0:0 |
| Prerequisites: Digital Circuits | | | | | |
| Objectives: | | | | | |
| <ol style="list-style-type: none"> 1. To understand the architecture of computers 2. To understand memory optimization and protection 3. To understand and analyse the instruction level parallelism, data level parallelism and thread level parallelism | | | | | |
| MODULE-I | | | | 8Hrs | |
| Fundamentals of Quantitative Design and Analysis: Introduction , Classes of Computers , Defining Computer Architecture , Trends in Technology , Trends in Power and Energy in Integrated Circuits , Trends in Cost , Dependability , Measuring, Reporting, and Summarizing Performance , Quantitative Principles of Computer Design , Putting It All Together: Performance, Price, and Power | | | | | |
| MODULE-II | | | | 8Hrs | |
| Memory Hierarchy Design: Introduction, Ten Advanced Optimizations of Cache Performance, Memory Technology and Optimizations, Protection: Virtual Memory and Virtual Machines, Crosscutting Issues: The Design of Memory Hierarchies | | | | | |
| MODULE-III | | | | 8Hrs | |
| Instruction-Level Parallelism and Its Exploitation: Instruction-Level Parallelism: Concepts and Challenges, Data Dependences and Hazards, Control Dependences, Basic Compiler Techniques for Exposing ILP, Reducing Branch Costs with Advanced Branch Prediction, Overcoming Data Hazards with Dynamic Scheduling, Hardware based speculation | | | | | |
| MODULE-IV | | | | 8Hrs | |
| Data-Level Parallelism in Vector, SIMD, and GPU Architectures: Introduction, Vector Architecture, SIMD Instruction Set Extensions for Multimedia, Graphics Processing Units, Similarities and Differences between Vector Architectures and GPUs | | | | | |
| MODULE-V | | | | 8Hrs | |
| Thread-Level Parallelism: Introduction, Multiprocessor Architecture: Issues and Approach, Challenges of Parallel Processing, Centralized Shared-Memory Architectures, Performance of Symmetric Shared-Memory Multiprocessors | | | | | |

| | | | | | |
|---|--------------------------------|----------------|----------|--------------|--------------|
| Course Title | C++ AND DATA STRUCTURES | | | | |
| Course Code | 22ET5PE1DS | Credits | 3 | L-T-P | 3:0:0 |
| Prerequisites: | | | | | |
| Introduction to C Programming | | | | | |
| Objectives: | | | | | |
| Ability to learn programming concepts | | | | | |
| Ability to implement mathematical concepts using programming | | | | | |
| Ability to learn data structures | | | | | |
| MODULE-I | | | | 8 Hrs | |
| Introduction to C++ & its Features | | | | | |
| Principles of object oriented programming, Beginning with C++, Tokens, Expressions and Control structures, Functions in c++, Classes and Objects | | | | | |
| MODULE-II | | | | 8Hrs | |
| Constructors, Destructors, Operator Overloading, Console I/O operations | | | | | |
| Parameterized constructors, Multiple constructors in a class, Constructors with default arguments, Dynamic initialization of objects, Copy constructor, Dynamic constructors, Destructors, Overloading unary and binary operators, Stream classes, Formatted and Unformatted I/O operations, Manipulators | | | | | |
| MODULE-III | | | | 8 Hrs | |
| Inheritance, Polymorphism, Templates, Exception handling | | | | | |
| Derived classes, Single/Multilevel/Multiple/Hierarchical/Hybrid Inheritance, Virtual base class, Pointer to Object, This pointer, Virtual/Pure virtual function, Virtual constructor and destructor, Class templates, Function templates , Exception handling | | | | | |
| MODULE-IV | | | | 8 Hrs | |
| Data structures | | | | | |
| Single linked lists and operations, Stacks, Queues- array and linked representation, skip lists, hash table, Binary tree and traversal mechanisms. | | | | | |
| MODULE-V | | | | 8 Hrs | |
| Applications of data structures | | | | | |
| Heap sort, tower of Hanoi, parenthesis matching, bin sort – algorithms and programming | | | | | |

Lab Experiments:

1. Program to implement classes and objects
2. Program to implement inline functions
3. Program to implement friend and virtual functions
4. Program to implement Constructors, parameterized constructors, multiple constructors in a class, copy constructor, dynamic constructors, and destructors.
5. Program to implement Operator overloading and type conversions: Overloading unary and binary operators, overloading using friends, rules for overloading.
6. Program to implement public, private and protected inheritance. Types of inheritance: Single, Multilevel, multiple, hierarchical, hybrid.
7. Program to implement Pointers, virtual functions and polymorphism.
8. Program to implement Class templates, function templates, overloading template functions
9. Program to implement stacks and queues using data structures
10. Program to implement hashing and trees using data structures

Module Choice: MODULE IV & MODULE V**Text books:**

1. Object Oriented Programming with C++, E. Balaguruswamy, TMH, 6th Edition, 2013.
2. Data structures, Algorithms, and applications in C++, Sartaj Sahni, Universities Press, 2nd Edition, 2005.

Reference books:

1. Object Oriented Programming using C++, Robert Lafore, Galgotia publication 2010.
2. D.S. Malik, Data structures using C++, India edition, CENGAGE Learning, 2003.

E- References:

1. <https://www.pdfdrive.com/introduction-to-c-and-c-programming-e4331665.html>
2. <https://www.pdfdrive.com/principles-of-data-structures-using-c-and-c-e19847224.html>

e-Learning :

1. Programming in C++ , NPTEL <https://archive.nptel.ac.in/courses/106/105/106105151/>
2. Introduction to data structures and algorithms, NPTEL <https://nptel.ac.in/courses/106102064>

Course Outcomes

At the end of the course on C++ and Data Structures, the student will have the ability to

| | | |
|-----|---|------------|
| CO1 | Ability to understand the programming concepts for data structures | -- |
| CO2 | Ability to apply the knowledge of Engineering mathematics and programming skills to develop efficient codes in C++ | PO1 |
| CO3 | Ability to analyze abstract object and real object using class | PO2 |
| CO4 | Ability to design programming solutions with operator overloading and memory management | PO3 |
| CO5 | Ability to work as an individual and thereby conduct experiments using any C compiler for a given application/problem statement. | PO5 PO9 |
| CO6 | Develop, test, analyze and demonstrate applications using C++ and Data structures through an Open-Ended Experiment | PSO3 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| CO5 | - | - | - | - | 1 | - | - | - | 1 | - | - | - | 1 |
| CO6 | - | - | - | - | - | - | - | - | 2 | - | - | 2 | 2 |

| Course Title | MINI PROJECT-1 | | | | |
|---|--|---|---|-------|-------|
| Course Code | 22ET5PWMP1 | Credits | 2 | L:T:P | 0:0:2 |
| General Instructions: | | | | | |
| 1.A team of two to four students shall be permitted to work on a single mini project. 2.The mini project shall comprise of hardware component. 3.Students shall be evaluated on regular and continuous basis as per the prevailing rubrics. 4.The team shall ensure that the project is in working condition during final demonstration. 5.The student is required to submit a report, one page poster and 3 minutes video based on the project work carried out. | | | | | |
| <i>At the end of the course, the student will have the ability to,</i> | | | | | |
| CO1 | Engage in relevant survey and identify the project to be implemented with desired specifications | PO2 (3) PO12 (3) | PSO1 (3) PSO2 (3) PSO3 (2) | | |
| CO2 | Identify the essential concepts, and identify the design for the project implementation | PO1 (3) PO2 (3) PO3 (2) | | | |
| CO3 | Implement and analyse the designed project, to match the specifications | PO4 (2) PO5 (3) | | | |
| CO4 | Prepare the project report, three minute video and the poster of the work | PO10 (3) | | | |
| CO5 | Engage in team work towards implementation of project relevant to society | PO6 (1) PO9 (1) PO11 (1) | | | |
| CO6 | Ability to demonstrate compliance to the prescribed standards/safety norms and abide by the norms of professional ethics | PO8(3) | | | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | 3 | - | - | - | - | - | - | - | - | - | 3 | 3 |
| CO2 | 3 | 3 | 3 | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | - | - | 2 | 3 | - | - | - | - | - | - | - | 3 |
| CO4 | - | - | - | - | - | - | - | - | - | 3 | - | - | 3 |
| CO5 | - | - | - | - | - | 1 | - | - | 1 | 1 | - | - | 1 |
| CO6 | - | - | - | - | - | - | - | 3 | - | - | - | - | 3 |

| Course Title | PROJECT MANAGEMENT AND FINANCE | | | | |
|--|--------------------------------|---------|---|---------------|-------|
| Course Code | 22ES5HSPMF | Credits | 2 | L:T:P | 2:0:0 |
| MODULE I | | | | [5Hr] | |
| Concepts of Project Management - Concepts of project, Categories of project, Project life cycle phases, Project management concepts, Tools and techniques for project management, The project manager, Need, Roles and responsibilities of project manager. Project Leadership and Ethics: Introduction to project leadership, ethics in projects, Multicultural and virtual projects. | | | | | |
| MODULE II | | | | [5Hr] | |
| 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, Fixing the Zero date. | | | | | |
| MODULE III | | | | [5Hr] | |
| Organizing Human Resources and Contracting - Delegation , Project managers authority, Project organization , Contract , Contract Planning, Tendering and Selection of Contractor, Team building. | | | | | |
| MODULE IV | | | | [5Hr] | |
| Organizing Systems and Procedures for Project Implementation – Working of Systems, Work breakdown structure, Planning, Scheduling and Monitoring, Critical Path Method, Gantt Chart/Time Chart, PERT, Project diary. | | | | | |
| MODULE V | | | | [5Hr] | |
| 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. | | | | | |
| Module Choice: | | | | | |
| Text Books: | | | | | |
| 1.Project Management – S Choudhury, 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.Vijay Kanabar | | | | | |
| 2.Project Management – David I Cleland – Mcgraw Hill International edition | | | | | |
| 3.Project Management – Gopalakrishnan – Mcmillan India Ltd | | | | | |
| 4. Project Management – Harry – Maylor- Peason Publication | | | | | |

| | | | | | |
|---------------------|--|----------------|-----------|--------------|--------------|
| Course Title | EFFECTIVE NEGOTIATION WITH EMOTIONAL INTELLIGENCE | | | | |
| Course Code | 22ET5NCENI | Credits | NC | L:T:P | 0:0:0 |

Objectives:

- Equip students with the necessary skills and knowledge to navigate professional and personal negotiations successfully.
- Introduce the concept of emotional intelligence and its importance in negotiation
- Illustrate how emotional intelligence can be integrated into negotiation strategies for better outcomes.
- Explore how empathy, self-awareness, and social skills can enhance communication and relationship-building during negotiations
- Empower students with the skills and mindset necessary to navigate diverse and complex negotiation scenarios in the engineering field.

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

| | | | |
|------------|--|---------------|--|
| CO1 | Apply emotional intelligence competencies, such as self-awareness, self-regulation, empathy, and social skills, in negotiation scenarios. | PO6(3) | |
| CO2 | Ability to demonstrate a thorough understanding of fundamental negotiation principles, including preparation, communication, collaboration, and problem-solving. | PO9(3) | |
| CO3 | Ability to exhibit an understanding of ethical considerations in negotiations, demonstrating integrity, honesty, and professionalism throughout the negotiation process. | PO8(3) | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|------------|------------|------------|------------|------------|------------|------------|------------|------------|------------|-------------|-------------|-------------|--------------|
| CO1 | - | - | - | - | - | - | - | 3 | - | - | - | - | 3 |
| CO2 | - | - | - | - | - | 3 | - | - | - | - | - | - | 3 |
| CO3 | - | - | - | - | - | - | - | - | - | 3 | - | - | 3 |

VI Semester

| | | | | | |
|---|-----------------------------|----------------|----------|--------------|--------------|
| Course Title | FUNDAMENTALS OF VLSI | | | | |
| Course Code | 22ET6PCVLS | Credits | 4 | L:T:P | 3:0:1 |
| Prerequisites: Analog and Linear Circuits, Digital Circuits | | | | | |
| Objectives: The purpose of the course is to facilitate the learners to: | | | | | |
| <ul style="list-style-type: none"> • To use mathematical methods and circuit analysis models in analysis of CMOS digital electronics circuits, including logic components and their interconnect. • To implement models of CMOS circuits that realize specified digital functions. • To design static CMOS combinational and sequential logic at the transistor level, including mask layout. • To analyze the general steps required for processing of CMOS integrated circuits. • To estimate and optimize combinational circuit delay using RC delay models and logical effort. | | | | | |
| MODULE I | | | | 8Hr | |
| <p>Basic MOS technology: Enhancement and depletion mode MOS transistors. nMOS fabrication, pMOS fabrication, CMOS fabrication: p-well process, n-well process, Twin-tub process, BiCMOS fabrication in n-well process. Thermal aspects of processing.</p> <p>Circuit design processes: MOS layers. Stick diagrams: CMOS design style. Basic physical design of simple logic gates, nMOS design for inverter.</p> <p>HDL Programming: Switch Level modeling of CMOS circuits</p> | | | | | |
| MODULE II | | | | 8Hr | |
| <p>CMOS logic structures : Complementary Logic, Pseudo-nMOS Logic, Dynamic CMOS Logic, Clocked CMOS Logic, Pass Transistor Logic, CMOS Domino Logic, Cascaded Voltage Switch Logic (CVSL), BiCMOS Logic, The Transmission Gate, Tri-state Inverter. HDL programming of special CMOS circuits.</p> | | | | | |
| MODULE III | | | | 8Hr | |
| <p>Basic circuit concepts: Sheet resistance, Area capacitance, Rise time and fall time calculations, nMOS inverter transfer characteristic.</p> <p>CMOS subsystem design: Architectural issues, General considerations, Switch logic, Gate logic, Design example of Multiplexer, Process illustration: Design of Combinational Bidirectional Shifter.</p> | | | | | |
| MODULE IV | | | | 8Hr | |
| <p>CMOS subsystem design implementation: Design of: Inverting shift register and non-inverting shift register using Pass Transistor logic/Transmission gate logic, 4X4 crossbar switch and 4X4 Barrel shifter.</p> <p>Adders: Manchester Carry chain, Carry Select Adders, Carry Skip adders, Carry Look-ahead</p> | | | | | |

adder. HDL programming of adders.

Multipliers: Serial-Parallel multiplier, Booth's Multiplier, Modified Booth's multiplier, Wallace tree multiplier.

MODULE V

8Hr

Memory, registers, and clock: Timing considerations of memory cells. 3T dynamic RAM cell, 1T dynamic memory cell, Pseudo-static register cell.

Testability: Performance parameters, Ground rules for design, Sensitized path testing, Practical DFT methodologies.

Module Choice: MODULE-I and MODULE-IV

Laboratory Component:

Part – A: HDL programming of VLSI circuits

1. CMOS Inverter
2. nMOS Inverter
3. Transmission gate
4. CPL
5. Tri-state Logic
6. Dynamic logic
7. Pseudo-nMOS logic
8. Flip flops
9. Adders

Part – B: Verification of parameters for different circuits using VLSI tools.

Design a circuit with given specifications, and completing the following design flow:

- a. Draw the Schematic and verify the DC analysis and Transient analysis
- b. Draw the layout and verify DRC

TEXT BOOKS:

1. Douglas A. Pucknell and Kamran Eshraghian, "**Basic VLSI Design**" PHI 3rd Edition, 2005.
2. John P. Uyemura, "**Introduction to VLSI Circuits and Systems**", Wiley Publications, 2002.
3. Nazeih Botros, "**HDL with Digital Design VHDL and Verilog** – Mercury Learning and Information, 2015.

REFERENCE BOOKS:

1. **Neil H. E. Weste and K. Eshragian,** "CMOS VLSI Design – A Circuits and Systems Perspective," 3rd edition, Pearson Education Pvt. Ltd.
2. **Sung Mo Kang and Yosuf Leblebici,** "CMOS Digital Integrated Circuits: Analysis and Design", Tata McGraw-Hill, Third Edition.

MOOCs:

3. https://onlinecourses.nptel.ac.in/noc19_ee25/
4. https://swayam.gov.in/nd1_noc19_cs74/preview

| | | |
|-----|---|----------------------------|
| CO1 | Ability to define, understand and explain concepts of nMOS and CMOS technology. | -- |
| CO2 | Ability to apply the knowledge of VLSI to fabricate the MOS circuits, illustrate different CMOS logic structures, subsystems and memory elements, calculate rise time and fall time estimations. | PO1(3) PSO3(3) |
| CO3 | Ability to analyze the monochrome layout and stick diagrams of MOS technology and CMOS logic structures and subsystems, deduce appropriate testability vectors for the given parameters. | PO2(3) PSO3(3) |
| CO4 | Ability to conduct experiments using VLSI tools for a given application/problem statement. | PO4(3) PO5(3) PO9(3) |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 3 | - | - | - | - | - | - | - | - | - | - | 3 |
| CO4 | - | - | | 3 | 3 | - | - | - | 3 | - | - | - | 3 |

| | | | | | |
|--|---------------------------------------|----------------|----------|--------------|--------------|
| Course Title | WIRELESS AND CELLULAR NETWORKS | | | | |
| Course Code | 22ET6PCWCN | Credits | 4 | L-T-P | 3:0:1 |
| Prerequisites: Digital communication | | | | | |
| Objectives: | | | | | |
| <ul style="list-style-type: none"> • To understand the evolution of wireless communication systems from 1G to 5G • To study the different types of Mobile radio propagation and its impact on the signal loss • To understand various concepts and architecture of cellular networks | | | | | |
| MODULE-I | | | | 8 Hrs | |
| <p>Evolution of wireless Communication Systems: Introduction, Historical Trend of Wireless Communications, Paging system, Cordless telephone system, Cellular telephone system, Advantages and disadvantages of mobile communications, Comparison of 3G, 4G and 5G networks, applications of wireless communications.</p> <p>The Cellular Concept-System Design fundamentals: Introduction, Frequency reuse, Channel assignment strategies, Handoff Strategies, interference, and system capacity Improving coverage and capacity in cellular systems.</p> | | | | | |
| MODULE-II | | | | 8 Hrs | |
| <p>Mobile Radio Propagation: Large scale Path loss-Introduction to radio wave propagation, free space propagation model, The three basic propagation mechanisms, Reflection, ground reflection model, Diffraction, Scattering Outdoor propagation models: Okumura model and Hata model, introduction to small scale fading, equalization and diversity techniques.</p> | | | | | |
| MODULE-III | | | | 8 Hrs | |
| <p>GSM: System overview, the Air interface, Logical and physical channels, Synchronization. Establishing a connection and handover, Examples of Different Kinds of Handovers- Handover between BTSs Belonging to the same BSC, Handover between Two BTSs that are Controlled by Different BSCs & the Same MSC. Services and Billing.</p> | | | | | |
| MODULE-IV | | | | 8 Hrs | |
| <p>LTE-Introduction and Background: Introduction to Multi Access, Frequency Division Multi Access, Time Division Multi Access, Space Division Multi Access, The Context for the Long Term Evolution of UMTS, Need for LTE, Requirements and Targets for the Long-Term Evolution, Technologies for the Long Term Evolution, High-Level Architecture of LTE (From UMTS to LTE).</p> | | | | | |
| MODULE-V | | | | 8 Hrs | |
| <p>Introduction to 5G: What is 5G? 5G – requirements and capabilities, Drivers for 5G- Evolution of LTE Technology to Beyond 4G, 5G Roadmap, 10 Pillars of 5G, Spectrum allocation and Dynamic spectrum sharing, Spectrum for 5G, 5G Architecture, 5G use cases.</p> | | | | | |

Lab Experiments

1. Simulate simple BSS with transmitting nodes in wireless LAN and determine the performance with respect to transmission of packets.
2. Simulate simple Wi-fi and Wimax with transmitting nodes in wire-less LAN by simulation and determine the performance with respect to transmission of packets.
3. MANET (Mobile Adhoc Networks) simulation using Omni-directional Antenna model and Analysis
4. Setting up of optical analog link
5. Setting up of optical digital link
6. To find various Fibre losses of the given optical fibre

Module Choice: Module I and Module II

Text books:

1. Wireless communications- Principles and Practice, Theodore S Rappaport, Pearson, 2nd Edition
2. Wireless Communications, Andreas F Molisch, Wiley, 2012
3. LTE – The UMTS Long Term Evolution From theory to practice, Stefania Sesia, Issam Toufik, Matthew Baker, 2nd edition, Wiley publications, 2011
4. An Introduction to LTE, Christopher Cox, 2nd edition, Wiley publications, 2014
5. 5G Technology, Harri Holma and Antti Toskala, Takehiro Nakamura Wiley, 2020

Reference books:

1. D. Tse and P. Viswanath, "Fundamentals of Wireless Communications," Cambridge Univ Press, 2005
2. LTE- The UMTS long term Evolution: From Theory to Practice Stefania, ISSan Toufik and Mathew Baker 2009 , John Wiley and Sons Ltd
3. Fundamentals of 5G Mobile Networks, Jonathan Rodriguez, 1st edition, Wiley 2015

E- References:

- | | |
|----|---|
| 1. | WIRELESS COMMUNICATIONS, Andrea Goldsmith, Cambridge University Press, 2005 |
|----|---|

e-Learning :

1. Wireless Communication <https://nptel.ac.in/courses/117/102/117102062/>
2. Introduction to wireless and cellular communication :<https://nptel.ac.in/courses/106/106/106106167/>

Course Outcomes

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

| | | |
|-----|--|--|
| CO1 | Ability to define, understand and explain concepts related to wireless communication and cellular network | - |
| CO2 | Ability to apply the knowledge of communication to wireless and cellular networks | PO1 |
| CO3 | Ability to analyze the cellular concepts, different propagation models and architecture of wireless networks | PO2 |
| CO4 | Ability to conduct experiments to demonstrate wireless concepts using the engineering tool such as QUALNET / MATLAB | PO5 PO9 |
| CO5 | Ability to perform in a team to prepare a report and make an effective oral presentation of the study on topics related to Wireless Networks, radiation hazards and use of 5G in healthcare, Security vulnerabilities/aspects | PO6 PO7 PO8 PO9 PO10 PO12 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 3 | - | - | - | - | - | - | - | - | - | - | 3 |
| CO4 | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| CO5 | - | - | - | - | 3 | - | - | - | 3 | - | - | - | 3 |

| | | | | | |
|--|---------------------------------------|----------------|----------|--------------|--------------|
| Course Title | TRANSMISION LINES AND ANTENNAS | | | | |
| Course Code | 22ET6PCTLA | Credits | 3 | L-T-P | 2:1:0 |
| Prerequisites: Engineering Mathematics , Electromagnetics | | | | | |
| Objectives: | | | | | |
| <ul style="list-style-type: none"> • Familiarise with the concepts of transmission lines and wire and broadband antennas • Understand, apply and analyse the transmission line relates concepts using Smith chart • Analyse radiated fields and radiation resistance for dipole and loop antennas • Make simple wire antenna considering gain, directivity, power, bandwidth, cost | | | | | |
| MODULE-I | | | | 8 Hrs | |
| TRANSMISSION – LINE THEORY: Line of Cascaded T sections, The transmission Line-general solution, The infinite line, The distortion less Line, Reflection on a Line not terminated in Z_0 , reflection coefficient, Open and short circuited Lines, Standing waves; nodes; standing-wave ratio, Reflection factor, Reflection loss, Insertion loss, T and PI sections equivalent to Lines. | | | | | |
| MODULE-II | | | | 8Hrs | |
| THE LINE AT RADIO FREQUENCIES: Line parameters: Parameters of the open-wire line at high frequencies, Parameters of the coaxial line at high frequencies Input impedance of the dissipation less line, Input impedance of open-and short-circuited lines, The quarter-wave line; impedance matching, The half-wave line, Single stub impedance matching on a line, the Smith circle diagram, Application of the Smith Chart, Single-stub matching with the Smith chart. | | | | | |
| MODULE-III | | | | 8 Hrs | |
| ANTENNA BASICS: Introduction, basic Antenna parameters, patterns, beam area, radiation intensity, beam efficiency, directivity and gain, antenna apertures, effective height, radio communication link, radiation efficiency, fields from oscillating dipole, Antenna field zones, | | | | | |
| Point sources, power patterns, power theorem, radiation intensity, field patterns, phase patterns. Array of two isotropic point sources, non-isotropic but similar point sources, principles of pattern multiplication, non isotropic and dissimilar point sources, linear array | | | | | |

| | |
|---|--|
| of n isotropic point sources of equal amplitude and spacing. | |
| MODULE-IV | 8 Hrs |
| WIRE ANTENNAS: The short electric dipole, the fields of a short dipole, Radiation resistance of short electric dipole, The thin linear Antenna, Radiation resistance of the $\lambda/2$ antenna, small loop, comparison of far fields of small loop and short dipole, loop antenna general case, far field patterns of circular loop antenna, Radiation Resistance of loops, Directivity of circular loop antenna. Application of moment method. | |
| MODULE-V | 8 Hrs |
| BROADBAND AND FREQUENCY INDEPENDENT ANTENNAS: Broad band basics, Infinite and finite bicolical antennas, directional biconicals, conical, disk cones and Bow ties, The frequency independent concept: Rumsey's Principle, the frequency-independent Planar log spiral antenna, log periodic antenna | |
| Lab Experiments: <ol style="list-style-type: none"> 1. Study the parameters of the transmission line 2. Study the Antenna parameters 3. To create dipole antenna and measure its parameters using HFSS 4. Study the parameters of dipole using Matlab 5. Make simple wire antenna | |
| Module Choice: Module I and Module III | |
| Text books: | |
| 1. | Network Lines and Fields - John D Ryder, 2e, PHI, 2003. |
| 2. | Antennas, John D. Krauss, III (SEI) edition, McGraw-Hill International edition, 2006. |
| Reference books: | |
| 3. | Antenna Theory Analysis and Design - C A Balanis, 2nd ED, John Wiley, 1997. |
| 4. | Antennas – fundamentals, design , measurement, Lamont V Blake, Maurice W Long, third edition, SCITECH publishing , Inc Raleigh, NC |
| E- References: | |
| 1 | Antennas: Theory and Practice – S A Schelkunoff, J Wiley 1952 |

| | |
|---------------------|---|
| 2 | https://www.google.co.in/books/edition/Electromagnetic_Field_Theory_and_Tra nsmi/tGk8BAAAQBAJ?hl=en&gbpv=1&dq=transmission+lines&printsec=front cover |
| e-Learning : | |
| 1 | https://archive.nptel.ac.in/courses/117/101/117101056/ |
| 2 | https://onlinecourses.nptel.ac.in/noc22_ee22/ |

Course Outcomes

At the end of the course on **Transmission Lines and antennas**, the student will have the ability to

| | | |
|-----|--|---|
| CO1 | Apply different properties/laws/theorems/ to solve/derive problems related to transmission lines and wired antennas | PO1 PSO3 |
| CO2 | Analyze the given specifications of different types of transmission lines and/or antennas in various configurations. | PO2 PSO3 |
| CO3 | Design solutions to meet the given specifications of transmission lines and antennas. | PO3 PSO3 |
| CO4 | conduct experiments to analyze concepts related to transmission lines and antennas using Matlab/HFSS | PO5 PSO3 |
| CO5 | Perform in a team to prepare a report and make an effective oral presentation of the study on topics from research papers related to transmission lines/ antenna applications/ radiation hazards/ broadcast standards/ EMC-EMI/ any other. | PO6 PO7 PO8 PO10 PO12 PSO3 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO2 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | - | - | 1 | - | - | - | - | - | - | - | - | - | 1 |
| CO4 | - | - | - | - | 1 | - | - | - | - | - | - | - | 1 |
| CO5 | - | - | - | - | - | 1 | 1 | 1 | - | 1 | - | 1 | 1 |

| | | | | | |
|---|-------------------------------|----------------|----------|--------------|--------------|
| Course Title | EMBEDDED SYSTEM DESIGN | | | | |
| Course Code | 22ET6PE2ES | Credits | 3 | L-T-P | 3:0:0 |
| Prerequisites: Digital Circuits, Microcontrollers | | | | | |
| Objectives: | | | | | |
| <ul style="list-style-type: none"> To understand the Concepts of Embedded system design To study the hardware and software components required for developing embedded system | | | | | |
| MODULE-I | | | | 8Hrs | |
| A System Engineering Approach to Embedded Systems Design: Introduction to Embedded Systems Architecture, The Embedded Systems Models, Embedded Hardware building blocks, Reading a Schematic. | | | | | |
| MODULE-II | | | | 8Hrs | |
| Embedded Processors & Memory: ISA Architecture Models: Application specific, Internal Processor Design, Processor Performance, Reading Processor's Datasheet, ROM, RAM, Cache Memory, Cache mapping techniques, Memory Management of External Memory, Board Memory and Performance | | | | | |
| MODULE-III | | | | 8Hrs | |
| Board I/O & Buses: Managing Data: Serial vs. Parallel I/O, Interfacing the I/O Components, I/O and Performance, Bus Arbitration and Timing, I2C, SPI, USB, CAN & PCI protocols, integrating the Bus with Other Board Components, Bus Performance. | | | | | |
| MODULE-IV | | | | 8Hrs | |
| Embedded Software: Device Drivers: Device Drivers for Interrupt-Handling, Memory Device Drivers, On-board Bus Device Drivers, Board I/O Driver. Embedded Operating Systems: Multitasking and Process Management, Memory Management, I/O and File System Management, OS Standards Example: POSIX, OS Performance Guidelines, OSs and Board Support Packages (BSPs). | | | | | |
| MODULE-V | | | | 8Hrs | |
| Middleware and Application Software: Introduction to Middleware, Applications with Examples, Application Layer Software Examples. Implementing the Design: Main Software Utility Tool: Writing Code in an Editor or IDE, Interpreters, Compilers, and Linkers, Debugging Tools, System Boot-Up. | | | | | |
| | | | | | |

| | |
|---|---|
| Module Choice: Module I and Module III | |
| Text books: | |
| 1 | Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers, Tammy Noergaard |
| Reference books: | |
| 1 | Computer Organization and Embedded Systems. 6th Edition. By Carl Hamacher and Zvonko Vranesic and Safwat Zaky and Naraig Manjikian 3. James K Peckol, “Embedded Systems – A contemporary Design Tool”, John Wiley, 2008 |
| 2 | Embedded system Design –Steve Heath , second edition |
| 3 | James K Peckol, “Embedded Systems – A contemporary Design Tool”, John Wiley, 2008. |
| E- References: | |
| 1. | https://ptolemy.berkeley.edu/books/leeseshia/releases/LeeSeshia_DigitalV2_2.pdf |
| 2. | https://mobileelectron.files.wordpress.com/2011/07/embedded-system-design-marwedel.pdf |
| e-Learning : | |
| 1. | https://onlinecourses.nptel.ac.in/noc23_cs54/preview |
| 2. | https://archive.nptel.ac.in/courses/106/105/106105193/ |

Course Outcomes

At the end of the **Embedded System Design** course, the student will have the

| | | |
|-----|---|----------------------|
| CO1 | Apply the embedded system models, features of processors, memory and I/O systems in developing embedded System. | PO1 |
| CO2 | Analyse the embedded OS functionality and device drivers used in multitasking embedded applications. | PO2 |
| CO3 | Design embedded applications using given specifications and concepts of development process. | PO3 |
| CO4 | Ability to implement mini projects to demonstrate applications of embedded systems. | PO5, PO9, PO10, PO12 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO2 | | 3 | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | | 2 | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | | | | | 1 | | | | 1 | 1 | | 1 | 1 |

| | | | | | |
|--|--|----------------|----------|--------------|--------------|
| Course Title | SATELLITE COMMUNICATION | | | | |
| Course Code | 22ET6PE2SC | Credits | 3 | L-T-P | 3:0:0 |
| Pre requisites: Communication Systems | | | | | |
| Objective: | | | | | |
| To study and understand the principles of Satellite communication and different subsystems of Satellite system | | | | | |
| MODULE-I | | | | 8 Hrs | |
| Orbits and Launching methods: Overview of satellite systems, Kepler's Laws, Orbital elements, Orbital perturbations, Inclined orbits, Sun synchronous orbits, The Geostationary Orbit-Antenna look angles, Sun transit outage, launching orbits | | | | | |
| MODULE-II | | | | 8Hrs | |
| The Space Segment and the Earth Segment: Power supply, Attitude control, Station keeping, Thermal control, TT&C subsystem, Transponders, Antennas subsystem, Earth segment: Transmit receive earth station. | | | | | |
| MODULE-III | | | | 8 Hrs | |
| The Space Link: EIRP, Transmission losses, The link power budget equation, system noise, carrier to noise ratio, Uplink, Downlink, Combined uplink and downlink C/N ratios and C/I ratio, Intermodulation noise. | | | | | |
| MODULE-IV | | | | 8 Hrs | |
| Satellite Access: FDMA, TDMA – pre assigned and demand assigned, switched TDMA, CDMA, satellite links and TCP | | | | | |
| MODULE-V | | | | 8 Hrs | |
| Satellite Applications: Direct Broadcast satellite services, Satellite mobile services, VSATs, Radarsat, GPS, Orbcomm, Indian Satellites, ITU Regulations, Standards | | | | | |
| Module Choice: Module I and Module III | | | | | |
| Text books: | | | | | |
| 1 | Satellite Communications: Dennis Roddy, Tata McGraw Hill | | | | |
| 2 | Satellite Technology Principles and Applications: 3rd Edition, by Anil K Maini, Varsha Agrawal, Publisher: John Wiley & Sons | | | | |
| Reference books: | | | | | |

| | |
|-----------------------|---|
| 1 | Satellite Communication: Timothy Pratt, Second Edition, John Wiley and sons. |
| 2 | Satellite Communication Systems Engineering – Louis J Ippolito Jr, Wiley Publishers |
| 3 | Satellite Communication: Concepts and Applications, K N Raja Rao, PHI Learning Pvt Ltd. 2013 |
| E- References: | |
| 1. | International Journal of Satellite Communication and Networking - https://onlinelibrary.wiley.com/journal/15420981 |
| e-Learning : | |
| 1. | https://www.ansys.com/en-in/products/missions/ansys-stk |
| 2. | https://orbitron.software.informer.com/ |

Course outcomes

At the end of the course on **Satellite Communication**, the student will have the ability to

| | | |
|-----|---|--------------------|
| CO1 | Apply the knowledge of science and engineering concepts to study the satellite communication systems | PO1(3) |
| CO2 | Analyze orbital parameters and satellite communication link to arrive at a suitable conclusion. | PO2(2) |
| CO3 | Function effectively as an individual or as a team member to make an effective oral presentation and prepare the report of the study that can be done through simulation of concepts or on topics related to advances in satellite technology. | PO5 (1), PO9(1) |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO2 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | - | - | - | - | 1 | - | - | - | 1 | - | - | - | 1 |

| Course Title | INTERNET OF THINGS | | | | |
|---|--------------------|--------------|---|-------|-------|
| Course Code | 22ET6PE2IT | Credits | 3 | L-T-P | 3:0:0 |
| MODULE-I | | 8 Hrs | | | |
| Introduction to IoT, Introduction, physical design of IoT, Logical Design of IoT, IoT enabling technology, IoT levels and deployment templates | | | | | |
| MODULE-II | | 8Hrs | | | |
| Smart Objects: The “Things” in IoT: Sensors, Actuators, and Smart Objects, Sensor Networks, Connecting Smart Objects, Communications Criteria, IoT Access Technologies: IEEE 802.15.4, IEEE 802.15.4g and IEEE 802.15.4e | | | | | |
| MODULE-III | | 8 Hrs | | | |
| IoT Access Technologies: IEEE1901.2a, IEEE 802.11ah, LoRaWAN, NB-IOT and other LTE variations IP as the IoT Network Layer: The Business Case for IP, The need for Optimization, Optimizing IP for IoT, Profiles and Compliances | | | | | |
| MODULE-IV | | 8 Hrs | | | |
| Application Protocols for IoT: The Transport Layer, IoT Application Transport Methods: Generic Web Based Protocols, IoT Application Layer Protocols IoT Platforms Design Methodology: Introduction, IoT Design Methodology , Case study on IoT system for weather Monitoring; IoT Systems – Logical Design using Python: Introduction, Python Data Types and Data structures | | | | | |
| MODULE-V | | 8 Hrs | | | |
| IoT Systems – Logical Design using Python: Control flow, functions, Modules, Packages, File Handling, Data/Time operations IoT Physical Devices and End points: what is an IoT Devices Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi, Raspberry Pi Interfaces | | | | | |
| Module Choice: Module IV and Module V | | | | | |
| TEXT BOOKS: | | | | | |
| <ol style="list-style-type: none"> Internet of Things, A Hands-on Approach , Arshdeep Bahga, Vijay Madisetti, Universities Press “IoT Fundamentals: Networking Technologies, Protocols and Use Cases for the Internet of Things”, David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton and Jerome Henry, 1st Edition, Pearson Education (Cisco Press Indian Reprint), ISBN: 978-93-868-7374- | | | | | |

REFERENCE BOOKS:

1. "Internet of Things", Srinivasa K. G., CENGAGE Learning India, 2017.
2. "Internet of Things: Architecture and Design Principles", Raj Kamal, 1st Edition, McGraw Hill Education, 2017

Course outcomes :

At the end of the course on **Internet of Things**, the student will have the ability to

| | | | |
|-----|---|----------------------------|--------------------|
| CO1 | Ability to understand, define and explain the fundamental concepts of Internet of things and wireless sensor networks | -- | PSO3 (1) |
| CO2 | Ability to apply the knowledge of communication, networks and coding to networks | PO1(2) | |
| CO3 | Ability to analyse the given network parameters and arrive at suitable conclusions | PO2(1) | |
| CO4 | Ability to implement and demonstrate the specified mini-project using suitable communication and sensor network parameters | PO3(2) PO5(2) PO9(1) | |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|------------|----------|----------|----------|-----|----------|-----|-----|-----|----------|------|------|------|----------|
| CO1 | | | | | | | | | | | | | |
| CO2 | 2 | | | | | | | | | | | | 2 |
| CO3 | | 1 | | | | | | | | | | | 1 |
| CO4 | | | 2 | | 2 | | | | 1 | | | | 5 |

| | | | | | |
|--|--------------------------|----------------|----------|--------------|--------------|
| Course Title | OPERATING SYSTEMS | | | | |
| Course Code | 22ET6PE2OS | Credits | 3 | L-T-P | 3:0:0 |
| Prerequisites: Basics of C programming | | | | | |
| Objectives: | | | | | |
| <ul style="list-style-type: none"> • Students will learn the importance of an Operating System • Students will learn difference between a process and a program • Introduce the concepts of CPU Scheduling and explain the method of evaluations of various scheduling algorithms • Explain and build applications using inter-process communication mechanisms. • Understand the deadlocks between processes and how to build systems to avoid deadlocks. • Learn about memory management, memory allocation by an OS to processes, virtual memory concepts including paging, segmentation and demand paging. • Understand the concepts of files and directories and build systems around these constructions. | | | | | |
| MODULE-I | | | | 8 hrs | |
| Introduction: Abstract view of operating system, Goals of an OS, Operation of an OS; Overview of Operating System : OS and the Computer System, Efficiency, System Performance and User Convenience, Classes operating System | | | | | |
| MODULE-II | | | | 8hrs | |
| Scheduling: Preliminaries, Non-preemptive scheduling policies, Preemptive Scheduling policies, Real Time Scheduling Memory Management: Memory allocation process, Reuse of Memory, Contiguous Memory allocation, Non-Contiguous Memory Allocation, Paging, Segmentation, Segmentation with Paging | | | | | |
| MODULE-III | | | | 8 hrs | |
| Virtual Memory : Virtual Memory Basics, Demand Paging – Overview of paging, Demand paging preliminaries, Page replacement ; Page Replacement Policies Process Concept: Overview, Process Scheduling, Operations on Process, Inter Process Communications (IPC); Multithreaded Programming: Overview, Multithreading models, Thread Libraries. | | | | | |
| MODULE-IV | | | | 8 hrs | |
| Process Coordination: Synchronization, The critical section problem, Peterson’s solution, Synchronization hardware, Semaphores, Classical problems of synchronization Deadlocks: Definition of deadlock, Deadlock in Resource Allocation, Handling Deadlocks, Deadlock Detection and Resolution, Deadlock Prevention, Deadlock Avoidance | | | | | |

| MODULE-V | | 8 hrs |
|--|---|--------------|
| File System: File Concept, Access Methods, Directory Structure, File system Mounting; Implementing File Systems: File - System Structure, File - System Implementation, Directory implementation, Allocation Methods, NFS | | |
| Module Choice: Module II and Module IV | | |
| Text books: | | |
| 1 | “Operating Systems - A Concept based Approach”, D. M. Dhamdhare, TMH, 3rd Ed, 2012. | |
| 2 | “ Operating System Principles” , Abraham Silberschatz, Peter Baer Galvin, Greg Gagne, Wiley, 7 th Edition | |
| Reference books: | | |
| 1 | Operating System – Internals and Design Systems, Willaim Stalling, Pearson Education, 4th Ed, 2006 | |
| E- References: | | |
| 1. | https://www.e-booksdirectory.com/listing.php?category=26 | |
| e-Learning : | | |
| 1. | https://onlinecourses.nptel.ac.in/noc23_cs101/preview | |
| 2. | https://archive.nptel.ac.in/courses/106/105/106105214/# | |

Course outcomes

At the end of the course on **Operating system**, the student will have the ability to

| | | |
|-----|--|----------------------------|
| CO1 | Explain the fundamental concepts of operating systems | |
| CO2 | Apply the concepts of mathematics and coding knowledge to obtain the solution for specified parameters | PO1(3) |
| CO3 | Analyse the given systems parameters and arrive at suitable conclusions | PO2(2) |
| CO4 | Implement and demonstrate the specified mini-project using suitable operating system algorithms | PO3(1) PO5(1) PO9(1) |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | 1 | - | 1 | - | - | - | 1 | - | - | - | 1 |

| | | | | | |
|--|--|----------------|----------|--------------|--------------|
| Course Title | COMPUTER COMMUNICATION NETWORKS | | | | |
| Course Code | 22ET6OE1CN | Credits | 3 | L-T-P | 3:0:0 |
| Prerequisites: Basics of Communication | | | | | |
| Objectives: Introduction to analysis and design of computer and communication networks through understanding the network layered architecture and the protocol stack and by conducting hands-on programming and lab activities. | | | | | |
| MODULE-I | | | | 8 Hrs | |
| Overview: Data communication , Networks, The Internet, Protocols and Standard; Network Models: Layered Tasks, The OSI Model, layers in the OSI model | | | | | |
| MODULE-II | | | | 8Hrs | |
| TCP/IP Protocol Suite, addressing; Physical Layer: Transmission media – Introduction, Guided media, Unguided Media- Wireless; Telephone networks, Cable TV networks, Cable TV for data transfer; Data link Control: Framing , Noiseless channels, Noisy channels | | | | | |
| MODULE-III | | | | 8 Hrs | |
| Data link Control :Multiple access: Random access, controlled access, channelization; Data Link Layer: Wire LANs: Ethernet – IEEE Standards , Standard Ethernet, Changes in standard | | | | | |
| MODULE-IV | | | | 8 Hrs | |
| Wireless LANs - Bluetooth; Connecting LANs, Backbone networks and Virtual LANs: Connecting Devices, Backbone Networks, Virtual LANs; Network layer: Logical Addressing: IPv4 addresses,IPv6 Addresses | | | | | |
| MODULE-V | | | | 8 Hrs | |
| Application layer: Domain Name system: Name space, Domain Name space, Distribution of name space, DNS in the internet, Resolution ; Remote logging, Electronics mail and File transfer: Electronic mail, File transfer ; WWW and HTTP: Architecture, web documents , HTTP | | | | | |
| Module Choice: Module II and IV | | | | | |
| Text books: | | | | | |

| | | | | | |
|---|---|----------------|----------|--------------|--------------|
| Course Title | DISTRIBUTED SYSTEMS | | | | |
| Course Code | 22ET6OE1DS | Credits | 3 | L-T-P | 3:0:0 |
| Prerequisites: Computer communication networks Objectives: Ability to learn distributed systems | | | | | |
| MODULE-I | | | | 8 Hrs | |
| Characterization of Distribution systems: Introduction, Examples of Distributed systems, Resource sharing and the Web, Challenges | | | | | |
| MODULE-II | | | | 8Hrs | |
| System Models: Introduction, Architectural models, Fundamental models | | | | | |
| MODULE-III | | | | 8 Hrs | |
| Networking and Internetworking: Introduction, Types of Network, Network Principles, Internet protocol | | | | | |
| MODULE-IV | | | | 8 Hrs | |
| Networking and Internetworking: Case studies: Ethernet, WiFi Inter Process Communication: Introduction, API for Internet Protocols, External Data Representation and Marshalling, Client – Server Communication, Group Communication | | | | | |
| MODULE-V | | | | 8 Hrs | |
| Distributed Multimedia systems: Introduction, Characteristics of Multimedia Data, Quality of Service Management, Resource management, Stream Adaptation, Caste study: The tiger video file server | | | | | |
| Unit Choice: MODULE IV & V | | | | | |
| Text books: | | | | | |
| 1 | Distributed Systems Concepts and Design, George Coulouris, Jean Dollimore, Tim Kindberg, Pearson, 4 th Edition | | | | |
| 2 | Andrew S Tanenbaum: Distributed Operating Systems, 3rd edition, Pearson publication, 2007 | | | | |
| Reference books: | | | | | |
| 1 | SunitaMahajan, Seema Shan, Distributed Computing, Oxford University Press,2015 | | | | |
| 2 | Ajay D. Kshemkalyani and MukeshSinghal, Distributed Computing: Principles, Algorithms and Systems, Cambridge University Press, 2008 | | | | |

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| E- References: | |
| 1. | https://nnrg.edu.in/PDF/Course/cse/R18/IV/DS.pdf |
| 2. | https://www.vturesource.com/vtu-syllabus/CS/2017/6/17CS654 |
| e-Learning : | |
| 1. | https://onlinecourses.nptel.ac.in/noc21_cs87/preview |
| 2. | https://onlinecourses.nptel.ac.in/noc21_cs15/preview |

Course outcomes

At the end of the course on **Distributed systems**, the student will have the ability to

| | | |
|-----|--|---------------|
| CO1 | Ability to understand the distributed systems concepts | -- |
| CO2 | Ability to apply the knowledge of APIs for internet protocols | PO1 |
| CO3 | Ability to analyze External Data Representation and Marshalling | PO2 |
| CO4 | Ability to present a seminar based on distributed systems concepts. | PO9,PO10,PO12 |

| | PO 1 | PO 2 | PO 3 | PO 4 | PO 5 | PO 6 | PO 7 | PO 8 | PO 9 | PO1 0 | PO1 1 | PO1 2 | Tota 1 |
|-----|------|------|------|------|------|------|------|------|------|-------|-------|-------|--------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 3 | - | - | - | - | - | - | - | - | - | - | - | 3 |
| CO3 | - | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | - | - | - | - | - | - | 3 | 3 | - | 3 | 3 |

| | | | | | |
|--|----------------------------|----------------|----------|--------------|--------------|
| Course Title | OPERATIONS RESEARCH | | | | |
| Course Code | 22ET6OE1OR | Credits | 3 | L-T-P | 3:0:0 |
| Prerequisites: Engineering mathematics | | | | | |
| Objective: To solve optimization problems for the management of resources using math, mind and tools. | | | | | |
| MODULE-I | | | | 8 Hrs | |
| LINEAR PROGRAMMING: Introduction, General system, Definition, mathematical formulation, standard form, graphical method: feasible, infeasible, multiple solution, unbounded solution and simplex method: feasible, infeasible, multiple solution, unbounded solution, Duality in LPP, Dual Simplex method. | | | | | |
| MODULE-II | | | | 8Hrs | |
| TRANSPORTATION PROBLEM: Formulation of transportation model, basic feasible solution using different methods, optimal solutions, degeneracy in transportation problems, unbalanced transportation problem | | | | | |
| ASSIGNMENT PROBLEM: Formulation, balanced, unbalanced and maximization assignment problem, travelling salesman problem using Hungarian method. | | | | | |
| MODULE-III | | | | 8 Hrs | |
| QUEUING THEORY: Queuing system and their characteristics, Analysis of Markovian queues, M/M/1, M/M/K queuing system. | | | | | |
| MODULE-IV | | | | 8 Hrs | |
| PROJECT MANAGEMENT USING NETWORK ANALYSIS: Network construction, determination of critical path and duration, floats using CPM. PERT-Estimation of project duration, Variance and crashing of projects | | | | | |
| GAME THEORY: Two persons - zero sum game, games with and without saddle point, graphical solution, dominance property. | | | | | |
| MODULE-V | | | | 8 Hrs | |
| COMPUTER BASED OR PROBLEM SOLVING | | | | | |
| Solving Operations Research problems - Constraint programming problems - Linear programming problems - Integer programming problems, Traveling Salesman Problem - Vehicle Routing Problem - Graph algorithms - shortest paths. Solving optimization problems using SciPy. Mathematical modelling, Solving simple examples, Implementation of Simplex method, Travelling Salesman problem, simulation of queuing model. | | | | | |
| Module Choice: Module I & Module IV | | | | | |
| Text books: | | | | | |
| 1. Operations Research and Introduction, Taha H A, Pearson Education, 9th | | | | | |

| | |
|--|--|
| Edition,2014 | |
| 2. Introduction to Operation Research, F K Hiller and Liberman, McGraw hill Education Pvt. Ltd, 9th Edition, 2011 | |
| 3. Operations Research –Principles and practice, Philips Ravindaran and Soleberg, Wiley Publication, 2nd Edition, 2007 | |
| Reference books: | |
| 1. Operations Research, S D Sharma, KedarNath, Ram Nath Publication, 2014 | |
| 2. Operations Research, Kanthiswarup and others, Sultan Chand and sons, 2014 | |
| 3. Operations Research Problems and Solutions, J K Sharma, McMillan Publishers, 3rd Edition, 2009. | |
| 4. Operations Research, P K Gupta and Hira, S Chand Publications, 2007 | |
| 5. Introduction to linear optimization Dimitris Bertsimas | |
| 6. Convex optimization by Stephen Boyd and Lieven Vandenberghe | |
| E- References: | |
| 1. | https://www.academia.edu/40241552/Operation_Research_Problems_Solving_in_Python |
| e-Learning : | |
| 1. | Introduction to Operations Research, IIT Madras, Prof. G. Srinivasan https://nptel.ac.in/courses/110106062 |
| 2. | Operations Research (1): Models and Applications by Ling –Chieh- Kung https://www.coursera.org/learn/operations-research-modeling |

Course outcomes

At the end of the course on **Operation Research**, the student will have the ability to

| | | |
|-----|--|----------------------|
| CO1 | Ability to understand the resource management using optimisation techniques | -- |
| CO2 | Ability to apply, analyse and classify operations research problems and obtain a feasible solution | PO1,PO2 |
| CO3 | Ability to design and model optimisation problems | PO3 |
| CO4 | Ability to conduct investigation through implementation of the experiment using software tools like Excel/ Java and/ Python | PO4,PO5,PO6,PO7,PO12 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| CO2 | 2 | 2 | - | - | - | - | - | - | - | - | - | - | 2 |
| CO3 | - | - | 2 | - | - | - | - | - | - | - | - | - | 2 |
| CO4 | - | - | - | 3 | 3 | 3 | 3 | - | - | - | - | 3 | 3 |

| | | | | | |
|---------------------|-----------------------|----------------|----------|--------------|--------------|
| Course Title | MINI PROJECT-2 | | | | |
| Course Code | 22ET6PWMP2 | Credits | 2 | L:T:P | 0:0:2 |

General Instructions:

1. A team of two to four students shall be permitted to work on a single mini project.
2. The mini project shall comprise of hardware / software component.
3. Students shall be evaluated on regular and continuous basis as per the prevailing rubrics
4. The team shall ensure that the project is in working condition during final demonstration.
5. The student is required to submit a report based on the project work carried out.
6. The team needs to demonstrate their mini project developed at the end of semester having scope to be taken to next higher level in next semester will be encouraged.

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

| | | | |
|------------|---|--|-----------------|
| CO1 | Engage in relevant survey and identify the standard to be implemented, together with listing the desired specifications | PO2 (3) PO12 (3) | PSO3 (3) |
| CO2 | Identify the essential concepts, and algorithms for the implementation | PO1 (3) PO3 (3) | |
| CO3 | Implement and analyse the designed program, to match the specifications | PO4 (2) | |
| CO4 | Calculate the performance analysis of the project | PO11 (2) | |
| CO5 | Prepare the project report , three minute video and the poster of the work | PO10 (3) | |
| CO6 | Engage in the team to document the business plan of the designed project, together with complying to relevant norms | PO7 (2) PO8 (3) PO9 (3) | |
| CO7 | Identify the community that shall benefit from the project | PO6 (1) | |

| Course Title | | INTERNSHIP BASED SEMINAR | | | |
|---|---|--------------------------|---|---------------|-------|
| Course Code | 22ET6SRIN2 | Credits | 1 | L:T:P | 0:0:1 |
| <p>During semester breaks, students are encouraged to take up Internships, each of duration 4 to 6 weeks. The work carried out in the semester break is assessed through an oral seminar accompanied by a written report.</p> <p>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:</p> <ul style="list-style-type: none"> • Successful completion of Value Added Programs/Training Programs/ workshops organized by academic Institutions and Industries • Active association with incubation/ innovation /entrepreneurship cell of the institute • 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/ NGO"s/ Government organizations/ Micro/ Small/ Medium enterprises • Development of a new product/ business plan/ registration of a start-up | | | | | |
| <p><i>At the end of the course, the student will have the ability to,</i></p> | | | | | |
| CO1 | Engage in internship in an engineering domain, and comprehend the professional norms of the organization | | | PO8 | |
| CO2 | Identify the key engineering, management, science, mathematics concepts, being transformed to a successful organization | | | PO1 PO11 | |
| CO3 | Identify the community that benefit from the product | | | PO6 | |
| CO4 | Identify and comprehend the professional norms and the model for sustainable development of the organization | | | PO7 | |
| CO5 | Identify the skills/concepts from various disciplines, and able to perform as a member of the multidisciplinary team | | | PO9 | |
| CO6 | Make an oral presentation based on the internship/development of a new product and prepare a report | | | PO10, PO12 | |

| | | | | | |
|---|---|----------------|----------|--------------|--------------|
| Course Title | INTELLECTUAL PROPERTY RIGHTS AND CYBER LAW | | | | |
| Course Code | 22ES6HSIPL | Credits | 2 | L-T-P | 2:0:0 |
| MODULE-I | | | | 5 Hrs | |
| 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. | | | | | |
| MODULE-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. | | | | | |
| MODULE-III | | | | 6 Hrs | |
| 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 | | | | | |
| MODULE-IV | | | | 5 Hrs | |
| 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 | | | | | |

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|--|--------------|
| MODULE-V | 4 Hrs |
| Indian Cyber law: Protecting Indian children online, Spam, contempt in cyber space, Indian consumers & cyber space, E-courts of India. | |
| Module Choice: Module II & III | |
| Text Books: | |
| <ol style="list-style-type: none"> 1. Dr. T Ramakrishna, "Basic principles and acquisition of Intellectual Property Rights", CIPRA, NSLIU -2005. 2. Dr. B. L. Wadehra, "Intellectual Property Law Handbook", Universal Law Publishing Co. Ltd., 2002. 3. Cyberlaw-The Indian perspective by Pavan Duggal, 2009 Edition. | |
| Reference books: | |
| <ol style="list-style-type: none"> 1. Dr. T Ramakrishna, "Ownership and Enforcement of Intellectual Property a. Rights", CIPRA, NSLIU -2005. 2. "Intellectual Property Law (Bare Act with short comments)", Universal Law a. Publishing Co. Ltd. 2007. 3. "The Trade marks Act 1999 (Bare Act with short comments)", Universal Law Publishing Co. Ltd., 2005. | |
| MOOC course: | |
| <ol style="list-style-type: none"> 1. https://nptel.ac.in/courses/110/105/110105139/ 2. https://nptel.ac.in/courses/109/106/109106137/ | |

At end of the course on **INTELLECTUAL PROPERTY RIGHTS AND CYBER LAW**, the student will be able to:

| COs | Course Outcomes | POs |
|-----|--|-----------|
| CO1 | Ability to understand and commit to professional ethics and responsibilities to obtain Intellectual property Rights like Patents, Copyright & Trademarks | PO8 |
| CO2 | Understand the impact of Patents, Copyright & Trademarks and demonstrate the knowledge of Cyber Law for the societal and environmental context | PO7 |
| CO3 | Ability to use IPRs and Cyber Law to access societal, health, safety & Cultural issues | PO6 |
| CO4 | Ability to work in multiple teams to effectively communicate IP & Cyber Law. | PO9, PO10 |

| | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PO8 | PO9 | PO10 | PO11 | PO12 | Total |
|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| CO1 | - | - | - | - | - | - | - | 1 | - | - | - | - | 1 |
| CO2 | - | - | - | - | - | - | 2 | - | - | - | - | - | 2 |
| CO3 | - | - | - | - | - | 2 | - | - | - | - | - | - | 2 |
| CO4 | - | - | - | - | - | - | - | - | 2 | 2 | - | - | 2 |

| | | | | | |
|---------------------|---|----------------|-----------|--------------|--------------|
| Course Title | PERSONALITY DEVELOPMENT, COMMUNICATION AND APTITUDE SKILLS | | | | |
| Course Code | 22ET6NCPDC | Credits | NC | L:T:P | 0:0:0 |

This course introduces to the following components:

Personality development:

Communication Skills:

Soft skills: Emotional Intelligence, Adaptability, Team player attitude, openness to feedback, growth mindset, work ethics, active listening

Aptitude skills:

The contents of this is to be developed.

It is planned to offer this course with support from alumni, or faculty/students from other departments.

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

| COs | | POs |
|------------|--|-------------|
| CO1 | Demonstrate professional communication skills | PO10 |
| CO2 | Demonstrate aptitude and reasoning skills | PO4 |
| CO3 | Demonstrate balanced emotional quotient and interpersonal skills | PO9 |