RAMAIAH
Institute of Technology

CURRICULUM

Outcome Based Education
(Effective from the Academic Year 2023 – 2024)

ELECTRONICS AND TELECOMMUNICATION ENGINEERING

V & VI SEMESTER B.E.

RAMAIAH INSTITUTE OF TECHNOLOGY
(Autonomous Institute, Affiliated to VTU)
Bangalore – 560054.

About the Institute:

Dr. M. S. Ramaiah a philanthropist, founded 'Gokula Education Foundation' in 1962 with an objective of serving the society. M S Ramaiah Institute of Technology (MSRIT) was established under the aegis of this foundation in the same year, creating a landmark in technical education in India. MSRIT offers 17 UG programs and 15 PG programs. All these programs are approved by AICTE. All eligible UG and PG programs are accredited by National Board of Accreditation (NBA). The institute is accredited with **'A+' grade by NAAC in March 2021** for 5 years. University Grants Commission (UGC) & Visvesvaraya Technological University (VTU) have conferred Autonomous Status to MSRIT for both UG and PG Programs since 2007. The institute has also been conferred autonomous status for Ph.D. program since 2021. The institute is a participant to the Technical Education Quality Improvement Program (TEQIP), an initiative of the Government of India. The institute has 380 competent faculty out of which 67% are doctorates. Some of the distinguished features of MSRIT are: State of the art laboratories, individual computing facility for all faculty members, all research departments active with sponsored funded projects and more than 300 scholars pursuing Ph.D. To promote research culture, the institute has established Centre of Excellence for Imaging Technologies, Centre for Advanced Materials Technology, Centre for Antennas and Radio Frequency systems (CARFS), Center for Cyber Physical Systems, Schneider Centre of Excellence & Centre for Bio and Energy Materials Innovation. **Ramaiah Institute of Technology has obtained "Scimago Institutions Rankings" All India Rank 107 & world ranking 600 for the year 2022.**

The Entrepreneurship Development Cell (EDC) and Section 8 company "Ramaiah Evolute" have been set up on campus to incubate startups. **M S Ramaiah Institute of Technology is recognized by Atal Ranking of Institutions on Innovation Achievements (ARIIA), MoE, Govt. of India.** MSRIT has a strong Placement and Training department with a committed team, a good Mentoring/Proctorial system, a fully equipped Sports department, large air-conditioned library with good collection of book volumes and subscription to International and National Journals. The Digital Library subscribes to online e-journals from Elsevier Science Direct, IEEE, Taylor & Francis, Springer Link, etc. The Institute is a member of DELNET, CMTI and VTU E-Library Consortium. The Institute has a modern auditorium, recording studio, and several hi-tech conference halls with video conferencing facilities. The institute has excellent hostel facilities for boys and girls. MSRIT Alumni have distinguished themselves by occupying high positions in India and abroad and are in touch with the institute through an active Alumni Association.

As per the National Institutional Ranking Framework (NIRF), MoE, Government of India, Ramaiah Institute of Technology has achieved 78th rank among 1314 top Engineering Institutions & 23rd Rank for School of Architecture in India for the year 2023.

About the department:

The Department of Electronics & Telecommunication Engineering (Formerly known as Department of Telecommunication Engineering) was established in 1996 to address the increasing demand for professionals with expertise in communication and networking technology in India. The Department has state of the art laboratories, equipment's, resources and committed faculty having best of the academic and industry recognition. The Department started a **M.Tech program in Digital Communication in the year 2004**. The Department also started a **Research Centre** in the year 2012 and currently has 07 Research Scholars carrying out their Research. Department has collaborations with some of the leading industries like **Ansys, Rohde & Schwarz, JV Micronics, Nokia, Huawei Technologies, Intel, Samsung,** and with leading national and international universities like **Bradley University, IIT-M**, enabling the department to focus on R&D, and thus providing new avenues for PG/UG students for placement and higher studies. Both UG and PG Programs are accredited by the **National Board of Accreditation**. There are **5 Funded Research projects** (Industry and Government) ongoing in the department involving students to carry out innovative projects. Many professional activities are organized regularly to the students under various professional societies like IEEE Sensor Council, IEEE Communication Society, IEEE Antenna and Propagation Society, IETE Bangalore and IEEE MTTs student Branch.

The department of ETE has established the Centre of Excellence – Centre for Antennas and Radio Frequency Systems (CARFS) Jointly with ECE department on 24th March 2021 to engage in advanced Research leading to innovation in the areas of Antennas & RF Systems. The CARFS has the State of the art Facilities to collaborate with Researchers in other Institutions across the Country and World in various projects.

VISION OF THE INSTITUTE

To be an Institution of International Eminence, renowned for imparting quality technical education, cutting edge research and innovation to meet global socio- economic needs

MISSION OF THE INSTITUTE

RIT shall meet the global socio-economic needs through

- Imparting quality technical education by nurturing a conducive learning environment through continuous improvement and customization
- Establishing research clusters in emerging areas in collaboration with globally reputed organizations
- Establishing innovative skills development, techno-entrepreneurial activities and consultancy for socio-economic needs

QUALITY POLICY

We at Ramaiah Institute of Technology strive to deliver comprehensive, continually enhanced, global quality technical and management education through an established Quality Management System complemented by the synergistic interaction of the stake holders concerned

VISION OF THE DEPARTMENT

To provide an ambience for the students to excel in studies, research and innovation, focusing on meeting global socio-economic needs from a Telecommunication Engineering perspective

MISSION OF THE DEPARTMENT

- Providing high quality technical education to create world class Telecommunication engineers.
- Creating an ambience for skill development, research and entrepreneurial activities to meet socio-economic needs

PROGRAM EDUCATIONAL OBJECTIVES (PEOs):

PEO1: Graduates will excel in professional careers in Industry, Academia and Research to meet Socio-Economic needs.

PEO2: Graduates will analyze problems specific to Telecommunication Engineering and multidisciplinary domains providing technically feasible solutions.

PE03: Graduates will exhibit professional communication skills, teamwork, leadership qualities, ethical behavior and lifelong learning.

PROGRAM OUTCOMES (POs):

PO1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principlesof 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 modeling 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 consequentresponsibilities 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, and 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 activitieswith 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 andunderstanding 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: Recognize 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):

PSO1: Identify, analyze, formulate, design and demonstrate applications relevant to Telecommunication engineering using electronic devices.

PSO2: Use current technology and modern tools to address solutions for telecommunication products by taking into account safety, healthy environmentalrequirements.

PSO3: Apply project management tools to solve Telecommunication systems byexhibiting teamwork and lifelong learning

NEP 2021-2025 Batch

B.E. in Electronics and Telecommunication Engineering
Scheme of Teaching V SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	ET51	Analog & Digital Communications	ETE	PCC	2	1	0	3	4
2	ET52	Embedded System Design	ETE	IPCC	2	0	1	3	4
3	ET53	Digital Signal Processing	ETE	PCC	2	1	0	3	4
4	ET54	Computer Communication Networks	ETE	PCC	3	0	0	3	3
5	ETE55x	Program Elective Course – 1	ETE	PEC	3	0	0	3	3
6	ETL56	Analog & Digital Communication Lab	ETE	PCC	0	0	1	1	2
7	ETL57	Digital Signal Processing Lab	ETE	PCC	0	0	1	1	2
8	AL58	Research Methodology & Intellectual property rights		HSMC	3	0	0	3	3
9	ETAEC510	Ability Enhancement Course – V	ETE	AEC	1	0	0	1	1
				Total	**16**	**2**	**3**	**21**	**26**
10	HS59	Environmental Studies *****		NCMC	0	0	0	0	1

* Environmental Studies is under the category of NCMC, 1-hour teaching per week has to be allocated in the time table.

Program Elective Course – 1	Internet of Things (ETE551)	Embedded Networks and Protocols (ETE552)	VLSI Circuits and Systems (ETE553)

Nomenclature: IPCC: Integrated Professional Core Course**, PCC:** Professional Core Course**, HSMC:** Humanity and Social Science & Management Courses**, PEC:** Professional Elective Courses**, AEC–**Ability Enhancement Courses,
NCMC: Non-credit Mandatory Course

L –Lecture, T – Tutorial, P- Practical/ Drawing

Note: XXE55x, where x=1,2,3,4,5

Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. Credit for IPCC is 03 and its Teaching–Learning hours (L : T : P) can be considered as (2 : 0 : 1). The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated only by CIE (no SEE). However, questions from the practical part of IPCC can be included in the SEE question paper.

Professional Elective Courses: A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum student's strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Innovation/ Societal/ Entrepreneurship based Internship: At the End of fourth Semester four - weeks Summer Internship Shall Be Carried Out – Based On industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. Credited in fifth Semester. All the students admitted shall have to undergo mandatory internship of 04 weeks during the vacation of IV semester. A Viva-Voce examination shall be conducted during VI semester and the prescribed credit shall be included in VI semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years' degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; 8th semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the 8th semester grade card.

The Non-Credit Mandatory Course The students shall attend classes for the course during the semester and complete all formalities of attendance and CIE. In case, any student fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured **'F'** grade. In such a case, the student has to fulfill the requirements during subsequent semester/s to appear for CIE. This Course shall not be considered for vertical progression, but completion of the course shall be mandatory for the award of the degree.

B.E. in Electronics and Telecommunication Engineering
Scheme of Teaching and Examination VI SEMESTER

Sl. No.	Subject Code	Subject	Teaching Department	Category	Credits				Total contact hours /week
					L	T	P	Total	
1	AL61	Management & Entrepreneurship	ETE	HSMC	3	0	0	3	3
2	ET62	Microwave & Antenna Engineering	ETE	PCC	2	1	0	3	4
3	ETE63X	Program Elective Course – 2	ETE	PEC	3	0	0	3	3
4	ETE64X	Program Elective Course – 3	ETE	PEC	3	0	0	3	3
5	ETL65	Microwave & Antenna Engineering Lab	ETE	PCC	0	0	1	1	2
6	ETL66	Computer Communication Networks Lab	ETE	PCC	0	0	1	1	2
7	ETOE01	Institutional Open Elective - 1		IOE	3	0	0	3	3
8	ETP67	Mini Project	ETE	PW	0	0	3	3	-
9	INT68	Innovation/Societal/ Entrepreneurship based Internship		INT	0	0	2	2	-
				Total	**14**	**1**	**7**	**22**	**20**

Program Elective Course – 2	Machine Learning ETE631	Operating Systems ETE632	Radar and Satellite Communication ETE633
Program Elective Course – 3	Data science using Python ETE641	Real Time Systems ETE642	Network Security ETE643
Institutional Open Elective - 1	HTML and PHP (ETOE01)		

Nomenclature, PCC: Professional Core Course**, PEC:** Professional Elective Courses, **IOE:** Institutional Open Elective, **PW:** Mini Project, **INT –** Internship

L –Lecture, T – Tutorial, P- Practical/ Drawing

Note: XXE63x , where x=1,2,3,4,5
XXE64x , where x=1,2,3,4,5
XXOE0x*, where x=1,2,..,… continued from previous

L –Lecture, T – Tutorial, P- Practical/ Drawing/ Project work

Professional Elective Courses: A professional elective (PEC) course is intended to enhance the depth and breadth of educational experience in Engineering and Technology curriculum. Multidisciplinary courses that are added supplement the latest trend and advanced technology in the selected stream of engineering. Each group will provide an option to select one course out of five courses. The minimum student's strength for offering professional electives is 10. However, this conditional shall not be applicable to cases where the admission to the program is less than 10.

Institutional Open Elective Courses:

Students belonging to a particular stream of Engineering and Technology are not entitled for the open electives offered by their parent department. However, they can take an elective offered by other departments, provided they satisfy the prerequisite condition, if any. Registration to open electives shall be documented under the guidance of the Program Coordinator/ Advisor/Mentor.

Selection of an open elective shall not be allowed if,

1. The candidate has studied the same course during the previous semesters of the program.
2. The syllabus content of open electives is similar to that of the Departmental core courses or professional electives.
3. A similar course, under any category, is prescribed in the higher semesters of the program.
4. The minimum students' strength for offering open electives is 10. However, this condition shall not be applicable to cases where the admission to the program is less than 10.

Mini-project work: Mini Project is a laboratory-oriented course which will provide a platform to students to enhance their practical knowledge and skills by the development of small systems/applications.

Based on the ability/abilities of the student/s and recommendations of the mentor, a single discipline or a multidisciplinary Mini- project can be assigned to an individual student or to a group having not more than 4 students.

CIE procedure for Mini-project:

(i) Single discipline: The CIE marks shall be awarded by a committee consisting of the Head of the concerned Department and two faculty members of the Department, one of them being the Guide. The CIE marks awarded for the Mini-project work shall be based on the evaluation of project report, project presentation skill, and question and answer session as per the rubrics defined by the department.

(ii) Interdisciplinary: Continuous Internal Evaluation shall be group-wise at the college level with the participation of all the guides of the project.

The CIE marks awarded for the Mini-project, shall be based on the evaluation of project report, project presentation skill, and question and answer session as per the rubrics defined by the parent department.

SEE component for Mini-Project: SEE will be conducted by the two examiners appointed by the Institute. SEE marks awarded for the mini project shall be based on the evaluation of project work report, project presentation skill and question and answer session.

Research/Industrial Internship - At the end of sixth / seventh semester (in two cycles to accommodate all the students of the) Research/Industrial Internship shall be carried out – Based on Industrial/Govt./NGO/MSME/Rural Internship/Innovation/Entrepreneurship. All the students admitted shall have to undergo mandatory internship of 24 weeks during the vacation of VI/VII semesters. A Viva-Voce examination shall be conducted during VII semester and the prescribed credit shall be included in VII semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take-up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

Research internship Students have to take up research internship at Centers of Excellence (CoE) / Study Centers established in the same institute and /or out of the institute at reputed research organization / Institutes. Research internship is basically intended to give you the flavor of current research going on in a particular topic/s. The internships serve this purpose. They help students get familiarized with the field, the skill needed the effort amount and kind of effort required for carrying out research in that field.

Industry internships: Is an extended period of work experience undertaken by /Institute students looking to supplement their degree with professional development. The students are allowed to prepare themselves for the workplace and develop practical skills as well as academic ones. It also helps them learn to overcome unexpected obstacles and successfully navigate organizations, perspectives, and cultures. Dealing with "unexpected contingencies" helps students recognize, appreciate, and adapt to organization realities by tempering knowledge with practical constraints.

AICTE Activity Points to be earned by students admitted to BE program (For more details refer to Chapter 6, AICTE, Activity Point Program, Model Internship Guidelines):

Every regular student, who is admitted to the 4-year degree program, is required to earn 100 activity points in addition to the total credits earned for the program. Students entering 4 years' degree program through lateral entry are required to earn 75 activity points in addition to the total credits earned for the program. The activity points earned by the student shall be reflected on the students 8th semester grade card. The activities to earn the points can be spread over the duration of the course. However, minimum prescribed duration should be fulfilled. Activity points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. Incase student fail to earn the prescribed activity points; 8th semester grade card shall be issued only after earning the required activity Points. Students shall be eligible for the award of degree only after the release of the 8th semester grade card.

ANALOG AND DIGITAL COMMUNICATIONS	
Course Code: ET51	**Credits: 2:1:0**
Pre – requisites: Signals and systems, Engineering Mathematics	**Contact Hours:** 28L+28T
Course Coordinator: Dr. Parimala.P	

Unit I

Analog modulation Techniques: Introduction to Amplitude Modulation, Description, Generation and Demodulation of AM, DSBSC, Single Side-Band Modulation, Vestigial sideband Modulation.

Introduction to Angle modulation, Description, Generation and Demodulation of FM and PM Modulation

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=NTcDup0_B4w

Unit II

Noise Basics and Noise in Continuous Wave Modulation Systems: Introduction to noise shot noise, thermal noise, white noise, noise equivalent bandwidth, noise figure, noise equivalent noise temperature, Cascade connection of two port network.

Receiver models, Noise in AM receivers, Noise in FM receivers, pre-emphasis and de-emphasis in FM.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=dg90YHKIh6o

Unit III

Signal Sampling: Basic signal processing operations in Digital communication, Sampling Theorem, PAM, TDM.

Waveform Coding Techniques: PCM block diagram, Different quantization techniques , DPCM, DM, Adaptive DM

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=W5q-Ac0JVdk

Unit IV

Base-Band Shaping for Data Transmission: Line Codes and their power spectra, Inter symbol interference.

Digital Modulation Techniques: Digital Modulation formats, Detection and Estimation, Model of DCS, Gram-Schmidt Orthogonalization procedure, Correlation receiver, Matched filter receiver.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=1u93CMn4sEg

Unit V

Introduction to Information theory and coding: Entropy, Zero memory sources and Markov sources, source coding

Error control coding :Channel coding techniques

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=bmtew4kzHXU

Text books:

1. Simon Haykin, "Communication Systems" 3rd edition John Wiley, 2010.
2. Simon Haykins, "An Introduction to analog and Digital communications", John Wiley, 2010.
3. K. Sam Shanmugam, "Digital and Analog Communication systems", John Wiley, 2012

References books:

1. B.P Lathi, "Modern Digital and Analog Communication Systems", 3rd edition 2011, Oxford University press.
2. Harold P.E Stern Samy and A Mahmoud, "Communication Systems", Pearson Education, 2009.
3. Singh and Spare, "Communication Systems: Analog and Digital", TMH 2nd edition, 2009

Web Links and Video Lectures (e-Resources)

1. NPTEL online course: https://www.digimat.in/nptel/courses/video
   a. /117105143/L01.html
2. https://www.digimat.in/nptel/courses/video/117105144/L01.html

Course Outcomes (COs):

1. Understand the concepts of various Analog Modulation, Digital modulation, detection, estimation and coding techniques. **(PO1, 2, 3, 4, 6, 7,9, 12) (PSO1, 2, 3)**
2. Apply and solve problems on Analog modulation, Digital modulation, detection, estimation and coding techniques **(PO1, 2, 3, 4, 6,7, 9, 12) (PSO1, 2, 3)**

3. Analyze sampling, quantization, digital modulation, detection and coding techniques **(PO1, 2, 3, 4, 6,7, 9, 12) (PSO1, 2, 3)**
4. Analyze the Base-Band Shaping for Data Transmission, Detection, and estimation, coding **(PO1, 2, 3, 4, 6,7, 9, 12) (PSO1, 2, 3)**
5. Evaluate of analog and digital modulation schemes in communication systems **(PO1, 2, 3, 4, 6,7, 9, 12) (PSO1, 2, 3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3
Internal test-II	30	CO1, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
MINI PROJECT	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

EMBEDDED SYSTEM DESIGN	
Course Code: ET52	**Credits: 2: 0: 1**
Pre – requisites: Microcontroller	**Contact Hours:** 28L+28P
Course Coordinator: Dr. S G Shivaprasad Yadav	

Unit-I

Introduction to Embedded Systems: Introduction, Characteristics of Embedded Computing Applications, The Embedded System Design Process, Requirements, Specification, Architecture Design, Designing Hardware and Software Components, System Integration, Formalisms for System Design, Structural Description, Behavioral Description.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Unit-II

ARM Cortex M-series Processors Fundamentals and Instruction set - Introduction to ARM Cortex-M series Processor, Architecture versions, The Thumb-2 Instruction Set Architecture (ISA), Cortex-M series Processor Applications, Overview of the Cortex-M3 and M4, Fundamentals, Registers, Special Registers, Operation Modes, The Built-In Nested Vectored Interrupt Controller, Exceptions and Interrupts, Vector Tables, Stack Memory Operations, Instruction Sets - Assembly Basics, Instruction set descriptions.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Unit-III

ARM Cortex-M Series Implementation and Exceptions - The Pipeline, Detailed Block Diagram, Bus Interfaces on the Cortex-M4, External Private Peripheral Bus, Debug Access Port Bus, Typical Connections, Reset Signals, Exception types, Definition of priorities, Vector Tables, Interrupt Inputs and Pending behavior, Fault exceptions, supervisor call and spendable service call

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Unit-IV

ARM Cortex M-series NVIC and Programming: NVIC and Interrupt Control, Basic

Interrupt Configuration, Interrupt Enable and Clear Enable, Interrupt Pending and Clear Pending, Example Procedures of Setting Up an Interrupt, Software Interrupts, Cortex-M3 Programming - Using Assembly, Using C, The Interface Between Assembly and C, A Typical Development Flow, Producing Outputs, Using Data Memory, Using Exclusive Access for Semaphores.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Unit-V

Real Time Operating System: Fundamentals of RTOS, Features, characteristics of RTOS, Tasks, Task states, State Transition Diagram, Task Control Block (TCB), Multitasking, Context Switching, Need and problems of shared data, Semaphores, Types of semaphores, Problems with semaphores, Deadlock, Priority Inversion and overcoming techniques, Overview of different types of RTOS - Features of VXWorks, Mucos.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc22_cs93/preview

Text Books:

1. Wayne Wolf, "Computers as Components Principles of Embedded Computer System Design", Second Edition, Elsevier, 2008.
2. Joseph Yiu, "The Definitive Guide to the ARM Cortex-M3 and M4 processors", Newnes Publications, 3rd edition, 2013
3. David E. Simon, "An Embedded Software Primer", Addison- Wesley, 1999
4. Rajkamal, "Embedded Systems: Architecture, Programming and Design, Tata McGraw Hill, New Delhi, 2003

References:

1. Frank Vahid / Tony Givargis "Embedded System Design A Unified Hardware/Software Introduction" 1st Edition, John Wiley & Sons, 2002.
2. Dr. K.V. K. K.Prasad "Embedded Real Time Systems: Concepts Design and Programming", Dreamtech Press New Delhi, 2003.
3. Arnold S.Berger, "Embedded System Design: An Introduction to Processes, Tools and techniques", CMP Book, Dec 200l.
4. Andrew N. Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide", Morgan Kaufamnn (Elsevier Inc.), 2004

LIST OF EXPERIMENTS:

Session Numbers	Topics
1	Program for Addition and subtraction of 64-bit data
2	Program for multiplication of data using shift and add technique
3	Program to demonstrate Data transfer with and without overlap
4	Program for swapping the data (Block Exchange)
5	Program for bit extraction and bit clearing of data
6	Program to compute the factorial of a given number
7	Programming for interfacing GPIO - LED
8	Programming for interfacing GPIO – multiple LEDs with buzzer
9	Program for interfacing LCD
10	Program for interfacing Keypad
11	Program for Interfacing Seven segment display
12	Program for Interfacing for ADC on LCD
13	Program for Interfacing for ADC on Seven segment display
14	Program for Interfacing RGB LEDs

Course Outcomes (COs):

1. Describe the differences between the general computing system and the embedded system, characteristics, challenges, embedded design process, their applications and need for RTOS in embedded systems. **(PO 1, 2, 3, 4, 6, 7, 11, 12) (PSO 1, 2, 3)**
2. Analyse the ARM Cortex Microcontrollers, architecture, its features, Interrupts, Bus Implementation, Exceptions and its various peripherals. **(PO 1, 2, 3, 4, 11, 12) (PSO 1 and 3)**
3. Proficiency in the usage of tools for developing and debugging “Assembly” and "C" programs for ARM Cortex M-series microcontrollers to simulate and configure various peripherals using Keil IDE **(PO1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12) (PSO 1, 2, 3)**
4. Ability to design embedded systems, component or a process including hardware/software interfaces for various Input - Output devices using the design process and optimizing it exploring the role of RTOS **(PO1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12) (PSO 1, 2, 3)**

5. Demonstrate technical ability to build interdisciplinary microcontroller-based systems and proficiency to document the work in a technical record/report involving teamwork **(PO1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3, CO4, CO5
Mini Project	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DIGITAL SIGNAL PROCESSING	
Course Code: ET53	**Credits: 2:1:0**
Pre – requisites: Signals & Systems	**Contact Hours:** 28L+28T
Course Coordinator: Dr. B K Sujatha	

Unit-I

Discrete Fourier Transforms: Definition of DFT and its inverse, Properties of DFT: linearity, time shift, frequency shift, symmetry for real sequences, complex conjugate, circular folding, multiplication, circular correlation, inner product, or Parseval's relation, linear filtering using DFT, signal segmentation method: overlap add, overlap save methods.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://nptel.ac.in/courses/117102060

Unit-II

Fast Fourier Transforms: FFT algorithms: direct computation of DFT, need for efficient computation of DFT (FFT algorithms), radix 2 FFT algorithms for computation of DFT, IDFT, decimation in time, decimation in frequency algorithms, Chrip Z transforms, Goertzel algorithm, relationship between DFT and other transforms. Frequency analysis of signals using DFT

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://nptel.ac.in/courses/117102060

Unit-III

IIR Filters: Frequency domain specification of IIR filters, frequency transformations, magnitude response and frequency response of Butterworth filters, and its properties, determination of filter order and transfer function of Butterworth filters. Magnitude frequency response of Chebyshev filters, and its properties, determination of filter order and transfer function of Chebyshev filters. Design of Butterworth and Chebyshev filters, Structure of digital filters, BLT and its properties, Backward difference method, numerical solutions for differential equations, Impulse Invariant transforms, Matched Z transforms, Design of analog filter using Digital filter.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://nptel.ac.in/courses/117102060

Unit-IV

FIR Filters: Need for FIR filters, Symmetry and Anti symmetry conditions for linear phase, design of FIR filters using -Rectangular, Hamming, Harming, Blackman, Bartlet

and Kaiser windows, FIR filter design using frequency sampling technique.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://nptel.ac.in/courses/117102060

Unit-V

Realization of FIR Filters: Direct form I and Direct form II relationship of an IIR filter, Cascade realization of an IIR filter, Parallel realization of an IIR filter, Direct form I realization of FIR filter, Realization of FIR filter with linear phase, Lattice realization of FIR filter.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://nptel.ac.in/courses/117102060

Text books:

1. Proakis & Monalakis, Digital signal processing - Principles Algorithms & Applications, Published by Pearson education (July 23rd 2021) – Copyright © 2022, 5th Edition.

Reference books:

1. Oppenheim & Schaffer, Discrete Time Signal Processing, PHI, 2012.
2. S. K. Mitra, Digital Signal Processing, Tata Mc-Graw Hill, 2nd Edition, 2013.
3. Dr.D. Ganesh Rao, Vineeta P Gejji, Digital Signal Processing-, 2E, Sanguine Technical Publications.

Course Outcomes(COs):

1. Acquire the basic knowledge of signal processing and apply this to the solution of complex engineering problems using DFT, IDFT & FFT, FIR and IIR concept**.**
   (PO 1, 2, 3, 4, 5, 9, 12) (PSO 1, 2)
2. Design of standard DFT, IDFT & FFT, FIR and IIR digital filters for low pass, high pass, band pass, band stop applications. **(PO 1, 2, 3, 4, 5, 8, 9, 12) (PSO 1, 2)**
3. Implementation of standard DFT, IDFT & FFT, FIR and IIR digital filters for low pass, high pass, band pass, band stop applications. **(PO 1, 2, 3, 4, 5, 8, 9, 12) (PSO 1, 2)**
4. Evaluate DFT, FFT filters and IIR and FIR filters using direct forms, cascade and parallel forms & lattice structures. **(PO 1, 2, 3, 4, 5, 8, 9, 10) (PSO 1, 2)**
5. Realization of different IIR and FIR filters using MATLAB **(PO 1, 2, 3, 4, 5, 8, 9) (PSO 1, 2)**

Course Assessment and Evaluation:

Continuous Internal Evaluation(CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3,CO4,CO5
Assignment	10	CO1,CO2,CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

COMPUTER COMMUNICATION NETWORKS	
Course Code: ET54	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours:** 42L
Course Coordinator: Dr. Venu K N	

Unit-I

Physical and datalink layer: Data communications, networks, network types, protocol layering, OSI model, TCP/IP protocol suite, multiplexing, transmission media, data link control, media access protocols. Link layer addressing

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=pVl1L1jrbFE

Unit-II

LAN, virtual LANs, and network layer: Ethernet**,** Wi-Fi, IEEE 802.11, Bluetooth, connecting devices, virtual LANS, services, packet switching, performance, IPV4

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=zVdyKTQyvVY

Unit-III

Next-generation IP and routing: IPV6, transition from IPV4 to IPV6, Routing algorithms, unicast routing protocols, multicast routing, IGMP.

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=FkaFr3cpg6U

Unit-IV

Transport layer: Transport layer services, transport layer protocols, transmission control protocol, SCTP

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=5ex1s4lURto

Unit-V

Application layer: Introduction, client/server paradigm, standard applications, domain name systems, socket interface programming, compression. Multimedia data and multimedia data in the internet

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=q3MwN9R0Br4

Text books:

1. Data communications and networking with TCP/IP protocol suite by

Beharouz A. Forouzan, 6th edition, 2022 by McGraw Hill

Reference books:

1. Leon-Garcia and Widjaja, "Communication Networks", MGH, 2nd edition, 2012.
2. Andrew.s. Tanenbaum, "Computer Networks", 4th edition, Pearson Education, 2010
3. William Stallings, "Data and Computer Communication", PHI, 2012.

Web Links and Video Lectures (e- Resources)

1. https://www.youtube.com/watch?v=swtH_okidQc&list=PLUtfVcb-iqn8dG1-Cn7NTEdILR3hRVgcN
2. https://www.youtube.com/watch?v=qiQR5rTSshw
3. https://www.youtube.com/watch?v=_9QayISruzo

Course Outcomes (COs):

1. Understand the importance of OSI and TCP layers and interpret the concepts behind the working of different media access protocols (**PO1,2,3,5,7) (PSO1,2)**
2. Interpret the concepts behind the working of LAN, virtual LANs, and the importance of IPV4 **(PO1,2,3,8,9) (PSO 1,2,3)**
3. Interpreting the need for IPV6 protocol and analyzing the working of different unicast and multicast routing protocols **(PO 1, 2, 3, 4, 10, 12) (PSO 1,3)**
4. Analyzer the role of Transmission control protocol for end-to-end communication as well as the use of UDP protocol **(PO 1, 2, 3, 4,11,12) (PSO 1,3)**
5. Understanding the role of domain name systems in computer communication **PO1,2,3,4,6,12) (PSO1,2,3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation(CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3,CO4,CO5
Assignment	10	CO1,CO2,CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ANALOG AND DIGITAL COMMUNICATION LAB	
Course Code: ETL56	**Credits:** 0:0:1
Pre – requisites: Signals and systems, Engineering Mathematics	**Contact Hours:** 28P
Course Coordinator: Dr. Parimala.P	

LIST OF EXPERIMENTS

1. Amplitude modulation using transistor (generation and detection).
2. Pre-emphasis and De-emphasis
3. Frequency modulation using 8038/2206
4. Verification of Sampling Theorem
5. Transistor mixer
6. Amplitude Shift Keying Modulation and Demodulation.
7. Frequency Shift Keying Modulation and Demodulation using IC4051.
8. Phase Shift Keying Modulation and Demodulation using IC4051.
9. Pulse Code Modulation and Demodulation using codec chip 44233.
10. Differential Phase Shift Keying Modulation and Demodulation using kit.
11. Quadrature Phase Shift Keying Modulation and Demodulation using kit.
12. Time Division Multiplexing
13. Simulation of source coding
14. Simulation of channel coding

Reference books:

1. Haribhat and Ganesh Rao, "Analog Communications", Sanguine Technical Publishers, 2015
2. Haribhat and Ganesh Rao, "Digital Communications", Sanguine Technical Publishers, 2015
3. Simon Haykin, "An Introduction to Analog and Digital Communication", John Wiley, 2016.
4. Simon Haykin, "Digital Communication", John Wiley, 2012

Web Links and Video Lectures (e-Resources):

1. https://www.youtube.com/watch?v=E5evBWUI9zIc
2. https://www.youtube.com/watch?v=-3XofUK2GUU

Course Outcomes (COs):

1. Design and evaluation of analog modulation circuits for AM, DSBSC and FM.
   (PO1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)
2. Design and evaluation of Pre-emphasis, De-emphasis, Transistor mixer
   (PO1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)
3. Design and verification of sampling theorem and Time division multiplexing.
   (PO1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)
4. Design and evaluation of Digital modulation techniques **(PO1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
5. Design, simulation and evaluation of source code and channel code **(PO1, 2, 3, 4, 5, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Weekly evaluation of laboratory observation/records after the conduction of every experiment, viva voce	30	CO1, CO2, CO3, CO4, CO5
Practical test	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

DIGITAL SIGNAL PROCESSING LAB	
Course Code: ETL57	**Credits: 0:0:1**
Pre – requisites: Signals and System and Signal Processing Lab	**Contact Hours:** 28P
Course Coordinator: Dr. Venu K N	

Experiments using OMAPl138 (6748 LCDK) DSP (TMS320C6748):

Part A

Non-Real Time Experiments with C6748 DSK:

1. Solution of Differential Equations, Generation of random signal and sine wave and to compute and plot Power Density Spectrum
2. To Verify Linear and circular Convolution
3. To find 8Point FFT (DIF), DFT and IDFT of Given Samples
4. Interpolation and Decimation Filters
5. FIR and IIR Filter implementation
6. Adaptive Filter implementation
7. MAC operation using various addressing modes (assembly programming).

Part B

Real Time Experiments with C6748 DSK using Audio CODEC: Audio Processing and Image Processing

1. Audio Processing with Audio loop back. Delayed Audio Loop Back, Echoed Audio
2. Waveform generation using Audio CODEC and Storing Audio Signals in External Memory
3. Applying DCT/IDCT on image
4. Pixel operations on images
5. Applying Filters to Image, Smoothing, Sharpening, Threshold and Sobel edge
6. Demo on Image Capturing and processing using USB Camber
7. Demo on Video Capturing and displaying in VGA monitor

Text books:

1. Donald Reay, “Digital Signal Processing and Applications with the OMAP - L138”, March 2012

2. Thad B. Welch, Cameron H.G. Wright and Michael G. Morrow, "Real-Time Digital Signal Processing from MATLAB to C with the TMS320C6x DSPs", Third Edition, Jan 2017

Reference books:

1. Alan V. Oppenheim and Ronald W. Schafer, "Discrete-Time Signal Processing", 3rd edition (2011) by "TMS320C6748 DSP" Technical Reference Manual, September 2016

Web Links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=zDwecHsZpcU
- https://www.youtube.com/watch?v=Apk1mMdBIx0

Course Outcomes (COs):

1. Proficiency in the usage of tools for DSP systems programming and debugging. **(PO1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12) (PSO 1, 2, 3)**
2. Develop "Assembly" and "C" programs for TMS320 C6748 DSK for various Real time and non-real time experiments using CCS IDE **(PO1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12) (PSO 1, 2, 3)**
3. An ability to design the Filters for various embedded DSP Applications using TMS320 C6748 DSP processor along with time and frequency domain analysis **(PO1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12) (PSO 1, 2, 3)**
4. Ability to design Embedded DSP applications including hardware/software interfaces and various Input/output devices **(PO1, 2, 3, 4, 5, 6, 7, 9, 10, 11, 12) (PSO 1, 2, 3)**
5. Demonstrate technical ability to build interdisciplinary DSP based systems and proficiency to document the work in a technical record/report involving teamwork (**PO1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Weekly evaluation of laboratory observation/records after the conduction of every experiment, viva voce	30	CO1, CO2, CO3, CO4, CO5
Practical test	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

RESEARCH METHODOLOGY & INTELLECTUAL PROPERTY RIGHTS	
Course Code: AL58	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours:** 42L
Course Coordinator: Dr. H R Ramya	

Unit I

Research Methodology

Introduction: Meaning of Research, Objectives of Research, Types of Research, Ethics in Research, Types of Research Misconduct.

Literature Review and Technical Reading, New and Existing Knowledge, Analysis and Synthesis of Prior Art, Bibliographic Databases, Conceptualizing Research, Critical and Creative Reading.

Citations: Functions and Attributes, Impact of Title and Keywords on Citations, Knowledge flow through Citations, Acknowledgments, and Attributions.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Unit II

Research Design: Need for Research Design, Important Concepts Related to Research Design: Dependent and Independent Variables, Extraneous Variable, Variable, Common Control, Confounded Relationship, Research Hypothesis, Experimental and Control Groups, Treatments.

Experimental Designs: Introduction to Randomised Block Design, Complete Randomised Design, Latin Square Design, and Factorial Design.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc22_ge08/preview

Unit III

Method of Data Collection: Primary and Secondary Data Collection.

Sampling Design: Sampling fundamentals, Measurement, and Scaling Techniques, Criteria of Selecting a Sampling Procedure, Characteristics of a Good Sample Design, and Types of Sample Design.

Data Analysis: Testing of Hypotheses: Null Hypothesis, Alternative Hypothesis, Type I and Type II Errors, Level of Significance. Procedure for Hypothesis Testing: Mean, Variance, Proportions. Chi-square Test, Analysis of Variance (One Way ANOVA), and Covariance (ANOCOVA)

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://onlinecourses.nptel.ac.in/noc23_ge36/preview

Unit IV

Intellectual Property

Rights Introduction to IPR: Different forms of IPR, Role of IPR in Research and Development. TRIPS Agreement, Patent Cooperation Treaty (PCT).
Patents: Brief history of Patents-Indian and Global Scenario, Principles Underlying Patent Law, Types of Patent Applications in India, Procedure for Obtaining a Patent. Non Patentable Inventions. Rights Conferred to a Patentee, Basmati Rice Patent Case.

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://archive.nptel.ac.in/courses/110/105/110105139/

Unit V

Design: What is a Design? Essential Requirements for a Registrable Design, Procedure of Registration of a Design,
Trademarks: Essentials of a Trademark, Registration, and Protection of Trademarks, Rights Conferred by Registration of Trademarks, Infringements, Types of Reliefs, Case Studies.
Copyrights: Characteristics of Copyrights, Rights Conferred by Registration of Copyrights, Registration of Copyrights, Infringements, Remedies against Infringement of Copyrights, Case studies

- Pedagogy: Chalk and Talk, PowerPoint Presentations
- Links: https://archive.nptel.ac.in/courses/110/105/110105139/

Textbooks:

1. C. R Kothari, Gourav Garg, Research Methodology – Methods and Techniques. New Age International Publishers.
2. Dr. B L Wadehra – Law relating to Intellectual property. Universal Law Publishing Co.
3. Dipankar Deb, Rajeeb Dey, Valentina E. Balas "Engineering Research Methodology", ISSN 1868-4394 ISSN 1868-4408 (electronic), Intelligent Systems Reference Library, ISBN 978-981-13-2946-3 ISBN 978-981-13-2947-0 (eBook), https://doi.org/10.1007/978-981-13-2947-0.

Reference Books:

1. David V. Thiel "Research Methods for Engineers" Cambridge University Press, 978-1-107-03488-4

Course Outcomes:

At the end of the course, the student will be able to:
CO1: Possess the knowledge of research and conduct a literature review**.** (PO-8, PO-

10, PO-12)

CO2: Apply the knowledge of research design and design of experiments. (PO-4, PO-8, PO 10, PO-12)

CO3: Analyse data collection methods, analysis, and sampling design. (PO-4, PO-8, PO-10, PO-12)

CO4: Understand the global and Indian scenarios of patents and patent applications. (PO-8, PO-10, PO-12)

CO5: Acquire the requirements of registration and infringements related to trademarks, copyrights, and designs. (PO-8, PO-10, PO-12)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcome attained**
Internal test - 1	30	CO1, CO2, CO3
Internal test - 2	30	CO4, CO5
The average of the two internal tests will be taken for 30 marks		
Other Components		
Assignment	10	CO1, CO2
Quiz	10	CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

ABILITY ENHANCEMENT COURSE – V- AGRICULTURE TECHNOLOGY	
Course Code: ETAEC510	**Credits: 1:0:0**
Pre – requisites: Nil	**Contact Hours:** 14L
Course Coordinator: Dr. Arvind Kumar G	

Unit-I

Introduction of Indian agricultural heritage; Ancient agricultural practices, Relevance of heritage to present day agriculture

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: http://eagri.org/eagri50/AGRO102/lec01.pdf

Unit-II

Agronomy and its scope, Principles of Agronomy, seeds and sowing, Methods of sowing, timing of sowing, Depth of Sowing.

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links:https://www.agricultureinindia.net/agronomy/principles/agronomy-principles-8-major-principles-of-agronomy-agriculture/19884

Unit-III

Crop nutrition, manures and fertilizers, nutrient use efficiency, water resources, and soil-plant-water relationship.

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: http://eagri.org/eagri50/AGRO102/lec01.pdf

Unit-IV

HYDROPONICS- Principles and Concepts of Hydroponic Technology, essential plant nutrient elements, Preparation of nutrient solution and rooting media

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: https://psci.princeton.edu/tips/2020/11/9/the-future-of-farming-hydroponics

Unit-V

IoT in Hydroponics – Why IoT in Agriculture. Basic Building Blocks of an IoT based Smart farming system. Development of a Smart Hydroponic system using IoT.

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: https://risehydroponics.in/step-by-step-guide-to-grow-plants-hydroponically/

Text books:

1. N.R. Das., "Introduction to crops of India", Scientific Publishers. 2020
2. ICAR, "Handbook of Agriculture" ICAR-New Delhi 2018
3. J. Benton Jones. Jr. "Growing Plants Hydroponically" 4th Edition, The Future Garden Press, 2003

Reference books:

1. Aubrey Ortiz, Hilary Rotatori, Liz Schreiber, George von Roth "Hydroponic Farming in Mahasarakham" scientific publishers 2019
2. Hydropnics Farming Technology –A skilling program training manual. By DoA Ministry of Agriculture and Forests, Royal Govt. of Bhutan. 2010

Course Outcomes (COs):

1. Understand the basic principles, practices and modernization of Indian Agriculture (PO 1, 7, 12) (PSO 2)
2. Understand the fundamentals of Agronomy, timing of seeds sowing, tillage and tilth (PO 1, 7, 12) (PSO 2)
3. Illustrate the need of crop nutrition, manures and fertilizers, nutrient use efficiency and water resources (PO 1,2,3,7,12) (PSO 2)
4. Appraise the need of Hydroponics farming (PO 1, 2, 3, 7, 12) (PSO 2)
5. Develop a prototype for Hydroponics farming. (PO 1, 2, 3, 7, 12) (PSO 2, 3)

COURSE ASSESSMENT AND EVALUATION

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO 1, 2, 3
Internal test-II	30	CO 3, 4, 5
Average of the two internal tests will be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
MINI PROJECT	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

ENVIRONMENTAL STUDIES

Course Code: HS59 **Credits: 0:0:0**
Pre-requisites: Nil **Contact Hours: 14L**
Course Coordinators: Dr. H U Raghavendra & Jyothi M R

Unit I

Environment, Ecology and Biodiversity: Definition, scope and importance. Multidisciplinary nature of Environmental studies. Food chain and food web. Energy flow and material cycling in ecosystem. Biodiversity and threats to biodiversity. Concept of sustainable development: Definition, objectives and applications.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos, Models
- Link: https://youtu.be/I_bnGkviWOU
- Link: https://youtu.be/Ar04qG1P8Es

Unit II

Natural resources: Forest resources: Ecological importance of forests. Water resources: Global water resources distribution. Mineral resources: Environmental effects of extracting and processing Mineral resources. Food resources: Effects of modern agriculture. Land resources: Soil erosion and Desertification.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos
- Link: https://youtu.be/vsXv3anIBSU
- Link: https://youtu.be/1rOVPqaUyv8

Unit III

Energy sources: Growing energy needs. Conventional and non-conventional / Renewable and Non-renewable energy sources. Bio Energy-Ethanol and Bio mass energy. Energy of the future – Hydrogen fuel cells and Nuclear energy. Environmental Impact Assessment (EIA): Definition, Objectives and benefits. Step by step procedure of conducting EIA.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Animations, Models
- Link: https://youtu.be/mh51mAUexK4
- Link: https://youtu.be/XS-eXqppf_w

Unit IV

Environmental pollution: Definition, Causes, Effects and control measures of Water pollution, Air pollution and Soil/ land pollution. Management of Municipal Solid Waste and treatment methods of municipal solid waste.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Videos
- Link: https://youtu.be/NRoFvz8Ugeo
- Link: https://youtu.be/DAQapF-F4Vw

Unit V

Environmental protection: Global warming and Climate change, Acid rain, Ozone layer depletion. Salient features of Environmental Protection Act, Air & Water Acts. Functions of Central and State Pollution Control Boards.

- Pedagogy/Course delivery tools: Chalk and Talk, Power point presentations, Opens source softwares
- Link: https://youtu.be/iV-BvYwl4Y8
- Link: https://youtu.be/BYqLRGawoH0

Text Books:

1. **Dr. S M Prakash**–Environmental Studies, Elite Publishers, 2007.

Reference Books:

1. **P. Venugopala Rao**–Principles of Environmental Science & Engineering Prentice Hall of India, 1st edition, 2006.

Web links and video Lectures (e- Resources):

1. https://youtu.be/I_bnGkviWOU
2. https://youtu.be/vsXv3anIBSU
3. https://youtu.be/mh51mAUexK4
4. https://youtu.be/NRoFvz8Ugeo
5. https://youtu.be/iV-BvYwl4Y8

Course Outcomes (COs):

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

1. Describe the importance of environmental studies, sustainable development and biodiversity (PO-1, 7)
2. Explain the importance and conservation of impacts of natural resources (PO-1, 7)
3. Distinguish the energy sources and identify the alternative energy sources for sustainable development (PO-1, 7)
4. Identify the causes, effects and control measures of pollution in developmental activities (PO-1, 7)
5. Outline the current environmental issues and the role of the agencies for environmental protection (PO-1, 7)

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes attained**
Internal Test-I	30	CO1, CO2 & CO3
Internal Test-II	30	CO4 & CO5
Average of the two internal test shall be taken for 30 marks		
Other components		
Assignment – MCQ, Objectives	10	CO1 & CO2
Assignment – Quiz, Group presentation	10	CO3 & CO4
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4 & CO5

ELECTIVE SYLLABUS
GROUP A: NETWORKS AND SYSTEMS

INTERNET OF THINGS	
Course Code: ETE551	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours:** 42L
Course Coordinator: Dr. Shobha K R	

Introduction & Concepts: Definition and Characteristics of IoT, Things in IoT, IoT Protocols {OCF, OneM2M), IoT Functional Blocks, IoT Communication Models, IoT Communication APIs, IoT Enabling Technologies, IoT Levels and Deployment Templates IoT and M2M, SDN and NFV for IoT,

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: https:// onlinecourses.nptel.ac.in /noc18_cs08/

Unit-II

Protocols for Internet of Things: 6LOWPAN, COAP, MQTT, RPL

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: https:// onlinecourses.nptel.ac.in /noc18_cs08/

Unit-III

IoT Physical Devices and End Points: Basic Building Blocks of an IoT Device, Raspberry Pi, Linux on Raspberry Pi, Raspberry Pi Interfaces: Serial, SPI, and I2C

Programming Raspberry Pi with Python: Basic programs for interfacing sensors, creating data logs and sending alerts to users, client server programming.

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: https:// onlinecourses.nptel.ac.in /noc18_cs08/

Unit-IV

Cloud and Data Analytics: Introduction to cloud storage Models and Communication APIs, and Data Analytics: Introduction to SmartThings, AWS

Python Web Application Framework Web Services for IoT, Data Analytics for IoT, Real-Time Data Analysis, Tools for IoT.

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: https:// onlinecourses.nptel.ac.in /noc18_cs08/

Unit-V

IoT Security Overview: Network and Transport layer challenges, IoT gateways and security, IoT routing attacks, Bootstrapping and Authentication

- Pedagogy / Course delivery tools: PPT, Chalk and Talk
- Links: https:// onlinecourses.nptel.ac.in /noc18_cs08/

Text book:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on Approach", Universities Press, 2015
2. Rajkumar Buyya and Amir Vahid Dastjerdi "Internet of Things Principles and Paradigms", Elsevier Publication, 2016

Reference books:

1. Ovidiu Vermesan, Peter Friess, "Internet of Things-From Research and Innovation to Market Deployment", River Publishers Series in Communication, 2013.
2. http://www.internet-of-things-research.eu/pdf/ IERC_Cluster_Book_2014_Ch.3_SRIA_WEB.pdf
3. Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", Wiley Publication,2013

Course Outcomes (COs):

1. Student will be able to understand the fundamentals and applications of Internet of Things. **(PO 1, 2, 4, 6, 9, 12) (PSO 1, 2, 3)**
2. Student will get exposure to the aspects of communication and protocols associated with IoT. **(PO 1, 2, 3, 6, 9, 12) (PSO 1, 2, 3)**
3. Students will be able to know the methodologies and tools involved in the design of IoT **(PO 1, 2, 3, 6, 9, 12) (PSO 1, 2, 3)**
4. Students will be able to understand aspects of hardware and software associated with the development of IoT **(PO 1, 2, 3, 5, 6, 9, 12) (PSO 1, 2, 3)**
5. Students will get exposure to the basics of cloud based aggregation and analysis of shared data and security aspects in IOT **(PO 1, 2, 3, 6, 9,12) (PSO 1, 2, 3)**

Course Assessment and Evaluation

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Lab	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

EMBEDDED NETWORKS AND PROTOCOLS	
Course Code: ETE552	**Credits: 3:0:0**
Pre – requisites: Microcontroller	**Contact Hours:** 42L
Course Coordinator: Ms. Akshata S Kori	

Unit-I

CAN bus: Concept of bus access and arbitration, Error Processing and Management, Increase your word power, Patents, License and certification**.**

CAN PROTOCOL: ISO 11898-1 Errors: Their intrinsic properties, detection and processing, the rest of the Frame-CAN 2.O B

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.youtube.com/watch?v=kS0d4GfCuVk&list=PLcbIZiT62e1gKGBxVBY3AKXmQBdGGvTQB

Unit-II

CAN Physical Layer: Introduction, CAN bit, Nominal Bit Time-CAN and Signal Propagation-Bit Synchronization, Network Speed.

Medium, Implementation and Physical Layers of CAN: The range of media and types of coupling to the network, high speed CAN, optical Media, Electro Magnetic Media

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=--QANl29EP0&list=PLcbIZiT62e1gKGBxVBY3AKXmQBdGGvTQB&index=2
  https://www.youtube.com/watch?v=nyef9xoZjqc&list=PLcbIZiT62e1gKGBxVBY3AKXmQBdGGvTQB&index=3

Unit-III

Components, Applications and Tools for CAN: CAN Components, application, application layer and development tools for CAN.

Flex Ray: Some general remarks, event triggered and time triggered aspects, TT CAN towards high speed, X-by- wire and redundant Systems-Flex Ray.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=V7nhDUA37dk
  https://www.youtube.com/watch?v=N8ZHn0hkWOE

Unit-IV

LIN: Introduction, Basic concept of LIN 2.0 Protocol, Cost and Market, Conformity of LIN, examples.

Fail –Safe SBC- Gateways: The Strategy and principles of Re-use, Demo board gateways managing the application layers.

Safe by Wire: Safe –by-wire plus-Some Words of Technology**.**

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.youtube.com/watch?v=TresvW4dxlc https://www.youtube.com/watch?v=wxmNtLT50SI

Unit-V

Audio –Video Buses: I2C Bus, D2B (Domestic digital) BUS, MOST (Media oriented systems transport) bus-IEEE BUS OR 'Firewire'.

RF Communication: Radio –frequency communication, Internal Radio-frequency communication, External –Wireless Networks

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=HGX457RA4IU https://www.youtube.com/watch?v=f-947qWzkSk

Text books:

1. Multiplexed Networks for Embedded Systems-CAN, LIN, Flexray, Safe-by-Wire – Dominique Paret, John Wiley & Sons Ltd, Paris, 2009.
2. Embedded Ethernet and Internet Complete- Jan Axelson, Penram publications, Madison, 2008

Reference books:

1. Embedded networking with CAN and CAN open - Glaf P. Feiffer, Andrew Ayre and Christian Keyold, Embedded System Academy, California, 2008
2. Principles of Embedded Networked Systems Design - Gregory J. Pottie and William J Kaiser, 2nd edition, Cambridge University press, New York, 2009

Web Links and Video Lectures (e-Resources)

1. NPTEL online course https://nptel.ac.in/courses/108102045

Course Outcomes (COs):

1. To build an understanding of concepts of Networks protocols, CAN bus, CAN protocols and their state-of-the-art applications **PO (1,2,3,4,7,8,9,11,12) PSO (1,2,3)**
2. To familiarize the students with Physical layer and Implementation details of CAN protocol **PO (1,2,3,4,7,8,9,11,12) PSO (1,2,3)**
3. To make the students familiarize with CAN components, applications and tools for CAN and Flexray **PO (1,2,3,4,7,8,9,11,12) PSO (1,2,3)**
4. To make the students understand the general principles behind LIN protocol,

Fail-Safe SBC gateways and Safe by wire protocol **PO (1,2,3,4,7,8,9,11,12) PSO (1,2,3)**

5. To introduce the student to common audio - video buses and RF communication PO **(1,2,3,4,7,8,9,11,12) PSO (1,2,3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
Mini Project	10	CO1, CO2, CO3, CO4, CO5
Surprise Test	10	CO4 and CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

VLSI CIRCUITS AND SYSTEMS	
Course Code: ETE553	**Credits: 3:0:0**
Pre – requisites: Digital Circuit Design	**Contact Hours:** 42L
Course Coordinator: Dr. Venu K N	

Unit-I

Overview of VLSI, logic design with MOSFETs: Complexity and design, basic concepts, ideal switches, MOSFETs as switches, basic and complex logic gates in CMOS, transmission gates, clocking and data flow control, integrated circuit layers, MOSFET's, CMOS layers, Designing FET arrays,

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=MuBiC9yz2fc

Unit-II

Fabrication of CMOS integrated circuits and elements of physical design: Overview of silicon processing, material growth and deposition, lithography, CMOS process flow, design rules, layout of basic structures, cell concepts, FET sizing and the unit transistor, physical design of logic gates, design hierarchies, DC characteristics of the CMOS inverter, inverter switching characteristics

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=_5mFvljk3hk

Unit-III

Designing high speed CMOS logic networks: Power dissipation, DC characteristics and transient response of NAND and NOR gates, analysis of complex logic gates, gate design for transient performance, transmission gates and pass transistors, gate delays, driving large capacitive loads, logical effort, BiCMOS drivers,

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=b1-W32Euc3s

Unit-IV

Advanced techniques in CMOS logic circuits and Design of an ALU subsystem: Mirror circuits, pseudo nMOS, tristate circuits, clocked CMOS, dynamic CMOS logic circuits, dual rail logic some observations on the design process, regularity, design of an ALU subsystem, Manchester carry chain, adder enhancement techniques, serial parallel multipliers, Bruan array, Baugh Wooley multiplier, Wallace tree multiplier, recursive decomposition of the multiplication

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=u9UfionZrio

Unit-V

Origin of FPGA and programming: Introduction to FGPA, key things about FPGA, A simple programmable function, Fusible link technologies, Antifuse technologies. Mask-programmed devices, PROMs, EPROM-based technologies, EEPROM-based technologies, FLASH-based technologies, SRAM-based technologies, Alternative FPGA Architectures, and Programming an FPGA.

- Pedagogy: Chalk and talk
- Links:https://www.youtube.com/watch?v=EDbutwR35bg&list=PLbMVogVj5nJSY-1XxFHgwgtj2F7mB7NuV

Text books:

1. Introduction to VLSI circuits and systems by John P Uyemura, Wiley,
2. Basic VLSI design by Douglas A. Pucknell and Kamran Eshraghian, PHI, 3rd edition,
3. The design warrior's guide to FPGAs, Clive Max field, 2004, Elsevier

Reference books:

1. CMOS VLSI Design, A circuits and systems perspective, Pearson 4th edition
2. Introduction to VLSI Design and Technology by J.N. Roy and D.N. Bose, 1st edition New age international

Web Links and Video Lectures (E- RESOURCES)

- https://www.youtube.com/watch?v=9SnR3M3CIm4&list=PL018645397D9487AF
- https://www.youtube.com/watch?v=Y8FvvzcocT4
- https://www.youtube.com/watch?v=EDbutwR35bg&list=PLdlPA9pGVVtZO09ZT3d_HsnYfnbK8OQYW

Course Outcomes (Cos):

1. Interpret VLSI design hierarchy and design of basic gates and transmission gates using CMOS structure **(PO1,2, 3, 6, 9,12) (PSO1,2,3)**
2. Analyse the use of design rules in the design of transistors and gates **(PO1,2,3, 6,9,12) (PSO1,2,3)**
3. Interpret the transient response and DC characteristics of NAND and NOR gates **(PO1,2,3,4,12) (PSO1,3)**
4. Analyse different ways of implementing multipliers and adders **(PO1,2,3,6,12) (PSO1,2,3)**
5. Understand the working of FPGA and programming them to quickly develop hardware chips for an application **(PO1,2,3,6,11,12) (PSO1,2,3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation(CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3,CO4,CO5
Assignment	10	CO1,CO2,CO3, CO4, CO5
Semester End Examination:	100	CO1, CO2, CO3, CO4, CO5

VI SEMESTER

MANAGEMENT AND ENTREPRENEURSHIP	
Course Code: AL61	**Credits: 3:0:0**
Pre – requisites: Nil	**Contact Hours:** 42
Course Coordinator: Dr. Venu K N	

Unit-I

Introduction to Management: Definition of Management, Its nature and purpose, Contributions of F.W. Taylor and Henry Fayol to management theory, Functions of managers.

Planning: Types of plans, Steps in planning, the planning process, Management By Objectives (MBO)

Organizing: The nature and purpose of organizing, Formal and informal organization. Organization levels and Span of management, Principle of span of management, the structure and process of organizing

Pedagogy: Chalk board, power point presentations
Links: https://onlinecourses.nptel.ac.in/noc23_mg33/preview
https://www.digimat.in/nptel/courses/video/110107150/L01.html

Unit-II

Staffing: Situational factors affecting staffing.

Leading: Human factors in managing, definition of leadership, Ingredients of leadership

Controlling: Basic control process, Critical control points and standards, Control as a feedback system, Feed forward control, Requirements for effective controls.

Pedagogy: Chalk board, power point presentations
Links: https://nptel.ac.in/courses/110107150

Unit-III

Introduction to Entrepreneurship: The Foundations of Entrepreneurship: What is an Entrepreneurship? The benefits of Entrepreneurship, The potential drawbacks of Entrepreneurship; Inside the Entrepreneurial Mind: From Ideas to Reality: Creativity, Innovation and Entrepreneurship, Creative Thinking, Barriers to Creativity

Pedagogy: Chalk board, power point presentations
Links: https://www.youtube.com/watch?v=Hgj_kRrvbhQ&list=PL7oBzLzHZ1wXW3mtolxV5nIGn48NLKwrb

Unit-IV

The Entrepreneurial Journey: Crafting a Business Plan: The benefits of creating a business plan, The elements of a business plan; Forms of Business Ownership and Buying an Existing Business: Sole proprietorships and partnership.

Pedagogy:	Chalk board, power point presentations
Links:	https://www.youtube.com/watch?v=Tzzfd6168jk&list=PLyqSpQzTE6M8EGZbmNUuUM7Vh2GkdbB1R

Unit-V

Launching the Business: Franchising and the Entrepreneur: Types of Franchising, the benefits of buying a Franchise; E-Commerce and the Entrepreneur: Factors to consider before launching into E-commerce, Ten Myths of E-Commerce.

Pedagogy:	Chalk board, power point presentations
Links:	https://www.youtube.com/watch?v=5RMqxtMwejM&list=PLyqSpQzTE6M9zMKj_PSm81k9U8NjaVJkR

Text books:

1. Harold Koontz, H. Weihrich, and A.R. Aryasri, Principles of Management, Tata McGraw-Hill, New Delhi, 2004.
2. Essentials of Entrepreneurship and Small Business Management – Norman Scarborough & Jeffrey Cornwall (Pearson, 2016)

Reference books:

1. Innovation & Entrepreneurship – Peter Drucker (Harper, 2006)
2. Entrepreneurship: The Art, Science, and Process for Success – Charles Bamford & Garry Bruton (McGraw-Hill, 2015)
3. Managent and Enterpreneuship-NVR Naidu, T Krishna Rao, I.K. International Publishing House Pvt. Ltd.@ 2008
4. Poornima M Charantimath, Entrepreneurship Development and Small Business Enterprises, Pearson Education, 2006.

Course Outcomes

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

1. Plan and organize for the manpower in the given type of organization (PO: 6,9,11)
2. Use staffing Leading and controlling function for the given organization. (PO: 6,8,9,10)

3. Understand the fundamentals of entrepreneurship with the goal of fulfilling the requirements of the industries and holding the responsibilities towards the society. (PO-6,7,8)
4. Design a basic business plan by considering case studies and show the involvement of ownership in Business. (PO-3,7,8,11)
5. Start a new small business with the help of E-Commerce and the current available technologies. (PO-5,11)

Course assessment and evaluation:

Continuous Internal Evaluation(CIE): 50 Marks		
Assessment tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3,CO4,CO5
Assignment	10	CO1,CO2,CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MICROWAVE AND ANTENNA ENGINEERING	
Course Code: ET62	**Credits: 2:1:0**
Pre – requisites: Electromagnetic Field Theory	**Contact Hours:** 28L+28T
Course Coordinator: Dr. Parimala.P	

Unit-I

Microwave Tubes: Introduction, Reflex Klystron Oscillator, Mechanism of Oscillations, Modesof Oscillations, Mode Curves

Microwave Network theory: Introduction**,** Symmetrical Z and Y-Parameters for reciprocal Networks, S matrix representation of Multi-Port Networks.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=Xgtq2HmK4K0
- Impartus recording:

Unit-II

Microwave Passive Devices: Coaxial Connectors and Adapters, Attenuators, Phase Shifters,Waveguide Tees, Magic tees.

Strip Lines: Introduction, Micro Strip lines, Parallel Strip lines, Coplanar Strip lines, Shielded Strip Lines**.**

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: http://www.digimat.in/nptel/courses/video/108101112/L09.html
- Impartus recording:

Unit-III

Antenna Basics: Introduction, Basic Antenna Parameters, Patterns, Beam Area, Radiation Intensity, Beam Efficiency, Directivity and Gain, Antenna Apertures, Effective Height, Radio Communication Link, Antenna Field Zones

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=qrx44IfmUwc
- Impartus recording:

Unit-IV

Point Sources and Arrays: Introduction, Point Sources, Power Patterns, Power Theorem,Radiation Intensity, Arrays of two isotropic point sources, Linear Arrays of n Isotropic Point Sources of equal Amplitude and Spacing.

Electric Dipoles: Introduction, Short Electric Dipole, Fields of a Short Dipole, Radiation Resistance of a Short Electric Dipole, Thin Linear Antenna

- Pedagogy / Course delivery tools: PPT, Chalk and talk

- Links: https://www.youtube.com/watch?v=xNZPdBPmbaw
- Impartus recording:

Unit-V

Loop and Horn Antenna: Introduction, Small loop, The Loop Antenna General Case, Radiation resistance of loops, Directivity of Circular Loop Antennas with uniform current, Horn antennas- Rectangular Horn Antennas.
Antenna Types: Helical Antenna, Yagi-Uda array, Parabolic reflector.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.youtube.com/watch?v=QX0-d54oB7I
- Impartus recording:

Text books:

1. Microwave Engineering – Annapurna Das, Sisir K Das, TMH, Publication, 2nd, 2010.
2. Microwave Devices and circuits- Samuel Y Liao, Pearson Education,2013
3. Antennas and Wave Propagation- John D. Krauss, Ronald J Marhefka, Ahmad S Khan, 4th Edition,McGraw Hill Education, 2013.

Reference books:

1. Microwave Engineering - David M Pozar, John Wiley India Pvt. Ltd., 3rd Edn, 2014.
2. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015
3. John Volakis," Antenna Engineering Handbook",IV Edition, Mc Graw Hill Publications, 2013

Web Links and Video Lectures (e-Resources):

1. NPTEL online course https://onlinecourses.nptel.ac.in/noc22_ee63/preview
2. Course era course: https://www.shiksha.com/online-courses/microwave-engineering-and-antennas-course-courl3077

Course Outcomes (COs):

1. Describe the use and advantages of microwave transmission **(PO 1, 2, 3, 4, 5, 9, 12) (PSO 1, 2)**
2. Analyze various parameters related to microwave transmission lines and waveguides **(PO 1, 2, 3, 4, 5, 9, 12) (PSO 1, 2)**
3. Identify microwave devices for several applications **(PO 1, 2, 3, 4, 5, 9, 12) (PSO 1, 2)**

4. Analyze various antenna parameters necessary for building a RF system **(PO 1, 2, 3, 4, 5, 9, 12) (PSO 1, 2)**
5. Recommend various antenna configurations according to the applications **(PO 1, 2, 3, 4, 5, 9, 12) (PSO 1, 2)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3
Internal test-II	30	CO1, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
MINI PROJECT	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

MICROWAVE AND ANTENNA ENGINEERING LAB	
Course Code: ETL65	**Credits: 0:0:1**
Pre – requisites: Electromagnetic Field theory Microwave and Antenna Engineering	**Contact Hours:** 28P
Course Coordinator: Dr.Parimala.P	

List of Experiments:

1. Determination of transit time, electronic tuning range and electronic tuning sensitivity of reflex klystron.
2. Measurement of VSWR, guide wavelength, operating frequency and impedance.
3. Determination of coupling coefficient, power division and insertion loss of a magic tee
4. Determination of coupling factor, insertion loss and directivity of a multi-hole directional coupler.
5. Measurement of Directivity, Half-power beam width and Gain of rectangular horn antenna and parabolic antenna.
6. Study of resonance in a Micro strip ring resonator and determination of dielectric constant of substrate.
7. Measurement of power division & isolation characteristics of 3dB power divider.
8. Determination of coupling and isolation characteristics of Micro strip branch line and backward couplers.
9. Determination of directivity and half power beam width of dipole and Yagi-uda antennas.
10. Introduction to HFSS tool for designing Microwave devices and antennas
11. Design and simulate waveguides and analyze current distribution using HFSS.
12. Design and simulate Rectangular Patch antenna analyzing S-parameters, VSWR, Smith Chart, Gain, 3D radiation pattern using HFSS.
13. Design and simulate 2 element antenna array and analyze the mutual coupling effects using HFSS.
14. Case study on utilizing Vector Network Analyzer, Spectrum Analyser for antenna measurements

Text Books:

1. Liao, "Microwave Devices and circuits", Pearson Education, 3 rd edition,2012
2. John D Kraus, Ronald J. Marhefka and Ahmed S Khan, "Antenna and Wave Propagation", Fourth edition, McGraw Hill Publication, 2010.

Reference books:

1. David M Pozar, "Microwave Engineering", John Wiley, 4 th edition, 2012
2. John Volakis, "Antenna Engineering Handbook", 4 th Edition, McGraw Hill Publications, 2010.

Web Links and Video Lectures (e-Resources):

1. https://onlinecourses.nptel.ac.in/noc22_ee63/preview
2. https://onlinecourses.nptel.ac.in/noc21_ee08/preview

Course Outcomes (COs):

1. Evaluate the characteristics of waveguide, working of klystron oscillator and GUNN diode. **(PO 1, 2, 3, 9,10,12) (PSO 1, 3)**
2. Analyse the working of passive and active microwave devices. **(PO 1, 2, 3,9,10) (PSO 1, 3)**
3. Analyses the antenna characteristics with antenna test bench **(PO 1, 2, 3, 5, 9, 10, 12) (PSO 1, 2, 3)**
4. Design antenna and microwave components using HFSS simulation software. **(PO1, 2, 3, 5, 9, 10, 12) (PSO 1, 2, 3)**
5. Evaluate the working of Antennas using HFSS. **(PO 1, 2, 3, 4, 7,8, 9,10,12) (PSO 1, 2, 3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Weekly evaluation of laboratory observation/records after the conduction of every experiment, viva voce	30	CO1, CO2, CO3, CO4, CO5
Practical test	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

COMPUTER COMMUNICATION NETWORKS LAB	
Course Code: ETL66	**Credits: 0:0:1**
Pre – requisites: Nil	**Contact Hours:** 28P
Course Coordinator: Dr. Venu K N	

List of experiments

1. Simple programs in C
2. Programming on Bit Stuffing
3. Programming on Bit De-stuffing
4. Programming on Character Stuffing
5. Programming on Character De-stuffing
6. Encryption and Decryption using Substitution method
7. Encryption and Decryption using Transposition method
8. Shortest Path Algorithm -Dijkstra's routing algorithm
9. Error control using CRC-CCITT
10. RSA Algorithm
11. Implementation of LAN using Packet tracer
12. Implementation of Connecting LANs by bridge
13. Implementation of IP hierarchical network
14. Implementation of home automation using packet tracer

Text books:

1. B Forouzan, "Data communication and networking", 6th edition, TMH, 2009.

Reference books:

1. Nobuo Funabiki, "Wireless Mesh Networks, Publisher: InTech, ISBN 978-953-307-519-8, January 14, 2011.
2. Yan Zhang, Jijun Luo and Honglin Hu, "Wireless Mesh Networking Architectures, Protocols and Standards", Auerbach Publications, ISBN 10: 0-8493-7399-9, 2007.

Web Links and Video Lectures (e-Resources)

1. https://www.youtube.com/watch?v=axwRWpXAnkA&list=PL8wrajtY2b2P_CNlJaut959GfgHUdHkF3

2. https://www.youtube.com/watch?v=I4z9ETcjic4&list=PLTri6RUwunTCL1dfRcHXn-WLC_iIR_SHN

Course Outcomes (COs):

1. Understand and analyze various mechanisms carried out at physical and data link layers (**PO1, 2, 4, 5, 7, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
2. Analyze various mechanisms followed in network layer **(PO1, 2, 4, 5, 7, 9, 10, 11, 12) (PSO 1, 2, 3)**
3. Detect error during transmission and error correction and analyze the same **(PO1, 2,3,7,8,9 10,11,12) (PSO 1,2, 3)**
4. Model network on the simulator and analyze it for various parameters **(PO1, 2, 3, 5,7,8, 9, 10,11,12) (PSO 1,2, 3)**
5. Analyze various algorithms using the simulator **(PO1, 2 3,4, 5, 8,9,10,11 12) (PSO 1, 2, 3)**

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Weekly evaluation of laboratory observation/records after the conduction of every experiment, viva voce	30	CO1, CO2, CO3, CO4, CO5
Practical test	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	50	CO1, CO2, CO3, CO4, CO5

MINI PROJECT	
Course Code: ETP67	**Credits:** 0:0:4
Pre – requisites: All Technical courses	**Contact Hours:**
Course Coordinator: Mrs. S M Kusuma	

Students will complete the technical mini project under the guidance of the faculty member in the department. The quality of the work will be judged in three presentations, where the panel consists of the guide and other faculty members in the project domain.

Subject code	**Subject**	**No. of Hrs/Week**		**Duration of exam**	**Marks**		**Total marks**	**Credits**
		Lecture	**Practical/ Field work**		**IA**	**Exam**		
ETP67	Mini-project	-	-	3 hours	50	50	100	0:0:4

Course Outcomes (COs):

1. Ability to review the literature and identify a suitable problem by analyzing the requirements based on current trends and societal needs in the domain of interest and arrive at the specifications. **(POs 1, 2, 4, 6, 7, 9, 12) (PSO 1, 2, 3)**
2. Ability to identify the methodology for implementing the project by visualizing the Hardware and Software. **(POs 1, 2, 3, 4, 7, 11) (PSO 1, 2, 3)**
3. Design and Implementation of identified Problem using appropriate tools and techniques in the area of telecommunication/ multidisciplinary areas. **(POs 1, 2, 3, 4, 5, 6, 7, 9) (PSO 1, 2, 3)**
4. Validate the achieved results and demonstrate good project defense, presentation skills, leadership and punctuality as a team/individual. **(POs 8, 9, 10, 11) (PSO 3)**
5. Ability to write the thesis following ethical values and attempt to publish the work in quality conferences/journals supporting lifelong learning abilities. **(POs 8, 9, 10, 12) (PSO 3)**

ELECTIVE SYLLABUS

MACHINE LEARNING	
Course Code: ETE631	**Credits: 3:0:0**
Pre – requisites: Programming Language	**Contact Hours:** 42L
Course Coordinator: Dr. Ramya H R	

Unit-I

Introduction: What is machine learning? Examples of machine learning applications, key terminologies, key tasks of machine learning, choosing right algorithms, steps in developing machine learning applications, why Python, getting started with numpy, classifying with k-Nearest Neighbors: Classifying with distance measurements Examples

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/
- Impartus recording: http://a.impartus.com/ilc/w/v/VGAs

Unit-II

Splitting Datasets One Feature at a Time: decision trees: Tree construction, plotting trees in Python with Matplotlib annotations, Testing and storing the classifier, Examples Classifying with probability theory: naïve Bayes: classifying with Bayesian decision theory, Conditional probability, Classifying with conditional probabilities, Document classification with naïve Bayes, Classifying text with Python, Examples

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/
- Impartus recording: http://a.impartus.com/ilc/w/v/VGAs

Unit-III

Logistic Regression: Classification with logistic regression and the sigmoid function: a tractable step function, using optimization to find the best regression coefficients, Examples Support vector machines: Separating data with the maximum margin, finding the maximum margin, efficient optimization with the SMO algorithm, speeding up optimization with the full Platt SMO, Using kernels for more complex data, Example

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/

- Impartus recording: http://a.impartus.com/ilc/w/v/VGAs

Unit-IV

Predicting Numeric Values: Regression: Finding best-fit lines with linear regression, locally weighted linear regression, shrinking coefficients to understand our data, the bias/variance tradeoff, Examples

Tree-Based Regression: Locally modeling complex data, building trees with continuous and discrete features, Using CART for regression, Building the tree, executing the code, Tree pruning, Model trees, Examples

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/
- Impartus recording: http://a.impartus.com/ilc/w/v/VGAs

Unit-V

Grouping Unlabeled Items Using K-Means Clustering: The k-means clustering algorithm, improving cluster performance with post processing, bisecting k-means, Examples Using Principal Component Analysis to Simplify Data: Dimensionality reduction techniques, Principal component analysis, moving coordinate axes, Performing PCA in NumPy, Example

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc23_cs18/
- Impartus recording: http://a.impartus.com/ilc/w/v/VGAs

Text books:

1. Peter Harrington, “Machine Learning in Action”, Manning Publications, 2012, ISBN 9781617290183

Reference books:

1. New Delhi,2015Christopher Bishop, "Pattern Recognition and Machine Learning", CBS Publishers & Distributors, New Delhi, 2010
2. Tom M Mitchell, “Machine Learning”, McGraw-Hill, Inc. New York, NY, USA 2017.
3. Ethem Alpaydin, "Introduction to Machine Learning" 3rd Edition, PHI Pvt. Ltd- Introduction to Machine Learning - Course – Nptel https:// onlinecourses.nptel.ac.in/ noc17_cs26

Course Outcomes (COs):

1. Identify the concepts of machine learning and specify solutions using python. **(PO 1, 2, 5, 6, 8, 9, 11, 12) (PSO 1, 2, 3)**

2. Design and develop solutions for classification problems using different approaches **(PO 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
3. Design and develop solutions for finding best parameters to classify data **(PO 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
4. Design and develop approaches for predicting numeric values **(PO 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**
5. Apply dimensionality reduction techniques and develop clustering methods as well as approaches to simplify data **(PO 1, 2, 3, 4, 5, 6, 8, 9, 10, 11, 12)(PSO 1, 2, 3)**

Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3
Internal test-II	30	CO1, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
Surprise Test	10	CO1, CO2, CO3, CO4, CO5
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

OPERATING SYSTEMS	
Course Code: ETE632	**Credits:** 3:0:0
Pre – requisites: Data Structures Using C	**Contact Hours:** 42L
Course Coordinator: Ms. Akshata S Kori	

Unit-I

Introduction Overview and structure of Operating systems: Introduction, Abstract views & goals of operating systems. Operations of operating systems, Input/output, Memory, Process management Memory hierarchy & protection Interrupts, Interrupt processing & System call Computing environments and Classes of operating systems. Operation & structure of OS, OS with monolithic structure & Layered design. Virtual machine operating systems, Kernel based & Microkernel based operating systems.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.youtube.com/watch?v=vBURTt97EkA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O
- https://www.youtube.com/watch?v=VjPgYcQqqN0&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O&index=2

Unit-II

Introduction to Process and Process scheduling: Process concepts, Operation on process, sharing, synchronization between processes, OS view of processes. Process control block. Scheduling principles, Non preemptive scheduling policies Preemptive Scheduling policies, Issues in real time scheduling.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.youtube.com/watch?v=OrM7nZcxXZU&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O&index=16
- https://www.youtube.com/watch?v=2h3eWaPx8SA&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O&index=19

Unit-III

Process, threads and synchronization: Process state transitions & its activities. Events, Threads and its Variants, Multithreaded programming, Processes in UNIX. Inter process communication, Race conditions.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.youtube.com/watch?v=pSW9d3Oaie8&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O&index=21
- https://www.youtube.com/watch?v=SFc3jt8t5rU&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O&index=22

Unit-IV

Memory management: Memory hierarchy, Execution of programs Memory allocation model Reuse of memory, Memory allocators. Contiguous and noncontiguous allocators, Paging and segmentation. Virtual memory Virtual memory basics Demand paging and paging preliminaries Page replacement, paging hardware, Virtual memory handler, and Page replacement policies

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.youtube.com/watch?v=uHtzOFwgD74&list=PLBlnK6fEyqRiVhbXDGLXDk_OQAeuVcp2O&index=24

Unit-V

Distributed operating system: Features of distributed operating system, nodes of distributed operating system, integrating operation nodes of a distributed operating system, reliable inter process communication, distributed computation paradigm.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.youtube.com/watch?v=-OTP2O-UHhI

Text books:

1. D M Dhamdhere, "Operating systems, A concept based approach" TMH, 2nd Edition, 2006.
2. Andrew S.Tanenbaum, "Modern operating systems", PHI learning, Third edition, 2011

Reference books:

1. Silberschatz and Galvin, "Operating systems concepts", John Wiley, 9 th edition, 2012
2. William Stallings, "Operating systems- Internals and Design principles" Pearson Education, 6 th edition, 2009
3. Harvey M. Deitel and Paul J. Deitel "Operating System", Pearson, Third edition 2014 4. Pradeep K Sinha "Distributed operating systems concepts and design", Prentice Hall of India, New Delhi ,2010

Web Links and Video Lectures (e-Resources):

1. NPTEL online course https://archive.nptel.ac.in/courses/106/105/106105214/

Course Outcomes (Cos):

1. Examine basics, structure, process and memory management concepts of operating systems. **PO(1,2,3,4,11,12) PSO (1,3)**
2. Analyze process, process synchronization and Input output software design aspects of operating systems **PO(1,2,3,4,7,8,9,11,12) PSO (1,2,3)**
3. Analyze process, threads, race conditions and critical section of operating systems and remote access of process in distributed operating systems **PO(1,2,3,4,7,8,9,11,12) PSO (1,2,3)**
4. Analyze performance of physical and virtual memory and process management

issues **PO(1,2,3,4,7,8,9,11,12) PSO (1,2,3)**

5. Analyze distributed operating system development/ deployment and its relation to standard operating systems. **PO(1,2,3,4,7,8,9,11,12) PSO (1,2,3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components		
Mini Project	10	CO1, CO2, CO3, CO4, CO5
Surprise Test	10	CO4 and CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

RADAR AND SATELLITE COMMUNICATION	
Course Code: ETE633	**Credits: 3:0:0**
Pre – requisites: Digital Signal Processing	**Contact Hours:** 42L
Course Coordinator: Mrs. Nisha S L	

Unit-I

Basic Principles of Radar: Antenna parameters, Radar equation. Performance parameters, target cross-section.

MTI and Doppler radar: Introduction to Doppler and MTI Radar, CW radar, FM CW, Delay line cancellers, Pulse Doppler Radar.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/105/108105154/
- Impartus recording: https://a.impartus.com/ilc/#/course/1309205/1112

Unit-II

Scanning, Duplexers and Radar receivers: Sequential lobbing, Conical Scanning, Monopulse Tracking RADAR, Tracking with surveillance RADAR, Acquisition, Radar receiver, Radar Displays and Duplexers.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://archive.nptel.ac.in/courses/108/105/108105154/
- Impartus recording: https://a.impartus.com/ilc/#/course/1309205/1112

Unit-III

Introduction & Orbital Mechanics: Introduction, Kepler's Law, Orbital elements, Orbital perturbations, Look angles, Geostationary Geosynchronous Orbits, Launches and launch vehicles.

Space Segment: Power supply, Attitude and Control system, Telemetry, Tracking and Command Subsystems (TT&C), Transponders and antenna subsystem.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:
  https://www.digimat.in/nptel/courses/video/117105131/L02.html
- https://www.digimat.in/nptel/courses/video/117105131/L06.html
- Impartus recording: https://a.impartus.com/ilc/#/course/1309205/1112

Unit-IV

Satellite Link Design: Basic transmission theory, System noise, Uplink, Concept of saturation of TWTA, Downlink, Combined uplink and downlink C/N ratio, Intermodulation noise.

- Pedagogy / Course delivery tools: PPT, Chalk and talk

- Links: https://www.digimat.in/nptel/courses/video/117105131/L11.html
- Impartus recording: https://a.impartus.com/ilc/#/course/1309205/1112

Unit-V

Satellite Access: Single access, pre-assigned FDMA, SCPC (spade system), TDMA and CDMA.

Satellite Services: Satellite mobile services, Direct broadcast satellite television and radio, VSATs, Radarsat, GPS system and GPS based navigation,

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.digimat.in/nptel/courses/video/117105131/L26.html https://www.digimat.in/nptel/courses/video/117105131/L39.html
- Impartus recording: https://a.impartus.com/ilc/#/course/1309205/1112

Text books:

1. Skolnik M. I, Introduction to Radar Systems, McGraw-Hill
2. Dennis Roody, "Satellite Communication" 5th edition, MGH,reprint 2015.

Reference books:

1. Timothy Pratt, Charles Bostian and Teremy Allnut, "Satellite Communication", John Wiley 2nd Edition, reprint 2012.
2. Richharia M, "Satellite Communication Systems", Macmillan Press Ltd, reprint 2012.

Web Links and Video Lectures (e-Resources)

1. https://www.youtube.com/watch?v=S22u7_Eq26g
2. https://www.tutorialspoint.com/satellite_communication/satellite_communication_orbital_mechanics.html

Course Outcomes (COs):

1. Recognize the need for satellite and Radar communication. **(PO 1, 2, 4, 6, 7, 10, 12) (PSO 1, 2, 3)**
2. Apply and Solve problems on Kepler's laws, satellite link and Radar equations **(PO 1, 2, 4, 6, 7, 10, 12) (PSO 1, 2, 3)**
3. Analyze various satellite subsystems, satellite link budget and **(PO 1, 2,3, 4, 6, 7, 8, 9, 10,11, 12) (PSO 1, 2, 3)**
4. Examine the different Satellite Access technologies and satellite services. **(PO 1, 2,3, 4, 6, 7, 8, 9, 10,11, 12) (PSO 1, 2, 3)**
5. Applications of modern radar systems. **(PO 1, 2,3, 4, 6, 7, 8, 9, 10,11, 12) (PSO 1, 2, 3)**

Course Assessment And Evaluation

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3, CO4, CO5
Internal test-II	30	CO1, CO2, CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Mini project	10	CO1, CO2, CO3, CO4, CO5
Quiz	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

DATA SCIENCE USING PYTHON	
Course Code: ETE641	**Credits:** 3:0:0
Pre – requisites: OOPS USIGN PYTHON LAB	**Contact Hours:** 42L
Course Coordinator: Dr. Venu K N	

Unit-I

Introduction to python, visualising data and linear algebra: Introduction to data science and python programming, Virtual environments, white space formatting, modules, functions, strings, exceptions, lists, dictionaries, defaultdict, counters, sets, control flow, truthiness, sorting, list comprehensions, automated testing and assert, object oriented programming, iterables and generators, randomness, regular expressions, zip and argument unpacking, args and kwargs, type annotations, matplotlib, line charts, scatterplots, vectors, matrices,

- Pedagogy: Chalk and talk
- Links:https://www.youtube.com/watch?v=HMAf_dSJujM&list=PLLy_2iUCG87CNafffzNZPVa9rW-QmOmEv&index=3

Unit-II

Statistics, probability hypothesis and inference and gradient descent:
Describing a single set of data, central tendencies, dispersion, correlation, Simpson's paradox, some other correlational caveats, dependence and independence, Baye's theorem, random variables, continuous and normal distributions, the central limit theorem, statistical hypothesis testing, p-values, confidence intervals, p-hacking, running an A/B test, Bayesian inference, the idea behind gradient descent, estimating the gradient, using the gradient, choosing the right step size, using gradient descent to fit models, minibatch and stochastic gradient descent,

- Pedagogy: Chalk and talk : chalk and talk
- Links: https://www.youtube.com/watch?v=KshIEHQn5ZM

Unit-III

Acquiring data and machine learning, k nearest neighbours and Naïve Bases: Stdin and stdout, reading files, scraping the web, using the twitter APIs, exploring one, two and many dimensional data, using NamedTuples, dataclasses, manipulating data, rescaling, tqdm library, dimensionality reduction, modelling, machine learning, over fitting and under fitting, bias variance trade-off, feature extraction and selection, K nearest neighbour models, example IRIS data set, the curse of dimensionality, spam filter, a more sophisticated spam filter, implementation, testing and using the model

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=2ATqoglcHus

Unit-IV

Linear, multiple regression, logistic regression and decision tree: Linear regression model, using gradient descent, maximum likelihood estimation, multiple regression model, assumptions of the least square model, fitting the model, interpreting the model, goodness of fit, standard errors of regression coefficients, regularization, logistic function, applying the model, goodness of fit, support vector machines, what is decision tree? Entropy, entropy of partition, creating a decision tree, putting it all together, random forests,

- Pedagogy: Chalk and talk
- Links: https://www.youtube.com/watch?v=z9XAXXGwUzM

Unit-V

Neural networks, deep learning, clustering and natural language processing: Perceptrons, feed forward neural networks, fizz buzz, the tensor, the layer abstraction, the linear layer, neural networks as a sequence of layers, loss and optimization other activation function, softmaxes and cross entropy, MNIST, saving and loading models, clustering idea and model, example clustering colours, bottom up hierarchical clustering, word clouds, n-gram language models, grammars, word vectors, recurrent neural networks. Using a character level RNN

- Pedagogy: Chalk and talk,
- Links:https://www.youtube.com/watch?v=xbYgKoG4x2g&list=PL53BE265CE4A6C056

Text books:

1. Data science from scratch first principles with python by Joel Gurus, second edition, Reilly 2019

Reference books:

1. Python for data analysis: data wrangling with Pandas, Numpy and IPython 2nd edition by William Mckinney
2. Automate the Boring Stuff with Python: Practical programming for Total Beginners 1st Edition by Al Sweigart
3. Machine Learning with Python Cookbook: Practical solutions from Pre-processing to Deep learning 1st Edition by Chris Albon

Web Links and Video Lectures (e- Resources):

1. https://www.youtube.com/watch?v=jGwO_UgTS7I&list=PLoROMvodv4rMiGQp3WXShtMGgzqpfVfbU
2. https://www.youtube.com/watch?v=N8RADjBmIws&list=PLyqSpQzTE6M_fFg

1zZmeGIkenMDgXKGYi

3. https://www.youtube.com/watch?v=4SJ7bEILPJk&list=PLLy_2iUCG87CNafffz NZPVa9rW-QmOmEv

Course Outcomes (COs):

1. Interpret the syntax of python programming language and understand the basics of linear algebra and its operation using python **(PO1,2,3,5, 8,10) (PSO1,2,3)**
2. Exploring the use of gradient descent model to find parameters that make the loss as small as possible **(PO1,2,3,5,8,10,12) (PSO1,2,3)**
3. Exploring different ways of getting data into Python and into the right formats **(PO1,2,3,8,12,12) (PSO1,2,3)**
4. Use of decision tree structure to represent a number of possible decision paths and an outcome for each path **(PO1,2,3,5,8,11,12) (PSO1,2,3)**
5. Exploring the use of neural networks that can solve a wide variety of problems like handwriting recognition and face detection**. (PO1,2,3,5,8,11,12) (PSO1,2,3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation(CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Quiz	10	CO1, CO2, CO3,CO4,CO5
Assignment	10	CO1,CO2,CO3, CO4, CO5
Semester End Examination:	100	CO1, CO2, CO3, CO4, CO5

REAL TIME SYSTEMS	
Course Code: ETE642	**Credits:** 3:0:0
Pre – requisites: Embedded Systems Design	**Contact Hours:** 42L
Course Coordinator: Dr. S G Shivaprasad Yadav	

Unit-I

Introduction to Real Time Systems: Real Time Systems, Applications, Basic Model of a Real Time System, Characteristics of a Real Time System, Safety and Reliability, Fault tolerance techniques, Types of Real Time Systems, Timing constraints, Modelling Timing constraints

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc21_cs98/preview

Unit-II

Operating systems for Real Time Systems - Real-time Multi-Tasking Operating systems, Scheduling strategies, Priority structures, Task Management, Scheduler and Real time Clock handlers, Memory Management, code sharing, Resource control, Task co-operating and communication, Mutual Exclusion, Data transfer.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc21_cs98/preview

Unit-III

Basic Concepts of Scheduling - Real-time applications, Real-time applications issues, Physical and logical architecture, Basic concepts for real-time task scheduling, Task description, Scheduling: definitions, algorithms and properties, Scheduling in classical operating systems, illustrating real-time scheduling

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc21_cs98/preview

Unit-IV

Scheduling of Independent Taks: Basic on-line algorithms for periodic tasks, Rate monotonic scheduling, Inverse deadline (or deadline monotonic) algorithm, Algorithms with dynamic priority assignment, Hybrid task sets scheduling, Scheduling of soft aperiodic tasks, Hard aperiodic task scheduling, Exercises.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc21_cs98/preview

Unit-V

Real Time Communication: Introduction, Network topologies, Protocols – Contention based, Token based, Stop-and-go multihop protocol, the Polled bus Protocol, hierarchical Round-Robin protocol, Deadline-based protocols, Fault tolerant routing protocols.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://onlinecourses.nptel.ac.in/noc21_cs98/preview

Text books:

1. Stuart Bennet, "Real-Time Computer Control", 2nd Edn. Pearson Education. 2008.
2. C.M. Krishna, Kang G. Shin, "Real Time Systems", Tata McGraw - Hil, 2019.
3. Rajib Mall, Real-Time Systems: Theory and Practice, Pearson Education, 2007.
4. Francis Cottet, Joëlle Delacroix, Claude Kaiser and Zoubir Mammeri, "Scheduling in Real-Time Systems", John Wiley, 2009
5. Jane W. S. Liu, Real-Time Systems, Pearson Education, 2019.

References books:

1. Philip A. Laplante, Seppo J. Ovaska, Real-Time Systems Design and Analysis, Wiley, 2012.
2. Giorgio C. Buttazzo, "Hard real-time computing systems: predictable scheduling algorithms and applications" , Springer, 2008.
3. C. Siva Ram Murthy, G. Manimaran, "Resource management in real-time systems and networks", PHI, 2009.

Course Outcomes (COs):

1. Explain the fundamentals of Real time systems, characteristics and its classifications. **(PO 1, 2, 3, 4, 6, 7, 11, 12) (PSO 1, 2, 3)**
2. Understand the concepts of scheduling properties and terminologies of real-time applications. **(PO 1, 2, 3, 4, 7, 11, 12) (PSO 1, 2, 3)**
3. Describe the operating system concepts and techniques required for real time systems. **(PO 1, 2, 3, 4, 11, 12) (PSO 1 and 3)**
4. Analyze the various scheduling algorithms to meet Real time applications and protocols for Real time communication. **(PO 1, 2, 3, 4, 6, 7, 11, 12) (PSO 1, 2, 3)**
5. Apply suitable methodologies to design and develop Real-Time Systems. **(PO 1, 2, 3, 4, 6, 7, 8, 9, 10, 11, 12) (PSO 1, 2, 3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Quiz	10	CO1, CO2, CO3, CO4, CO5
Assignment	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

NETWORK SECURITY	
Course Code: ETE643	**Credits:** 3:0:0
Pre – requisites: Basics of Computing	**Contact Hours:** 42 L
Course Coordinator: Dr. Arvind Kumar G	

Unit-I

Symmetric Ciphers: Introduction to Network Security, Research trends & applications, Symmetric Cipher Model, Substitution Techniques, Transposition Techniques, traditional block cipher structure, the data encryption standard (DES). A DES example, the strength of DES, AES structure, AES transformation function.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://cseweb.ucsd.edu/classes/wi22/cse127-a/scribenotes/13-symmetriccrypto-notes.pdf

Unit-II

Block Cipher operation: block cipher design principles, multiple encryption and triple DES, Electronic Code Book (ECB), Cipher block chaining mode (CBC), Cipher feedback mode (CFM).

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://engineering.purdue.edu/kak/compsec/NewLectures/Lecture3.pdf

Unit-III

Public key cryptography: Principles of Public-Key Cryptosystems, The RSA Algorithm, Key management, Diffie-Hellman Key Exchange, Elliptic Curve Arithmetic

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links:https://www.ibm.com/docs/en/ztpf/1.1.0.15?topic=concepts-public-key-cryptography

Unit-IV

Message Authentication and Hash Functions: Authentication requirements, Authentication functions, Message authentication codes, Hash functions, Security of hash functions and MAC‘s

Digital Signature and Authentication Protocol: Digital signature, Authentication protocols.

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: http://orion.towson.edu/~mzimand/cryptostuff/N7-Hash.pdf

Unit-V

Electronic Mail Security: Pretty good privacy, S/MIME, Data compression using ZIP, Radix-64conversion, PGP random number generator.

IP Security: Overview, IP security architecture, Authentication header, ESP (encapsulating security payload), Security associations, Key management, Problems).

- Pedagogy / Course delivery tools: PPT, Chalk and talk
- Links: https://www.geeksforgeeks.org/introduction-to-electronic-mail/
- https://www.idconline.com/technical_references/pdfs/data_communications/Ip_Security_Overview.pdf

Text books:

1. William Stallings, "Cryptography and Network Security", Pearson Education, 6th edition, 2014

Reference Books:

1. Behrouz A. Forouzan, "Cryptography and Network Security", TMH, 2014
2. Atul Kahate, "Cryptography and Network security"**,** TMH, 2014

Course Outcomes (COs):

1. Analyze the basic concepts of network security to predict and classify attacks on a network **(PO1, 2, 3, 5, 7) (PSO 1, 2)**
2. Illustrate the process for hiding the information with cryptographic algorithms **(PO1, 2, 3, 8, 9, 10) (PSO 1, 3)**
3. Understand different key management distribution mechanisms **(PO1, PO2, PO3, PO5, PO7) (PSO 1, 2)**
4. Analyze security issues in IP and wireless networks **(PO1, 2, 3, 4) (PSO1)**
5. Analyze the mechanisms of implementing user authentication and intruder detection **(PO1, 2, 4, 5, 6, 7) (PSO 1, 2)**

Course Assessment And Evaluation

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal Test-I	30	CO1, CO2, CO3, CO4, CO5
Internal test-II	30	CO1, CO2, CO3, CO4, CO5
Average of the two internal tests will be taken for 30 marks.		
Other components	**Marks**	**Course outcomes addressed**
Assignment	10	CO1, CO2, CO3, CO4, CO5
Surprise Test	10	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5

OPEN ELECTIVE

HTML AND PHP	
Course Code: ETOE01	**Credits:** 3:0:0
Pre – requisites: Nil	**Contact Hours:** 42 L
Course Coordinator: Dr. Arvind Kumar G.	

Unit-I

Introduction to HTML, XHTML Syntax and Semantics, Fundamental HTML Elements, Relative URLs, Lists, tables, Frames, Forms, Creating HTML Documents

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https: https://web.stanford.edu/class/cs142/lectures/HTML.pdf

Unit-II

Introduction to Cascading Style Sheets, Features, Core Syntax, Style Sheets and HTML Style Rule Cascading

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https: https://web.stanford.edu/class/cs142/lectures/CSS.pdf

Unit-III

JavaScript: The JavaScript Language-History and Versions, Introduction to Java script, JavaScript in Perspective, Basic Syntax, Variables and Data Types, Statements, Operators, Literals, Functions, Objects, Arrays.

- Pedagogy / Course delivery tools: Chalk and talk
- Links:https://www.cs.toronto.edu/~mashiyat/csc309/Lectures/javascript.pdf

Unit-IV

PHP:Overview of PHP, XAMPP, Syntactic characteristics, Primitives, Variables and Operators, Controlling program flow, working with HTML forms.

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://www.w3schools.com/php/

Unit-V

MySQL:Using user-defined functions and classes, PHP and MySQL

- Pedagogy / Course delivery tools: Chalk and talk
- Links: https://www.w3schools.in/mysql/intro

Text Books

1. Steven Holzner., "HTML Black book: the Programmers Complete HTML Reference Book" Coriolis Group Books.
2. John Pollock., "Javascript A Beginners Guide" Third Edition Tata McGraw-Hill, 2010
3. Robert W. Sebesta., "Programming the World Wide Web" Pearson International,4th Edition.
4. Vikram Vaswani: "PHP: A Beginner's Guide", Tata McGraw-Hill, 2009.

Reference Books:

1. Deitel H.M. and Deitel P.J., "Internet and World Wide Web How to program", Pearson International, 2012, 4th Edition.

Course Outcomes (COs):

1. Gain knowledge on creating a WEB page using HTML and CSS **(PO: 1,3,6,9,10,12. PSO:1,3)**
2. Learn and study Java scripts. **(PO: 1,2,3,5,9,10, 12)(PSO: 1,3)**
3. Design a web based application with data transfers from and to a backend database table without errors using the concepts of connecting PHP to MySQL database **(PO: 1,2,3,5,9,10, 12)(PSO: 1,3)**
4. Identify and apply the concepts of user-defined functions and classes for a given problem **(PO: 1,2,3,5,9,10, 12) (PSO: 1,3)**
5. Identify, design and develop a web based application for a real world problem. **(PO: 1,2,3,5,9,10, 12) (PSO: 1,3)**

Course Assessment and Evaluation:

Continuous Internal Evaluation (CIE): 50 Marks		
Assessment Tool	**Marks**	**Course outcomes addressed**
Internal test-I	30	CO1, CO2, CO3
Internal test-II	30	CO3, CO4, CO5
Average of the two internal tests shall be taken for 30 marks.		
Other components		
Miniproject	20	CO1, CO2, CO3, CO4, CO5
Semester End Examination (SEE)	100	CO1, CO2, CO3, CO4, CO5