Vidyalankar Institute of Technology

An Autonomous Institute affiliated to University of Mumbai

Bachelor of Technology

in

Electronics & Telecommunication Engineering
with Multidisciplinary Minor

Second Year Scheme and Syllabus
(R-2024)

(As per NEP 2020, with effect from the Academic Year 2025-26)

Preamble

The National Education Policy (NEP) framework aims to break the mould from teacher centric to student centric educational practices. It empowers the students with flexibility in terms of choosing courses across different faculties and mode of learning.

This multidisciplinary approach will encourage learners to follow their passion and inherent interests. The learner is free to learn at a pace that he is comfortable with and this enables life long learning. It also enhances the scope for holistic personality development.

This premise is truly reflected in preamble of the NEP document, "The future of nation is decided in the classrooms of the schools and colleges today".

Details of implementation:

NEP curriculum framework enables us to accelerate change, redesign systems with equity in mind, respond to feedback, encourage collaboration, catch and pollinate ideas and create a culture of research and development. It will allow us to offer the required academic flexibility which will focus on improving competency level of students with diverse strengths.

The curriculum planned by VIT has vertical Program Courses consisting of core courses (PCC) of branch of engineering positioned and sequenced to achieve sequential and integral learning of the entire breadth of the specific branch. This vertical also includes Programme elective courses (PEC) which offer flexibility and diversity to learners to choose specialization from a basket of recent developments in their field of technology. The selection of unique programme elective courses based on industrial requirements and organizing them into tracks is a special feature of this curricula ensuring employability. The vertical Multidisciplinary Courses consists of Open Elective (OE) courses and multidisciplinary minor (MD M) courses. Special vocational and skill development courses are included as a part of Skill courses vertical that make student capable to work in industrial environment.

The student is expected to demonstrate their ability through course in Experiential Learning Courses vertical like internships/On Job Training, Community Engagement Project, Real Industry Project/ research problem. Our curriculum also introduces Social Service Internship and Internship with institutes abroad along with courses like Design Thinking. This will lead to creation of products and/ or patents through this program.

For holistic development of students, apart from technical courses, Ability Enhancement Courses, Entrepreneurship/Economics/Management Courses, Indian Knowledge System and Value Education courses from vertical Humanities and Social Science and Management develop the required soft-skills and attitude amongst learners.

In Liberal Learning vertical. courses like Various Dance Forms, Global citizenship Education, Facets of Astronomy etc. aims to create balance in brain hemispheres and hence improve learners' clarity in thoughts and responses.

In addition to core courses, professional and open electives; our framework offers honor degree in each programme of engineering. It includes specialized courses along with field/ domain study that make student capable of working on industry relevant problems.

Chairman, Board of Studies
Department of Electronics and Telecommunication Engineering
Vidyalankar Institute of Technology

Chairman, Academic Council
Vidyalankar Institute of Technology

Course Structure and Assessment Guidelines

for

S. Y. Bachelor of Technology

in

Electronics and Telecommunication Engineering

with Multidisciplinary Minor

Second Year B. Tech. Electronics & Telecommunication Engineering Preferred Semester: III

Course Structure and Assessment Guidelines

	Course		Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@40 % of total marks)
NEP-Vertical	**Code**	**Name**			**ISA**	**MSE**	**ESE**	
BSC	BSC06	Engineering Mathematics-III	Theory	3	20	30	50	100
PC_PCC	PCET108T	Computer architecture and organization	Theory	2	15	20	40	075
	PCET108P	Computer architecture and organization lab	Practical	1	25	-	25	050
	PCET01T	Electronic Devices and Circuits	Theory	2	15	20	40	075
	PCET01P	Electronic Devices and Circuits Lab	Practical	1	25	-	25	050
	PCET101T	Network Theory and Transmission lines	Theory	2	15	20	40	075
	PCET101P	Network Theory and Transmission lines lab	Practical	1	25	-	25	050
MDM	MDMXXXX*	As per MDM course list[##]	As per course	4	45	30	50	125
VSEC	VSEC05	Skill Based Lab1	Practical	1	50	-	-	050
HSSM_AEC	AEC04	Technical Communication	Practical	1	50	-	-	050
HSSM_EEMC	EEMC01	Design Thinking	Theory/ Tutorial	3	50	-	50	100
Total Credits				**21**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination

*Selection based on the subset of courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Multidisciplinary Minor (MDM)

Sr. No.	Title of MDM	Course Code	Course Name	Assessment guidelines (Marks)			Credits	Total marks (Passing@ 40% of total marks)
				ISA	MSE	ESE		
1	-	MDM01	Seminar	25	-	50	2	075
2	Bioinformatics	MDMBI01	Introduction to Bioinformatics	45	30	50	4	125
		MDMBI02	Algorithms and Data Structures in Bioinformatics	45	30	50	4	125
		MDMBI03	Machine Learning Applications in Bioinformatics	45	30	50	4	125
3	Innovation, Entrepreneurship and Venture Development	MDMIE01	Foundations of Innovation and Entrepreneurship	45	30	50	4	125
		MDMIE02	Startup Planning and Development	45	30	50	4	125
		4MDMIE03	Innovation Management and Scaling Startups	45	30	50	4	125
4	Business Development, Marketing and Finance	MDMBD01	Introduction to Business Development and Marketing Principles	45	30	50	4	125
		MDMBD02	Financial Basics for Engineers and Technopreneurs	45	30	50	4	125
		MDMBD03	Strategic Marketing and Business Planning	45	30	50	4	125
5	Robotics	MDMRB01	Fundamentals of Robotics and Control	45	30	50	4	125
		MDMRB02	Machine Vision and Robotic	45	30	50	4	125

Sr. No.	Title of MDM	Course Code	Course Name	Assessment guidelines (Marks)			Credits	Total marks (Passing@ 40% of total marks)
				ISA	MSE	ESE		
			Perception					
		MDMRB03	Intelligent Mobile Robotics	45	30	50	4	125
6	Computer Science	MDMCS01	Computational Logic and Data Structures	45	30	50	4	125
		MDMCS02	Operating System & Computer Networks	45	30	50	4	125
		MDMCS03	Database Systems & Introduction to Data Mining	45	30	50	4	125

Second Year B. Tech. Electronics & Telecommunication Engineering Preferred Semester: IV

Course Structure and Assessment Guidelines

	Course		Head of Learning	Credits	Assessment guidelines (Marks)			Total marks (Passing@ 40% of total marks)
NEP-Vertical	**Code**	**Name**			**ISA**	**MSE**	**ESE**	
PC_PCC	PCET106T	Mathematical theory of Communication	Theory	2	15	20	40	075
	PCET106P	Mathematical theory of Communication Lab	Practical	1	25	-	25	050
	PCET109T	Microcontrollers	Theory	2	15	20	40	075
	PCET109P	Microcontrollers Lab	Practical	1	25	-	25	050
	PCET06T	Integrated Circuits	Theory	2	15	20	40	075
	PCET06P	Integrated Circuits Lab	Practical	1	25	-	25	050
	PCET02T	Principles of Communication Engineering	Theory	2	15	20	40	075
	PCET02P	Principles of Communication Engineering Lab	Practical	1	25	-	25	050
	PCET100T	Signal and systems	Theory	2	15	20	40	075
	PCET100P	Signal and systems Lab	Practical	1	25	-	25	050
MDM	MDMXX*	As per MDM course list[##]	As per course	4	45	30	50	125
ELC_INT/OJ	PRJET45	Mini Project	Practical	2	25	-	50	075
ELC-CEP	CEP01[#]	CEP/FP course	As per course	2	25	-	50	075
			Total Credit	**23**				

ISA=In Semester Assessment, MSE= Mid Semester Examination, ESA= End Semester Examination
*Selection based on the subset of courses made available by the Institute for the semester.

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall

be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

[##]For details of MDM courses refer program structure for multidisciplinary minor (MDM) program

[#]**For CEP01- Social Service Internship/ Project:** 2 hours / week slot will be provided during the semester (in regular timetable). Additional work of 30 hours needs to be completed during the semester (besides regular timetable).
NOTE: As per Institute guidelines, course credits completed during the previous inter-semester break will appear in this semester's mark sheet

Second Year B. Tech. Electronics and Telecommunication Engineering - Summer Break

Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
OEC01[$]	Collaborative Inter-Institute Studies	As per course	4	125	-	-	125

[$] **For OEC01- Collaborative Inter Institute Studies (Credit Transfer):** Internship with other reputed institutes equivalent to 4 credits is recommended to be done by learner during second year inter semester break (i.e. summer break between semester 4 and semester 5).
NOTE: As per Institute guidelines, result of courses completed in inter semester break will appear in marksheet of next semester.

Multidisciplinary Minor (MDM)

Sr. No.	Title of MDM	Course Code	Course Name	Assessment guidelines (Marks)			Credits	Total marks (Passing@ 40% of total marks)
				ISA	MSE	ESE		
1	-	MDM01	Seminar	25	-	50	2	075
2	Bioinformatics	MDMBI01	Introduction to Bioinformatics	45	30	50	4	125
		MDMBI02	Algorithms and Data Structures in Bioinformatics	45	30	50	4	125
		MDMBI03	Machine Learning Applications in Bioinformatics	45	30	50	4	125
3	Innovation, Entrepreneurship and Venture Development	MDMIE01	Foundations of Innovation and Entrepreneurship	45	30	50	4	125
		MDMIE02	Startup Planning and Development	45	30	50	4	125
		4MDMIE03	Innovation Management and Scaling Startups	45	30	50	4	125
4	Business Development, Marketing and Finance	MDMBD01	Introduction to Business Development and Marketing Principles	45	30	50	4	125
		MDMBD02	Financial Basics for Engineers and Technopreneurs	45	30	50	4	125
		MDMBD03	Strategic Marketing and Business Planning	45	30	50	4	125
5	Robotics	MDMRB01	Fundamentals of Robotics and Control	45	30	50	4	125
		MDMRB02	Machine Vision and Robotic	45	30	50	4	125

Sr. No.	Title of MDM	Course Code	Course Name	Assessment guidelines (Marks)			Credits	Total marks (Passing@ 40% of total marks)
				ISA	MSE	ESE		
			Perception					
		MDMRB03	Intelligent Mobile Robotics	45	30	50	4	125
6	Computer Science	MDMCS01	Computational Logic and Data Structures	45	30	50	4	125
		MDMCS02	Operating System & Computer Networks	45	30	50	4	125
		MDMCS03	Database Systems & Introduction to Data Mining	45	30	50	4	125

Detailed syllabus of Second Year Semester - III

Course Name: Engineering Mathematics-III

Course Code: BSC06

Category: BSC

Preamble:

The objective of the course is to impart the knowledge of Laplace Transform, Inverse Laplace Transform, Fourier Series, Fourier Transforms and Complex Variable. The course clarifies the concept of transforms and its applications. The course will enable students to learn different transforms of a function, Complex Variable and it will provide with a sound foundation in Mathematics to prepare them for graduate studies in Electronics and Telecommunication Engineering.

Pre-requisites:

Applied Mathematics-I (BS02), Applied Mathematics-II (BS04)

Course Objectives:

- To understand and apply Laplace and inverse Laplace transform to solve differential equations.
- Understanding the fundamental of Fourier series, Fourier transform, Eigen value and Eigen vectors and Complex Variable to solve real world problems.
- To create a strong foundation by studying the basics of Engineering Mathematics and interfacing to various peripherals which will lead to a well-designed based System.
- To provide students with the sound foundation of Mathematics, Science, and Engineering fundamentals necessary to formulate, solve and analyse engineering problems and prepare them for Graduate studies.
- To impart knowledge of interfacing techniques and educate the student in the domain of Electronics and Telecommunication Engineering.

Course Outcomes:

Student will be able to:

CO1: Compute Laplace Transform of a given function
CO2: Apply Inverse Laplace Transform to convert frequency domain into time domain.
CO3: Obtain Fourier series of a given periodic functions by decomposing it into sine and cosine series.
CO4: Apply Fourier transforms to solve problems involving periodic and non-periodic functions.
CO5: Solve problems involving eigenvalues and eigenvectors to understand their applications in different contexts.
CO6: Analyze complex functions to determine if they are analytic and apply C-R equations to verify their analyticity.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	-	3	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	20	30	50	100

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Laplace Transform	Definition of Laplace transform Laplace Transform (L) of Standard Functions, Properties of Laplace Transform: Linearity, First Shifting theorem, Second Shifting Theorem, change of scale Property, Multiplication by t, Division by t, Laplace Transform of derivatives and integrals (All Properties are without proofs). Evaluation of integral using Laplace Transform.	8
2	Inverse Laplace Transform	Formulae of Inverse Laplace Transform, Laplace Inverse using partial fraction, Properties of Inverse Laplace Transform, convolution Theorem (without proof).	6
3	Fourier Series	Fourier series of a periodic function in the interval of period 2π, 2L. Half range Sine and Cosine Fourier series, Complex form of Fourier series.	8
4	Fourier Transform	Fourier Transform, Fourier Sine & Cosine Transform. Inverse Fourier transforms.	6
5	Eigen Values and Eigen Vectors	Eigen values and Eigen vectors Properties, Cayley Hamilton theorem (without proof), examples based on verification of Cayley Hamilton Theorem and by using it to find inverse and power of given matrix.	8

6	Complex variable	Analytic function, C-R equations in polar & Cartesian form (without proof), Harmonic function. Finding analytic function if $u\ or\ v\ or\ (u+v)\ or\ (u-v)$ is given, Milne-Thompson method, Orthogonal trajectories.	9
		Total	**45**

Textbooks:

1. Dr. B. V. Ramana "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, India 2006
2. P. N. Wartikar and J N Wartikar "Textbook of Applied Mathematics Volume I & II, Vidyarthi Ghriha Prakashan Pune 2005 9th Edition.
3. Kanti B Datta, "Mathematical methods for Science and Engineering", Cengage learning 2012.
4. N P Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publication 2006.

Reference Books:

1. Dr. B S Grewal, "Higher Engineering Mathematics", Khanna Publication, 44th Edition
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, 10th Edition.
3. C. R. Wylie & L. C. Barrett, "Advanced Engineering Mathematics", Tata McGraw India, 6th Edition.
4. H K Das, "Advanced Engineering Mathematics", S Chand, 22nd Edition.
5. Murray R. Spiegel. "Schaum's Outline of Laplace Transform", Tata McGraw India, 1st Edition.
6. Murray R. Spiegel. "Schaum's Outline of Fourier analysis with applications", Tata McGraw India ,1stEdition.
7. Dr. B S Tyagi, "Function of a Complex variable", Kedar Nath & Ram Nath publication, 2021.

Course Name: Computer Architecture and Organization

Course Code: PCET108T

Category: PC_PCC

Preamble:

Computers are used for wide range of applications in day today life. This subject provides fundamental understanding for working of a computer. It introduces working of basic functional blocks of a computer like Blocks like Central Processing Unit (CPU) and Memory Unit.

Pre-requisites:

- C Programming
- Object Oriented Programming
- Logic Circuits

Course Objectives:

- To understand the functional blocks and working of a Computer with fundamental model.
- To understand standard algorithms in the design of ALU.
- To conceptualize memory organization in computer
- To comprehend processor organization with various design methods of processor.
- To explore different types of input output organization techniques in computer.
- To analyze different parallel organizations like pipelined architecture.

Course Outcomes:

Student will be able to:

CO1: Understand working of computer using standard model.
CO2: Apply standard algorithms to solve ALU operations.
CO3: Use different types of memory systems of a computer.
CO4: Do comparative analysis of different design methods of processor.
CO5: Assess different types of input output organization techniques.
CO6: Analyze pipelined architecture of processor.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head	ISA	MSA	ESE	Total
Theory	15	20	40	75

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module no	Module name	Content	No of Hours
1	Computer Fundamentals	Functional blocks of a computer, Von Neumann model, working of computer, thought of computer architecture and organization	4
2	Operations of Arithmetic Logic Unit	Review of adder and subtractor, Booth's algorithm, Restoring division algorithm, Non restoring division algorithm, IEEE 754 standard,	6
3	Memory Organization	Memory hierarchy, characteristics, cache memory, cache coherence and handling cache coherence, cache mapping techniques, segmentation, virtual memory	6
4	Processor Organization	Concept of RISC and CISC, control unit design - microcode program unit, hardwired control unit	6
5	Input Output organization	Standard Input Output data transfer techniques, different types of input output buses, bus arbitration	4
6	Advanced processor organization	improving performance of processor, pipelined architecture, parallel processing	4
Total			**30**

Textbooks:

1. Computer Organization and Architecture: Designing for Performance, William Stallings Pearson publication, 8th edition.
2. Computer Organization, Carl Hamacher, Zvonko Vranesic, Tata McGraw-Hill publication, 5th edition.
3. Computer Architecture and Organization, John Hayes, Tata McGraw-Hill publication, 3rd edition.
4. Structured Computer Organization, Andrew S. Tanenbaum, Pearson publication.

Reference Books:

1. Computer Architecture and Organization: Design Principles and Applications, B. Govindarajulu, McGraw Hill publications, 2nd edition.
2. Advance Computer Architecture: Parallelism, Scalability, Programmability Kai Hwang , Tata-McGraw Hill publications, 3rd edition.

Assessment:

1. **ISA (In-Semester-Assessment):** In semester assessment will carry total 15 marks. It will consist of weekly graded assignments based on modules (each carrying 10 marks). The assignments are self-study work and need to be completed by individual students separately. Every student will be submitting four completed assignments. Students are encouraged to develop their own problem statements and devise a proper method / solution. Importance will be given to the concept understanding and applying it to solve the industrial problem using coding.

2. **MSA (Mid-Semester-Assessment):** Mid Semester Assessment will consist of three mid semester internal theory test carrying 20 marks based on completion of minimum modules. This test will be common for all the students. ***Repeat examination will not be conducted.***

3. **ESE (End-Semester-Examination):** End Semester Examination will be conducted for total of 40 marks based on the completion of remaining modules post completion of mid semester examination or an entire syllabus. This test will be common for all the students.

Course Name: Computer Architecture and Organization Laboratory

Course Code: PCET108P

Category: PC_PCC

Preamble:

Computers are used for wide range of applications in day today life. This subject provides fundamental understanding for working of a computer. It introduces working of basic functional blocks of a computer like Blocks like Central Processing Unit (CPU) and Memory Unit.

Pre-requisites:

- C Programming
- Object Oriented Programming
- Logic Circuits

Course Objectives:

- To understand the functional blocks and working of a Computer with fundamental model.
- To understand standard algorithms in the design of ALU.
- To conceptualize memory organization in computer
- To comprehend processor organization with various design methods of processor.
- To explore different types of input output organization techniques in computer.
- To analyze different parallel organizations like pipelined architecture.

Course Outcomes:

Student will be able to:

CO1: Understand model for working of a computer.
CO2: Implement standard algorithms for different ALU operations.
CO3: Use different types of memories for working with computer.
CO4: Select appropriate processor for computer based application.
CO5: Use different techniques of input output organization for computer based applications.
CO6: Evaluate performance of pipelined architecture of a processor.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head	ISA	MSA	ESE	Total
Lab	25	--	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Conversion between standard bases like decimal to binary.
2. Develop model demonstrating working of computer.
3. Implement Booth's Algorithm.
4. Implement Restoring division algorithm.
5. Implement Non-restoring division Algorithm.
6. Implement IEEE 754 standard.
7. Develop model demonstrating working of memory.
8. Develop cache memory block or page replacement algorithm.
9. Mini project

Textbooks:

1. Computer Organization and Architecture: Designing for Performance, William Stallings Pearson publication, 8th edition.
   Computer Organization, Carl Hamacher, Zvonko Vranesic, Tata McGraw-Hill publication, 5th edition.
2. Computer Architecture and Organization, John Hayes, Tata McGraw-Hill publication, 3rd edition.
3. Structured Computer Organization, Andrew S. Tanenbaum, Pearson publication.

Reference Books:

2. Computer Architecture and Organization: Design Principles and Applications, B. Govindarajulu, McGraw Hill publications, 2nd edition.
2. Advance Computer Architecture: Parallelism, Scalability, Programmability Kai Hwang, Tata-McGraw Hill publications, 3rd edition.

Course Name: Electronic Devices and Circuits

Course Code: PCET01T

Category: PC_PCC

Preamble:

This course introduces students about Working and characteristics of various Active devices used to build various circuits. The course will offer in depth knowledge about modelling of devices and analysis and designing of various circuits used to develop the Electronics system.

Pre-requisites:

Nil

Course Objectives:

- Understanding, working, characteristics and biasing of BJT.
- Analyzing and designing various amplifiers using MOSFET
- To understand and evaluating various types of power amplifier circuits.
- Analyzing and designing various types of low and high frequency oscillator circuits.
- Understanding and Analysing MOSFET based differential amplifier circuits.

Course Outcomes:

Student will be able to:

CO1: Students will be able to Analyse various performance parameter of BJT & MOSFET Amplifier circuits.
CO2: Students will be able to Design Electronic circuits for given specification using BJT & MOSFET.
CO3: Students will be able to understand Operation of Power Amplifier.
CO4: Students will be able to understand Oscillator.
CO5: Students will be able to understand Differential Amplifier.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Bipolar Junction Transistor	Construction and working of B.J.T. CE Configuration of BJT and their characteristics. Biasing of BJT and its various circuits. BJT Modelling (hybrid-π model only). Introduction to CE Amplifier and Analysis of only CE Amplifier using only hybrid-π Model. Numerical based on BJT biasing and BJT Amplifier.	8
2	MOSFET	Construction working and characteristics of Enhancement MOSFET and depletion MOSFET. Dc load line and Biasing circuits for EMOSFET, DMOSFET. Numerical on Biasing circuits. Small Signal Equivalent circuits of MOSFET. Introduction and Analysis of CS Amplifier.	6
3	Power Amplifier:	Introduction to various types of power amplifier. Analysis of Class A, class B, Class AB power Amplifier using BJT. Heat sink and its need. Study of Class C amplifier(study of transformer coupled and transformer less Push Pull amplifiers)	5
4	Oscillator	Concept of feedback. Introduction to Positive and Negative Feedback [only block diagram and concept. No circuits and derivation] .Barkhauson's Criteria. RC phase shift and Wien bridge oscillator using BJT. General Topology of Tank circuits oscillator, Hartley, Colpitt and Clapp oscillator using BJT	6

5	Differential Amplifier.	Differential Amplifier: Need of Differential amplifier. Dc transfer characteristics of MOSFET passive load different amplifier DC & AC Analysis of MOS passive load Amplifier.	5
Total			**30**

Text Books:

1. Electronic Circuit Analysis and Design. D. A. Neamen, Tata McGraw Hill 2nd Edition, 2012
2. Microelectronics Circuits, Sedra and Smith OXFORD 7thEdition.

Reference Books:

1. Electronic Devices and Circuit. T. F. Bogart, Merrill 6thEdition. Reference Books
2. Electronic Devices and Circuits Salivahanan, N. Suresh Kumar, Tata McGraw Hill, 3rdEdition
3. Electronic Devices and Circuits J. Millman, Christos CHalkias, and Satyabratat Ajit, Millman's, Tata McGraw Hill, 3rdEdition
4. Microelectronics Circuits Analysis and Design Muhammad H. Rashid, Cengage Learning, 2nd Edition

Course Name: Electronic Devices and Circuits Lab

Course Code: PCET01P

Category: PC_PCC

Preamble:

This course introduces students about Working and characteristics of various Active devices used to build various circuits. The course will offer in depth knowledge about modelling of devices and analysis and designing of various circuits used to develop the Electronics system.

Pre-requisites:

Nil

Course Objectives:

- Understanding, working, characteristics and biasing of BJT.
- Analyzing and designing various amplifiers using MOSFET
- To understand and evaluating various types of power amplifier circuits.
- Analyzing and designing various types of low and high frequency oscillator circuits.
- Understanding and Analysing MOSFET based differential amplifier circuits.

Course Outcomes:

Student will be able to:

CO1: Students will be able to Analyse various performance parameter of BJT & MOSFET Amplifier circuits.
CO2: Students will be able to Design Electronic circuits for given specification using BJT & MOSFET.
CO3: Students will be able to understand Operation of Power Amplifier.
CO4: Students will be able to understand Oscillator.
CO5: Students will be able to understand Differential Amplifier.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Implementation and designing of various biasing circuits for BJT.
2. Implementation and designing of various biasing circuits for MOSFET.
3. Implementation and verifying the results of Common Emitter Amplifier.
4. Implementation and verifying the results of Common Source Amplifier
5. Frequency analysis of Common Emitter Amplifier.
6. Frequency analysis of Common source Amplifier.
7. Implementation of R-C Phase shift oscillator using BJT.
8. Implementation of Hartley oscillator using BJT
9. Implementation of Transformer coupled Class A Power Amplifier using BJT
10. Implementation of Transformer coupled Class B Power Amplifier using BJT
11. Implementation of Passive load Differential Amplifier using MOSFET.
12. V-I Characteristics of BJT using LT-SPICE.
13. V-I Characteristics of MOSFET using LT-SPICE
14. Simulation of Wien-Bridge Oscillator using BJT.
15. Simulation of Colpitt Oscillator using BJT

Suggested List of Mini-Project:

1. 5V DC Power supply.
2. Bugler Alarm
3. Light operated switch.
4. Auto door opening using sensors.
5. Pre Amplifier circuit.
6. Musical Siren.

Text Books:

1. Electronic Circuit Analysis and Design. D. A. Neamen, Tata McGraw Hill 2nd Edition, 2012
2. Microelectronics Circuits, Sedra and Smith OXFORD 7th Edition.

Reference Books:

1. Electronic Devices and Circuit. T. F. Bogart, Merrill 6thEdition. Reference Books
2. Electronic Devices and Circuits Salivahanan, N. Suresh Kumar, Tata McGraw Hill, 3rdEdition
3. Electronic Devices and Circuits J. Millman, Christos CHalkias, and Satyabratat Ajit, Millman's, Tata McGraw Hill, 3rdEdition
4. Microelectronics Circuits Analysis and Design Muhammad H. Rashid, Cengage Learning, 2ndEdition.

Course Name: Network Theory and Transmission Lines

Course Code: PCET101T

Category: PC_PCC

Preamble:

This course introduces students to the basics of Electrical Circuit Theory and its analysis using various network solving techniques in time and frequency domain for different input signals. Students are introduced to the different network synthesis techniques. This course also discusses transmission lines which are used to carry information and energy, and its analysis using distributed circuit theory.

Pre-requisites:

Basic Electrical & Electronics Engineering

Course Objectives:

- To analyse electrical circuits by using circuit theory concepts and network theorems.
- To analyse the electrical circuits in time and frequency domain.
- To understand network functions, network parameters, inter relationship among various circuit parameters, and to solve more complex network using these parameters.
- To synthesize passive networks by various methods.
- To analyse transmission lines using distributed circuit theory.

Course Outcomes:

Student will be able to:

CO1: Analyse electrical circuits using network basic concepts and network theorems.
CO2: Analyse the circuits for various inputs in time domain and frequency domain.
CO3: Determine various network parameters and network functions of two port networks.
CO4: Synthesize different network functions using various synthesis techniques.
CO5: Analyse transmission line at RF frequencies.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Analysis of DC and AC Circuits	Dependent Sources circuit analysis using mesh and node analysis Network Theorems: Superposition, Thevenin's, Norton's, and Maximum power transfer.	6
2	Time and Frequency Domain Analysis of R-L-C Circuits	Time Domain Analysis: Initial and final conditions of R, L, & C components. Time domain analysis of first order R-L and R-C Circuits, and second order RLC circuits. Frequency Domain Analysis: Frequency domain representation of R, L, and C components, Laplace Transform in analysis of electrical circuits. Initial and final value theorems of Laplace transform.	6
3	Network Functions and Two Port Networks	Network functions: One port and Two port network functions, Poles and Zeros of Network functions. Two port networks: Open Circuits, short Circuit, Transmission and Hybrid parameters, conditions for reciprocity and symmetry, relationship among the parameters. Interconnections of Two-Port Networks.	6
4	Synthesis of Networks	Tests for Hurwitz polynomial: Routh Array and continued fraction expansion method. Positive Real Functions: Concept of positive real function, testing for necessary and sufficient conditions for Positive Real Functions. Synthesis of LC, RC & RL Circuits: properties of LC, RC & RL driving point functions, LC, RC & RL network	6

		Synthesis in Foster-I &II forms, Cauer-I & II forms.	
5	Transmission Line Theory	Transmission Line parameters, equivalent circuit, transmission line equation and its solution. Parameters of radio frequency lines: Propagation constant, attenuation constant, phase constant, group velocity, input impedance, characteristic impedance, reflection coefficient, standing wave ratio, VSWR, ISWR, Introduction to Smith Chart.	6
Total			**30**

Text Books:

1. Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan, 2nd.ed. 1966
2. D Roy Choudhury, "Networks and Systems", New Age International 1998
3. David M. Pozar, "Microwave Engineering", Wiley, Third Edition
4. Sudhakar, Shyammohan S. Palli, "Circuits and Networks", Tata McGraw Hill, Third Edition

Reference Books:

1. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 26th Indian Reprint, 2000
2. A Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., Delhi, 6th Edition
3. W L Everitt and G E Anner, "Communication Engineering", Mc-GrawHill, New York, 3rd Edition
4. Annapurna Das and S. K. Das, "Microwave Engineering", McGraw Hill, Third Edition

Course Name: Network Theory and Transmission Lines Lab

Course Code: PCET101P

Category: PC_PCC

Preamble:

This course introduces students to the techniques, concepts of Electrical Circuit analysis using simulations and experimentations. It also discusses transmission line analysis for radio wave propagation.

Pre-requisites:

Basic Electrical & Electronics Engineering

Course Objectives:

- To analyse and verify electrical circuits concepts and network theorems using simulation and experimentation.
- To analyse the response of R-L, R-C and R-L-C circuits.
- To analyse two port networks using network parameters.
- To analyse transmission lines for radio wave propagation.

Course Outcomes:

Student will be able to:

CO1: Analyse electrical/electronic circuits with the help network analysis concepts and theorems using simulation and experimentation.
CO2: Analyse the R-C and R-L-C circuits in time and frequency domain.
CO3: Analyse and represent the network in terms of network parameters.
CO4: Analyse transmission lines using transmission line parameters.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	50

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Dependent Sources implementation and analysis.
2. Thevenin's/Norton's Theorems verification/implementation and its applications.
3. Maximum power transfer theorem and its applications.
4. Transient analysis of network.
5. Charging and discharging of R-C circuit and its applications.
6. Second order R-L_C circuit analysis.
7. Two port networks parameters analysis and its interpretation.
8. Interconnections of two port networks and its analysis.
9. Transmission line parameters calculations and analysis.
10. Transmission line analysis.

Text Books:

1. Franklin F Kuo, "Network Analysis and Synthesis", Wiley Toppan, 2nd.ed. 1966
2. D Roy Choudhury, "Networks and Systems", New Age International 1998
3. David M. Pozar, "Microwave Engineering" , Wiley, Third Edition
4. A. Sudhakar, Shyammohan S. Palli, "Circuits and Networks", Tata McGraw Hill, Third Edition

Reference Books:

1. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi, 26th Indian Reprint, 2000
2. A Chakrabarti, "Circuit Theory", Dhanpat Rai & Co., Delhi, 6th Edition
3. W L Everitt and G E Anner, "Communication Engineering", Mc-Graw Hill, New York, 3rd Edition
4. Annapurna Das and S. K. Das, "Microwave Engineering", McGraw Hill, Third Edition

Course Name: Skill Based Lab-1

Course Code: VSEC05

Category: VSEC

Preamble:

This course aims to provide fundamentals of Python Programming supplemented over the structural and object oriented programming. Student will learn the flexibility and comprehensiveness of Python programming and appreciate the application development through simple problem statements.

Pre-requisites: ES04: Structured Programming

Course Objectives:

- Describe the core syntax and semantics of Python programming language.
- Explore file handling in Python
- Infer the Object-oriented Programming concepts in Python
- Formulate GUI Programming operations in Python
- Develop applications using variety of libraries and functions

Course Outcomes:

After successful completion of the course student will be able to:
CO1: Create functions, modules and packages to develop different
CO2: Implement different file system objects.
CO3: Develop Python programs using Object Oriented Programming concepts.
CO4: Develop GUI
CO5: Preprocess & Visualize data using different Python libraries like Numpy, Pandas and Matplotlib.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	50	-	-	50

Detailed Syllabus:

Module no.	Module name	Topics	Hours
1	Object Oriented Programming	Classes and Objects, Public and Private Members, Class Declaration and Object Creation, Object Initialization, Class Variables and methods, Accessing Object and Class Attributes, Inheritance, Constructor in Inheritance	2
2	Introduction to Python	Introduction to Python, Installation and resources, Identifiers and Keywords, Comments, Indentation and Multi-lining, Variables (Local and Global), data types, Arithmetic, Comparative, Logical and Identity Operators, Bitwise Operators, Expressions, Print statement and Formats, Input Statements in python Strings, Lists, Tuples, Dictionaries, Sets, Accessing Elements, Properties, Operations and methods on these data structures. Decision Flow Control Statement: if and else statement, Nested If statement, Loop Statement: While Loop, do and while loop, for loop statement, Continue, Break and pass Statement, Conditional Statements	6
3	Functions & Modules	Functions: Built-in-functions, library functions, Defining and calling the functions, return statements, Passing the arguments, Recursive functions, Modules and importing packages in python code.	5
4	File I/O Handling	File Input/output: Files I/O operations, Read / Write Operations, File Opening, Modes, with keywords, Moving within a file, pickling	5
5	Graphical User Interface	Graphical User Interface using Tkinter Library module, creating simple GUI, Buttons, Labels, entry fields, widget attributes.	6
6	Numpy, Pandas, Matplotlib, Seaborn, Scipy	Introduction to Numpy, Creating and Printing Ndarray, Class and Attributes of Ndarray, Basic operation, Copy and view, Mathematical Functions of Numpy. Introduction to Pandas, Understanding Data frame, View and Select Data, Missing Values, Data Operations, File read and write operation. Introduction to Matplotlib library, Line properties, Plots and subplots, Types of Plots	6
		Total	30

Text Books:

1. "Let us Python: Python is Future", Yashvant Kanetkar, BOB publication
2. "Core Python Programming", Nageshwar Rao
3. "Python & Tkinter Programming", John Grayson, Manning publications
4. Python 3 object oriented programming, Dusty Philips, PACKT Publisher
5. Introduction to coputing & problem solving using Python, E. Balguruswami, McGraw Hill Education.

Reference Books:

1. Python Cookbook:Receipes for Mastering Python 3, David Beazely, O'Reilly Media
2. "Head First Python", Paul Barry, O'Reilly
3. "Tkinter GUI Application Development Blueprints: Master GUI programming in Tkinter as you design, implement and deliver 10 real world application",Packt Publishing
4. "Python Crash Course A habds-on, Project Based Introduction to programming", Eric Matthes, No Starch Press.

Software Tools:

1. Python IDE: https://www.python.org/downloads/

2. Anaconda Environment: https://www.anaconda.com/distribution/

Online Repository:

1. Github
2. Python 3 Documentation: https://docs.python.org/3/
3. "The Python Tutorial", http://docs.python.org/release/3.0.1/tutorial/
4. http://spoken-tutorial.org
5. Python 3 Tkinter library Documentation: https://docs.python.org/3/library/tk.html
6. Numpy Documentation: https://numpy.org/doc/
7. Pandas Documentation: https://pandas.pydata.org/docs/
8. Matplotlib Documentation: https://matplotlib.org/3.2.1/contents.html
9. Scipy Documentation: https://www.scipy.org/docs.html
10. Machine Learning Algorithm Documentation: https://scikit-learn.org/stable/
11. https://nptel.ac.in/courses/106/106/106106182/

Course Name: Technical Communication

Course Code: AEC04

Category: HSSM_AEC

Preamble:

This course introduces the participants gain an understanding and knowledge of genres such as reports, feasibility studies, proposals, and specifications. Participants will construct a logical outline of a technical document; write with awareness of expository techniques such as definition, classification, and causal analysis; and design an effective format and layout for a technical publication.

Pre-requisites:

Nil

Course Objectives:

- Demonstrate rhetorical knowledge to create effective technical writing documents for end-users.
- Apply and adapt flexible writing process strategies to produce clear, high-quality deliverables in a multitude of technical writing genres.

Course Outcomes:

Student will be able to:

CO1: Write effective reports and design documentation
CO2: Make effective presentations
CO3: Apply ethical practices in technical communication

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	50	-	-	50

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose the revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Fundamentals of Technical Communication	Technical Communication: Features; Distinction between General and Technical Communication; Language as a tool of Communication; Dimensions of Communication: Reading & comprehension; Technical writing: sentences; Paragraph	6
2	Forms of Technical Communication	White paper writing, Email writing, Technical report, Synopsis writing, Technical research Paper writing, Lab manual, Instruction manual, Reading datasheets	10
3	Technical Presentation: Strategies & Techniques	Presentation: Classroom presentation, Poster presentation Public Speaking: method; Techniques: Clarity of substance; emotion; Humour; Modes of Presentation; Overcoming Stage Fear: Confident speaking; Audience Analysis & retention of audience interest. Methods of Presentation: Interpersonal; Impersonal; Audience Participation: Quizzes & Interjections Video making and presentation	10
4	Technical Communication Skills	Interview skills Group Discussion: Objective & Method; Features of Body Language Voice Modulation: Quality, Pitch; Rhythm; intonation; Pronunciation; Articulation; stress & accent Linguistic features of voice control: Vowel & Consonant Sounds	4
Total			**30**

Reference Books:

1. Technical Communication: Process and Product, MLA Update (9th Edition), by Sharon J. Gerson, Steven M. Gerson. Publisher: Pearson; 9 edition (February 9, 2017). ISBN-10: 0134678869. ISBN-13: 978-0134678863
2. The Elements of Style, Fourth Edition. Aug 2, 1999, by William Strunk Jr. and E. B. White. Publisher: Pearson. http://www.bartleby.com/141/

3. Technical Communication: A Practical Approach (8th Edition) Jan 7, 2012, by William S. Pfeiffer and Kaye A. Adkins, Publisher: Pearson.
4. Pocket Guide to Technical Communication (5th Edition) 5th Edition, by William S. Pfeiffer. Publisher: Pearson.
5. Engineering Communication (January 1, 2014). Knisely, Charles W., Knisely, Karin I. Publisher: Cengage

Course Name: Design Thinking

Course Code: EEMC01

NEP Verticals_ Basket: EEMC

Preamble:

Design thinking is a powerful tool for rethinking and revitalizing strategy—and for driving organizational performance. By placing customers' needs at the center of a product, service, process, or business model, you can reframe strategic challenges and develop more effective solutions. Drawing on right-brained creativity and left-brained analytics, the course on design thinking enables you to broaden your strategic perspective, find novel opportunities for innovation, and keep your business moving forward.

Pre-requisites:

NIL

Course Objectives:

- To impart knowledge on the concepts of design thinking
- To impart knowledge on the phases of design thinking
- To apply design thinking concepts

Course Outcomes:

Learner will be able to:
CO1: Understand the concepts of design thinking approaches.
CO2: Create design thinking teams and conduct design thinking sessions.
CO3: Apply both critical thinking and design thinking in parallel to solve problems.
CO4: Apply design concept to their daily work.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
2	1	2	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory + Tutorial	50	-	50	100

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment

methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Design Thinking Overview	What is different about design thinking, Design thinking skills, Design thinking mindset, Principles of Design thinking	2
2	General Approaches to Design Thinking	The basics of Design thinking, Design thinking frameworks, Design thinking team, Design thinking workshops and meeting – Characteristics and types	4
3	Design Thinking approach in stages	Apply design thinking framework, emphasize with customers/users, Define the problem, Ideate, Prototype, Test solution.	7
4	Design Thinking Techniques	Listening and emphasizing techniques – Engagement, Observation, showing empathy, Define and ideation techniques – Unpacking, Personas, Pattern recognition and connecting the dots, Prototype, and testing techniques – Types of prototypes, forms of testing in design thinking,	7
5	General Design Thinking Practices	Use of diagrams and maps in design thinking – empathy map, affinity diagram, mind map, journey map. Story telling techniques – Improvisation, scenarios, K-scripts	8
6	Adopt and Adapt Design thinking	Cautions and pitfalls – assumptions, pitfalls and cautions indesign thinking workgroups, best practices	2
Total			**30**

Reference Books:

1. Change by Design - How Design Thinking Transforms Organizations and Inspires Innovations by Tim Brown
2. The Design Thinking Toolbox: A Guide to Mastering the Most Popular and Valuable Innovation Methods by Larry J.Leifer, Michael Lewerick, and Patrick

Detailed syllabus of Third Year Semester – III

Multidisciplinary Minor (MDM)

Course Name: Introduction to Business Development and Marketing Principles

Course Code: MDMBD01

Category: MDM

Preamble:

The objective of this course is to introduce engineering students to the fundamentals of business development and marketing using a customer centric lens. Students will learn how to conceptualize a basic business idea, understand market needs, and align engineering innovations with customer demand.

Pre-requisites:

None

Course Objectives:

- Understand basic business structures and concepts.
- Identify customer needs and conduct basic market research.
- Learn fundamentals of marketing strategy in a technology-driven world.
- Appreciate the role of engineering in business innovation.

Course Outcomes:

Student will be able to:

CO1: Explain key concepts in business development and marketing relevant to engineers.
CO2: Conduct simple market research and competitor analysis for a tech-based idea.
CO3: Draft a basic value proposition and elevator pitch.
CO4: Identify business opportunities through innovation in telecom and electronics domains.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Tutorial	Theory	Tutorial
3	1	3	1

Assessment Guidelines:

Head of learning	**ISA**	**MSE**	**ESE**	**Total**

Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Foundations of Business	Types of businesses, vision-mission-goals, legal forms of business, introduction to entrepreneurship.	8
2	Marketing Essentials	Needs vs wants, Segmentation, targeting, positioning, Marketing mix (4Ps), digital vs traditional marketing.	8
3	Customer Focus	Basics of customer journey, personas	7
4	Technology Product Planning	Basics of product lifecycle, innovation funnel, idea screening.	10
5	Market Research Basics	Research Types, Research steps, Sampling,, Surveys, interviews, SWOT, competitor analysis.	6
6	Business Idea Pitch	Business idea pitch, value proposition canvas, storytelling.	6
		Total	**45**

PO Mapping by Module:

- Module 1: PO6, PO8, PO12
- Module 2: PO3, PO6, PO10
- Module 3: PO2, PO10
- Module 4: PO1, PO3, PO5
- Module 5: PO4, PO11
- Module 6: PO9, PO10

Textbooks:

1. Marketing Management by Kotler

Reference Books:

1. Marketing Basics PDF by MIT OpenCourseWare

Course Name: Introduction to Bioinformatics

Course Code: MDMBI01

Category: MDM

Preamble:

This course is designed with the objective of equipping students with a robust understanding of the integration between biology and computational science, key bioinformatics concepts, methodologies, and applications. Through a combination of theoretical knowledge and practical applications, students will develop a holistic understanding of how computational methods can enhance the comprehension of biological processes. It also emphasizes on real-world biological questions and research challenges, empowering them to make meaningful contributions to the rapidly evolving field of bioinformatics.

Pre-requisites:

None

Course Objectives:

- To enable learners to understand the basic principles of bioinformatics.
- Build foundational understanding of biology, types of biological data, and the role of computing in biology

Course Outcomes:

Learner will be able to:

CO1: understand the basic principles of bioinformatics.

CO2: understand foundational understanding of biology, types of biological data, and the role of computing in biology**.**

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Explain foundational molecular biology concepts and their relevance to bioinformatics, including DNA, RNA, proteins, and gene functions.	Understanding
CO2	Access, compare, and utilize various biological databases and sequence file formats to retrieve and analyze genomic and proteomic data effectively.	Applying
CO3	Apply key sequence alignment algorithms and computational techniques to analyze biological sequences and construct phylogenetic relationships.	Applying
CO4	Implement bioinformatics algorithms and data structures to solve problems in genomics, proteomics, and systems biology, including gene	Applying

	prediction and motif discovery.	
CO5	Evaluate current applications and emerging trends in bioinformatics, including personalized medicine, big data analytics, ethical issues, and the integration of AI/ML technologies in biological research.	Analyse

Course Scheme:

Contact Hours		Credits Assigned	
Theory	**Tutorial**	**Theory**	**Tutorial**
3	1	3	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Basics of Molecular Biology	Structure and function of DNA, RNA, and proteins, Central Dogma of Molecular Biology (Replication, Transcription, Translation), Codons and genetic code, types of genes (structural, regulatory), Mutations and their biological effects. ***Self-Learning Topics***: *Overview of transcription factors, epigenetics, and recent genetic editing technologies (CRISPR).*	8
2	Biological Databases	Types: Primary, Secondary, Specialized databases, GenBank, EMBL, DDBJ – comparative study, UniProt, PDB, RefSeq, Ensembl, Sequence file formats (FASTA, GenBank, GFF, SAM/BAM), Querying biological databases (using NCBI Entrez, EBI search tools) ***Self-Learning Topics***: *Meta-databases and integrative*	8

		resources (e.g., UniProt, INSD)	
3	Sequence Analysis	Types of biological sequences: DNA, RNA, Protein,Pairwise and Multiple Sequence Alignment (MSA),Scoring matrices (PAM, BLOSUM),Tools: BLAST, FASTA, ClustalW, Applications: gene finding, phylogeny, structure prediction ***Self-Learning Topics****:* Evolutionary models used in sequence analysis	8
4	Genomics & Human Genome Project	Genome organization and structure, Sequencing techniques: Sanger, Next Generation Sequencing (NGS), Nanopore, Applications: disease gene identification, forensic genomics, Human Genome Project: goals, achievements, ethical issues, Comparative genomics ***Self-Learning Topics****: Public repository of genomic data*	12
5	Applications of Bioinformatics	Bioinformatics in personalized medicine, Drug discovery and vaccine design, Agriculture and animal genomics Role of AI/ML in bioinformatics	9
Total			45

Books and Resources:

1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laborator Press, New York. 2004
2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by Baxevanis, A.D. and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009
3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson Education. 1999

Course Title: Foundations of Innovation and Entrepreneurship

Course Code: MDMIE01

NEP Vertical_Basket: MDC_MDM

Preamble:

This course provides a foundational understanding of how innovation emerges, how entrepreneurs identify and act on opportunities, and how new ventures can be developed to address real-world challenges. It explores the intersection of creativity, strategic thinking, and risk-taking, emphasizing both individual initiative and collaborative problem-solving.

Pre-requisites: NIL

Course Objectives:

- To introduce the foundational concepts of innovation and entrepreneurship.
- To build awareness of opportunity recognition, creativity, and idea validation.
- To expose students to business modelling and startup ecosystems.

Course Outcomes:
Students will be able to:
CO1: Understand key entrepreneurial trends and innovation drivers
CO2: Apply ideation tools to enhance entrepreneurial ideas.
CO3: Create basic business models using modern tools.
CO4: Evaluate entrepreneurial case studies and pitch early-stage ideas and take critical feedback.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Tutorial	Theory	Tutorial
MDMBI01	3	1	3	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total

Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Entrepreneurship	• Definition, importance, and scope • Types of entrepreneurs • Entrepreneurial mindset and characteristics	8
2	Innovation Basics	• Types of innovation (product, process, business model) • Disruptive vs. incremental innovation Design Thinking fundamentals	8
3	Idea Identification & Evaluation	• Creativity and ideation tools (brainstorming, SCAMPER, mind-mapping) • Problem-solving frameworks • Validating ideas	10
4	Business Case presentation	• Business Model Canvas • Value Proposition Design • Customer Segments and Customer Discovery	6
5	Leveraging the Entrepreneurial Ecosystem	• Role of incubators, accelerators, and funding bodies • Startup India, Atal Innovation Mission, etc	7
		Total	**45**

Tutorials (1 Credit):

- Case studies on startups
- Group exercises on ideation
- Hands-on practice with the Business Case presentation
- Ideation workshops
- Business culture studies exercises
- Group discussion and presentations

Reference books:

- Steve Blank, The Startup Owner's Manual, K&S Ranch Publishing Inc
- Alexander Osterwalder, Business Model Generation, John Wiley and Sons

Peter F. Drucker, Innovation and Entrepreneurship, HarperCollins Publishers Inc

Course Name: Fundamentals of Robotics and Control

Course Code: MDMRB01

Category: MDM

Preamble:

This course introduces the foundational principles of robotics, including kinematics, dynamics, and control systems. The course explores real-world robotic applications and the growing role of automation in modern industries. Students will gain hands-on experience with robotic systems and process automation tools. The course integrates Robotic Process Automation (RPA) to bridge physical and digital automation domains.

Course Objectives:

- Understand the foundational prin ciples of robotics, including kinematics, dynamics, and control of robotic systems.
- Apply basic control strategies such as PID to robotic manipulators and mobile robots
- Explore the role of Robotic Process Automation (RPA) as a complementary software-based automation technique and build simple RPA workflows.

Pre-requisites:

1. Engineering Mathematics-I
2. Engineering Mathematics-II
3. Structured Programming
4. Object Oriented Programming

Course Outcome:

The students will be able to:
CO1: Explain the components and types of robotic systems and their applications.
CO2: Derive and apply forward and inverse kinematics for simple manipulators.
CO3: Analyze and implement feedback control systems, including PID controllers
CO4: Simulate basic robotic arm motion and trajectory control using software tools..
CO5: Describe the fundamentals of Robotic Process Automation (RPA) and its uses in industry.
CO6: Develop a basic RPA workflow to automate a simple rule-based software task.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	**Practical**	**Theory**	**Practical**
3	2	3	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory - practical	45	30	50	125

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose a revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Module Contents	No. of Hours
01	Introduction to Robotics	Types of robots: manipulators, mobile robots, humanoids Robot anatomy: joints, links, actuators, sensors Applications in manufacturing, healthcare, and services	06
02	Kinematics of Robotic Manipulators	Coordinate systems and transformations, Denavit–Hartenberg (D-H) parameters, Forward and inverse kinematics for 2-DOF and 3-DOF arms	09
03	Dynamics and Trajectory Planning	Basic concepts in robot dynamics (torque, inertia – overview), Joint and Cartesian trajectory planning, Linear and cubic interpolation	06
04	Control of Robotic Systems	Introduction to control systems, PID control: tuning, implementation, and real-time control, Stability and feedback concepts	08
05	Introduction to Robotic Process Automation	What is RPA, Difference from physical robotics, Components of an RPA system: bots, orchestrators, recorders, Overview of popular RPA tools (e.g., UiPath)	06
06	RPA Workflow Design and	Creating simple bots to automate tasks (e.g., Excel, web forms),	10

Module No.	Module Name	Module Contents	No. of Hours
	Integration	Control structures, data handling, and triggers in RPA, Conceptual integration: using RPA to initiate physical robot actions	
Total			**45**

Suggested List of Value-Added Home Assignments:

1. Research a real-life robotic system (e.g., Da Vinci surgical robot, warehouse AGVs, Boston Dynamics' Spot). Analyze its components, sensing and actuation methods, and control logic. Propose a reconfiguration or redesign for a different application.
2. Design a 2-DOF or 3-DOF manipulator in MATLAB or Python. Simulate a simple pick-and-place routine.
3. Design a time-optimized trajectory considering joint velocity and acceleration limits for trajectory planning for a Robotic Painter
4. Implement a PID controller to stabilize an inverted pendulum model. Simulate using MATLAB/Python
5. Identify a repetitive digital task in your daily academic/work life. Automate them using tools
6. Create an RPA bot that responds to an email, form submission, or file upload.

Reference Books / Articles

1. Robert Shilling, Fundamentals of Robotics-Analysis and control, Prentice Hall of India, 2003.
2. John J. Craig, Introduction to Robotics–Mechanics &Control Pearson Education, India, Third Edition, ,2009.
3. Katsuhiko Ogata, Modern Control Engineering
4. Alok Mani Tripathi, Learning Robotic Process Automation
5. Fu, Gonzales and Lee, Robotics, Robotics, McGraw Hill, SecondEdition,2011.
6. Staughard, Robotics and AI, Prentice Hall of India.
7. Grover, Wiess, Nagel, Oderey Industrial Robotics, , McGraw Hill.
8. Walfram Stdder, Robotics and Mechatronics, Mc Graw Hill, New York 2008.
9. Saeed B Niku, Introduction to Robotics, Pearson Education.
10. Mittal, Nagrath, Robotics and Control, Tata McGraw Hill publications

Course Name: Computational Logic and Data Structures

Course Code: MDMCS01

Category: MDM

Preamble:

The course introduces students to key concepts in discrete structures and data structures, providing a foundational understanding essential for many areas in computer science. Students will explore topics related to the organization, management, and manipulation of data, as well as learn about basic data structures, their associated algorithms, and principles of design and analysis. Emphasis will be placed on both theoretical understanding and practical application, enabling students to effectively use these concepts to solve complex computational problems.

Pre-requisites:

1. ES04T (Structured Programming).
2. ES05T (Object Oriented Programming)

Course Objectives:

- To establish foundational knowledge of discrete mathematical structures and their properties, enabling students to recall and apply these concepts in computational problem-solving.
- To develop conceptual understanding of linear/non-linear data structures (stacks, queues, trees, graphs), their memory representations, and operational principles for efficient data organization.
- To build practical skills in implementing, analyzing, and optimizing data structure operations while evaluating time/space complexity using asymptotic notations.
- To apply integrated knowledge of discrete mathematics and data structures to design solutions for real-world engineering challenges.

Course Outcomes:

Learner will be able to:

CO1: Recall fundamental concepts of set theory, logic, relations, and algebraic structures, including definitions, properties, and notations.

CO2: Explain the working principles of linear and non-linear data structures (stacks, queues, trees, graphs) and their representations in memory.

CO3: Explain the principles of linear and non-linear data structures (stacks, queues, trees, graphs) and their memory representations.

CO4: Implement basic operations (insert/delete/search) on linear data structures (arrays, stacks, queues, linked lists) using appropriate programming constructs.

CO5: Analyze and compare time/space complexity of different data structure implementations using asymptotic notations (Big-O, Omega, Theta).

CO6: Evaluate the application of discrete mathematical concepts (graph theory, algebraic structures) in solving engineering problems like network design or cryptography.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	2	3	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory and Practical	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No	Module name	Content	No of Hours
1	Set Theory and Logic	Definition and representation of Sets, Types of sets, operations on sets, Laws of set, Principle of Inclusion & Exclusion (3 sets), Partition of set. Counting principle, Pigeonhole Principle, Mathematical Induction.	6
2	Relations and Functions	Relation: Definition, Representation of relation, Properties of relation, Closure properties of relation (Reflexive, Symmetric and Transitive), partial order and equivalence relation. Function: Definition, Types of function, Inverse function, composite functions.	8
3	Algebraic Structures	Algebraic structures with one binary operation: Groupoid, Semigroup, Monoid and Group, Abelian group, Cyclic groups, order and subgroup, Group Homomorphism, Isomorphism and Automorphism.	7

Module No	Module name	Content	No of Hours
4	Introduction to Data Structures and Complexity	Introduction to Data Structures, Types of Data Structures-Linear and Nonlinear, Operations on Data Structures. Time Complexity of Algorithm. Space Complexity of Algorithm. Notations (Big O, Omega and Theta).	4
5	Stack, Queue and Linked List	Introduction of Stack, Operations on Stack, Array Implementation of Stack. Introduction of Queue, Operations on Queue, Array Implementation of Queue, Types of Queue-Circular Queue, Priority Queue, Double Ended Queue. Introduction to Linked List, Representation of Linked List, Linked List v/s Array, Singly Linked List.	10
6	Graph and Trees	Introduction to Graph , Graph Terminologies, Representation of Graph, Graph Traversals-Depth First Search (DFS) and Breadth First Search (BFS). Introduction to Tree, Tree Terminologies, Binary Tree, Types of Binary Tree, Binary Tree Traversals. Binary Search Tree, Operations on Binary Search Tree. Applications of Binary Tree-Expression Tree, Huffman Encoding	10
Total			**45**

Text Books:

1. C. L. Liu, "Elements of Discrete Mathematics", TMH, ISBN 10:0-07-066913-9.
2. N. Biggs, "Discrete Mathematics", 3rd Ed, Oxford University Press, ISBN 0 –19-850717–8.
3. Kenneth H. Rosen, "Discrete Mathematics and its Applications", Tata McGraw-Hill, ISBN 978- 0-07-288008-3
4. Cryptograph and Network Security by B. A. Forouzan & D. Mukhopadhyay, 11th edition, McGraw Hill Publication.
5. Network Security and Cryptograph by Bernard Menezes, Cengage Learning Publication.
6. Reema Thereja," Data Structures using C", 2nd edition, Oxford Press, 2014
7. Aaron M Tenenbaum, Yedidyah Langsam, Moshe J Augenstein, "Data Structures Using C", First Edition, Pearson Publication, 2019

Reference Books:

1. Bernard Kolman, Robert C. Busby and Sharon Ross, "Discrete Mathematical Structures",Prentice-Hall of India /Pearson, ISBN: 0132078457, 9780132078450.
2. Narsingh Deo, "Graph with application to Engineering and Computer Science", Prentice Hall of India, 1990, 0 – 87692 – 145 – 4.
3. Eric Gossett, "Discrete Mathematical Structures with Proofs", Wiley India Ltd, ISBN:978-81-265-2758-8.

Detailed syllabus of Second Year Semester – IV

Course Name: Mathematical Theory of Communication

Course Code: PCET106T

Category: PC_PCC

Preamble:

This course introduces students to Mathematical theory of Communication, with detailed Mathematical introduction to Complex Integration, Vector Spaces, Vector Integration, Probability Distributions and Statistical Techniques like, Correlation and Regression which are widely applicable in Electronics and Telecommunication Engineering. This Course will also offer in-depth understanding of fundamental and theoretical underpinnings, applications, best practices, and research activities.

Students will learn how to integrate complex variables by using Cauchy's theorems. This course is designed for students with a solid understanding of Linear Algebra in the form of vector Space, Vector Calculus, Probability with Discrete & continuous random variable's distribution functions and Statistical Techniques. By the end of the course, students will have a deep understanding of calculus and probability distributions and will be equipped with the various advanced mathematical tools and techniques which are necessary to solve wide range of computational problems in telecommunication fields.

Pre-requisites:

Engineering Mathematics-I (BS02), Engineering Mathematics-II (BS04)

Course Objectives:

- Understand the integration methods for complex variables in the annular regions and interpretation of their significances.
- Understand the concept of Linear Algebra especially Vector Spaces used in ML, AI & Data Science as optimization technique and their significances.
- Understand the concepts of Vector Differentiation and Integration to evaluate line integral and work done by Green's theorems.
- Apply various techniques of Probability Distributions for data analysis to solve discrete and continuous random variable problems.
- Understand the concept of statistical techniques like Correlation and Regression lines for the field of Data analytic, machine learning and other fields that require strong analytical and problem-solving abilities.

Course Outcomes:

Student will be able to:

CO1:- Apply the knowledge of integration methods for complex variables in the annular regions and interpretation of its significances.
CO2:- Apply various the concepts of Linear Algebra- Vector Spaces used in ML, AI & Data Science as optimization technique and its significances.
CO3:- Understand the concepts of Vector Differentiation and Integration to evaluate line integral and work done by Green's theorems.
CO4:- Understand the concept of probability and distribution functions for data analysis.
CO5:- Understand & apply the concept of statistical techniques like Correlation and Regression lines for the field of Data analytic, machine learning and other fields that require strong analytical and problem-solving abilities.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	**Complex Integration**	1.1 Line Integral, Cauchy 's Integral theorem (without proof), 1.2 Cauchy's Integral formula (without proof). 1.3 Taylor 's and Laurent 's series 1.4 Residues, Cauchy 's Residue Theorem (without proof) **Self-learning Topics:** Application of Residue Theorem to evaluate real integrations, Z- Transform of sequence	6

		in complex function.	
2	**Linear Algebra: Vector Spaces**	2.1 N-dimensional vector, angles norms, Inner dot product. 2.2 Cauchy-Schwarz inequality (with proof), 2.3 Vector Spaces over a real field, Subspaces. 2.4 Orthogonal projection, Orthonormal basis, Gram-Schmidt process for vectors. **Self-Learning Topics:** Linear combinations, linear Dependence, and Independence, QR decomposition, SVD Decomposition.	6
3	**Vector Differentiation and Integration**	3.1 Basics of Gradient, Divergence and Curl (Without Proof). 3.2 Properties of vector field: Solenoidal and Irrotational (conservative) vector field. 3.3 Line Integral, work done. 3.4 Green's theorem in a plane (Without Proof) only evaluation. **Self-learning Topics:** Surface Integral, Gauss divergence theorem and its applications.	6
4	**Probability Distributions**	4.1 Random Variable: Probability distribution for discrete and continuous random variable. 4.2 Bayes Theorem (without proof) 4.3 Expectation, Variance for discrete and continuous random variable. 4.4 Probability distributions: Poisson, and Normal distributions. **Self-learning Topics:** Mean & variance by Moment generating function, T-distribution (t-tests and regression coefficients), $\chi 2$-distribution (chi-square test and log linear analysis), F-distribution (ANOVA, Levene's test), Continuous uniform distribution in Engineering.	6
5	**Statistical Techniques**	6.1 Karl Pearson's Coefficient of correlation (r). 6.2 Spearman 's Rank correlation coefficient (R) (repeated and non-repeated ranks) 6.3 Lines of regression: Fitting of first-degree curve. **Self-learning Topics:** Covariance, Fitting of second-degree and exponential curves.	6
Total			**30**

Textbooks:

1. Dr. B V Ramana "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, India 2006, ISBN 13: 9780070086241
2. P N Wartikar and J N Wartikar "*Textbook of Applied Mathematics Volume I & II, Vidyarthi* Ghriha Prakashan Pune 2005 9th Edition.
3. Kanti B Datta, "Mathematical methods for Science and Engineering", Cengage learning 2012.
4. N P Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publication 2006.

Reference Books:

1. Dr. B S Grewal, "Higher Engineering Mathematics", Khanna Publication, 44th Edition, ISBN 13: 9788193328491
2. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, 10th Edition, ISBN 13: 9788126508273
3. C. R. Wylie & L. C. Barrett, "Advanced Engineering Mathematics", Tata McGraw India, 6th Edition.
4. H K Das, "Advanced Engineering Mathematics", S Chand, 22nd Edition, ISBN 13: 9788121903455
5. Murray R. Spiegel. "Schaum's Outline of Vector analysis", Tata McGraw India, 1st Edition.
6. Murray R. Spiegel. "Schaum's Outline of Complex analysis with applications", Tata McGraw India.
7. Kenneth Hoffman. "Linear Algebra", Pearson 2018.
8. Dr. B S Tyagi, "Function of a Complex variable", Kedar Nath & Ram Nath publication, 2021.

Course Name: Mathematical Theory of Communication Lab

Course Code: PCET106P

Category: PC_PCC

Preamble:

This course introduces students to experimental implementation of Mathematical theory of Communication, with detailed Mathematical introduction to Complex Integration, Vector Spaces, Vector Integration and Statistical Techniques like Probability Distribution, Correlation and Regression using various software tools like python, MATLAB, sage etc. which are widely applicable in Electronics and Telecommunication Engineering. This Course will also offer hands on to code various mathematical problems.

Pre-requisites:

Engineering Mathematics-I (BS02), Engineering Mathematics-II (BS04)

Course Objectives:

- To understand and analyse the behaviour of functions defined in the complex plane and extends the integration of real valued function to complex valued functions.
- To develop fundamental understanding algebraic structure that underline the various areas of mathematics and its applications.
- To provide skills and knowledge to understand and apply vector integration techniques to solve problems involving vector fields, curves, surface and volumes.
- To provide students with a solid foundation in probability theory, including both discrete and continuous distributions and to develop analytical and problem-solving skills in applying probability distributions to real-world scenarios and to prepare students for further studies in statistics, data analysis, and related fields
- To provide students with solid foundation in the analysis and understanding of joint distribution marginal and conditional distributions.

Course Outcomes:

Student will be able to:

CO1: Evaluate complex integrals, compute residues & evaluate various contour integrals.
CO2: Understand the basics of Vector Spaces used in the field of Machine learning, AI, and Data science.
CO3: Evaluate problems on line integrals, green theorem and stokes theorem.
CO4: Illustrate the understanding of concept of probability distribution of various data.
CO5: Compute problems on joint distribution, marginal and conditional distributions.
CO6: Understand the basic statistical techniques like Correlation and Regression lines for the field of Data analysis.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Computing residue of integrand and residue theorem
2. Verification of Cauchy schwartz inequality
3. Finding Norm, angle, inner product between two vectors
4. Implementing Gram Smith Process for basis of vector space
5. Probability analysis of a random experiment. (E.g.Binary Communication Channel)
6. Probability density and distribution analysis for a random experiment.
7. Mean and variance analysis of random phenomenon using standard random variable distributions.
8. Simple data analysis using standard random variable distributions.

Textbooks:

1. Erwin Kreyszig, "Advanced Engineering Mathematics", John Wiley & sons, 10th Edition.
2. Dr. B V Ramana "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, India 2006
3. P N Wartikar and J N Wartikar "Textbook of Applied Mathematics Volume I & II, Vidyarthi Ghriha Prakashan Pune 2005 9th Edition.
4. N P Bali and Manish Goyal, "A textbook of Engineering Mathematics", Laxmi Publication 2006.

Reference Books:

1. Dr. B S Grewal, "Higher Engineering Mathematics", Khanna Publication, 44th Edition.
2. C. R. Wylie & L. C. Barrett, "Advanced Engineering Mathematics", Tata McGraw India, 6th Edition.
3. H K Das, "Advanced Engineering Mathematics", S Chand, 22nd Edition.
4. Kenneth Hoffman. "Linear Algebra", Pearson 2018.

5. Seymour Lipschutz, "Schaum's Outline of Linear Algebra", Tata McGraw India, 6th Edition.
6. Seymour Lipschutz, Schaum's Outline of Probability and Statistics", Tata McGraw India, 1st Edition.
7. T. Veerarajan, "Probability, Statistics and Random processes", Tata McGraw India, 2nd Edition.
8. Robert Weinstock, "Calculus of variation with application to physics and Engineering", Dover
9. Publications, New York, 1st Edition.

Course Name: Microcontrollers

Course Code: PCET109T

Category: PC_PCC

Preamble:
The course on *Microcontrollers* introduces undergraduate students to the foundational concepts and practical skills essential for the design and development of embedded systems. With a primary focus on the 8051 microcontroller, programming techniques, interfacing of input/output devices. The course also incorporates Embedded-C programming as a vital tool to develop application programming.

Pre-requisites:

- Computer Architecture and Organization
- C Programming
- Object Oriented Programming
- Logic Circuits

Course Objectives:

- To Introduce the architecture and functional features of the 8051 microcontroller.
- To Develop proficiency in assembly language and Embedded C programming for the 8051 microcontroller to implement basic and advanced control tasks.
- Enable students to design and interface various input/output devices with the microcontroller.
- Familiarize students with serial communication protocols and interrupt handling mechanisms in microcontroller-based systems.
- Encourage hands-on learning through practical experiments and mini-projects to strengthen the understanding of microcontroller-based embedded systems design.

Course Outcomes:

Student will be able to:

CO1: Explain the architecture and key components of the 8051 microcontroller.
CO2: Develop assembly programs using 8051 instruction set and addressing modes.
CO3: Configure and program 8051 on-chip peripherals such as timers, interrupts, and UART
CO4: Write Embedded C programs to control microcontroller peripherals and I/O devices.
CO5: Interface external devices and sensors with the 8051 microcontroller.
CO6: Describe and program a modern microcontroller/development board platform for embedded applications.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head	ISA	MSA	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module no	Module name	Content	No of Hours
1	Introduction to Microcontrollers and 8051 Architecture	Difference between microprocessors and microcontrollers, Overview of embedded systems and microcontroller applications, Introduction to 8051 microcontroller family (MCS-51), Detailed architecture: ALU, accumulator, general-purpose and special function registers (SFRs), stack, Internal memory organization: code memory, data memory, bit-addressable memory	6
2	Assembly language programming	8051 instruction set: data transfer, arithmetic, logic, branch, bit manipulation. Addressing modes: immediate, register, direct, indirect, relative, and indexed. Assembler directives and program structure. Writing and debugging simple programs in assembly language	4
3	Peripheral devices of 8051 microcontroller	I/O ports, Timers/counters: modes, Interrupts, Serial communication (UART), Peripheral-based programming in Assembly and Embedded C.	5
4	Embedded C Programming	Introduction to Embedded C and IDEs (Keil or equivalent), Basic syntax, data types, conditional statements, and functions, Mapping and accessing SFRs using Embedded C, Bitwise operations and delay	5

		generation, Port, timer, interrupt, and serial communication programming using Embedded C	
5	Interfacing Devices	Interfacing LEDs, switches, buzzers, 7-segment displays, Keypad and LCD (16x2), ADC, DAC, sensors (temperature, IR, LDR), Motors (DC, stepper), relays, Application examples using Embedded C	6
6	Advanced Microcontroller and Development Board	Overview of ARM Cortex-M (STM32) or Arduino architecture and features, Comparison with 8051 microcontroller, Development environment setup (STM32CubeIDE/Arduino IDE), Basics of programming using C/C+, Simple GPIO programming and peripheral control.	4
Total			**30**

Textbooks:

1. Shibu K. V "Introduction to embedded systems" McGraw Hill.
2. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010.
3. M. A. Mazidi, J. C. Mazidi, Rolin D. McKinlay "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson Education, 2nd edition.
4. Microcontrollers – Theory and Applications- By Dr. Ajay V. Deshmukh, Tata McGraw–Hill Companies –2005.

Reference Books:

1. MCS@51 Microcontroller, Family User's Manual" Intel
2. ATmega328P 8-bit AVR Microcontroller with 32K Bytes In-System Programmable Flash datasheet, Atmel**.**
3. P89V51RB2/RC2/RD2 8-bit 80C51 5 V low power 16/32/64 kB flash microcontroller, Data Sheet NXP founded by Philips.

Assessment:

1. **ISA (In-Semester-Assessment):** In semester assessment will carry total 15 marks. It will consist of weekly graded assignments based on modules (each carrying 10 marks). The assignments are self-study work and need to be completed by individual students separately. Every student will be submitting four completed assignments. Students are encouraged to develop their own problem statements and devise a proper method / solution. Importance will be given to the concept understanding and applying it to solve the industrial problem using coding.

2. **MSA (Mid-Semester-Assessment):** Mid Semester Assessment will consist of three mid semester internal theory test carrying 20 marks based on completion of minimum modules. This test will be common for all the students. ***Repeat examination will not be conducted.***

3. **ESE (End-Semester-Examination):** End Semester Examination will be conducted for total of 40 marks based on the completion of remaining modules post completion of mid semester examination or an entire syllabus. This test will be common for all the students.

Course Name: Microcontrollers Lab

Course Code: PCET109P

Category: PC_PCC

Preamble:

The laboratory sessions are designed to provide hands-on experience with the 8051 microcontroller and embedded C programming, reinforcing theoretical concepts covered in lectures. Students will learn to program microcontrollers in assembly and C, configure on-chip peripherals, and interface various input/output devices and sensors.

Pre-requisites:

- Computer Architecture and Organization
- C Programming
- Object Oriented Programming
- Logic Circuits

Course Objectives:

- To understand the functional blocks and working of a Computer with fundamental model.
- To understand standard algorithms in the design of ALU.
- To conceptualize memory organization in computer
- To comprehend processor organization with various design methods of processor.
- To explore different types of input output organization techniques in computer.
- To analyze different parallel organizations like pipelined architecture.

Course Outcomes:

Student will be able to:

CO1: Apply assembly language programming techniques to perform basic arithmetic, logical, and data manipulation operations.
CO2: Demonstrate proficiency in configuring and programming on-chip peripherals.
CO3: Interface and control external hardware devices with microcontroller.
CO4: Write and test Embedded C programs for real-time microcontroller-based applications.
CO5: Develop and execute basic programs on a modern microcontroller platform.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head	ISA	MSA	ESE	Total
Lab	25	--	25	050

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Basic Arithmetic Operations Using 8051 Assembly.
2. Logical and Bitwise Operations in 8051 Assembly.
3. Data Transfer, data Search and Exchange operations.
4. IO Ports to interface and generate LED patterns.
5. Timer and Counter Programming for Delay Generation.
6. Interfacing 7-Segment Display and Matrix Keypad for interactive display.
7. Interfacing LCD (16x2) and display message with different options.
8. Interrupt Programming on 8051.
9. Introduction to GPIO and Peripheral Programming on Modern Microcontroller (STM32/Arduino)
10. Mini Project

Textbooks:

1. Shibu K. V "Introduction to embedded systems" McGraw Hill.
2. C. Kenneth J. Ayala and D. V. Gadre, "The 8051 Microcontroller & Embedded system using assembly & 'C' ", Cengage Learning, Edition 2010.
3. M. A. Mazidi, J. C. Mazidi, Rolin D. McKinlay "The 8051 Microcontroller and Embedded Systems Using Assembly and C", Pearson Education, 2nd edition.
4. Microcontrollers – Theory and Applications- By Dr. Ajay V. Deshmukh, Tata McGraw–Hill Companies –2005.

Reference Books:

1. MCS@51 Microcontroller, Family User's Manual" Intel
2. ATmega328P 8-bit AVR Microcontroller with 32K Bytes In-System Programmable Flash datasheet, Atmel**.**
3. P89V51RB2/RC2/RD2 8-bit 80C51 5 V low power 16/32/64 kB flash microcontroller, Data Sheet NXP founded by Philips.

Course Name: Integrated Circuits

Course Code: PCET06T

Category: PC_PCC

Preamble:

This course introduces the Linear Integrated circuits which are used to design basic building blocks of electronic system. This course introduces designing the linear circuit for given mathematical equations. This course also consists of Analysis and designing of various linear and non-linear applications using Operational Amplifier ICS. This course also includes special integrated circuits used to design various communication circuits.

Pre-requisites:

Electronics Devices and circuits.

Course Objectives:

Students will be able to

- Understand the Concept, working and Key Application of Various Linear Integrated circuits.
- To perform analysis of circuits based on linear integrated circuits.
- To Design circuits and systems for applications using linear integrated circuits.
- To Create DC Power supply for given Application and Specifications.
- Outline and classify all types of integrated circuits.

Course Outcomes:

Student will be able to:

CO1: Describe the Ideal and Practical characteristics of various Integrated circuits.
CO2: Design circuits for Various Linear and Non-Linear applications.
CO3: Identify the appropriate integrated circuit modules for designing engineering applications.
CO4: Demonstrate the application of Voltage regulator, Timer and PLL.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall beapproved by a panel constituted at Institute level and published to the learners before the commencementof the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Differential and Operational Amplifier.	1.1 Block diagram and working of Operational Amplifier. Various parameters of Operational Amplifier. Typical values for IC741. 1.2 Inverting, Non-Inverting amplifier using op-amp (Both open and close loop). Arithmetic circuits like Adder, Subtractor. Numerical based on op-amp circuits.	4
2	Linear applications of Operational Amplifier.	2.1 Need of Instrumentation amplifier analysis of 3 op-amps Instrumentation Amplifier. Basic and PracticalIntegrator and Differentiator circuits. Voltage to current and current to voltage converter circuits. 2.2 Filters using op-amp. Analysis and designing of 1st Order Butterworth Filter using op-amp. Working and designing of 2nd order filter using op-amp (No derivation for 2nd order filter)	7
3	Non-Linear Application of Operational amplifier	3.1 Comparator using op-amp, Working, analysis, designing and application of Schmitt-Trigger using op-amp. Precision half wave and full wave rectifier using op-amp. Sample and hold circuit, peak detector circuit using op-amp.	5
4	Voltage Regulator.	4.1 Functional Block diagram of voltage regulator. Working and designing of three terminal fixed voltage regulators (78XX, 79XX). 4.2Functional block diagram, working and designing of general-purpose IC 723 Regulator. 4.32Functional block diagram, working and designing of general-purpose IC LM317 Regulator 4.4 Block diagram of SMPS, comparison between Switching and linear regulator.	5

5	Timer IC 555	5.1 Functional block diagram, specification and working of IC555.Design and working of Astable and Monostable Multivibrator using 555. 5.2 Application of 555 like VCO, PWM.	5
6	Special Purpose Integrated circuits	6.1 Functional block diagram and working of VCO IC 566. 6.2 Functional block diagram and working of PLL IC 565.	4
Total			**30**

Textbooks:

1. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, Pearson 4th Edition 2015
2. DESIGN WITH OP-AMP AND ANALOG INTEGRATED CIRCUITS by Sergio Franko, Tata McGraw Hill, 3rdEdition.
3. Linear Integrated circuits by Roy Choudhary, New age International Publishers,4th Edition

Reference Books:

1. Operational Amplifiers and Linear ICs, David A. Bell, Oxford,3rd Edition 2011
2. Linear Integrated Circuits S. Saliva Hanan, et al McGraw Hill 2nd Edition,2014

Course Name: Integrated Circuits Lab

Course Code: PCET06P

Category: PC_PCC

Preamble:

This course introduces the Linear Integrated circuits which are used to design basic building blocks of electronic system. This course introduces designing the linear circuit for given mathematical equations. This course also consists of Analysis and designing of various linear and non-linear applications using Operational Amplifier ICS. This course also includes special integrated circuits used to design various communication circuits.

Pre-requisites:

Electronics Devices and circuits (ET06)

Course Objectives:

Students will be able to

- Understand the Concept, working and Key Application of Various Linear Integrated circuits.
- To perform analysis of circuits based on linear integrated circuits.
- To Design circuits and systems for applications using linear integrated circuits.
- To Create DC Power supply for given Application and Specifications.
- Outline and classify all types of integrated circuits.

Course Outcomes:

Student will be able to:

CO1: Describe the Ideal and Practical characteristics of various Integrated circuits.

CO2: Design circuits for Various Linear and Non-Linear applications.

CO3: Identify the appropriate integrated circuit modules for designing engineering applications.

CO4: Demonstrate the application of Voltage regulator, Timer and PLL.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall beapproved by a panel constituted at Institute level and published to the learners before the commencementof the semester.

Suggested List of Practical's:

1. Design and implementation of Inverting and Non-inverting amplifier using IC741.
2. Frequency response of Operational Amplifier using IC741.
3. Design and Implementation of 1st and 2nd order Filter using IC 741.
4. Design and Implementation of Practical Integrator circuit using IC741.
5. Design and Implementation of Practical Differentiator circuit using IC741.
6. Design and Implementation of various Arithmetic circuits using IC741.
7. Design and Implementation of Instrumentation amplifier using IC741.
8. Design and Implementation of Schmitt -trigger circuit using IC741.
9. Design and Implementation of Precision rectifier using IC741.
10. Design and Implementation of voltage regulator circuit using IC723.
11. Design and Implementation of Astable Multivibrator circuit using IC555.
12. Design and Implementation of Monostable Multivibrator circuit using IC555.

Textbooks:

1. Op-Amps and Linear Integrated Circuits, Ramakant A Gayakwad, Pearson 4th Edition 2015
2. DESIGN WITH OP-AMP AND ANALOG INTEGRATED CIRCUITS By Sergio Franko, Tata McGraw Hill, 3rd Edition
3. Linear Integrated circuits by Roy Choudhary, New age International Publishers,4th Edition

Reference Books:

1. Operational Amplifiers and Linear ICs, David A. Bell, Oxford,3rd Edition 2011
2. Linear Integrated Circuits S. Saliva Hanan, et al McGraw Hill 2nd Edition,2014

Course Name: Principles of Communication Engineering

Course Code: PCET02T

Category: PC_PCC

Preamble:

This course introduces students to basics of Communication Engineering with detailed understanding of various analog, angle modulation and demodulation techniques and all the applications dealt in detail. The course also covers pulse analog and digital modulation and demodulation techniques

Pre-requisites:
Nil

Course Objectives:

- To illustrate fundamentals of basic communication system
- To enable learners to understand various analog modulation and demodulation techniques
- To focus on applications of analog modulation and demodulation techniques
- To explain the key concepts of analog and Digital Pulse modulation and demodulation techniques

Course Outcomes:

Student will be able to:
CO1: Understand the basic components of communication and noises in communication system.
CO2: Explain various modulation and demodulation techniques.
CO3: Compare the performance of Transmitters and Receivers.
CO4: Explain various analog and Digital Pulse Modulation & Demodulation techniques.
CO5: Understand Time Division and Frequency Division Multiplexing & De-multiplexing.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment

methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Basics of Communication System	Block diagram, electromagnetic spectrum, signal bandwidth and power, types of communication channels, Introduction to time and frequency domain. Basic concepts of wave propagation. Types of noise signal to noise ratio, noise figure, noise temperature and Friss formula.	4
2	Amplitude Modulation and Demodulation	Basic concepts, need for modulation, waveforms (time domain and frequency domain), modulation index, bandwidth, voltage distribution and power calculations. DSBFC: Principles, low-level and high-level transmitters, DSB suppressed carrier, Balanced modulators with diode (Ring modulator and FET) and SSB systems. Amplitude demodulation: Diode detector, practical diode detector, Comparison of different AM techniques, Applications of AM and use of VSB in broadcast television.	7
3	Angle Modulation and Demodulation	Frequency and Phase modulation (FM and PM): Basic concepts, mathematical analysis, FM wave (time and frequency domain), sensitivity, phase and frequency deviation, modulation index, deviation ratio, bandwidth requirement of angle modulated waves, narrowband FM and wideband FM. Varactor diode modulator, FET reactance modulator, stabilized, AFC, Direct FM transmitter, indirect FM Transmitter, noise triangle, pre- emphasis and de-emphasis FM demodulation: Balanced slope detector, Foster-Seely discriminator, Ratio detector, FM demodulator using Phase lock loop, amplitude limiting and thresholding, Applications of FM and PM.	7

4	Radio Receivers	Characteristics of radio receivers, TRF, Super - heterodyne receiver block diagram, tracking and choice of IF, AGC and its types and Communication receiver. FM receiver block diagram, comparison with AM receiver.	4
5	Analog and Digital Pulse Modulation & Demodulation	Sampling theorem for low pass signal, proof with spectrum, Nyquist criteria, Sampling techniques, aliasing error and aperture effect. PAM, PWM, PPM generation, detection and applications. Basics of PCM system and differential PCM system. Concepts of Delta modulation (DM) and Adaptive Delta Modulation (ADM).	6
6	Multiplexing & De-multiplexing	Frequency Division Multiplexing transmitter & receiver block diagram and applications. Time Division Multiplexing transmitter & receiver block diagram and applications	2
Total			**30**

Text Books:

1. Kennedy and Davis, "Electronics Communication System, Tata McGraw Hill publication
2. B.P Lathi, Zhi Ding, "Modern Digital and Analog Communication system, Oxford University press, Fourth Edition
3. Wayne Tomasi, "Electronics Communication System, Pearson education, Fifth Edition

Reference Books:

1. Taub,Schilling and Saha "Taub's Principles of communication Systems, Tata McGraw Hill, Third Edition
2. P.Sing and S.D Sapre, "Communication Systems: Analog and Digital", Tata McGraw Hill, Third edition
3. Dennis Roddy and John Coolen, Electronic Communication, Pearson, 4/e, 2011
4. Simon Haykin, Michel Moher, "Introduction to Analog and Digital Communication", Wiley, Second edition
5. Louis Frenzel, "Communication Electronics", Tata McGraw Hill, Third Edition

Course Name: Principles of Communication Engineering Lab

Course Code: PCET02P

Category: PC_PCC

Preamble:

This course introduces students to basics of Communication Engineering with detailed understanding of various analog, angle modulation and demodulation techniques and all the applications dealt in detail. The course also covers pulse analog and digital modulation and demodulation techniques

Pre-requisites:

Nil

Course Objectives:

- To illustrate performance of different analog modulation and demodulation techniques using experimentation/simulation
- To enable learners to demonstrate sampling theorem and various sampling techniques using experimentation
- To focus on various pulse modulation schemes used for data transmission using experimentation/simulation
- To explain the key concepts of multiplexing techniques using experimentation/simulation

Course Outcomes:

Student will be able to:

CO1: Analyse performance of different analog modulation and demodulation techniques using experimentation/simulation.
CO2: Demonstrate Sampling theorem and various sampling techniques using experimentation.
CO3: Analyse analog and Digital Pulse Modulation & Demodulation techniques using experimentation/simulation
CO4: Understand the concept of Multiplexing & De-multiplexing using Experimentation/simulation.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Generation of AM modulation and demodulation.
2. Generation of FM modulation and demodulation.
3. Design and implement Pre-emphasis and De-emphasis circuit.
4. SSB Generation and Detection
5. Verification of sampling theorem.
6. Generation of PAM modulation and demodulation.
7. Generation of PWM and PPM modulation and demodulation.
8. Demonstrate Digital pulse transmission technique (DM, ADM)
9. Observation of TDM multiplexing and de-multiplexing signals.
10. Observation of FDM multiplexing and de-multiplexing signals.
11. Obtain Frequency Spectrum of AM and determine its BW
12. Performance analysis of AM and FM

Text Books:

1. Kennedy and Davis, "Electronics Communication System, Tata McGraw Hill publication
2. B.P. Lathi, Zhi Ding, "Modern Digital and Analog Communication system", Oxford University press Fourth Edition
3. Wayne Tomasi, "Electronics Communication System, Pearson education, Fifth Edition

Reference Books:

1. Taub, Schilling and Saha "Taub's Principles of communication Systems, Tata McGraw Hill, Third Edition
2. P. Sing and S.D Sapre, "Communication Systems: Analog and Digital", Tata McGraw Hill, Third edition
3. Dennis Roddy and John Coolen, Electronic Communication, Pearson, 4/e, 2011
4. Simon Haykin, Michel Moher, "Introduction to Analog and Digital Communication", Wiley, Second edition

Louis Frenzel, "Communication Electronics", Tata McGraw Hill, Third Edition

Course Name: Signals and Systems

Course Code: PCET100T

Category: PC_PCC

Preamble:

This course introduces students to the basics of signals and systems and its classification, operations and analysis in time domain. Analysis of signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain using Laplace, Fourier and Z-transforms. Introduction to FIR and IIR systems and its realization in different forms.

Pre-requisites:

Nil

Course Objectives:

- To introduce to the basics of signals and systems, and its classification, operations and analysis in time domain.
- To analyse the signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain.
- To provide foundation of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.

Course Outcomes:

Student will be able to:

CO1: Classify and analyse different types of signals and systems.
CO2: Analyse continuous time and discrete time LTI systems time domain.
CO3: Analyse continuous time signals and systems and LTI systems in frequency domains using Laplace transform.
CO4: Analyse continuous time signals and systems and LTI systems in frequency domains using Fourier transform.
CO5: Analyse discrete time signals and systems and LTI systems in frequency domain using Z-transform.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
2	-	2	-

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	15	20	40	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to signals and systems	**Introduction to Signals:** Basic Elementary signals: exponential, sine, step, impulse, ramp, rectangular, triangular. Classification of Signals: analog and discrete time signals, even and odd signals, periodic and non-periodic signals, deterministic and non-deterministic signals, energy and power signals. Operations on signals. **Systems and Classification of systems:** System Representation, continuous time and discrete systems, system with and without memory, causal and non-causal system, linear and nonlinear system, time invariant and time variant system, stable system.	6
2	Time domain analysis of Continuous Time and Discrete Time systems	Linear Time Invariant (LTI) systems: Representation of systems using differential /difference equation, Impulse, step and exponential response, System Stability and Causality. Use of convolution integral and convolution sum for analysis of LTI systems, properties of convolution integral/sum, Correlation, auto-correlation, cross correlation, and spectral Density.	6
3	Laplace Transform and Continuous time LTI systems	Need of Laplace Transform, Concept of Region of Convergence, Properties of Laplace Transform, Relation between continuous time Fourier Transform and Laplace Transform, unilateral Laplace Transform, inverse Laplace Transform. Analysis of continuous time LTI systems using Laplace Transform: Causality and stability of systems in s-	6

		domain, Total response of a system	
4	Fourier Analysis of Continuous and Discrete Time Signals and Systems	Fourier transform of periodic and non-periodic functions, Properties of Fourier Transform, Inverse Fourier Transform, Frequency Response: computation of Magnitude and Phase Response, LTI system analysis using Fourier transform, Introduction to discrete time Fourier transform.	5
5	z-Transform and Discrete time LTI systems	Need of z-Transform, z-Transform of finite and infinite duration sequences, Concept of Region of Convergence, z-Transform properties, Standard z-transform pairs, relation between Z-transform and discrete time Fourier Transform, one sided Z-Transform. Inverse z-Transform: Partial Fraction method only. Analysis of discrete time LTI systems using Z-Transform: Systems characterized by Linear constant coefficient difference equation, Transfer Function, plotting Poles and Zeros of a transfer function, causality and stability of systems, Total response of a system.	7
Total			**30**

Text Books:

1. Nagoor Kani, Signals and Systems, Tata McGraw Hill, Third Edition, 2011.
2. Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, Signals and Systems, Pearson Education,
3. Fourth Edition 2009.
4. Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, Prentice-Hall of India, Second Edition, 2002.
5. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004.

Reference Books:

1. Hwei. P Hsu, Signals and Systems, Tata McGraw Hill, Third edition, 2010
2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004. 3) V. Krishnaveni and A. Rajeshwari, Signals and Systems, Wiley-India, First Edition 2012.
3. Michael J Roberts, Fundamentals of Signals and systems, Tata McGraw Hill, special Indian Economy edition, 2009.
4. Luis F. Chaparro, Signals and Systems Using MATLAB, Academic Press
5. Rangaraj M. Rangayyan, "Biomedical Signal Analysis- A Case Study Approach", Wiley 2002.
6. Signals and Systems Laboratory: Virtual Laboratory http://ssl-iitg.vlabs.ac.in/

Course Name: Signals and Systems Lab

Course Code: PCET100P

Category: PC_PCC

Preamble:

This course introduces students to the basics of signals and systems and its classification, operations and analysis in time domain. Analysis of signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain using Laplace, Fourier and Z-transforms. Introduction to FIR and IIR systems and its realization in different forms.

Pre-requisites:

Engineering Mathematics-I, II, & III, Network Theory and Transmission lines, Signals and Systems, Matlab Basics

Course Objectives:

- To introduce to the analysis in time domain of signals and systems.
- To analyse the signals and systems in frequency domain and analysis of LTI continuous and discrete systems in frequency domain.
- To provide applications of signal and system concepts to areas like communication, control and comprehend applications of signal processing in communication systems.
- To analyse FIR and IIR systems.

Course Outcomes:

Student will be able to:

CO1: Analyse different types of continuous and discrete signals and systems.
CO2: Analyse continuous time and discrete time LTI systems in time domain.
CO3: Analyse continuous time signals and systems and LTI systems in frequency domain using Laplace Transform.
CO4: Analyse continuous time signals and systems and LTI systems in frequency domain using Fourier Transform.
CO5: Analyse discrete time signals and systems and LTI systems in frequency domain.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	2	-	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	25	050

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Suggested List of Practical:

1. Generation of various continuous and discrete time signals.
2. Operations on signals and discrete time signals.
3. Convolution between signals and discrete time signals.
4. Auto correlation and cross correlation.
5. Continuous time signals and systems analysis using Laplace transform.
6. Continuous time signals and systems analysis using Fourier transforms and inverse Fourier transform.
7. Discrete time signals and systems analysis using Z-transform.
8. Noise analysis in systems.
9. Synthesis of sound signal.
10. Stability analysis of LTI systems.

Text Books:

1. Nagoor Kani, Signals and Systems, Tata McGraw Hill, Third Edition, 2011.
2. Rodger E Ziemer, William H. Tranter and D. Ronald Fannin, Signals and Systems, Pearson Education, Fourth Edition 2009.
3. Alan V. Oppenhiem, Alan S. Willsky and S. Hamid Nawab, Signals and Systems, Prentice-Hall of India, Second Edition, 2002.
4. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004.

Reference Books:

1. Hwei. P Hsu, Signals and Systems, Tata McGraw Hill, Third edition, 2010
2. Simon Haykin and Barry Van Veen, Signals and Systems, John Wiley and Sons, Second Edition, 2004.
3. V. Krishnaveni and A. Rajeshwari, Signals and Systems, Wiley-India, First Edition 2012.
4. Michael J Roberts, Fundamentals of Signals and systems, Tata McGraw Hill, special Indian Economy edition, 2009.
5. Luis F. Chaparro, Signals and Systems Using MATLAB, Academic Press
6. Rangaraj M. Rangayyan, "Biomedical Signal Analysis- A Case Study Approach", Wiley 2002.
7. Signals and Systems Laboratory: Virtual Laboratory http://ssl-iitg.vlabs.ac.in/

Course Name: Mini Project.

Course Code: PRJET45

Category: ELC_INT/OJ

Preamble:

This course introduces students to the implementation of concepts of both hardware & software domain. Students can develop basic projects based on Hardware circuit, Software tool or simulation based.

Pre-requisites:

Knowledge of core subject, tools & software in which students are doing the mini-project.

Course Objectives:

- To make students familiar with the basics of. Various development boards (Arduino and its variants, MSP430, STM32, VEGA development boards, Raspberry Pi, FPGA etc.)
- To familiarize the students with the designing and making of Printed circuit boards (PCB).
- To familiarize the students with Communication devices and interfacing techniques: (Bluetooth, Zig-Bee, RFID and Wi-Fi).
- To familiarize the students with IDEs (Integrated development environment), programming languages and Operating systems for software development of any platform.
- The learner may develop a software based mini project using Python, MATLAB or similar advanced programming languages for applications like remote sensing, implementation of AI, ML, etc.

Course Outcomes:

After successful completion of the course, the student will be able to

1. Identify technical problems relevant to the domain of interest.
2. Design engineering solutions to the problem identified.
3. Perform experimentation/simulation/programming/interpretation of data.
4. Demonstrate responsibility as team member/leader during the completion of the mini projects.
5. Communicate effectively the said work.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
-	4	-	2

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Practical	25	-	50	075

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Project Guidelines:

- Project work must be carried out by the group of at least 2 students and maximum 4 students and must be original.
- Students are encouraged to take live projects from industry and make sure that they should evolve them in the unique way as per the guidelines given by industry and internal project guide.
- The project work can be undertaken in research institute or organization/company/any business establishment.
- Students must consult internal guide along with the external guide (if any) in selection of topic.
- Head of the Department and senior staff in the department will take the decision regarding selection of project topic. However internal guide will have all the rights of selecting the final year project topic of their individual group.
- **Students have to submit weekly report to the internal guide and whereas internal guide has to keep track on the progress of the project and also has to maintain attendance report. The progress report can be used for awarding the ISA Marks.**
- In case of Industry projects, visit by internal guide will be proffered.

Project Synopsis format:

At the end of semester each project group have to submit the Project synopsis report should be preferably contain at least following details.

- Abstract.
- Introduction.
- Literature survey.
    1. Survey of existing system.
    2. Limitation of the existing system or research gap.
    3. Problem statement and objective.
    4. Scope.
- Proposed system.
    1. Analysis/Framework/Algorithm.
    2. Details of hardware and software system.
    3. Design details.
    4. Methodology (Your approach to solve the problem).
- Implementation plan for next semester.
- Conclusions.

- References.

In semester assessment (ISA).

Distribution of ISA Marks should be as follow.

- Weekly attendance on project day.
- Contribution in the project work.
- Synopsis report.
- Term end presentation (Internal).

The final certification and acceptance of ISA ensures the satisfactory performance on the above aspects.

Oral and practical examination:

The oral and practical examination of Mini-Project should be conducted by Internal and External examiners approved by Mumbai University and college. Students have to Present and Demonstrate Mini-Project topic.

CEP01- Social Service Internship/ Project: 2 hours / week slot will be provided during the semester (in regular timetable). Additional work of 60 hours needs to be completed during the semester (besides regular timetable).
NOTE: As per Institute guidelines, course credits completed during the previous inter-semester break will appear in this semester's marksheet

Second Year B. Tech. Electronics and Telecommunication Engineering - Summer Break

Course		Head of Learning	Credits	Assessment Guidelines (Marks)			Total marks (Passing@40% of total marks)
Code	Name			ISA	MSE	ESE	
OEC01[$]	Collaborative Inter-Institute Studies	As per course	4	125	-	-	125

[$] **For OEC01- Collaborative Inter Institute Studies (Credit Transfer):** Internship with other reputed institutes equivalent to 4 credits is recommended to be done by learner during second year inter semester break (i.e. summer break between semester 4 and semester 5).
NOTE: As per Institute guidelines, result of courses completed in inter semester break will appear in marksheet of next semester.

Detailed syllabus of Third Year Semester – IV

Multidisciplinary Minor (MDM)

Course Name: Financial Basics for Engineers and Technopreneurs

Course Code: MDMBD02

Category: MDM

Preamble:

The objective of this course is to equip students with basic financial skills needed to evaluate and manage technical projects or business ventures. It covers the principles of cost analysis, budgeting, financial statements, and introduction to funding models.

Pre-requisites:

Introduction to Business Development and Marketing Principles

Course Objectives:

- Learn basic financial terminology and concepts.
- Understand components of a budget and perform break-even analysis.
- Analyse financial viability of a project or startup.
- Gain exposure to funding options.

Course Outcomes:

Student will be able to:

CO1: Interpret and analyze basic financial statements (P&L, balance sheet).
CO2: Prepare a project cost sheet and conduct break-even analysis.
CO3: Explain sources of capital and funding stages for startups.
CO4: Apply budgeting techniques to engineering project proposals

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Tutorial	Theory	Tutorial
3	1	3	1

Assessment Guidelines:

Head of learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No. of Hours
1	Introduction to Finance	Financial definitions, roles in business, overview of income, expenses, assets, liabilities, cash flows.	8
2	Costing and Budgeting	Types of costs (fixed/variable), project budgeting, break-even analysis, basic forecasting.	8
3	Financial Statements	Structure and interpretation of P&L, balance sheet, cash flow statements.	10
4	Time Value of Money	Simple vs compound interest, Net Present Value (NPV), Internal Rate of Return (IRR) concepts.	6
5	Funding Sources	Equity, debt, bootstrapping, angel investment, venture capital, crowdfunding.	7
6	Financial Decision Making	Financial ratios (ROI, ROE), pricing basics, cost-benefit analysis, breakeven models.	6
Total			**45**

PO Mapping by Module:

- Module 1: PO11, PO1
- Module 2: PO4, PO11
- Module 3: PO2, PO11
- Module 4: PO1, PO4
- Module 5: PO6, PO11
- Module 6: PO11, PO12

Textbooks:

1. Finance for Non-Finance Managers, by: V.G. Narayanan, Publisher: Cengage India, ISBN: 9789353501786
2. Finance for Non-Financial Managers by Gene Siciliano, McGraw Hill, Second Edition, (pdf available online)

Reference Books:

1. Introduction to Finance - Yale Online Course
2. Investopedia - Financial Statements Guide

Course Name: Algorithms and Data Structures in Bioinformatics

Course Code: MDMBI02

Category: MDM

Preamble:

This course is designed with the objective of equipping students with a robust understanding of the integration between biology and computational science, key bioinformatics concepts, methodologies, and applications. Through a combination of theoretical knowledge and practical applications, students will develop a holistic understanding of how various data structures and algorithms can enhance the comprehension of biological processes. It also emphasizes on real-world biological questions and research challenges, empowering them to make meaningful contributions to the rapidly evolving field of bioinformatics

Pre-requisite: Introduction to Bioinformatics

Course Objectives:

- To enable learners to understand the basic data structures for Bioinformatics.
- Build foundational understanding of various algorithms

Course Outcomes:

Learner will be able to:

CO1: understand the basic data structures for Bioinformatics.

CO2: Build foundational understanding of various algorithms

Course Outcome	Course Outcome Statement	Bloom's Level
CO1	Apply fundamental data structures and algorithms (arrays, trees, graphs, hashing, etc.) to solve computational problems in bioinformatics.	Apply
CO2	Analyze and implement sequence alignment algorithms for comparing DNA, RNA, and protein sequences, including global, local, and heuristic approaches.	Analyse
CO3	Construct and interpret phylogenetic trees using distance-based and character-based algorithms for evolutionary analysis.	Applying
CO4	Use algorithmic and statistical models, such as HMMs and motif-finding tools, to predict genes and regulatory elements in genomic sequences.	Applying
CO5	Design and evaluate scalable bioinformatics workflows and pipelines using big data technologies and cloud platforms for handling large-scale genomic datasets.	Evaluate

Course Scheme:

Contact Hours		Credits Assigned	
Theory	**Tutorial**	**Theory**	**Tutorial**
3	1	3	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	45	30	80	125

The assessment guidelines for the courses of different credits are mentioned above. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Review of Data Structures and Algorithms	Arrays, strings, stacks, queues, Graphs and trees: DFS/BFS with examples from biological data, Suffix trees, suffix arrays, tries, Hashing techniques for genome indexing	8
2	Sequence Alignment Algorithms	Needleman-Wunsch algorithm (global alignment) Smith-Waterman algorithm (local alignment) Space optimization (Hirschberg's algorithm) Heuristic alignment methods (BLAST internals) Complexity analysis of sequence alignment algorithms	10

3	Phylogenetic Tree Construction	Multiple Sequence Alignment (MSA) pre-processing Distance-based methods: UPGMA, Neighbor-Joining Character-based methods: Maximum Parsimony, Maximum Likelihood,Tree visualization tools: MEGA, iTOL	10
4	Gene Prediction and Motif Finding	Regulatory elements in genomes Basics of Hidden Markov Models (HMMs) Motif discovery tools (MEME, FIMO) Promoter and enhancer identification Use of regular expressions in motif searches	10
5	Big Data in Bioinformatics	Challenges of large-scale genomic and multi-omics data, Hadoop and Spark frameworks for bioinformatics,Bioinformatics pipelines: Snakemake, Nextflow,Cloud platforms for genomics: AWS, Google Genomics,Case studies: 1000 Genomes Project, Cancer Genome Atlas	7
Total			45

Books and Resources :

1. Bioinformatics: Sequence and Genome Analysis by Mount D., Cold Spring Harbor Laboratory Press, New York. 2004

2. Bioinformatics- a Practical Guide to the Analysis of Genes and Proteins by

Baxevanis, A.D and Francis Ouellellette, B.F., Wiley India Pvt Ltd. 2009

3. Introduction to bioinformatics by Teresa K. Attwood, David J. Parry-Smith. Pearson

Education. 1999

Course : Startup Planning and Development

Course Code: MDMIE02

Category: MDM

Preamble:

This course is designed with the objective of equipping students with understanding of s Startup Planning and Development

Pre-requisite: Foundations of Innovation and Entrepreneurship

Course Objectives:

- To develop skills for building, validating, and planning a new venture.
- To understand basic startup finance, legalities, and market strategy.
- To enable students to create business plans and investor pitches.

Course Outcomes:

Learner will be able to:

CO1: Design MVPs and apply lean startup methods.

CO2: Conduct market and competitor analysis.

CO3: Prepare financial models and pitch decks.

CO4: Understand legal frameworks and intellectual property.

Course Scheme:

Course Code	Contact Hours		Credits Assigned	
	Theory	Tutorial	Theory	Tutorial
MDMBI02	3	1	3	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	45	30	80	125

Detailed Syllabus:

Module No.	Module Name	Content	No of Hours
1	Lean Startup Methodology	• MVP (Minimum Viable Product) • Pivoting and iteration • Build-Measure-Learn loop	9
2	Market Research and Strategy	• TAM-SAM-SOM analysis • Competitive analysis • Go-to-market strategy	9
3	Startup Finance	• Basics of financial modelling • Unit economics, pricing, and revenue models • Funding sources: bootstrapping, angels, VCs, crowdfunding	9
4	Legal & Regulatory Aspects	• Company formation: types and registration • IPR basics: patents, trademarks, copyrights • Compliance and taxation	9
5	Business Plan Development	• Writing an effective business plan • Pitch deck essentials	9
Total			45

Tutorials:

- Building a mock startup pitch deck
- Simulated investor pitch
- Budgeting and forecasting exercises

Textbook and Resources

1. Zero to One by Peter Thiel
2. The Lean Startup by Eric Ries
3. Venture Deals by Brad Feld

Course: Machine Vision and Robotic Perception

Course: MDMRB02

Category: MDM

Preamble:

This course introduces the fundamentals of computer vision and perceptual systems in robotics. It focuses on enabling robots to sense, interpret, and act upon their environment using visual inputs. Students will explore feature detection, image processing, 3D vision, and sensor fusion techniques. Hands-on activities and simulations bridge theory with real-world robotic perception applications.

Course Objectives:

- To introduce fundamental concepts in machine vision and perception relevant to autonomous robots.
- To equip students with techniques for image processing, object detection, and feature extraction.
- To develop the ability to integrate vision systems into robotic control and decision-making.

Pre-requisites:

Fundamentals of Robotics and Control (BMMDM1T)

Course Outcome:

The students will be able to:

CO1: Explain the principles of image formation and the role of cameras in robotic vision systems.

CO2: Apply basic image processing techniques for feature extraction and noise reduction.

CO3: Detect and match key visual features for use in localization and object recognition.

CO4: Analyze depth and motion using stereo vision and 3D reconstruction techniques.

CO5: Implement object detection and scene understanding in robotic applications.

CO6: Integrate visual data with other sensor modalities for robust robotic perception.

Course Scheme:

Contact Hours		**Credits Assigned**	
Theory	Practical	Theory	Practical
3	2	3	1

Assessment guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory+ Tutorial	45	30	50	125

The assessment/evaluation guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to decide her/his assessment methodology based on the nature of the course. Faculty may propose a revised assessment methodology for his/her course. However, the revised assessment methodology shall be approved by a panel constituted at institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No.	Module Name	Module Contents	No. of Hours
01	Introduction to Machine Vision	Role of vision in robotics, camera models, perspective projection, image formation, lens distortions	06
02	Image Processing Basics	Grayscale and color models, filtering, edge detection, noise reduction, histogram equalization	08
03	Feature Extraction and Matching	Interest point detection (Harris, FAST), descriptors (SIFT, SURF, ORB), template matching, homographies	07
04	3D Vision and Depth Estimation	Stereo vision, structure from motion, depth cameras, triangulation, visual odometry	08
05	Object Detection and Scene Understanding	Image segmentation, object classification (traditional and CNN-based), scene interpretation, semantic mapping	08
06	Sensor Fusion and Perception Systems	Integration of vision with other sensors (IMU, LIDAR), Kalman and particle filters, SLAM fundamentals, case studies	08
Total			**45**

Suggested List of Value-Added Home Assignments:

1. Design a vision-based system that can detect traffic violations like red-light running or illegal turns using video footage.
2. Use a stereo camera or simulated stereo images to generate a 3D point cloud and reconstruct a small indoor environment.
3. Create a system that inspects manufactured parts (e.g., PCB boards, bottles, machined components) and flags defects or anomalies using image processing.
4. Develop a mobile robot that can autonomously locate and scan barcodes or QR codes placed in a room to log inventory data.
5. Implement a system that uses AprilTags or ArUco markers to help a robot localize itself within an indoor environment.
6. Build a system that allows a robot to respond to hand gestures (like stop, go, turn) using a webcam and gesture recognition model.

Recommended Online Courses:

1. Computer Vision Specialization (by University of Buffalo)
   https://www.coursera.org/specializations/computer-vision
2. Computer Vision, https://www.udacity.com/course/computer-vision-nanodegree--nd891
3. OpenCVBootcamp,https://opencv.org/university/free-opencv-course/?utm_source=google&utm_medium=cpc&utm_campaign=WW_tut_OBC&utm_term=best%20opencv%20tutorial&gad_source=1&gad_campaignid=21004628838&gbraid=0AAAACbv-xhUM70mKirK31LiktTRipo8G&gclid=Cj0KCQjw9O_BBhCUARIsAHQMjS7VA3JEdz8KONvGanFNC7KAqSt2HModiDtp5hB_PJKX_oKTK80pNxQaAlcVEALw_wcB

Reference Books / Articles

1. Richard Szeliski, Computer Vision: Algorithms and Applications, Springer, 1st Edition, 2011.
2. Peter Corke, Robotics, Vision and Control: Fundamental Algorithms in MATLAB, Springer, Second Edition, 2017.
3. Adrian Kaehler and Gary Bradski, Learning OpenCV 4: Computer Vision with Python and OpenCV Library, O'Reilly Media, 1st Edition, 2019.
4. Rafael C. Gonzalez and Richard E. Woods, Digital Image Processing, Pearson Education, Fourth Edition, 2018.
5. Richard Hartley and Andrew Zisserman, Multiple View Geometry in Computer Vision, Cambridge University Press, Second Edition, 2004.
6. Sudeep Sarkar, Computer Vision: A First Course, Cambridge University Press, First Edition, 2022

Course Name: Operating Systems and Computer Networks

Course Code: MDMCS02

Category: MDM

Preamble:

This course introduces the basics of Operating Systems and intermediate concepts in Computer Networks, focusing on how systems manage processes and enable communication. Students will learn key OS functions, networking protocols, and explore their integration through hands-on tasks like scheduling, subnetting, and socket programming. The course emphasizes real-world relevance in areas like virtualization, cloud computing, and secure communications.

Pre-requisites:

3. ES04T (Structured Programming)
4. ES04T (Object Oriented Programming)

Course Objectives:

- To establish foundational understanding of operating system principles, including process management, memory management, and system-level functionalities, enabling students to recall and apply these concepts in computing tasks.
- To develop conceptual clarity of computer networking fundamentals such as layered architectures, addressing schemes, protocols, and network models to support effective communication between systems.
- To build practical skills in configuring networks, analysing traffic using tools, and simulating OS-level tasks like scheduling and memory allocation for system efficiency.
- To apply integrated knowledge of operating systems and computer networks in designing and implementing basic client-server applications and exploring modern environments like cloud and containerized systems.

Course Outcomes:

Learners will be able to

CO1: Recall fundamental concepts of operating systems such as process states, memory management techniques, and system calls.

CO2: Explain core principles of computer networks including OSI and TCP/IP models, IP

addressing, and transport layer protocols.

CO3: Describe the interaction between operating systems and network components for enabling process communication and data transfer.

CO4: Implement basic OS-level algorithms such as process scheduling and memory allocation and simulate network operations using tools.

CO5: Analyse the performance of OS and network mechanisms with respect to efficiency, scalability, and resource utilization.

CO6: Evaluate the role of OS and networking integration in solving real-world problems such as secure communication, client-server architecture, and containerized deployment.

Course Scheme:

Contact Hours		Credits Assigned	
Theory	Practical	Theory	Practical
3	2	3	1

Assessment Guidelines:

Head of Learning	ISA	MSE	ESE	Total
Theory	45	30	50	125

The assessment guidelines for the courses of different credits are mentioned in the above table. Notwithstanding the above, each course faculty shall have the choice to propose her/his assessment methodology based on the nature of the course. However, the proposed assessment methodology shall be approved by a panel constituted at Institute level and published to the learners before the commencement of the semester.

Detailed Syllabus:

Module No	Module name	Content	No of Hours
1	Introduction to Operating Systems	Overview of Operating Systems, types of OS (batch, multitasking, real-time), components (kernel, shell), system calls, functions and services of OS, booting process.	6

Module No	Module name	Content	No of Hours
2	Process and Memory Management	Process concepts, process states, scheduling algorithms (FCFS, SJF, Round Robin), memory management basics, paging and segmentation (conceptual).	6
3	Network Fundamentals	OSI and TCP/IP models, data encapsulation, IP addressing (IPv4 basics), subnetting, MAC address, ARP, DHCP, DNS, routing and switching fundamentals.	12
4	Transport and Application Layer Protocols	TCP vs UDP, 3-way handshake, flow and congestion control, protocols: HTTP, FTP, SMTP, HTTPS. Use of port numbers, socket basics.	8
5	Wireless Networking and Security	Wireless networks (WLAN, Bluetooth, 5G basics), VPN, firewalls, basics of encryption (symmetric vs. asymmetric), SSL/TLS, secure browsing practices.	7
6	OS-Network Integration & Application	Role of OS in networking: sockets, inter-process communication, threads with network programming, introduction to container networking (Docker), client-server applications.	6
Total			**45**

Text Books:

1. Abraham Silberschatz, Peter B. Galvin, Greg Gagne, Operating System Concepts, 10th Edition, Wiley, ISBN: 978-1119456339
2. Andrew S. Tanenbaum, Herbert Bos, Modern Operating Systems, 4th Edition, Pearson, ISBN: 978-0133591620
3. Behrouz A. Forouzan, Data Communications and Networking, 5th Edition, McGraw-Hill, ISBN: 978-0073376226
4. James F. Kurose, Keith W. Ross, Computer Networking: A Top-Down Approach, 7th Edition, Pearson, ISBN: 978-0136681557
5. William Stallings, Operating Systems: Internals and Design Principles, 9th Edition, Pearson, ISBN: 978-0134670959

Reference Books:

1. William Stallings, Data and Computer Communications, 10th Edition, Pearson, ISBN: 978-0133506488
2. Daniel P. Bovet, Marco Cesati, Understanding the Linux Kernel, 3rd Edition, O'Reilly Media, ISBN: 978-0596005658

3. Douglas E. Comer, Computer Networks and Internets, 6th Edition, Pearson, ISBN: 978-0133587937
4. Tanenbaum and Steen, Distributed Systems: Principles and Paradigms, 2nd Edition, Pearson, ISBN: 978-8131734031
5. Thomas L. Floyd, Network Fundamentals, Pearson Education, ISBN: 978-0131973831