



आईएफटीएम विश्वविद्यालय, मुरादाबाद, उत्तर प्रदेश
IFTM University, Moradabad, Uttar Pradesh
NAAC ACCREDITED

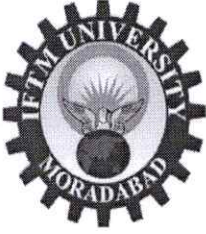
Course Structure
&
Syllabus
Of
M.Tech
Electronics & Communication Engineering

[Applicable w.e.f. Academic Session - 2022-23]
[As per CBCS guidelines given by UGC]

SCHOOL OF ENGINEERING & TECHNOLOGY
DEPARTMENT OF ELECTRONICS & COMMUNICATION
ENGINEERING
IFTM UNIVERSITY, MORADABAD



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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING
IFTM UNIVERSITY, MORADABAD
www.iftmuniversity.ac.in

**Study & Evaluation Scheme of
Master of Technology (M.Tech) Electronics & Communication Engineering**

Programme:	Master of Technology in Electronics & Communication Engineering
Course Level:	PG Degree
Duration:	02 Years (Four semesters) Full Time
Medium of instruction:	English
Minimum Required Attendance:	75%
Maximum credits:	58

Programme Outcomes (POs):

Students completing this programme will be able to:

- To understand and integrate existing and new acquired knowledge in the discipline for future enrichment.
- To conduct literature surveys and contribute in emerging areas through collaborative and multidisciplinary research.
- Understanding of tools and techniques, and their usage in analysis and design.
- Ability of creative thinking, critical analysis and decision making for productive research and development.
- Devise feasible and optimal solutions to the problems in the area of expertise, amenable to society and environment.
- Ability of independent and reflective learning.
- To improve capability for solving engineering problems.
- Ability to write reports and communicate through effective presentations.
- To impart research skills amongst the graduates with professional and ethical attitude.
- Understanding of the professional and ethical responsibilities.



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Programme Specific Outcomes (PSOs):

The learning and abilities or skills that a student would have developed by the end of two-years.

- Understanding and Analyzing the real time problems and to develop solutions by applying appropriate mathematical logic and algorithms.
- Applying knowledge in various domains to identify research gaps and hence to provide solution to new ideas and innovations.
- Applying skills acquired for retrieving, analyzing and managing large data leading to effective decision making and application development using suitable engineering tools.

Choice Based Credit System (CBCS):

Choice based credit system (CBCS), provides a learning platform wherein the student or knowledge seeker has the flexibility to choose their course from a list of elective, core and soft skill courses. This is a student-centric approach to achieve his target number of credits as specified by the UGC and adopted by our University.

Groups of CBCS:

The following is the course module designed for the M.Tech program:

1. Engineering Core Courses (ECC)
2. Engineering departmental Elective (EDE)
3. Dissertation/Seminar (DS)

- **Engineering Core courses (ECC):**

Engineering Core courses of M.Tech program will provide a holistic approach to master education, giving students an overview of the field, a basis to build and specialize upon. These core courses are the strong foundation to establish engineering knowledge and provide broad multi-disciplined knowledge can be studied further in depth during the elective phase.

The core courses will provide more practical-based knowledge, case-based lessons and collaborative learning models. It will train the students to analyze, decide, and lead-rather than merely know-while creating a common student experience that can foster deep understanding, develop decision-making ability and contribute to the business and community at large.

A wide range of core courses provides groundwork in the basic engineering disciplines: The integrated foundation is important for students because it will not only allow them to build upon existing skills, but they can also explore career options in a range of industries, and expand their understanding of various research fields.

- **Engineering Departmental Elective (EDE):**

Engineering departmental Elective is an interdisciplinary additional subject that is compulsory in the first, second and third semester of a program. The score of Electives is counted in your overall aggregate marks under Choice Based Credit System (CBCS). Each Elective paper will be of 4 Credits and students will have the choice of taking electives. Each student has to take Electives from department other than the parent department. These courses are of 4 credits each.



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- **Dissertation/Seminar(DS):**
 1. Dissertation with a department faculty.
 2. The students, who take up experiential dissertation in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other than their regular classes.
 3. Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries .Our institute organizes such visits to enhance students' exposure to practical learning and work out for are port of such a visit relating to their specific topic, course or even domain.

M.Tech. Electronics & Communication Engineering: Two-Year (4-Semester) CBCS Programme			
Basic Structure: Distribution of Courses			
S.No.	Type of Course	Credit	Total Credits
1	Engineering Core courses (ECC)	09 Courses of 4 Credits each (Total Credit 6X4)	36
2	Engineering Departmental Elective (EDE)	02 Courses of 4 Credits each (Total Credit 3X4)	08
3	Dissertation/Seminar (DS)	02 Courses of 2 Credits each (Total Credit 2X2) 1 Course of 10 Credits (Total credit 1x10)	14
Total Credits			58

Evaluation of Performance

1. Programmes: Evaluation of performance of the students in a programme shall be a continuous process based on their performance in the class test, assignments and the end semester examinations.

Theory papers in semester system (Maximum Marks: 100)

The evaluation will be done through two class test and one end semester examination. This will be in addition to assignments, attendance, etc. Each class test will carry a weightage of 10 marks, and the end semester examination will carry a weightage of 70 marks. The remaining 10 marks will be awarded on the basis of attendance and performance in quizzes and assignments.

2. Dissertation, Seminar: Seminar, Dissertation, and other learning-oriented activities shall have associated maximum marks and credits, as stated in the syllabus.

3. Examination:

- a. The minimum Grade required to pass in each Theory & Practical paper is 'GRADE D'.
- b. A candidate, in order to pass, minimum CGPA of 4.50 is required in a particular academic year inclusive of both semesters of that academic.
- c. There shall be no minimum Grade required to pass in General Proficiency (GP). However, Grade obtained in General Proficiency (GP) shall be included in SGPA.
- d. For further information, examination ordinance of IFTM University can be followed.

Evaluation Scheme:			
	Internal	External	Total
Theory	30	70	100
Seminar	100	--	100
Pre-Dissertation	50	50	100
Dissertation	250	250	500



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Unique practices adopted:

The method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on **experiential learning**.

Audio-Visual Based Learning:

It is clear that audio visual aids are important tools for teaching learning process. It helps the teacher to present the lesson effectively and students learn and retain the concepts better and for longer duration. Use of audio-visual aids improves student's critical and analytical thinking. It helps to remove abstract concepts through visual presentation. However, improper and unplanned use of these aids can have negative effect on the learning outcome. Therefore, teachers should be well trained through in-service training to maximize the benefits of using these aids. The curriculum should be designed such that there are options to activity-based learning through audio-visual aids. In addition, government should fund resources to purchase audio-visual aids in colleges

Field / Live Projects:

The objective of their training program is to enhance knowledge of the students on any one of the Trending technologies according to the industry standards without which the student degree is a mere degree. This is done by making students work on live projects which equip them with the required skill needed for the corporate world.

Personality Development Program (PDP):

It is conducted by professional trainers/experts from corporates as also by dedicated in-house faculty to actually bring a change in the traits of students in terms of values, behavior and personal growth. It enhances their body language, self-discipline, includes boosting one's confidence, improving language speaking abilities and widening one's scope of knowledge. Following PDP programs are undertaken in the Institute.

- **Aptitude:** Prepare students for placements by enhancing students' understanding in reasoning, numeric aptitudes, language proficiencies and general awareness.
- **Resume Writing:** Trains students about the current trend to present their Personal, Educational & Professional achievements and Strengths in an impressive manner. They learn how to write covering letter through which they can efficiently present their extra information. They also get an exposure to the Social Professional Sites like LinkedIn.
- **Group Discussion:** Help students to improve their ability to understand a topic/idea from different perspectives. They are able to realize its importance as a standard recruitment and selection tool. Students are trained to demonstrate their leadership, team work, oral and body language skills.
- **Personal Interview:** A platform to train students in improving their listening abilities and handling interviewer's questions and answer accordingly so that they are able to remove hesitation and anxiety during placement process.

Student Development Programs (SDP):

SDP has various modules dealing with professional development, Awareness and opinion building, communication and self-presentation etc. The purpose of these modules is to help students grow as individuals, develop the power of critical thinking and, at a material level, secure better placements

Special Guest Lectures (SGL):

Guest lectures are a highly useful medium to provide exceptional knowledge to students, it also adds an extra variety to the classroom routine and universities put a lot of emphasis on the importance of Guest lectures. The Guest lecturers are the "real-world" arriving in the classroom in order to make classes more interesting.

Industrial Visits:

Industrial visits are an integral part of Engineering and acknowledgment of technological up gradation. Industrial visit is considered as one of the tactical methods of teaching. The main reason behind this, it lets student to know things practically through interaction, working methods and employment practices. Moreover, it gives exposure



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from academic point of view. Main aim of industrial visit is to provide an exposure to students about practical working environment. They also provide students a good opportunity to gain full awareness about industrial practices. Through industrial visit students get awareness about new technologies. Technology development is a main factor, about which a students should have a good knowledge. Visiting different companies actually help students to build a good relationship with those companies.

Industry Focused programs:

Industry oriented education is an approach to learning from an industry perspective where core subjects are taught in the context of application of that knowledge to product design, development and operation. Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses/contents are to be delivered by industry experts to provide practice based insight to the students.

Mentoring scheme:

The new process has been established as Mentoring System". Each faculty will be the mentor of a group of 20 to 25 students. Every Student shall be provided with a faculty Mentor to help him /her in their personal & Academic Issues. The mentor maintains a register of all his/her mentees with complete personal & parents 'details. It is essential to have at least to meet once in a month. The mentor enters the discussions held, advice given and efforts & improvements made by the mentee.

Extracurricular Activities:

In IFTM University, various Co-Curricular and Extra-Curricular activities are regularly conducted along with regular Academic activities and students are continuously inspired and motivated to participate in these various activities to ensure the overall development of the students.

- **Cultural Activities:** The various activities undertaken are – Singing, Dancing, Playing Musical Instruments, Compering, Skit, Band, Stand-up Comedy, Poetry, Fashion Show etc. These activities help to develop self-confidence, cultural interest, creativity and sense of cooperation among students.
- **Games & Sports:** IFTM strongly believes that a healthy physique leads to a healthy mind. The Institute encourages sports culture and students also reciprocate by actively participating and distinguishing themselves at Sports Meets. IFTM possesses proper playgrounds and hard courts for outdoor sports. In Boys hostels students enjoy the facilities of Gym, badminton, and Table Tennis. The various sports activities undertaken are – cricket, football, basketball, volley ball, carom, chess, badminton, athletics etc. They increase self-esteem & mental alertness among students and promote team spirit. They also lead to balanced mental and physical growth of the students and teach them life skills like discipline, teamwork, leadership, patience, perseverance etc.
- **Induction program:** Every year induction program is organized for 1st year students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.



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IFTM UNIVERSITY, MORADABAD

(Established under UP Govt. Act No. 24 of 2010 and approved under section 22 of UGC Act 1956)

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DEPARTMENT OF ELECTRONICS & COMMUNICATION ENGINEERING CBCS Programme

Effective from Session 2022-23

Course Code		CBCS BASKET	Credits			
Engineering Core Courses(ECC)			L	T	P	C
TMEC-101		Advanced Semiconductor Devices & circuits	3	1	0	4
TMEC-102		Advanced Digital Communication	3	1	0	4
TMEC-103		Advanced Digital Signal Processing	3	1	0	4
TMEC-301		Optical Fiber Communication	3	1	0	4
TMEC-201		Advanced Information Theory and Coding	3	1	0	4
TMEC-202		Advanced Digital Logic Design	3	1	0	4
TMEC-203		Wireless Communication Systems	3	1	0	4
Engineering Departmental Elective (EDE)			L	T	P	C
Elective - I	TMEC-010	VLSI Technology	3	1	0	4
	TMEC-020	VLSI Design	3	1	0	4
Elective - III	TMEC-031	Optical Networks	3	1	0	4
	TMEC-030	Neural Networks and Fuzzy logic	3	1	0	4
Dissertation/Seminar (DS)			L	T	P	C
TMEC-351		Seminar	0	0	4	2
TMEC-352		Dissertation*	0	0	4	2
TMEC-451		Dissertation	0	0	20	10



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Master of Technology (M.Tech) Electronics & Communication Engineering

**STUDY AND EVALUATION SCHEME (Effective from 2022-23)
YEAR I, SEMESTER-I**

S.N.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits	
				L	T	P	CT	Mid Term Exam		External Exam			
								AS	AT				Total
THEORY													
1.	ECC	TMEC-101	Advanced Semiconductor Devices & Circuits	3	1	0	20	10	10	30	70	100	4
2.	ECC	TMEC-102	Advanced Digital Communication	3	1	0	20	10	10	30	70	100	4
3.	ECC	TMEC-103	Advanced Digital Signal Processing	3	1	0	20	10	10	30	70	100	4
4.	ECC	TMEC-010	VLSI Technology	3	1	0	20	10	10	30	70	100	4
TOTAL				12	04	00	-	-	-	-	-	400	16

Elective – I

- | | | |
|---|----------|--|
| 1 | TMEC010 | VLSI Technology |
| 2 | TMEC011 | Microwave Engineering |
| 3 | TMEC012 | Artificial Intelligence and its Applications |
| 4 | TMEC013 | Parallel Processing |
| 5 | TMEC014 | Advanced Computer Networks |
| 6 | TMEC015 | Internet of Things |
| 7 | TMEC 016 | Introduction to Information Security |
| 8 | TMEC 017 | Automotive Electronics |
| 9 | TMEC018 | Electronic waste management |



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Master of Technology (M.Tech) Electronics & Communication Engineering

STUDY AND EVALUATION SCHEME (Effective from 2022-23)

YEAR I, SEMESTER- II

S.N.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits	
				L	T	P	CT	Mid Term Exam		External Exam			
								AS	+AT				Total
THEORY													
1.	ECC	TMEC-201	Advanced Information Theory and Coding	3	1	0	20	10	10	30	70	100	4
2.	ECC	TMEC-202	Advanced Digital Logic Design	3	1	0	20	10	10	30	70	100	4
3.	ECC	TMEC-203	Wireless Communication Systems	3	1	0	20	10	10	30	70	100	4
4.	EDE	TMEC-020	VLSI Design	3	1	0	20	10	10	30	70	100	4
TOTAL				12	04	00	-	-	-	-	-	400	16

Elective – II

1. TMEC020 VLSI Design
2. TMEC021 Antenna System Design
3. TMEC022 Simulation & Modelling
4. TMEC023 Adaptive Signal Processing
5. TMEC024 High Performance Communication Networks
6. TMEC025 Automotive Software Engineering

Note: The student has to select Elective in each semester.



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STUDY AND EVALUATION SCHEME (Effective from 2022-23)

YEAR II, SEMESTER-III

S.N.	Category	Course Code	Course Name	Periods				EVALUATION SCHEME				Course Total	Credits
				L	T	P	CT	Mid Term Exam		External Exam			
								AS	AT		Total		
THEORY													
1.	ECC	TMEC-301	Optical Fiber Communication	3	1	0	20	10	10	30	70	100	4
2.	ECC	TMEC-	Elective -III	3	1	0	20	10	10	30	70	100	4
3.	EDE	TMEC-	Elective -IV	3	1	0	20	10	10	30	70	100	4
PRACTICALS / PROJECT													
4.	DS	TMEC-351	Seminar	0	0	4	-	-	-	100	-	100	2
5.	DS	TMEC-352	Dissertation*	0	0	4	-	-	-	50	50	100	2
TOTAL				09	03	08	-	-	-	-	-	500	16

Elective – III

1	TMEC030	Neural Network and Fuzzy logic
2	TMEC031	Optical Networks
3	TMEC032	PIC's and SCADA
4	TMEC033	Speech Processing
3	TMEC034	Digital Image Processing and Analysis
4	TMEC035	Cryptography & Network Security
5	TMEC036	Bio Informatics
6	TMEC037	Nano Electronics Devices Engineering
7	TMEC038	Advanced Embedded Systems Design
8	TMEC039	Robotics Automation
9	TMEC040	Automotive Transmission
10	TMEC041	Chassis and Body Electronics
11	TMEC042	Vehicle Body Engineering & Safety
12	TMEC043	Hybrid Electric Vehicles (HEV's)
13	TMEC044	Vehicle Engineering
14	TMEC045	Automotive Instrumentation
15	TMEC046	PLCs and Industrial Automation

Note: The student has to select Elective in each semester.

Note: Dissertation to be started in III Semester and continued in IV Semester.



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**STUDY AND EVALUATION SCHEME (Effective from 2022-23)
YEAR II, SEMESTER-IV**

S.N.	Category	Course Code	Course Name	Periods			EVALUATION SCHEME				Course Total	Credits
				L	T	P	Mid Term Exam		External Exam			
							CT	AS+AT		Total		
PRACTICALS / PROJECT												
1.	DS	TMEC-451	Dissertation	0	0	20	-	-	-	250	250	10
TOTAL				-	-	20	-	-	-	-	500	10



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TMEC101: ADVANCED SEMICONDUCTOR DEVICES & CIRCUITS

Objectives: The objective of this course is to gain an understanding crystal properties of semiconductor material, Excess carriers in semiconductors, Junctions-equilibrium conditions, BJT operations and Optoelectronic devices and negative conductance microwave devices for skill development & Employability.

UNIT-I

(10 Sessions)

Crystal properties and energy bands and charge carriers in semiconductors, semiconductor materials, crystal lattices, bulk crystal growth, epitaxial growth, bonding forces and energy bands in solids ,charge carriers in semiconductors, carrier concentrations drift of carriers in electric and magnetic fields, invariance of the fermi level at equilibrium for employability.

UNIT-II

(08 Sessions)

Excess carriers in semiconductors, optical absorption, luminescence, carrier lifetime and photoconductivity, diffusion of carriers for entrepreneurship & Employability.

UNIT-III

(10 Sessions)

Junctions-equilibrium conditions, forward and reverse biased junctions; steady state conditions, reverse -bias breakdown (zener, avalanche and other breakdown diodes),transient and a-c conditions, deviations from the simple theory, effects of contact potential on carrier injection, recombination and generation in the transition region, ohmic losses, graded junctions, metal -semiconductor junctions, hetrojunctions for Employability.

UNIT-IV

(12 Sessions)

Bipolar junction transistor-fundamentals of bjt operation, amplification with bjts, BJT fabrication, minority carrier distributions and terminal currents, generalized biasing, switching, other important effects (drift in base region, base narrowing, injection level),frequency limitations of transistors (capacitance and charging times, transit time effect), heterojunction bipolar transistors for skill development.

UNIT-V

(10 Sessions)

Optoelectronic devices and negative conductance microwave devices-photodiodes, light-emitting-diodes, lasers, semiconductor lasers, tunnel diodes, the IMPATT diodes, the Gunn diodes for employability.

Course Outcomes:

Students completing this course will be able to:

CO1: Crystal properties and energy bands and charge carriers in semiconductors for skill development for employability.

CO2: Optical absorption, luminescence, carrier lifetime and photoconductivity for skill development and employability.

CO3: Global Junctions-equilibrium conditions for skill development, employability and entrepreneurship development.

CO4: Bipolar junction transistor-fundamentals of bjt operation for skill development and employability.

CO5: Classify and describe the international semiconductor devices for special applications for skill development, employability and entrepreneurship development.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	2	1	1	1	1	1	1	1
CO2	1	1	1	2	1	2	1	1	1
CO3	2	1	1	1	1	1	1	1	1
CO4	1	1	1	1	1	3	1	1	1
CO5	1	1	2	1	2	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	1	2	1
CO2	2	1	1
CO3	2	2	3
CO4	1	1	1
CO5	3	2	2

Reference books:

1. B.G.Streetman,"Solid State Devices".
2. Millman and Halkas"Integrated Circuits".
3. A.S.sedre and K.C.Smith"Microelectronics Devices".

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in
4. Grade up online course on transistors (www.gradeup.org)

Note: Adhere to latest edition of the suggested readings.



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TMEC102: ADVANCED DIGITAL COMMUNICATION

Objective: The objective of this course introducing and understanding advanced topics in digital communications and providing students with up-to-date knowledge of the techniques used in modern communication systems and the principles underlying their design to provide employability & skills.

Unit I

(08 Sessions)

Introduction Elements of a digital communication system – Communication channels and their characteristics–Mathematical models for channels. Representation of Band Pass Signals and digitally modulated signals, Signal Space representation, Spectral Characteristics of Digitally Modulated Signals for skill development.

Unit II

(08 Sessions)

Optimum Receivers for AWGN Channels: Optimum Receiver for signals Corrupted by AWGN, Maximum likelihood Sequence Detector. Performance of Optimum receiver for memoryless modulation, Optimum receiver for CPM, Optimum Receiver for Signals with random Phase in AWGN Channel, Performance analysis for wire line and radio communication systems for skill development and employability.

Unit III

(08 Sessions)

Channel Capacity and Coding: Source coding, measurement of information, Coding for Discrete Sources, Channel Models and channel capacity, Random Selection of codes, Linear block codes, Cyclic Codes (hard & soft decision coding & decoding) Convolutional codes - Tree, Trellis and State diagrams – Systematic, Non-recursive and recursive convolutional codes – The inverse of a convolutional Encoder and Catastrophic codes – Decoding of convolutional codes - Maximum likelihood decoding, Viterbi algorithm and other decoding algorithms. Probability of error of Convolutional Codes, Comparison of error rates in coded and uncoded transmission for skill development, employability and entrepreneurship development.

Unit IV

(08 Sessions)

Pulse Shaping and Equalization Pulse shaping: Characterization of Band limited channels, ISI – Nyquist criterion, Design of band limited signals with Controlled ISI, Optimum Receiver for Channels with ISI and AWGN.

Equalization: Linear equalization, Decision feedback equalization, ML detectors, Iterative equalization – Turbo equalization. Adaptive linear equalizer, Adaptive decision feedback equalization, Blind equalization for skill development, employability and entrepreneurship development.

Unit V

(08 Sessions)

Multichannel and Multicarrier Systems: Multichannel Digital communication in AWGN channel, Multicarrier communication. Spread Spectrum Digital Communication, Direct Sequence Spread Spectrum Signals, Frequency Hopped Spread spectrum Signals, Synchronization of spread spectrum system. Introduction to multiple Access Techniques for skill development, employability and entrepreneurship development.

Course Outcomes:

Students completing this course will be able to:

CO1: Apply the knowledge of international statistical theory of communication and explain the conventional digital communication system for skill development.



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CO2: Apply the knowledge of signals and system and evaluate the performance of digital communication system in the presence of noise for skill development and employability to compete with local, national, and international standards.

CO3: Apply the knowledge of digital electronics and describe the error control codes like block code, cyclic code for skill development, employability and entrepreneurship development.

CO4: Describe and analyze the digital communication system with spread spectrum modulation for skill development and employability.

CO5: Design as well as conduct experiments, analyze and interpret the results to provide valid conclusions for digital modulators and demodulator using hardware components and communication systems using CAD tool for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	1	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	1	1
CO4	1	1	1	3	1	1	1	1	1
CO5	1	1	1	3	2	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference books:

1. John G. Proakis and Masoud Salehi, "Digital Communications," 5th edition, Tata McGraw Hill, 2008.
2. H. Taub, D L Schilling, Goutom Saha, "Principles of Communication", 3rd Edition, Tata McGraw-Hill Publishing Company Ltd.
3. B.P. Lathi, "Modern Digital and Analog communication Systems", 4th Edition, Oxford University Press, 2010.
4. Marvin K. Simon, Sami M. Hinedi and William C. Lindsey, "Digital Communication Techniques: Signal Design and Detection" Prentice Hall of India, 2009.

Website sources:

1. <https://www.edx.org/course/communication>
2. www.nptel.ac.in

Note: Adhere to latest edition of the suggested readings.



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TMEC103: ADVANCED DIGITAL SIGNAL PROCESSING

Objective: The objective of this course is to make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of signal processors for better employability in industry.

UNIT I

(10Sessions)

SIGNALS AND SYSTEMS: Basic elements of digital signal Processing –Concept of frequency in continuous time and discrete time signals –Sampling theorem –Discrete time signals. Discrete time systems –Analysis of Linear time invariant systems –Z transform –Convolution and correlation for skill development.

UNIT II

(08Sessions)

FAST FOURIER TRANSFORMS: Introduction to DFT – Efficient computation of DFT Properties of DFT – FFT algorithms Radix-2 and Radix-4 FFT algorithms – Decimation in Time – Decimation in Frequency algorithms Use of FFT algorithms in Linear Filtering and correlation for skill development and employability.

UNIT III

(08Sessions)

IIR FILTER DESIGN: Structure of IIR – System Design of Discrete time IIR filter from continuous time filter – IIR filter design by Impulse Invariance. Bilinear transformation – Approximation derivatives – Design of IIR filter in the Frequency domain for better employability in industry.

UNIT IV

(07Sessions)

FIR FILTER DESIGN: Symmetric & Anti-symmetric FIR filters – Linear phase filter – Windowing technique – Rectangular, Kaiser windows – Frequency sampling techniques – Structure for FIR systems for better employability in industry.

UNIT V

(07Sessions)

FINITE WORD LENGTH EFFECTS: Quantization noise – derivation for quantization noise power – Fixed point and binary floating point number representation – comparison – over flow error – truncation error – co-efficient quantization error - limit cycle oscillation – signal scaling – analytical model of sample and hold operations – Application of DSP ones for skill development and employability, Model of Speech Wave Form – Vocoder.

Course Outcomes:

After the successful completion of the course, student should be able to:

CO1: Know the analysis of discrete time signals for skill development.

CO2: To study the modern digital signal processing algorithms and their international applications for skill development and employability.

CO3: Have an in-depth knowledge of use of digital systems in real time applications for better employability in industry.

CO4: Understand the global applications of DSP in speech processing and spectrum analysis for skill development and employability.

CO5: Apply the algorithms for wide area of recent applications for employability and entrepreneurship.

PO-CO Mapping (Please write 3, 2, 1 wherever required)



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(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	3	2	1	1	2	1	1	1
CO2	1	3	1	1	3	1	1	1	1
CO3	1	2	1	3	1	1	1	1	1
CO4	1	2	1	1	3	1	1	1	1
CO5	1	1	2	1	1	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	2	1
CO3	1	3	1
CO4	1	3	1
CO5	1	1	3

Reference books:

1. Alan V Oppenheim, Ronald W Schafer and John R Buck, "Discrete Time Signal Processing", PHI/Pearson Education, 2000, 2nd Edition.
2. JohnyR.Johnson, "Introduction to Digital Signal Processing", Prentice Hall of India/Pearson Education, 2002.
3. SanjitK.Mitra, "Digital Signal Processing: A Computer – Based Approach", Tata McGraw-Hill, 2001, Second Edition.

Website Sources:

1. www.en.wikipedia.org
2. www.studynama.com
3. www.onlinecourses.nptel.ac.in
4. www.gupshupstudy.com
5. www.tutorialspoint.com

Note: Adhere to latest edition of the suggested readings.



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TMEC010: VLSI Technology

Objective: The objective of this course is to familiarize the students with the advanced VLSI Technology processes and industrial manufacturing of Integrated circuits to inculcate skill, provide employability & entrepreneurial skills. This course also helps them to understand the advanced concepts of diffusion system, Ion- implantation, metallization, packaging technologies and VLSI process in various technologies involved in fabrication.

UNIT I

(08Sessions)

Introduction to IC Technology, Device miniaturization, IC Fabrication facilities, clean room and pure water system. Silicon crystal Growth, Wafer preparation and specifications for knowledge for employability, Chemical cleaning. Epitaxy: Vapour-Phase Epitaxy for silicon, chemistry of growth, Molecular beam epitaxy.

UNIT II

(08Sessions)

Native films, thermal oxidation of silicon, oxidation techniques and systems, Evaluation of Native films. Lithography, Optical lithography, Electron beam lithography, X-ray lithography knowledge to upgrade skill.

UNIT III

(08Sessions)

Diffusion Equations, Diffusion profiles, Solid Liquid and Gaseous Sources, diffusion from an unlimited source, diffusion from a limited source. Diffusion systems for Silicon to improve knowledge and skill. Ion-Implantation: Ion Implantation systems, Implantation Damage, Annealing.

UNIT IV

(08Sessions)

Metallization: Applications, ohmic contacts. Thin film Vacuum Evaporation technique, Evaporator Systems, Sputtering. Assembling Techniques and Packaging of VLSI chips. Package Types, Packaging design considerations to improve knowledge for employability.

UNIT V

(08Sessions)

VLSI process Integration to improve knowledge for employability, NMOS IC Technology, C MOS IC Technology, Fabrication Process sequence. Yield and Reliability: Mechanisms of yield Loss in VLSI, Processing Effects, Circuit sensitivities, Point Defects, Reliability requirements for VLSI.

Course Outcomes:

Students completing this course will be able to:

CO1: To understand the basic of international IC Technology, NMOS, PMOS, CMOS Technology and Fabrication for employability.

CO2: To understand photolithography, etching process for skill development and employability.

CO3: To understand Oxidation and Diffusion techniques for skill development and employability.

CO4: To learn various types and design of global packaging for employability.

CO5: To study the various metallization process and Ion- Implantation techniques for employability.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	1	2	1	1	1	1	1
CO2	1	1	1	3	1	1	1	1	1



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CO3	1	1	1	3	1	1	1	1	1
CO4	1	1	1	1	1	1	1	1	1
CO5	2	1	1	2	1	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	1
CO2	2	3	1
CO3	2	3	1
CO4	2	3	1
CO5	2	3	1

Reference books:

1. VLSI Technology, S.M.Sze, McGrawHill
2. VLSI Fabrication Principles of Silicon and Gallium Arsenide, SorabK.Ghandi, JOHN Wiley & Sons
3. The Science and Engineering of Microelectronics Fabrication, Stephen A. Campbell, Oxford University Press.

Website Sources:

- ndl.iitkgp.ac.in
- online.courses.nptel.ac.in
- en.wikipedia.org
- www.tutorialspoint.com
- www.vlab.co.in

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TMEC011: MICROWAVE ENGINEERING

Objective: The objective of this course is to familiarize the students with to the advanced concepts of microwave Engineering. The primary objective of this course is to understand the concept of microwave engineering and to be able measure various parameters in microwave, this will help students to know more about theoretical and practical problem solving to improve skill and provide employability.

Unit-I **(08Sessions)**

Review of boundary conditions: Wave-guides and Cavity resonates (rectangular, circular & cylindrical) passive Circuits (design principles), impedance transformers, filters, hybrids, isolates. Detail discussion on S-matrix for skill development.

Unit-II **(08Sessions)**

High frequency semi-conductor devices: Intel valley Scattering, Gunn diodes, IMPATT diodes, Step recovery diodes. Lumped elements: Equivalence circuits of Capacitors and Inductors, Design of lumped element resonators and circuits, Basic blocks in RF system and their VLSI implementation, Design of mixer, Basic topologies VCO and phase noise, Various RF Synthesizer architecture and frequency dividers, Design issues in integrated RF filters. Thin & Thick film technologies for skill development.

Unit-III **(08Sessions)**

Design aspects: Transmission lines fir microwave circuits, Strip lines, Micro-strip lines, Slot line & Coupled lines. Characteristics impedance, Lumped parameters etc. Design considerations and implementation using simulation tools, Design of power dividers, combiners, and directional couplers for skill development.

Unit-IV **(08Sessions)**

Microwave measurements: SWR, Return loss, impedance, Scattering parameters, attenuation and familiarization with equipment such as vector network analyzer, Spectrum analyzer, power meters and their block diagrams discussion. Fabrication techniques in microwave for skill development.

Unit-V **(08Sessions)**

Computational techniques for microwave: moment method & Finite difference time Domain method. Comparison of Simulation Software for microwave applications. Computer aided design for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study boundary conditions, impedance, filters for skill development.

CO2: To understand the global concept of high frequency semiconductor devices for skill development.

CO3: To understand the concept of Design parameters and simulation for skill development employability to compete with local, national, and international standards.

CO4: To study measurement of various parameters for skill development.

CO5: To understand the concept of computational techniques for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	2	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	2
CO5	3	2	1

Reference Books:

1. B.Bhat & S.koul , Stripline- Loke Transmission lines for MICS, John Wiley
2. T.K. Ishii, Hand book of Microwave Technology, Vol.1, Academics Press.
3. Y.Konishi, Microwave integrated Circuit, Marcel Dekker
4. S.Y.Liao, Microwave Circuit Analysis and Amplifier Design, PHI
5. B.Razavi, RF Micro-Elements,PH.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC012: ARTIFICIAL INTELLIGENCE AND ITS APPLICATIONS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of artificial intelligence. The primary objective of this course is to understand the concept of artificial intelligence and to be able implement in practical life, this will help students to understand practical problems and how to solve in real life so as to improve skill and provide employability.

Unit – I

(08Sessions)

Introduction: Agents, Problem formulation, Problem solving; Problem Definition as a State Space Search; Production System; Control Strategies; Heuristic Search; Production System; Characteristics, Basic Problem Solving Method; Search strategies: Breadth-First Search, Depth-First Search, Problem Reduction, Mini-Max Search, Alpha-Beta Pruning for skill development.

Unit – II

(08Sessions)

Logical agents: Representation, Reasoning, and Logic Representation, propositional logic, inferences in first-order logic, unification, forward and backward chaining, Completeness of resolution for skill development.

Unit – III

(08Sessions)

Planning: Problem Solving to Planning, Basic Representations for Planning, Partial-Order Planning Algorithm and example, Practical Planners, Hierarchical Decomposition, conditional planning for skill development.

Unit – IV

(08Sessions)

Uncertainty: review of probability, probabilistic Reasoning: Representing Knowledge in an Uncertain Domain, Semantics of Belief Network, Inference in Belief Networks, Other Approaches to Uncertain Reasoning for skill development.

Unit – V

(08Sessions)

Learning from observation: Inductive learning, Decision trees, Computational Learning Theory, Explanation based Learning, Reinforcement Learning for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study agents, global production system for skill development.

CO2: To understand the logical agents, representations, chaining for skill development.

CO3: To understand the global concept of planning and algorithms for skill development.

CO4: To study problem related to uncertainty and uncertain domains internationally for skill development.

CO5: To understand the concept of inductive learning and other learning techniques for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	3	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1



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CO3	1	1	1	2	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference books:

1. S. Russel and P. Norvig, "Artificial Intelligence – A Modern Approach", Second Edition, Pearson Education, 2003.
2. David Poole, Alan Mackworth, Randy Goebel, "Computational Intelligence : a logical approach", Oxford University Press, 2004.
3. G. Luger, "Artificial Intelligence: Structures and Strategies for complex problem solving", Fourth Edition, Pearson Education, 2002.
4. J. Nilsson, "Artificial Intelligence: A new Synthesis", Elsevier Publishers, 1998.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC013: PARALLEL PROCESSING

Objective: The objective of this course is to familiarize the students with to the advanced concepts of parallel processing. The primary objective of this course is to understand the concept of parallel processing and to be able to know details about parallel processing. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit – I

(08Sessions)

Theory of Parallelism: Parallel computer models - the state of computing, Multiprocessors and Multicomputers and Multivectors and SIMD computers, PRAM and VLSI models, Architectural development tracks. Program and network properties Conditions of parallelism, Program partitioning and scheduling, Program flow mechanisms, System interconnect architectures for skill development.

Unit – II

(08Sessions)

Pipelined Vector Processor: Vector Operations; General Pipelines, Concept of Reservation Tables; Pipelining of Vector Operations; Performance Measures; Vectorizing Compilers; Vector Computers: CRAY-1, CRAY-XM

Principles of scalable performance - performance matrices and measures, parallel processing applications, speedup performance laws, scalability analysis and approaches for skill development.

Unit – III

(08Sessions)

Hardware Technologies: Processor and memory hierarchy advanced processor technology, superscalar and vector processors, memory hierarchy technology, virtual memory technology, bus cache and shared memory - backplane bus systems, cache memory organisations, shared memory organisations, sequential and weak consistency models for skill development.

Unit – IV

(08Sessions)

Multiprocessors: Tightly Coupled and Loosely Coupled Systems; Amdahls Law; Gustufson-Barsis Law; Synchronization and Communication Costs; Speed-up; Shared Memory and Message Passing Models; Deadlock and Task Scheduling for skill development.

Unit – V

(08Sessions)

Parallel Numerical Algorithms: Introduction; Solving Linear Equations Using Gauss Elimination Method on Multiprocessors; Solving Tri-diagonal System Using Cyclic Reduction Method; Solution of ODE and PDE on Multiprocessors; Applications for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study international theory of parallelism for skill development.

CO2: To understand the concept pipelined vector processor for skill development.

CO3: To understand the concept global Hardware Technologies for skill development.

CO4: To study various multiprocessors for skill development.

CO5: To understand the concept of parallel numerical algorithms for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Hwang and Briggs, Computer Architecture and Parallel Processing, McGraw Hill, 2012.
2. Kai Hwang, Advanced Computer Architecture, McGraw Hill, 2003.
3. Quinn M.J., Designing Efficient Algorithms for Parallel Computers, McGraw Hill, 1987.
4. Lewis TG and El-Rewini, Introduction to Parallel Computing, Prentice Hall, 1992.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC014: ADVANCED COMPUTER NETWORKS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of advanced computer networks. The primary objective of this course is to understand the concept of advanced computer networks and to be able to know details about advanced computer networks. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

Overview: Computer Network. Network Hardware and Software, Network Topologies. LAN, MAN, and WAN. The OSI reference model, TCP/IP reference model. Addressing, Circuit Switched, Datagram and Virtual Circuit Networks. Hubs, Bridges, switches, Routers and Gateways. Transmission Media and Impairments

Data Link Layer: Design Issues, Error Control, Flow-control protocols: Stop-and-wait, and Sliding window. Link protocols: HDLC, SLIP, and PPP Protocols for skill development.

Unit II

(08Sessions)

Local/ Personal Area Networks:

IEEE LAN standards: Ethernet (802.3), Gigabit Ethernet, Wireless LAN (802.11), Bluetooth, and Broadband Wireless (802.16).

Wide Area Networks: X-25, Frame Relay, ATM for skill development.

Unit III

(08Sessions)

Network Layer: Routing Algorithms: Shortest path routing, Flooding, Distance-vector routing, Link-state routing, Hierarchical routing, Broadcast routing and Multicast routing. Congestion control: Principles and policies congestion control in Virtual-circuit and Datagram subnets. Load shedding and Jitter control. Quality of Service: Techniques for achieving good Quality of Service. Integrated Services. Differentiated Services. Label Switching and MPLS for skill development.

Unit IV

(08Sessions)

Internetworking and Internet Protocols: Tunneling, Fragmentation. The IPv4 Protocol, IPv4 addresses, IPv6 Protocol, Mobile IP, OSPF, BGP, ARP, DHCP, Internet Control Protocols, Classless Inter-domain Routing (CIDR), Network Address Translation (NAT), Subnetting and Super netting

Transport Layer:

Transport layer protocol issues: Addressing, Connection Establishment, Connection Release, Flow control and Multiplexing. Internet Transport Protocols: TCP and UDP for skill development.

Unit V

(08Sessions)

Network Applications:

DNS, Electronic Mail, TELNET, FTP, SNMP, World-wide Web, Multi-media.

Network Security:

Introduction to Network Security, Cryptography, Symmetric-key and Asymmetric Key Algorithms. Digital Signatures for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study computer network, network hardware, topologies and international protocols for skill development.

CO2: To understand the concept of local/personal area networks for skill development.



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CO3: To understand the concept of Network layers for skill development.

CO4: To study internetworking and internet protocols for skill development.

CO5: To understand the concept global Network Applications for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Computer Networks, 4th Ed, A. S. Tanenbaum, Pearson Education.
2. Data and Computer Communications, 7th Ed, William Stallings, Pearson Education.
3. Data Communications and Networks, 2nd Ed, Forouzan. Tata McGraw Hill.
4. Computer Networks and Internets. 2nd Ed., COMER, D.E., Delhi: Pearson Education Asia.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC015: INTERNET OF THINGS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of internet of things (IOT's). The primary objective of this course is to understand the concept of internet of things (IOT's) and to be able to know details about advanced internet of things (IOT's). This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit-I

(08Sessions)

Internet of Things (IoT): Vision, Definition, Conceptual Framework, Architectural view, technology behind IoT, Sources of the IoT, M2M Communication, IoT Examples . Design Principles for Connected Devices: IoT/M2M systems layers and design standardization, communication technologies, data enrichment and consolidation, ease of designing and affordability for skill development.

Unit-II

(08Sessions)

Hardware for IoT: Sensors, Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, NetArduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex for skill development.

Unit-III

(08Sessions)

Network & Communication aspects in IoT: Wireless Medium access issues, MAC protocol survey, Survey routing protocols, Sensor deployment & Node discovery, Data aggregation & dissemination for skill development.

Unit-IV

(08Sessions)

Programming the Arduino: Arduino Platform Boards Anatomy, Arduino IDE, coding, using emulator, using libraries, additions in arduino, programming the arduino for IoT for skill development.

Unit-V

(08Sessions)


Challenges in IoT Design challenges: Development Challenges, Security Challenges, Other challenges IoT Applications : Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, Communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

- CO1:** To understand the basic concept of global internet of things for skill development.
- CO2:** To understand the concept of hardware for IOT's Conventional international Cryptographic Techniques for skill development.
- CO3:** To understand the concept of network and communication for skill development.
- CO4:** To study Programs related to Arduinos for skill development.
- CO5:** To understand the challenges in IOT's for skill development and employability.




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COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	2	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	2
CO5	3	2	2

Reference books:

1. Olivier Hersent, David Boswarthick, Omar Elloumi "The Internet of Things key applications and protocols", Wiley
2. Jeeva Jose, Internet of Things, Khanna Publishing House
3. Michael Miller "The Internet of Things" by Pearson
4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016
5. Arshdeep Bahga, Vijay Madisetti "Internet of Things (A hands on approach)" 1ST edition, VPI publications, 2014
6. Adrian McEwen, Hakin Cassimally "Designing the Internet of Things" Wiley India.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundry.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC016: INTRODUCTION TO INFORMATION SECURITY

Objective: The objective of this course is to familiarize the students with to the advanced concepts of information security. The primary objective of this course is to understand the concept of information security and to be able to know details about information security. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit-I (08Sessions)
 Introduction to Information Security: Attacks, Vulnerability, Security Goals, Security Services and mechanisms for skill development.

Unit-II (08Sessions)
 Conventional Cryptographic Techniques: Conventional substitution and transposition ciphers, One-time Pad, Block cipher and Stream Cipher, Steganography. Symmetric and Asymmetric Cryptographic Techniques: DES, AES, RSA algorithms for skill development.

Unit-III (08Sessions)
 Authentication and Digital Signatures: Use of Cryptography for authentication, Secure Hash function, Key management – Kerberos for skill development.

Unit-IV (08Sessions)
 Program Security : No malicious Program errors – Buffer overflow, Incomplete mediation, Time-of-check to Time-of- use Errors, Viruses, Trapdoors, Salami attack, Man-in-the- middle attacks, Covert channels for skill development.

Unit-V (08Sessions)
 Security in Networks : Threats in networks, Network Security Controls – Architecture, Encryption, Content Integrity, Strong Authentication, Access Controls, Wireless Security, Honeypots, Traffic flow security, Firewalls – Design and Types of Firewalls, Personal Firewalls, IDS, Email Security – PGP,S/MIME for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

- CO1:** To understand the basic concept of international information security for skill development.
- CO2:** To understand the concept Conventional Cryptographic Techniques for skill development.
- CO3:** To understand the global concept Authentication and Digital Signatures for skill development.
- CO4:** To study Program Security features for skill development.
- CO5:** To understand the concept of Security in Networks for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	2	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1



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CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	2
CO5	3	2	2

Reference books:

1. Security in Computing, Fourth Edition, by Charles P. Pfleeger, Pearson Education
2. Cryptography And Network Security Principles And Practice, Fourth or Fifth Edition, William Stallings, Pearson
3. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall.
4. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC017: AUTOMOTIVE ELECTRONICS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of automotive electronics. The primary objective of this course is to understand the concept of automotive electronics and to be able to know details about automotive electronics. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit-I

(08Sessions)

Batteries: Principles and construction of lead-acid battery. Characteristics of battery, rating capacity and efficiency of batteries. Various tests on battery condition, charging methods. Constructional aspect of alkaline battery for skill development.

Unit-II

(08Sessions)

Starting System: Condition at starting. Behaviour of starter during starting. Series motor and its characteristics. Principle & construction of starter motor. Working of different starter drive units, care and maintenance of starter motor. Starter Switches for skill development.

Unit-III

(08Sessions)

Charging System: Generation of direct current. Shunt generator characteristics. Armature reaction. Third brush regulation. Cut-out. Voltage and current regulators. Compensated voltage regulator alternators principle & constructional aspects and bridge benefits for skill development.

Unit-IV

(08Sessions)

Ignition, Lighting Systems and accessories: Types, Construction & working of battery coil and magneto ignition systems. Relative merits, Centrifugal and vacuum advance mechanisms, types and construction of spark plugs, electronic ignition systems. Lighting System & Accessories: Insulated & earth return systems. Positive & negative earth systems. Details of head light and side light. Headlight dazzling and preventive methods. Electrical fuel-pump, Speedometer, Fuel, oil & temperature gauges, Horn, Wiper systems for skill development.

Unit-V

(08Sessions)

Sensors and Actuators: Basic sensor arrangement, Types of sensors such as-Oxygen sensors, Crank angle position sensors-Fuel metering/vehicle speed sensor and detonation sensor Altitude sensor, flow sensor. Throttle position sensors. Solenoids, stepper motors, and relays for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: Understand and explain fundamentals of national and international automotive electrical and electronics systems for skill development.

CO2: Apply the various concepts of electrical and electronics to small vehicle system for skill development.

CO3: Analyze the design considerations of various engine control systems in automotive electrical and electronics for skill development.

CO4: To study Sensors and actuators for skill development employability to compete with local, national, and international standards.

CO5: Engage in independent study as a member of a team and make an effective oral presentation on the usage of software tools/mini project for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	2	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	2
CO5	3	2	2

Reference books:

1. Judge. A.W., Modern Electrical Equipment of Automobiles, Chapman & Hall, London, 1992.
2. Vinal. G.W., Storage Batteries, John Wiley & Sons Inc., New York, 1985.
3. William B. Ribbens, Understanding Automotive Electronics, 5th Edition, Butterworth, Heinemann Woburn, 1998.
4. Automotive Hand Book, Robert Bosch, Bently Publishers, 1997, Reprint 2012.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC018: ELECTRONIC WASTE MANAGEMENT

Objective: The objective of this course is to familiarize the students with to the advanced concepts of electronic waste management. The primary objective of this course is to understand the concept of electronic waste management and to be able to know details about electronic waste management. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit – I

(08Sessions)

Introduction: E- waste; composition and generation. Global context in e- waste; E-waste pollutants, E waste hazardous properties, Effects of pollutant (E- waste) on human health and surrounding environment, domestic e-waste disposal, Basic principles of E waste management, Component of E waste management, Technologies for recovery of resources from electronic waste, resource recovery potential of e-waste, steps in recycling and recovery of materials-mechanical processing, technologies for recovery of materials, occupational and environmental health perspectives of recycling e-waste in India for skill development.

Unit – II

(08Sessions)

E-waste hazardous on Global trade: Essential factors in global waste trade economy, Waste trading as a quint essential part of electronic recycling, Free trade agreements as a means of waste trading. Import of hazardous e-waste in India; India's stand on liberalizing import rules, E-waste economy in the organized and unorganized sector. Estimation and recycling of e-waste in metro cities of India for skill development.

Unit – III

(08Sessions)

E-waste control measures Need for stringent health safeguards and environmental protection laws in India, Extended Producers Responsibility (EPR), Import of e-waste permissions, Producer-Public-Government cooperation, Administrative Controls & Engineering controls, monitoring of compliance of Rules, Effective regulatory mechanism strengthened by manpower and technical expertise, Reduction of waste at source for skill development.

Unit – IV

(08Sessions)

E- waste legislation E-waste (Management and Handling) Rules, 2011; and E-Waste (Management) Rules, 2016 - Salient Features and its likely implication. Government assistance for TSDFs. The international legislation: The Basel Convention; The Bamako Convention. The Rotterdam Convention. Waste Electrical and Electronic Equipment (WEEE) Directive in the European Union, Restrictions of Hazardous Substances (RoHS) Directive for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To know about the national and international environmental impacts of e-waste for skill development.

CO2: To apply various concept learned under e-waste management hierarchy for skill development.

CO3: To distinguished the role of various national and internal act and laws applicable for e-waste management skill development.

CO4: To analyze the global e – waste management measures proposed under national and global legislations for skill development and employability.

CO5: To use e-waste management for the development of society for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	2	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	3
CO5	3	3	3

Reference Books:

1. Hester R.E., and Harrison R.M. 2009. Electronic Waste Management. Science.
2. Fowler B. 2017. Electronic Waste – 1 st Edition (Toxicology and Public Health Issues). Elsevier.
3. Johri R., “E-waste: implications, regulations, and management in India and current global best practices”, TERI Press, New Delhi

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC201: ADVANCED INFORMATION THEORY AND CODING

Objective: The objective of this course to introduce the principles and applications of information theory. The course will study how information is measured in terms of probability and entropy, and there relationships among conditional and joint entropies; how these are used to calculate the capacity of a communication channel, with and without noise; coding schemes, including error correcting codes for employability and skill development.

Unit – I

(08Sessions)

Elements of information theory: Measurement of information and the Entropy Function, Entropies defined, and why they are measures of information, marginal entropy, joint entropy, Conditional entropy and the Chain Rule for Entropy for skill development.

Sources with and without Memory: Sources coding theorem, Prefix, Variable and Fixed- length Codes. Error Correcting Codes

Unit – II

(08Sessions)

Channel Types, Properties, Noise and Channel Capacity: Perfect communication through a noisy channel. The binary symmetric channel, their classification and capacity of a noiseless discrete channel. The Hartley and Shannon laws for channel capacity for skill development.

Unit – III

(08Sessions)

Continuous Information; Density; Noisy Channel Coding Theorem: Extensions of the discrete entropies and measures to the continuous case. Signal-to-noise ratio; power spectral density, Gaussian channels, Relative significance of bandwidth and noise limitations. The Shannon rate limit and efficiency for noisy continuous channels for employability & skill development.

Unit – IV

(08Sessions)

Error Control Coding: Linear block codes and their properties, hard-decision decoding, cyclic codes, Convolution codes, Soft-decision decoding, Viterbi decoding algorithm for skill development.

Unit – V

(08Sessions)

Advanced Coding Techniques and Cryptography: BCH codes, Trellis coded modulation, introduction to cryptography, overview of encryption techniques, symmetric cryptography, DES, IDEA, asymmetric algorithms, RSA algorithm for employability & skill development.

Course Outcomes:

Students completing this course will be able to:

CO1: Calculate the information content of a random variable from its probability distribution for skill development to compete with local, national, and international standards.

CO2: Relate the joint, conditional, and marginal entropies of variables in terms of their coupled probabilities for skill development and employability for skill development.

CO3: Define channel capacities and properties using Shannon's Theorems for skill development and employability for employability & skill development.

CO4: Construct efficient codes for data on imperfect communication channels for skill development, employability and entrepreneurship development for skill development.

CO5: Understand the basic concepts of cryptography for skill development, employability and entrepreneurship development for employability & skill development to compete with local, national, and international standards.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	1	1	1	1	1	1
CO2	1	2	1	1	1	1	1	1	1
CO3	1	3	1	1	1	1	1	1	1
CO4	1	1	2	2	1	1	1	1	1
CO5	1	1	1	1	1	2	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	1	3	1
CO2	2	1	1
CO3	1	2	1
CO4	2	1	1
CO5	1	2	1

Reference books:

1. Ranjan Bose, Information Theory, Coding and Cryptography, Tata McGraw Hill
2. Richard B. Wells, Applied Coding and Information Theory for Engineers, Pearson
3. R.W.Hamming, Coding and Information Theory, 2nd edition, Prentice Hall
4. R.G.Gallager, Information Theory and Reliable Communication, Wiley
5. R.J. McEliece, The Theory of Information and Coding. Addison –Wesley
6. M.Mansuripur, Introduction to information Theory: Prentice Hall,1987
7. Thomas Cover & Joy Thomas, Elements of Information Theory, John Wiley & Sons

Website sources:

1. <https://www.edx.org/course/Information theory and coding>
2. www.nptel.ac.in
3. en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.



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TMEC202: ADVANCED DIGITAL LOGIC DESIGN

Objective: The objective of this course is to familiarize the students with digital integrated circuits including testing, fabrication, circuit design, implementation methodologies, design methodologies, software's and future trends such as VHDL in the fields of digital electronics to provide employability & skills.

UNIT I

(08Sessions)

Introduction to Digital Design Concepts: Design Constraints and Logic Representation of System, Levels of abstraction, typical design process, Hazard-free design. Axiomatic definition of Boolean algebra, Basic theorems of Boolean algebra. Boolean functions, Digital logic gates. Extension to multiple inputs and multiple operators. Gate implementations for skill development.

UNIT II

(08Sessions)

Analog interfacing: A/D conversion concepts, Analog & Digital Conversion related errors. Function Minimization by using K – Map, XOR patterns and Reed - Muller Transformation Forms for skill development and employability.

UNIT III

(08Sessions)

Combinational Logic Design and Implementation: Multiplexer/Decoder, Encoders, Code Converters, Magnitude Comparators, Parity Generators, Error Checking Systems, Combinational Shifters, Steering Logic and Tri-State Gate Applications, Introduction to VHDL Description of Combinational Primitives PLA/PAL/GAL, ROM, CPLD and FPGA level customized design, ALU for skill development, employability and entrepreneurship development.

UNIT IV

(08Sessions)

Sequential Logic Design and Implementation: Practical Synchronous and asynchronous circuit design. Design and Implementation of sequential digital system, state representation, analysis of digital systems, synchronization, design criteria, design procedure. High level modeling of digital systems, controller realization, Timing & Frequency consideration, system examples for skill development, employability and entrepreneurship development.

UNIT V

(08Sessions)

Synchronous FSM Design Considerations and Application, Fault, Fault coverage in digital circuits, internal scan test methodology, BIST and Boundary scan (JTAG) techniques for skill development, employability and entrepreneurship development.

Course Outcomes:

Students completing this course will be able to:

CO1: To understand the international Digital Design Concepts and to develop Hazard free designs for skill development.

CO2: To implement and remove Analog & Digital Conversion related errors for skill development and employability.

CO3: To study and develop Combinational Logic Design with Implementation and to study hardware languages like VHDL and Verilog for skill development, employability and entrepreneurship development.

CO4: To study and develop Sequential Logic Design with Implementation and to study hardware languages like VHDL and Verilog for skill development, employability and entrepreneurship development.



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CO5: To understand FSM global Design and the various faults in digital circuits for skill development, employability and entrepreneurship development.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	1	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	1	1
CO4	1	1	1	3	1	1	1	1	1
CO5	1	1	1	3	2	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	2
CO5	3	2	2

Reference books:

1. An Engineering Approach to Digital Design, W. I. Fletcher, Pearson Education.
2. Digital Design – 4 edition; M. Morris Mano, Prentice Hall.
3. Digital Design principles and practices, 3RD Edition, J. F. Wakerly. Prentice Hall International.
4. Z. Kohavi, Switching and Finite Automata Theory, McGraw-Hill

Website Sources:

1. ndl.iitkgp.ac.in
2. online.courses.nptel.ac.in
3. www.tutorialspoint.com
4. www.vlab.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC203: WIRELESS COMMUNICATION SYSTEMS

Objective: To get an understanding of mobile radio communication principles, types and to study the recent trends adopted in cellular and wireless systems and standards for employability & skill development.

Unit I (08Sessions)

Mobile Communication: Types of Mobile Communication Systems, Mobile radio systems around the world, Trends in cellular radio and personal communications.

Cellular Design Fundamentals: Frequency reuse, Channel alignment strategies, handoff strategies, interference and system capacity, improving coverage and capacity in cellular systems, mechanism for capacity improvement-cell splitting, cell sectoring, and micro cell zone concept for skill development.

Unit II (08Sessions)

Multiple access schemes : TDMA, FDMA, CDMA, WCDMA, OFDMA, Random Multiple access Scheme, Packet Radio Protocols, CSMA, Reservation Protocols, Capacity of Cellular systems. GSM Architecture & Protocols, GSM Burst structure, Carrier and Burst Synchronization, Design Consideration. Security Aspects, Power Control strategies for employability.

Unit III (08Sessions)

CDMA Digital Cellular Standards, Services and Security Aspects, Network Reference Model and Key Features, Advantages over TDMA, CDMA WLL System for skill development.

Unit IV (08Sessions)

Multipath Propagation: Fading, Large scale path loss, reflection, Diffraction, Scattering, Outdoor Propagation model-Okumura Model, Hata Model, Indoor Propagation Models. Small-scale multipath propagation, Types of small scale fading, Rayleigh and Ricean distributions. Diversity Schemes for skill development.

Unit V (08Sessions)

Introduction to 3G Wireless Networks: WiFi, WiMax, and Bluetooth, AMPS, MATS-D, CD-900 for employability.

Course Outcomes:

Students completing this course will be able to:

CO1: Explain and apply the global concepts telecommunication switching, traffic and networks for skill development.

CO2: Analyze the telecommunication traffic for skill development and employability to compete with local, national, and international standards.

CO3: Analyze radio channel and cellular capacity for skill development, employability and entrepreneurship development.

CO4: Explain and apply concepts of GSM and CDMA system for skill development and employability.

CO5: Analyze the concept of multipath propagation for skill development, employability and entrepreneurship development for employability & Skill development.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	1	1	1	1	1	1	1	1
CO2	1	1	1	1	1	1	1	1	1
CO3	1	2	1	1	1	1	1	1	1
CO4	1	1	1	2	1	1	1	1	1
CO5	1	3	1	1	2	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	1	2	1
CO2	2	1	1
CO3	3	1	2
CO4	2	1	1
CO5	1	2	1

Reference books:

1. Wireless Communication, Rappart (PHI)
2. Mobile and personal Communication Systems and services, Raj Pandya (PHI)
3. Mobile Communication, Lee (TMH)

Website sources:

1. <http://www.wideskills.com/>
2. www.nptel.ac.in
3. en.wikipedia.org

Note: Latest editions of all the suggested readings must be used.



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TMEC020: VLSI DESIGN

Objective: The objective of this course is to familiarize the students with the advanced VLSI Design processes and industrial manufacturing of Integrated circuits. This course also helps them to understand the advanced concepts of CMOS, BiMOS implantation, packaging design and various technologies involved in fabrication. This course helps student to learn software language like HDL and VHDL for research in the field of VLSI for employability.

UNIT I

(08Sessions)

Introduction to integrated circuit technology, basic MOS transistors, Enhancement and Depletion mode transistor, n-MOS fabrication, CMOS fabrication, BiCMOS. Electrical properties of MOS circuits, MOS transistor threshold voltage, Trans-conductance, output conductance, figure of merit for skill development.

UNIT II

(08Sessions)

n- MOS inverter, Pull-up to Pull-down ratio for an n-MOS inverter, Alternative forms of Pull-up, CMOS inverter, Latch up in CMOS, the Pass Transistor. Stick diagrams, n MOS design style; CMOS design style, Design rules and layout, Lambda-based design rules for skill development and employability.

UNIT III

(08Sessions)

Basic circuit concept, sheet resistance, area capacitance of layers, delay time, inverter delays, propagation delays, scaling of MOS circuits, scaling models and scaling factors, limitation of scaling, limits of miniaturization for skill development, employability and entrepreneurship development.

UNIT IV

(08Sessions)

Subsystem design and layout, some architecture issues, switch logic, gate logic, combinational logic, clocked sequential circuits. CMOS Design methods, programmable logic, Reprogrammable Gate arrays, FPGA architecture, CMOS standard cell Design for employability and entrepreneurship development.

UNIT V

(08Sessions)

Design- capture tools, HDL and VHDL design, schematic design, layout design, floor planning, chip composition. VLSI Testing, Fault types and models, controllability and observability, Ad HOC Testable design techniques, scan-based techniques, Built-In self-Test (BIST) Techniques, current monitoring IDDQ Test for skill development, employability and entrepreneurship development.

Course Outcomes:

Students completing this course will be able to:

CO1: To identify the various international IC fabrication methods for skill development.

CO2: To express the Layout of advance MOS circuit using Lambda based design rules for skill development and employability.

CO3: To differentiate various latest global FPGA architectures for skill development, employability and entrepreneurship development

CO4: To Design an application using software's for skill development, employability and entrepreneurship development.

CO5: To develop concepts of modeling a digital system using Hardware Description Language for skill development, employability and entrepreneurship development.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	2	1	1	1	1	1	1	1
CO2	1	1	2	1	1	2	1	1	1
CO3	2	1	1	1	1	1	1	1	1
CO4	3	1	1	1	1	2	1	1	1
CO5	1	1	2	1	3	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	1
CO2	1	1	1
CO3	2	1	3
CO4	1	2	1
CO5	2	1	2

Reference books:

1. Basic VLSI design, Douglas A. Pucknel, K. Eshriaghian, PHI.
2. Principles of CMOS VLSI Design- A system Perspective, by Niel H.E Weste, K. Eshriaghian, Pearson Education.
3. CMOS Digital Integrated Circuit Analysis and Design, Sung.mo Kang and Yusuf Leblebici, Tata McGraw-Hill

Website Sources:

1. ndl.iitkgp.ac.in
2. online courses.nptel.ac.in
3. www.tutorialspoint.com
4. www.vlab.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC021: ANTENNA SYSTEM DESIGN

Objective: The objective of this course is to familiarize the students with to the advanced concepts of antenna system design. The primary objective of this course is to understand the concept of antenna system design and to be able to know details about antenna system design. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit – I

(08Sessions)

Antenna Analysis: Retarded Potentials and Directional Weighting Functions; Radiation Patterns of Different Antenna Elements in Terms of Weighting Functions; Linear Array preliminaries, and Schelkunoff's Unit Circle Representation for skill development.

Unit – II

(08Sessions)

Linear Array Synthesis: Sum and Difference Radiation Patterns; Dolph-Chebyshev Synthesis; Taylor's Synthesis; Modified Taylor's Sum Patterns; Bayliss Difference Pattern; Arbitrary Side Lobe Topology; Discretization of a Continuous Line Source Distribution; Null Free Pattern Design for skill development.

Unit – III

(08Sessions)

Planar Arrays: Rectangular Grid Arrays; Separable and Non-separable Aperture Distributions; Circular Taylor Patterns; Modified Circular Taylor Patterns; Sampling Generalized Taylor Distributions for Rectangular and Circular Grid Arrays; Discretizing Techniques; Circular Bayliss Patterns for skill development.

Unit – IV

(08Sessions)

Impedance and Feeding Systems: Self and Mutual Impedance of Antenna Elements; Design of Feeding Structures for Antenna Elements and Arrays for skill development.

Unit – V

(08Sessions)

Continuous Aperture Antennas: Different Traveling Wave Antennas and Arrays; Design of Reflector and Lens Antennas for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study various antenna analysis for skill development to compete with local, national, and international standards.

CO2: To understand the global concept of linear array synthesis for skill development.

CO3: To understand the concept of Planar arrays for skill development.

CO4: To study the impedance and feeding techniques in antenna for skill development.

CO5: To understand the concept of continuous Aperture Antennas for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1



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CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Elliot, R. S., Antenna analysis and design, Prentice Hall of India Private Ltd, New Delhi, 1985.
2. Weeks, W. L., Antenna Engineering, Tata McGraw Hill, 1974.
3. Kraus, J. D., Antennas, II ed. Tata McGraw Hill Publishing Co. Ltd, New Delhi, 1997.
4. Jesic, H., Antenna Engineering Hand book, McGraw Hill Book Co., 1981.
5. Jordon, E. C. and Balmain, K. G., Electromagnetic Waves and Radiating Systems, Prentice Hall Ltd, New Delhi, 1987.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in



Note: Latest editions of all the suggested readings must be used.

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TMEC022: SIMULATION & MODELLING

Objective: The objective of this course is to familiarize the students with to the advanced concepts of simulation and modelling. The primary objective of this course is to understand the concept of simulation and modelling and to be able to know details about simulation and modelling. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit – I

(08Sessions)

Modelling: State and events, abstraction, Modelling approaches, Graphical Analogue, Scaled, Model characteristics for skill development.

Unit – II

(08Sessions)

System Simulation: Technique of simulation, montecarlo method, Comparison and simulation with analytical method, numerical computation techniques. Stochastic variables, Discrete and continuous probability functions, Numerical evaluation, Random number generators, discrete distribution generation for skill development.

Unit – III

(08Sessions)

Arrival patterns: poisson, Exponential distribution, Coefficient of variations, Service times, Queuing, Solution of queuing, Solution of Queuing problems. **Discrete System Simulation:** Discrete events, Representation of time, Arrival patterns, Gathering statistics, Measuring utilization and occupancy for skill development.

Unit – IV

(08Sessions)

Analysis of Simulation Output: Nature of the problems, Estimation methods, Simulation run statistics, Time series analysis, Discrete and continuous random variables, Probability mass function, Distribution functions, Reliability, Discrete and continuous Markov Chains for skill development.

Unit – V

(08Sessions)

Statistical Interference: Regression, correlation and analysis of variance. Simulation kernels, Strong predicted events, Event cancellation for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of simulation and modelling for skill development to compete with local, national, and international standards.

CO2: To understand the concept of system simulation techniques for skill development.

CO3: To understand the concept of various arrival patterns for skill development.

CO4: To study and analyze the simulation output for skill development to compete with local, national, and international standards.

CO5: To understand the concept of statistical interferences techniques for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	3

Reference Books:

1. Geoffrey Gordon System Simulation, Prentice Hall of India
2. Kishor S. Trivedi, Probability and statistics with Reliability, Queuing and computer Science Applications, Prentice Hall of India (EEE)
3. Narsing Deo, System Simulation with Digital Computer, Prentice Hall of India
4. Jerry Banks, John S. Carson II, Barry L. Nelson, Discrete Event System Simulation, Prentice Hall of India, 2nd Ed.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC023: ADAPTIVE SIGNAL PROCESSING

Objective: The objective of this course is to familiarize the students with to the advanced concepts of adaptive signal processing. The primary objective of this course is to understand the concept of adaptive signal processing and to be able to know details about adaptive signal processing. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit-I **(08Sessions)**
 Complex-Valued Adaptive Signal Processing: Optimization in the Complex Domain, Widely Linear Adaptive Filtering, Nonlinear Adaptive Filtering with Multilayer Perceptrons, Complex Independent Component Analysis for skill development.

Unit-II **(08Sessions)**
 Robust Estimation Techniques for Complex-Valued Random Vectors: Statistical Characterization of Complex Random Vectors, Complex Elliptically Symmetric (CES) Distributions, Tools to Compare Estimators, Scatter and PseudoScatter Matrices Array Processing Examples, MVDR Beamformers Based on M-Estimators for skill development.

Unit-III **(08Sessions)**
 Turbo Equalization: Communication Chain, Turbo Decoder: Overview, Forward-Backward Algorithm, Simplified Algorithm: Interference Canceler, Capacity Analysis, Blind Turbo Equalization, Convergence, Multichannel and Multiuser Settings for skill development.

Unit-IV **(08Sessions)**
 Subspace Tracking for Signal Processing: Linear Algebra Review, Observation Model and Problem Statement, Preliminary Example: Oja's Neuron, Subspace Tracking,, Eigenvectors Tracking, Convergence and Performance Analysis Issues for skill development.

Unit-V **(08Sessions)**
 Particle Filtering: The Basic Idea, The Choice of Proposal Distribution and Resampling, Some Particle Filtering Methods, Handling Constant Parameters, Rao-Blackwellization, Prediction, Smoothing for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

- CO1: To study international complex-valued adaptive signal processing for skill development.
- CO2: To understand the concept of robot estimation techniques for skill development.
- CO3: To understand the global concept of turbo equalization for skill development.
- CO4: To study and analyze subspace tracking for signal processing for skill development.
- CO5: To understand the concept of particle filtering for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1



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CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	3

Reference Books:

1. Tu'lay Adalı ,Simon Haykin," Adaptive Signal Processing", John Wiley & Sons

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC024: HIGH PERFORMANCE COMMUNICATION NETWORKS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of high performance communication networks. The primary objective of this course is to understand the concept of high performance communication networks and to be able to know details about high performance communication networks. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit-I (08Sessions)
Principles Of Networks, networking principles, Network services, High performance networks, Network elements, network mechanisms, layered architecture Packet Switched Networks Principles, OSI & TCP/IP models, transmission media, routing algorithms, Congestion control algorithms, Internetworking for skill development.

Unit-II (08Sessions)
Ethernet (IEEE 802.3), Tokenring (IEEE 802.5), Tokenbus (IEEE802.4), FDDI., Network security(cryptography, symmetric key algorithms, private key algorithms, digital signatures, authentication protocols) The Internet And TCP/IP Networks & Circuit Switched Networks for skill development.

Unit-III (08Sessions)
Overview of Internet protocols, Internet control protocols, Elements of transport Protocols, TCP & UDP, Performance of TCP/IP networks, SONET, DWDM, Solitons. Optical Networks fiber principles (elements of optical fiber communication, acceptance angle, Numerical aperture, modes, fiber types) for skill development.

Unit-IV (08Sessions)
Optical links (point to point links, attenuation, optical budgeting, dispersion),splices ,connectors optical Lans,non-Semiconductors, optical amplifiers, Erbium doped Fiber amplifiers, couplers/splitters, optical switches for skill development.

Unit-V (08Sessions)
ATM networks Main features of ATM, Addressing, and signaling, routing, ATM header structure for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study the principle of networking for skill development.

CO2: To understand the global concept of Ethernet, TCP/IP for skill development.

CO3: To understand the global concept of internet protocols for skill development.

CO4: To study and analyze optical links for skill development to compete with local, national, and international standards.

CO5: To understand the concept of ATM features for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. Gerd Keiser, MC Graw Hill International edition, optical fiber communication , third edition
2. John M Senior, PHI limited, optical fiber communication , third edition
3. Leon Gracia, Widjaja, " Communication Networks", Tata Mc Graw –Hill, New Delhi, 2000.
4. Behroz a. Forouzan, "Data communication and networking ", Tata MC Graw –Hill, New Delhi
5. Sumit Kasera, Pankaj Sethi, " ATM Networks", Tata Mc Graw- Hill, New Delhi , 2000

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC025: AUTOMOTIVE SOFTWARE ENGINEERING

Objective: The objective of this course is to familiarize the students with to the advanced concepts of automotive software. The primary objective of this course is to understand the concept of automotive software and to be able to know details about automotive software. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit-I **(08Sessions)**

Engine/Vehicle Sensors: Introduction, basic sensor arrangement, types of sensors, oxygen sensors, fuel metering/vehicle speed sensors, detonation sensor. Flow sensor. Throttle position sensors. Solenoids, stepper motors, and relays for skill development.

Unit-II **(08Sessions)**

Electronic Fuel Injection system: Introduction, feedback carburetor system (FBC), types of gasoline fuel injection system, Throttle body injection and multi-port of point fuel injection, injection system control. Robert Bosch gasoline fuel injection system controls .Fuel air ration sensing .Turbo charged engine fuel system. Electronic Ignition system: Advantages of electronic ignition system, principle of operation, high energy ignition distributors operation, simplified operational diagram for a distributor less ignition system, Electronic spark timing /control for skill development.

Unit-III **(08Sessions)**

Digital engine control system : Open loop and close loop control system, engine cooling and warm up control, Acceleration, detonation and idle speed control-integrated engine system, exhaust emission control engineering, on-board diagnostics, diagnostics, future automotive electronic systems, Warning and alarm instruments : Brake actuation warning system, traficators, flash system, oil pressure warning system, engine over heat warning system, air pressure warning system, speed warning system, door lock indicators, gear neutral indicator, horn design, permanent magnet horn, air & music horns for skill development.

Unit-IV **(08Sessions)**

Dash board amenities : Car radio and stereo, courtesy lamp, time piece, cigar lamp, car fan, wind shield wiper, window washer, instrument wiring system and electromagnetic interference suppression, wiring circuits for instruments, electronic instruments, dash board illumination for skill development.

Unit-V **(08Sessions)**

Comfort and safety : seats, mirrors and sun-roofs, central locking and electronic windows, cruise control, in-car multimedia, security, airbag and belt tensioners, other safety and comfort systems, advanced comfort and safety systems, New developments in comfort and safety The system approach to control & instrumentation, Antilock breaking system (ABS).Electronic Ride Microprocessor control for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study the international principle of engine sensors and there working for skill development.

CO2: To understand the global concept of electronic fuel injection system for skill development.

CO3: To understand the concept of digital engine control system for skill development.

CO4: To study and analyze dashboard amenities for skill development.

CO5: To understand the concept of control and safety of vehicles for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books :

1. Robert N. Brandy- Automotive Computers & Digital Instrumentation, Prentice Hall Eaglewood, Cliffs, NJ
2. Wiliam B. Ribbens- Understanding Automotive Electronics, Allied Publishers Pvt. Ltd., Chennai.
3. Tom Denton- Automobile Electrical & Electronic Systems, Allied Publishers Pvt. Ltd., Chennai.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC301: OPTICAL FIBER COMMUNICATIONS

Objective: The objective of this course is to expose the students to the basics of signal propagation through optical fibers, fiber impairments, components and devices and system design to incorporate skill, provide knowledge for employability.

Unit I

(09Sessions)

Review of Optical Fiber Communication:

Need of optical transmission, Fiber optic communication system, Advantage of OFC, Basic optical laws and transmission parameters to improve knowledge for employability. Geometrical optics description: Step Index Fiber & Graded Index Fiber, Mode Theory for optical propagation, Modes in planar wave, Phase & Group Velocity. **Signal Degradation in OFS:** Attenuation, Material Absorption, Scattering Loss, Bending Loss, Information Capacity Determination, Group Delay, Material Dispersion, Waveguide Dispersion, Higher order Dispersion, Polarization Mode Dispersion.

Unit II

(07Sessions)

Optical Transmitter: Basic Concept: Emission and absorption Rates, p-n junctions, Non-radiative recombination, semiconductor materials, LED: Power current relationship, LED spectrum, LASER Diodes, ILD & its characteristics to improve knowledge for employability, Optical Gain, Feedback and Laser threshold.

Optical Receivers: Optical detection principles & devices, Detection response time, p-i-n photo-diode, Avalanche photodiode, Receiver operation: Digital Transmission, Error sources, Receiver configuration, Digital receiver performance, Probability of error, the quantum limit.

Unit III

(07Sessions)

Digital and Analog Transmission System: Point to point links to inculcate skill: System consideration, Link power budget, Rise time budget, First generation distance, Transmission distance for single mode fiber. Line coding: NRZ codes, RZ codes, error correction, noise effects on system performance, Overview of Analog links, carrier to noise ratio.

Unit IV

(06Sessions)

Optical Amplifier: Basic application and types of optical amplifiers to gain knowledge for better employability, Semiconductor optical amplifiers, Erbium doped fiber amplifiers: architecture and types, Amplifier-noise, Raman Amplifier, wavelength converters.

Unit V

(08Sessions)

Optical Networks: Basic Networks for better skilling of entrepreneurship, SONET/SDH networks, Operational principle of WDM networks, Nonlinear effects on network performance, Performance of WDM+EDFA system, Solitons, Optical CDMA & TDMA, Optical Switches/Cross Connect, Add/Drop Mux.

Course outcomes:

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

CO1: Distinguish Step Index, Graded index fibers and compute mode volume for skill development.

CO2: Explain the international Transmission Characteristics of fiber and Manufacturing techniques of fiber/cable for employability.

CO3: Classify the construction and characteristics of optical sources and detectors for skill development to compete with local, national, and international standards.



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CO4: Discuss splicing techniques, passive optical components and explain noise in optical system for employability .

CO5: Design short haul and long-haul Analog/ Digital optical communication system and explain advanced optical transmission systems for skill development and entrepreneurship.

PO-CO Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	2	2	1	3	1	2	1	1	1
CO2	1	1	1	3	1	2	1	1	1
CO3	1	1	1	3	1	2	1	1	1
CO4	1	1	1	3	1	2	1	1	1
CO5	1	1	1	3	1	2	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	2	3	1
CO2	2	3	1
CO3	2	3	1
CO4	2	3	1
CO5	2	3	2

Reference books:

1. Fiber-optic communication system, Govind P. Agrawal 3RD Edition, Wiley Publication.
2. Optical Fiber Communications by Gerdkeiser, 3RD edition, Mc. Graw Hill.
3. Optical Fiber communications, John M Senior, 4th Edition, PHI India.
4. Optical Networks, Black, Pearson education

Website Sources:

1. <https://www.stephouse.net/2015/07/compare-fiber-vs-wireless-services/>
2. https://www.rp-photonics.com/fiber_optic_links.html
3. <https://www.ofsoptics.com/>

Note: Adhere to latest edition of the suggested readings.



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TMEC030: NEURAL NETWORK AND FUZZY LOGIC

Objective: The objective of this course is to familiarize the student with the concept of neural network that traces biological functions of human beings to create a system that work as humans for skill development.

Unit I

(08Sessions)

Fundamentals of Neural Networks: Introduction, Biological Neurons and Memory, Structure & Function of a single Neuron, Artificial Neural Networks (ANN). Typical Application of ANN - Classification, Clustering, Pattern Recognition, Function Approximation. Basic approach of the working of ANN –Training, Learning and Generalisation for skill development.

Unit II

(08Sessions)

Supervised Learning: Learning Processes, Single-layer Networks, Linear Separability, handling linearly non-separable sets. Training algorithm. Error correction & gradient decent rules. Multi-layer network- Architecture, Back Propagation Algorithm (BPA) – Various parameters and their selection, Applications, Feed-forward Network, Radial- Basis Function (RBF) network & its learning strategies for skill development, employability and entrepreneurship development.

Unit III

(08Sessions)

Unsupervised Learning: Winner-takes all Networks, Hamming Networks. Adaptive Resonance Theory, Kohonen's Self-organising Maps for skill development, employability and entrepreneurship development.

Unit IV

(08Sessions)

Neuro-dynamical models: Stability of Equilibrium states, Hopfield Network, Brain-state-in-a-Box network, Bidirectional associative memories for skill development, employability.

Unit V

(08Sessions)

Fuzzy Logic: Basic concepts of Fuzzy Logic, Fuzzy Vs. Crisp set Linguistic variables, membership functions, operations of fuzzy sets, Crisp relations, Fuzzy relations, Approximate reasoning, fuzzy IF-THEN rules, variable inference, techniques, defuzzification techniques, Fuzzy rule based systems. Applications of fuzzy logic for skill development, employability and entrepreneurship development.

Course Outcome:

Students completing this course will be able to:

CO1: Analyze the working process of networks that help machines perform dedicated tasks for skill development.

CO2: Understand the global concept of artificial intelligence for skill development and employability.

CO3: Understand the concept of recursive learning of machines for skill development, employability and entrepreneurship development.

CO4: Analyze the key points of neural network working methodology for skill development and employability to compete with local, national, and international standards.

CO5: Analyze the application of fuzzy logic control to real time systems for skill development, employability and entrepreneurship development.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	2	1	1	1	1	1	1	1
CO2	1	1	3	1	1	1	1	1	1
CO3	2	1	1	1	1	1	1	1	1
CO4	2	1	1	1	1	2	1	1	1
CO5	1	1	2	1	1	1	1	1	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	1	2	1
CO2	2	1	1
CO3	1	2	1
CO4	2	1	1
CO5	1	3	2

Reference books:

1. Satish Kumar – Neural Network: A classroom approach, TMH
2. Simon Haykin- Artificial Neural Network, PHI India
3. Hagan, Demuth & Beale – Neural Network Design.
4. T. J. Ross – Fuzzy logic with engineering applications

Website Sources:

1. www.nptel.ac.in
2. www.gradeup.in
3. en.wikipedia.org
4. www.ainetworks.in

Note: Latest edition of the suggested readings must be used.



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TMEC031: OPTICAL NETWORKS

Objective: The objective of this course is to familiarize the students with the optical fiber technology provide better connectivity in short span of time for the end user for skill development, employability and entrepreneurship development.

UNIT I **(08Sessions)**

Introduction to Optical Networks: Principles and Challenges and its Generation, Characteristics of Optical Fibre in nonlinear region ,Optical Packet Switching, Transmission Basics, Multiplexers & Filters for skill development.

Unit II **(08Sessions)**

Optical Amplifiers: Tun-able Lasers, Switches, Wavelength Converters. Sub-Carrier Modulation and Multiplexing, Spectral efficiency, Crosstalk, Introduction of Soliton systems for skill development and employability.

Unit III **(08Sessions)**

SONET/SDH: Multiplexing, SONET/ SDH Layers, Frame Structure, Physical Layer, Elements of a SONET/SDH Infrastructure, Ethernet. Optical Transport Network, Generic framing Procedure, IP routing and forwarding and QOS. WDM Network Elements Optical Line Terminals, Optical Line Amplifiers, Optical Add/ Drop Multiplexers, Optical Cross Connects for skill development, employability.

Unit IV **(08Sessions)**

WDM Network Design Cost Trade-offs: Light path Topology Design, and Routing and wavelength assignment problems, Dimensioning Wavelength Routing Networks, Network Survivability Basic Concepts, Protection in SONET/SDH, Protection in client layer, Optical Layer Protection, Different Schemes, Interworking between Layers Access Networks Network Architecture Overview, Enhanced HFC, FTTC, PON evolution for skill development, employability.

Unit V **(08Sessions)**

Optical Switching: OTDM, Synchronization, Header Processing, Buffering, Burst Switching. Deployment Considerations- SONET/SDH core Network for skill development, employability and entrepreneurship development.

Course Outcomes:

Students completing this course will be able to:

CO1: Formulate international optical communication networks for skill development.

CO2: Solve optical communication networks related problems using efficient technical approaches for skill development and employability.

CO3: Applications of modern solid state physics results into solid state electronics for skill development, employability and entrepreneurship development.

CO4: Design optical networks as well as to interpret statistical and physical data for skill development and employability to compete with local, national, and international standards.

CO5: Familiar with Design considerations of fiber optic systems for skill development, employability and entrepreneurship development.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	2	1	1	1	1	1	1	1
CO2	1	1	1	1	1	2	1	1	1
CO3	3	1	1	1	1	1	1	1	1
CO4	2	1	1	1	1	1	1	1	1
CO5	1	1	2	1	1	1	1	1	1

CO-Curriculum Enrichment Mapping (Please \checkmark wherever required)

	Skill Development	Employability	Entrepreneurship Development
CO1	1	2	1
CO2	2	1	1
CO3	3	1	2
CO4	3	1	1
CO5	2	2	1

Reference books:

- 1.R. Ramaswami, & K. N. Sivarajan, "Optical Networks a Practical perspective", Morgan Kaufmann Publishers, 3rd Ed.
2. U. Black, "Optical Networks: Third Generation Transport Systems"/ PearsonEducations
3. Biswanath Mukherjee "Optical WDM Networks" Springer Pub2006.

Website Sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.gradeup.in
4. www.networks.in

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TMEC032: PLCs AND SCADA

Objective: The objective of this course is to familiarize the students with to the advanced concepts of PLC's and SCADA. The primary objective of this course is to understand the concept of PLC's and SCADA and to be able to know details about PLC's and SCADA. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

Introduction to automation: Brief Description of a Control System, Micro Controller, PID Controller, PLC Controller, History & Need of Industrial Automation, Application of Industrial Automation, Basic Components of Automation, and Hardware Classification of Automation for skill development.

Unit II

(08Sessions)

PLC Introduction: Fundamental Control Concepts, PLC System, CPU-Architecture, Programmers and Monitors, PLC Input and Output Modules-Analog and Digital, power Supply of PLCs, Internal Timers, Counters, and Flags. Criteria for Selection of PLC, PLC vs. PC. Memory requirements for skill development.

Unit III

(08Sessions)

SCADA: Architecture, Potential benefits of SCADA. Introduction to SCADA software (RS VIEW-32)Project Creation, Alarming, Data Logging, Trending, Object keys, Derived Tags Event Generation, Macros, Object Linking & Embedding, Security, PLC based SCADA Systems for skill development.

Unit IV

(08Sessions)

Programming Procedures: Different programming formats like ladder diagram, statement list, Boolean etc. Programming based on ladder diagrams using relay, timers counters sequencers, data transfer, comparison, arithmetic, logical instructions & software flags, Programming equipments like computer, hand-held programmer, on-board programming, Human machine interface, Program Scanning, Proximity Sensors and their connection to PLC, PLC as PID Controller for skill development.

Unit V

(08Sessions)

NETWORKING: Networking of PLCs, Types of Networking, and Cell control by PLCs for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study various global automation and control system techniques for skill development.

CO2: To understand the concept of international PLC, CPU architecture, programmers for skill development.

CO3: To understand the concept of SCADA for skill development.

CO4: To study the programming procedures for skill development.

CO5: To understand the concept of networking for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1



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CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Introduction to Programmable Logic Controllers by Gray Dunmig, Boston, Delmar
2. Manuals on PLCs by Siemens/Allen Bradley
3. Programing Logic Controllers by Hackworth and Hackworth Jt.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC033: SPEECH PROCESSING

Objective: The objective of this course is to familiarize the students with to the advanced concepts of speech processing. The primary objective of this course is to understand the concept of speech processing and to be able to know details about speech processing. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

Introduction to Digital Speech Processing: The Speech Signal, Speech Stack, Fundamentals of Human Speech Production: Introduction, The Process of Speech Production, Short-Time Fourier Representation of Speech, Acoustic Phonetics, Auditory perception: psycho acoustics for skill development.

Unit II

(08Sessions)

Time Domain Methods for Speech Processing: Time domain parameters of Speech signal – Methods for extracting the parameters Energy, Average Magnitude, Zero crossing Rate – Silence Discrimination using ZCR and energy – Short Time Auto Correlation Function – Pitch period estimation using Auto Correlation Function for skill development.

Unit III

(08Sessions)

Frequency Domain Method for Speech Processing: Short Time Fourier analysis: Fourier transform and linear filtering interpretations, Sampling rates - Spectrographic displays - Pitch and formant extraction - Analysis by Synthesis - Analysis synthesis systems: Phase vocoder, Channel Vocoder - Homomorphic speech analysis: Cepstral analysis of Speech, Formant and Pitch Estimation, Homomorphic Vocoders for skill development.

Unit IV

(08Sessions)

Linear Predictive Analysis of Speech: Basic Principles of linear predictive analysis – Auto correlation method – Covariance method – Solution of LPC equations – Cholesky method – Durbin's Recursive algorithm – Application of LPC parameters – Pitch detection using LPC parameters – Formant analysis – VELP – CELP for skill development.

Unit V

(08Sessions)

Application of Speech & Audio Signal Processing: Algorithms: Dynamic time warping, K-means clustering and Vector quantization, Gaussian mixture modeling, hidden Markov modeling - Automatic Speech Recognition: Feature Extraction for ASR, Deterministic sequence recognition, Statistical Sequence recognition, Language models - Speaker identification and verification – Voice response system – Speech synthesis: basics of articulatory, source-filter, and concatenative synthesis – VOIP for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study digital speech processing for skill development to compete with local, national, and international standards.

CO2: To understand the concept of time domain methods for speech processing for skill development.

CO3: To understand the global concept of frequency domain methods for speech processing for skill development.

CO4: To study Linear Predictive Analysis of Speech for skill development.



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CO5: To understand the concept of Application of Speech & Audio Signal Processing for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. L. R. Rabiner and R. W. Schaffer, "Digital Processing of Speech signals", Prentice Hall, 1978.
2. Ben Gold and Nelson Morgan, "Speech and Audio Signal Processing", John Wiley and Sons Inc., Singapore, 2004.
3. Quatieri, "Discrete-time Speech Signal Processing", Prentice Hall, 2001.
4. L.R. Rabiner and B. H. Juang, "Fundamentals of speech recognition", Prentice Hall,

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC034: DIGITAL IMAGE PROCESSING AND ANALYSIS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of digital image processing and analysis. The primary objective of this course is to understand the concept of digital image processing and analysis and to be able to know details about digital image processing and analysis. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

Introduction: Fundamental concept of digital image processing, component of image processing system, image acquisition. Basic Image Fundamentals: Pixels, sampling, quantization, resolution, representation as a matrix, operation, camera angles and perspective transformation for skill development.

Unit II

(08Sessions)

Image Enhancement: Concept of Spatial Domain and Frequency domain enhancement, Basic Gray Level Transformation, Histogram Processing, Enhancement using Arithmetic/logic Operations, Subtraction, Averaging, Basics of Spatial Filtering for skill development.

Unit III

(08Sessions)

Image Restoration: Model of the image Degradation/Restoration Process, Noise Models, Restoration in the presence of Noise, point spread function Different point spread functions, Blurring, Deblurring Algorithm for skill development.

Unit IV

(08Sessions)

Color Image Processing: Color Fundamentals, Color Models, Basics of Full-Color image processing, Color Transformations. Image Compression: Coding redundancy, Interpixel redundancy, Psycho visual redundancy, Huffman Coding, Arithmetic coding, Lossy compression techniques, JPEG Compression for skill development.

Unit V

(08Sessions)

Image Segmentation & Representation: Point, Line and Edge Detection, Thresholding, Edge and Boundary linking, Hough transforms, Region Based Segmentation, Boundary representation, Boundary Descriptors, Regional Descriptors for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of international digital image processing for skill development.

CO2: To understand the global concept Image Enhancement for skill development.

CO3: To understand the concept Image Restoration for skill development.

CO4: To study Color Image Processing for skill development.

CO5: To understand the concept of Image Segmentation & Representation for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Digital Image processing by R.C. Gonzalez and R.F.Woods (Pearson Education)
2. Algorithms for image Processing and Computer Vision by James R.Parker
3. Fundamentals of Digital Image Processing by A.K Jain
4. The Image Processing Handbook, Fourth Edition by John C. Ruses
5. Digital Image Processing by W.K.Pratt
6. Digital Image Processing using MATLAB by Woods & Gonzalez (Pearson Education)

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC035: CRYPTOGRAPHY & NETWORK SECURITY

Objective: The objective of this course is to familiarize the students with to the advanced concepts of cryptography and network security. The primary objective of this course is to understand the concept of cryptography and network security and to be able to know details about cryptography and network security. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

Introduction: Network and computer security issues. Security attacks, Security Services, and Security Mechanisms. Network security models. Symmetric Key Cryptography: Substitution and Transposition techniques. Block cipher principles. Data Encryption Standard (DES), Triple DES. Block cipher modes of operation. Stream cipher structure and RC4 algorithm. Confidentiality using symmetric key encryption. Symmetric key distribution. Asymmetric Key Cryptography: Prime numbers overview. Fermat's and Euler's theorems. Principles of public key cryptosystems. RSA algorithm. Distribution of public keys. Diffie-Hellman key exchange for skill development.

Unit II

(08Sessions)

Message Authentication: Authentication requirements and functions. Message Authentication Code. Hash functions. Hash and MAC algorithms: MD5, Secure Hash Algorithm (SHA) and HMAC. Digital Signatures and Authentication: Digital Signatures. Authentication protocols. Digital Signature Standard. Authentication Applications: Kerberos for skill development.

Unit III

(08Sessions)

Email Security: Pretty Good Privacy (PGP) operation. S/MIME specifications and functionality. **IP Security:** Architecture, Authentication Header, Encapsulating Payload, Security Associations, Key Management for skill development.

Unit IV

(08Sessions)

Web Security: Secure Socket Layer. Transport Layer Security. Secure Electronic Transaction, Intrusion Defense Mechanisms: Intrusion Detection techniques for skill development.

Unit V

(08Sessions)

Malicious Software: Viruses and related threats. Virus countermeasures. Distributed Denial of Service Attacks.

Firewalls: Design Principles, Characteristics, Types of Firewalls, Firewall Configuration. Trusted System for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study Network and computer security issues for skill development.

CO2: To understand the concept of Message Authentication for skill development.

CO3: To understand the concept of national and international Email Security for skill development.

CO4: To study measurement of global Web Security for skill development.

CO5: To understand the concept of Malicious Software for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Stallings, Willam ; "Cryptography and Network Security-Principles and Practices", 4th edition. Pearson Education, PHI.
2. Kahate, Atul, "Cryptography and Network Security", 2nd Edition, TMH
3. Tanenbaum, A.S. ; "Computer Networks", 4th Edition, Pearson Education
4. Forouzan, B.A. ; "Cryptography and Network Security", McGraw-Hill.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC036: BIO INFORMATICS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of bio informatics. The primary objective of this course is to understand the concept of bio informatics and to be able to know details about bio informatics. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

The NCBI Data Model: Introduction, PUBs: Publication of perish, SEQ-Ids: What's in a Name? BIOSEQs: Sequences, BIOSEQ-SETs: Collection of Sequences, SEQ-ANNOT: Annotating the sequence, SEQ-DESCR: Describing the sequence, using the Model. **The GenBank Sequence Database:** Introduction, primary and secondary Databases, Format Vs Content: Computers Vs Humans, The Database, The Genbank Flatfile: A Dissection for skill development.

Unit II

(08Sessions)

Submitting DNA Sequences to the Databases: Introduction: Why, Where and What to submit?, DNA/RNA, Population, phylogenetic and Mutation Studies, Protein- only submissions, How to submit on the World Wide Web, how to submit with Sequin updates, Consequences of the data model, EST/STS/GSS/HTG/SNP and Genome Centers for skill development.

Unit III

(08Sessions)

Structure Databases: Introduction to Structures, PDB: Protein data bank at the research collaboratory for structural file formats, Visualizing structural information, Database structure viewers, advanced structure modeling, Structures similarity searching. Interplay of mapping and sequencing Genomic map elements, Types of maps complexities and pitfalls of mapping for skill development.

Unit IV

(08Sessions)

Sequence Alignment and Database Searching: Introduction, The evolutionary basis of sequence alignment, The modular nature of proteins, optimal alignment methods, Substitution scores and gap penalties Statistical significance of alignments, Database similarity searching, FASTA, BLAST, Database searching artifacts, Position –Specific scoring matrices, Spliced alignments for skill development.

Unit V

(08Sessions)

Expressed Sequence Tags (ESTs): What is EST? EST Clustering, TIGR Gene Indices, STACK, ESTs and Gene Discovery, The human Gene Map, Gene prediction in Genomic DNA, ESTs and Sequence Polymorphisms, Assessing levels of Gene expression using ESTs for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study international NCBI Data Model for skill development.

CO2: To understand the concept of global DNA Sequences to the Databases for skill development.

CO3: To understand the concept of Structure Databases for skill development.

CO4: To study Sequence Alignment and Database Searching for skill development.

CO5: To understand the concept of Expressed Sequence Tags (ESTs) for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. R. Durbin, S. Eddy, A. Krogh and Mitchison, "Biological Sequence Analysis: Probabilistic models of proteins and nuclei acids"
2. David W. Mount, "Bioinformatics: Sequence & Genome Analysis."

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC037: NANO ELECTRONICS DEVICES ENGINEERING

Objective: The objective of this course is to familiarize the students with to the advanced concepts of nano electronic devices. The primary objective of this course is to understand the concept of nano electronic devices and to be able to know details about nano electronic devices. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I **(08Sessions)**

Materials for Nano-Electronics: Crystal lattices, bonding in Crystals, Electron energy bands, Semiconductor: Si, Si-Ge, Hetrostructures. Strained Si, III-V Semiconductors, Carbon- Nano- tube, Silicon nanowires for skill development.

Unit II **(08Sessions)**

Properties of Individual Nanoparticles: Introduction to semi conducting Nanoparticles, introduction to quantum Dots, wells, wires, preparation of quantum nanostructures, Introduction to carbon nano tubes, Fabrication , Structure, Electrical properties, vibrational properties, Mechanical properties for skill development.

Unit III **(08Sessions)**

Bio-logical Materials: Biological building blocks-polypeptide, nucleic acids- DNA, Biological nanostructure, Biological methods for Nano scale fabrication for skill development.

Unit IV **(08Sessions)**

Tools: TEM, Infrared and Raman Spectroscopy, Photoemission and X-RAY spectroscopy, Electron microscopy, SPMs, AFMs, Electrostatic force microscopy, Magnetic force microscopy for skill development.

Unit V **(08Sessions)**

Nano-scale Devices: Introduction, Nanoscale MOSFET-Planer and non-planer, Resonant-tunneling diodes, Single electron transistor, Quantum-dot Nano-electromechanical systems, Molecular/Bio molecular electron devices for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study Materials for Nano-Electronics for skill development.

CO2: To understand the global concept Properties of Individual Nanoparticles for skill development.

CO3: To understand the concept of Bio-logical Materials for skill development.

CO4: To study measurement of TEM, Infrared and Raman Spectroscopy for skill development to compete with national, and international standards.

CO5: To understand the concept of Nano-scale Devices for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1



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CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. C.P.Polle and F.J.Owens, "Introduction to Nanotechnology", John Wiley & Sons, 2003.
2. M.A.Rather & D.Rather, "Nano-technology: a gentle introduction to the next big idea", Prentice Hall, 2003.
3. "Nanometer Structures: Theory, Modeling and Simulation", Editor: Akhlesh Lakhtakia, ASME Press, 2004.
4. S.E.Lyshevski, "Nano and Micro-electromechanical systems fundamentals of nano and micro-engineering", 2nd Edition, CRC Press, 2004.
5. K.E. Drexler, Nano-Systems, Wiley (1992)
6. Waser Ranier, Nano-Electronics & Information Technology, Wiley (2003)

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

Note: Latest editions of all the suggested readings must be used.



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TMEC038: ADVANCED EMBEDDED SYSTEMS DESIGN

Objective: The objective of this course is to familiarize the students with to the advanced concepts of advanced embedded system design. The primary objective of this course is to understand the concept of advanced embedded system design and to be able to know details about advanced embedded system design. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I **(08Sessions)**

Introduction to Embedded System: Their classification & characteristics, Concepts and Processes of system level design of embedded system for skill development.

Unit II **(08Sessions)**

Microcontrollers: Introduction to microcontrollers, Memory , Buses, Direct Memory Access , Interrupts, Microprocessor Architecture, Interrupt Basic, Shared Data Problems, Interrupt Latency, PIC 16F8XX Flash Microcontrollers, CPU architecture, Register file structure, Instruction Set, Programs, Timers and Interrupts, Interrupt Service Routine , Features of Interrupts, Interrupt vector & Priority, Timing Generation & Measurements, Interfacing Methods, I/O Interface, LCD interfacing, Seven segment interfacing, I2 C Bus, DAC, ADC, UART for skill development.

Unit III **(08Sessions)**

Program Modeling Concepts in Single and multiprocessor system Software-Development Process: Modeling Processes for software Analysis before software implementation, Program model for event controlled, Modeling of Multiprocessor Systems for skill development.

Unit IV **(08Sessions)**

Embedded Core Based Design: System -on -Chip, Application specific Integrated circuit, Overview of Embedded Processors like ARM, MIPS and Intel MMX series, Architecture, Organization and instruction set, Memory management, High level logic synthesis. Data parallel issues e.g SIMD, MIMD, MISD, SISD for skill development.

Unit V **(08Sessions)**

Real Time programming and Operating System (RTOS) RTOS Overview, Basics of RT- Linux as a RTOS, Assembly language, C++ for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of international Embedded System for skill development.

CO2: To understand the concept of Microcontrollers for skill development.

CO3: To understand the concept of Software-Development Process for skill development.

CO4: To study measurement of Embedded Core Based Design for skill development to compete with national, and international standards.

CO5: To understand the concept of Real Time programming and Operating System for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. Microcontrollers (Theory and Applications)- Ajay V. Deshmukh
2. An Embedded System Primer, by David E. Simon
3. Embedded system Design by Steve Heath
4. PIC Microcontroller by John B. Peatman
5. ARM system architecture by Steve Furber(Addison Wesley)
6. Programming Embedded System in C/C++ by M.Barr
7. Real Time Systems by H. Kopetz
8. Embedded Systems- Raj Kamal

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC039: ROBOTICS AUTOMATION

Objective: To provide comprehensive knowledge of robotics in the design, analysis and control point of view for skill development and employability.

UNIT I **(08Sessions)**

BASIC CONCEPTS

Definition and origin of robotics – different types of robotics – various generations of robots – degrees of freedom – Asimov’s laws of robotics – dynamic stabilization of robots for skill development.

UNIT II **(08Sessions)**

POWER SOURCES AND SENSORS

Hydraulic, pneumatic and electric drives – determination of HP of motor and gearing ratio – variable speed arrangements – path determination – micro machines in robotics – machine vision – ranging – laser – acoustic – magnetic, fibre optic and tactile sensors for skill development.

UNIT III **(08Sessions)**

MANIPULATORS, ACTUATORS AND GRIPPERS

Construction of manipulators – manipulator dynamics and force control – electronic and pneumatic manipulator control circuits – end effectors – U various types of grippers – design considerations for skill development.

UNIT IV **(08Sessions)**

KINEMATICS AND PATH PLANNING

Solution of inverse kinematics problem – multiple solution jacobian work envelop – hill climbing techniques – robot programming languages for skill development.

UNIT V **(08Sessions)**

CASE STUDIES

Multiple robots – machine interface – robots in manufacturing and non- manufacturing applications – robot cell design – selection of robot for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study the various parts of robots and fields of robotics for skill development.

CO2: To study the various kinematics and inverse kinematics of robots for skill development.

CO3: To study the Euler, Lagrangian formulation of Robot dynamics for skill development.

CO4: To study the trajectory planning for robot for skill development to compete with local, national, and international standards.

CO5: To study the control of robots for some specific national and international applications for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1



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CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Mikell P. Weiss G.M., Nagel R.N., Odraj N.G., Industrial Robotics, McGraw-Hill Singapore, 1996.
2. Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers, Chennai, 1998.
3. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
4. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
5. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
6. McKerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
7. Issac Asimov I Robot, Ballantine Books, New York, 1986.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC040: AUTOMOTIVE TRANSMISSION

Objective: To impart basic knowledge to students with respect to transmission system of automobiles and impart knowledge that will enable the student to understand the latest developments in the field. This will help students to enhance their skills and employability.

UNIT – I **(08Sessions)**

Gear Box: method of calculation of gear ratios for vehicles, performance characteristics in different speeds, different types of gear boxes, speed synchronizing devices, gear materials, lubrication. Fluid coupling: advantages and limitations, construction details, torque capacity, slip in fluid coupling, performance characteristics. Means used to reduce drag torque in fluid coupling for skill development.

UNIT – II **(08Sessions)**

All spur and internal gear type planetary gearboxes, Ford T-model, Cotal and Wilson Gear box, determination of gear ratios, automatic overdrives for skill development.

UNIT – III **(08Sessions)**

Principal of torque conversion, single, multi stage and polyphase torque converters, performance characteristics, constructional and operational details of typical hydraulic transmission drives (e.g.) Leyland, White Hydro torque drives for skill development.

UNIT – IV **(08Sessions)**

Automatic transmission: relative merits and demerits when compared to conventional transmission, automatic control of gears, study of typical automatic transmissions, Ford and Chevrolet drive, automatic control of gear box for skill development.

UNIT – V **(08Sessions)**

Hydrostatic drives: advantages and disadvantages, principles of hydrostatic drive systems, construction and working of typical hydrostatic drives, Janney Hydrostatic drive. Electrical drives: advantages and limitations, principles of Ward Leonard system of control Modern electric drive for buses and performance characteristics for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of global gear box system for skill development.

CO2: To understand the concept of different type of spurs and internal parts for skill development.

CO3: To understand the concept of torque conversion Process for skill development.

CO4: To study the types of automatic transmission for skill development to compete with national, and international standards.

CO5: To understand the concept of hydrostatic drive, electrical drives for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1



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CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. Heldt P.M - Torque converters- Chilton Book Co.-1992
2. Newton and Steeds - Motor Vehicle- Illiff Publisher- 2000
3. Design Practices, passenger Car Automotive Transmissions- SAE Hand book- 1994.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC041: CHASSIS AND BODY ELECTRONICS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of chassis and body electronics. The primary objective of this course is to understand the concept of chassis and body electronics and to be able to know details about chassis and body electronics. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit-I

(08Sessions)

Introduction to Chassis System: Introduction: Requirements of an automobile with types of automobiles, layout of an automobile with reference to power plant, power required for propulsion, various resistances to motion of the automobile. Frames: Types of frames, materials, calculation of stresses on sections, constructional details, loading points, testing of frames. Wheels and tyres: Types of wheels, construction. Structure and function of tyres for skill development.

Unit-II

(08Sessions)

Steering systems: Types of steering gears, front axle. Under steer and over steer, wheel alignment, power steering, steering geometry, wheel balancing, centre point steering, steer ability for skill development.

Unit-III

(08Sessions)

Brakes: Necessity of brake, stopping distance and time. Brake efficiency, weight transfer, brake shoe theory, determination of braking torque, braking systems -mechanical, hydraulic, disc, parking and emergency brakes, servo and electrical brakes, details of hydraulic system, mechanical system and components. Types of master cylinders, factors influencing operation of brakes such as operating temperature, lining, brake clearance, pedal pressure, linkages etc for skill development.

Unit-IV

(08Sessions)

Suspension: Types of suspension, leaf springs, materials, independent suspension, torsion bar, air bellows or pneumatic, suspension, hydraulic suspension, constructional details of telescopic shock absorbers, types, vibrations and riding comfort, roleaxis of spring suspension for skill development.

Unit-V

(08Sessions)

Wheel Mounting: Front Wheel Mounting, Rear Wheel Mounting, engine mounting, various types of springs used in suspension system. Requirements and various types, Material. Testing: Testing procedures, types of tests and chassis components, equipment for lab and road tests, preparation of test reports. Classification of two and three wheelers, construction details, construction details of frames and forks, suspension systems and shock absorbers, different arrangement of cylinders. Carburetion system and operation for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of chassis system for skill development to compete with local, national, and international standards.

CO2: To understand the concept of steering systems for skill development.

CO3: To understand the global concept of brake, linkages for skill development.

CO4: To study the types of suspension for skill development.

CO5: To understand the concept of wheel mounting and classification of vehicles for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. Automotive chassis and body -P. L. Kohli, TMH
2. Automobile engineering –Sudhirkumar –university science press
3. Introduction to automobile engineering -N.R. Khatawate.Khanna pub.
4. Automotive mechanics -Joseph I heintner. Affiliated East West Press
5. Problems in Automobile Engineering -N.K.Giri, Khanna Pub
6. Automotive Chassis -P.M. Heldt, Chilton & Co.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC042: VEHICLE BODY ENGINEERING & SAFETY

Objective: At the end of the course, the students will be able to have a sound knowledge for the design of the vehicles body to give maximum comfort for the passengers and exposed to the methods of stream lining the vehicles body to minimize drag. This course will help students for their skill development and employability.

UNIT-I

(08Sessions)

CAR BODY DETAILS: Types: saloon, convertibles, limousine, estate car, racing and sports car. Visibility: regulations, driver's visibility, tests for visibility, methods of improving visibility and space incars. Safety: safety design, safety equipment's for cars. Car body construction; design criteria, prototype making, initial tests, crash tests on full scale model, Dummies and Instrumentation for skill development.

UNIT-II

(08Sessions)

VEHICLE AERODYNAMICS: Objectives. Vehicle drag and types; various types of forces and moments, effects of forces and moments, side wind effects on forces and moments, Various body optimization techniques for minimum drag, wind tunnel testing: flow visualization techniques, scale model testing, component balance to measure forces and moments for skill development.

UNIT- III

(08Sessions)

BUS BODY DETAILS: Types: mini bus, single decker, double-decker, two level and articulated bus. Bus body layout; floor height, engine location, entrance and exit location, seating dimensions. Constructional details: frame construction, double skin construction, types of metal sections used, Regulations, Conventional and integral type construction for skill development.

UNIT-IV

(08Sessions)

COMMERCIAL VEHICLE DETAILS: Types of body; flat platform, drop side, fixed side, tipper body, tanker body, Light commercial vehicle body types. Dimensions of driver's seat relation to controls. Drivers cab design for skill development.

UNIT -V

(08Sessions)

BODY MATERIALS, TRIM AND MECHANISMS: Sheet, timber, plastic, GRP, properties of materials; Corrosion, anticorrosion methods. Selection of paint and painting process. Body trim items. Body mechanisms for skill development and employability.

SAFETY DESIGN AND CONCEPTS: Design of the body for safety, engine location, deceleration of vehicle inside passenger compartment, deceleration on impact with stationary and movable obstacle, concept of crumple zone, safety sandwich construction. Active safety: driving safety, conditional safety, perceptibility safety, operating safety- passive safety: exterior safety, interior safety, deformation behaviour of vehicle body, speed and acceleration characteristics of passenger compartment on impact.

Course Outcomes:

Students completing this course will be able to:

CO1: To study global basics of car body details for skill development.

CO2: To understand the concept of car aerodynamics for skill development.

CO3: To understand the concept of bus body details for skill development.

CO4: To study the types of body materials, trim and mechanism for skill development.

CO5: To understand the international concept of safety design for skill development and employability.

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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. J. Powloski - "Vehicle Body Engineering" - Business Books Ltd, London -1989
2. Giles. J.C. - "Body construction and design" - Liiffe Books Butterworth & Co. - 1971.
3. John Fenton - "Vehicle Body layout and analysis" - Mechanical Engg. Publication Ltd., London - 1982.
4. Braithwaite. J.B. - "Vehicle Body building and drawing" - Heinemann Educational Books Ltd., London - 1977.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundry.co.in

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TMEC043: HYBRID ELECTRIC VEHICLES

Objective: The objective of this course is to familiarize the students with to the advanced concepts of hybrid electric vehicles. The primary objective of this course is to understand the concept of hybrid electric vehicles and to be able to know details about hybrid electric vehicles. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit 1

(08Sessions)

Introduction to Hybrid Electric Vehicles: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies.

Conventional Vehicles: General Description of Vehicle Movement, Vehicle Resistance, Dynamic Equation, Tire-Ground Adhesion and Maximum Tractive Effort, Power Train Tractive Effort and Vehicle Speed Vehicle Power Plant and Transmission Characteristics and Vehicle Performance for skill development.

Unit 2:

(08Sessions)

Hybrid Electric Drive-trains: Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis.

Electric Drive-trains: Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis for skill development.

Unit 3:

(08Sessions)

Electric Propulsion unit: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency for skill development.

Unit 4:

(08Sessions)

Energy Storage: Batteries in Electric and Hybrid Vehicles, Battery Basics and Parameters, Electrochemical Cell Fundamentals - electrochemical reactions, thermodynamic voltage, specific energy, specific power, energy efficiency, Traction Batteries - lead acid batteries, nickel-based batteries, lithium-based batteries, Ultra-capacitors, Ultrahigh-Speed Flywheels and Hybridization of Energy Storages for skill development.

Unit 5:

(08Sessions)

Alternative and Novel Energy Sources and Stores: Solar Photovoltaic, Flywheels, and Fuel Cells - Hydrogen Fuel Cells, Fuel Cell Thermodynamics, Hydrogen storage system for skill development and employability.

Case Studies:

1. Power Electronics Converters: DC-DC Converters.
2. Rechargeable Battery Vehicles: Electric bicycles, Electric mobility aids, Low speed vehicles, Battery powered cars and vans.
3. Hybrid Vehicles: The Honda Insight, The Toyota Prius.



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Course Outcomes:

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

CO1: Explain the knowledge of international fundamental concepts, principles, and history of Hybrid and Electric vehicles for skill development.

CO2: Analyse the architectures of Hybrid and Electric Vehicles for skill development.

CO3: Explain the electric propulsion systems and their operation and maintenance for skill development.

CO4: Understand the global energy storage elements like rechargeable battery types, energy storage devices and battery parameters for skill development.

CO5: Explain the principle, working and applications of alternative energy sources for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004.
3. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC044: VEHICLE ENGINEERING

Objective: To impart knowledge to students in various systems of Automobile Engineering and to have the practice for Assembling and Dismantling of Engine Parts. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit 1

(08Sessions)

VEHICLE STRUCTURE AND ENGINES: Types of Automobiles - Vehicle Construction – Chassis – Frame and Body – aerodynamics.

Components of Engine – Their forms, Functions and Materials - Review of Cooling and lubrication systems in Engine – Turbo Chargers – Engine Emission Control by 3-Way Catalytic Controller – Electronic Engine Management System for skill development.

Unit 2

(08Sessions)

ENGINE AUXILIARY SYSTEMS: Carburetor–working principle- Electronic fuel injection system – Mono-point and Multi - Point Injection Systems – Construction, Operation and Maintenance of Lead Acid Battery - Electrical systems – Battery generator – Starting Motor and Drives – Lighting and Ignition (Battery, Magneto Coil and Electronic Type) -Regulators-cut outs for skill development.

Unit 3

(08Sessions)

TRANSMISSION SYSTEMS: Clutch – Types and Construction – Gear Boxes, Manual and Automatic – Simple Floor Mounted Shift Mechanism – Over Drives – Transfer Box Fluid flywheel-Torque convertors– Propeller shaft – Slip Joint – Universal Joints – Differential and Rear Axle – Hotchkiss Drive and Torque Tube Drive for skill development.

Unit 4

(08Sessions)

STEERING, BRAKES AND SUSPENSION: Wheels and Tyres – Wheel Alignment Parameters - Steering Geometry and Types of steering gear box Power Steering – Types of Front Axle – Suspension systems – Braking Systems – Types and Construction – Diagonal Braking System – Antilock Braking System for skill development.

Unit 5

(08Sessions)

ALTERNATIVE ENERGY SOURCES: Use of Natural Gas, LPG, Biodiesel, Gasohol and Hydrogen in Automobiles - Electric and Hybrid Vehicles, Fuel Cells for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of vehicle structure and engines for skill development.

CO2: To understand the concept of engine auxiliary system for skill development.

CO3: To understand the concept of transmission system for skill development.

CO4: To study the national and international types of steering, brakes and suspension for skill development.

CO5: To understand the global concept of alternative energy sources for skill development and employability.



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Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. Sethi H.M, "Automobile Technology", Tata McGraw-Hill-2003
2. Kirpal Singh "Automobile Engineering Vol. 1& 2", Standard Publishers, New Delhi.
3. Crouse and Anglin "Automotive Mechanism", 9th Edition. Tata McGraw-Hill, 2003.
4. Newton, Steeds and Garet, "Motor vehicles", Butterworth Publishers, 1989.
5. Srinivasan.S , " Automotive Mechanics" 2nd edition, 2003, Tata McGraw-Hill.
6. Joseph Heitner, "Automotive Mechanics", 2nd edition, East-West Press, 1999.

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC045: AUTOMOTIVE INSTRUMENTATION

Objective: The objective of this course is to familiarize the students with to the advanced concepts of automotive instrumentation. The primary objective of this course is to understand the concept of automotive instrumentation and to be able to know details about automotive instrumentation. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

Basic concept of measurement, types of errors, standards, Device under calibration, calibration techniques, requirement of calibration laboratory, Analysis of measurement data, Uncertainty & Reporting the outcome of measurement process for skill development.

Unit II

(08Sessions)

Sensors, Actuators & systems. Static & Dynamic characteristics of sensors & systems including Frequency response, response time, damping, reliability. Generalized mathematical model of measurement system. Instrumentation system for measurement of Displacement, Strain, Vibration pressure, force & Torque Design of Instrumentation systems for a practical application using above sensors. Data acquisition systems using digital methods including PC based systems for skill development.

Unit III

(08Sessions)

Concept of open loop, closed loop control systems for a typical Instrumentation system. Mathematical analysis of first order & higher order systems for a typical practical Instrumentation system. Analysis of control system for a typical automobile. (Examples of Engine, Braking systems can be considered) for skill development.

Unit IV

(08Sessions)

Metrology: Standards, Slip gauges, Measurement of angles, tapers, threads. Mechanical inspection methods, Inspection of straightness, flatness, alignment & surface finish for skill development.

Unit V

(08Sessions)

Specifying product features using mechanical, Pneumatic, Electronic & Optical methods. Use of Optical flats & Interferometer for skill development and employability.

Course outcomes:

Upon completion of this course, student should be able to:

CO1: To understand the international philosophy of instrumentation concept applied to automotive systems for skill development.

CO2: To understand the global method of measurement of physical quantities, analyse the data & compute the uncertainty involved considering physical variables for skill development.

CO3: To develop Instrumentation systems involving parameters based on Force, Vibration, Temperature, Proximity, Displacement, and Pressure for skill development.

CO4: To Understand & develop mathematical model of Instrumentation system based on concept of open & closed loop systems & to use the techniques, skills, and modern engineering tools necessary for engineering practice for skill development.

CO5: To develop Data acquisition system including communication protocols and to apply theory of metrology & understand mechanical measurement methods for skill development and employability.



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COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	2

Reference Books:

1. Experimental methods for engineers: J. Holman 6th edition, McGrawhill
2. Instrumentation, Measurement & Analysis: B.C.Nakra& K.K. Choudhary, TMH
3. Measurement systems, Application & Design: E.O. Doebelin 4th edition, Mcgrahill
4. Mechanical measurement: T.G.Beckwith, N.L.Buck& R.D. Martangoni, 3rd edition, Narosa Publishing House.
5. Metrology for Engineers: J.W.F Gallies&C.R.Shotbolt
6. PC based Instrumentation- Concepts & practice: N.Mathivanan PHI

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC046: PLC's AND INDUSTRIAL AUTOMATION

Objective: The objective of this course is to familiarize the students with to the advanced concepts of PLC's and industrial automation. The primary objective of this course is to understand the concept of PLC's and industrial automation and to be able to know details about PLC's and industrial automation. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

Introduction: What Is A PLC, Technical Definition Of PLC, What Are Its Advantages, Characteristic Functions Of A PLC, Chronological Evolution Of PLC, Types Of PLC, Unitary PLC Modular PLC, Small PLC, Medium PLC, Large PLC, Block Diagram Of PLC, Input / Output (I / O) Section, Processor Section, Power Supply, Memory, Central Processing Unit, Processor Software / Executive Software, Multitasking, Languages, Ladder Language for skill development.

Unit II

(08Sessions)

BIT LOGIC INSTRUCTIONS: Introduction, Input And Output Contact Program, Symbols, Numbering System Of Inputs And Outputs, Program Format, Introduction To Logic, Equivalent Ladder Diagram Of AND Gate, Equivalent Ladder Diagram Of OR Gate, Equivalent Ladder Diagram Of NOT Gate, Equivalent Ladder Diagram Of XOR Gate, Equivalent Ladder Diagram Of NAND Gate, Equivalent Ladder Diagram Of NOR Gate, Equivalent Ladder Diagram to demonstrate De Morgan Theorem, Ladder Design for skill development.

Unit III

(08Sessions)

PLC TIMERS AND COUNTERS

Timer And Its Classification, Characteristics Of PLC Timer, Functions In Timer, Resetting –Retentive And Non-Retentive, Classification Of PLC Timer, On Delay, And Off Delay Timers, Timer-On Delay, Timer Off Delay, Retentive And Non-Retentive Timers, Format of a Timer Instruction. PLC Counter, Operation Of PLC Counter, Counter Parameters, Counter Instructions. Overview, Count Up (CTU), Count Down (CTD) for skill development.

Unit IV

(08Sessions)

ADVANCED INSTRUCTIONS

Introduction, Comparison Instructions, Discussions On Comparison Instructions, Addressing Data Files, Format Of Logical Address, Addressing Format For Micro logic System, Different Addressing Types. Data Movement Instructions, Logical Instructions. Mathematical Instructions. Main Features of Mathematical Instructions. Special Mathematical Instructions, Scale with Parameters or SCP Instruction. Data Handling Instructions Main Features Of Data Handling Instructions. Program Flow Control Instructions. Proportional Integral Derivative (PID) Instruction for skill development.

Unit V

(08Sessions)

PLC INPUT OUTPUT (I/O) MODULES AND POWER SUPPLY

Introduction, Classification Of I/O, I/O System Overview, Practical I/O System And Its Mapping, Addressing Local And Expansion I/O, Input-Output Systems, Direct I/O Parallel I/O Systems, Serial I/O Systems, Sinking And Sourcing, Sourcing and Sinking in PLC Interfacing, Discrete Input Module, Discrete DC Input Module, Discrete AC Input Module, Rectifier with Filter, Threshold Detection, Isolation, Logic Section, Specifications Of Discrete Input Module Discrete Output Modules, Advantages And Disadvantages Of Output Modules, Specifications Of Analog Input Module , Types



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Of Analog Input Module, Special Input Modules, Analog Output Module I/O Modules In Hazardous Locations, Power Supply Requirements Filters for skill development and employability.

Unit VI

(08Sessions)

INDUSTRIAL COMMUNICATION AND NETWORKING

Introduction, Evolution of Industrial Control Process, Types of Communication Interface, Types of Networking Channels, Parallel Communication Interface. Serial Communication Interface, Synchronous And Asynchronous Transmissions Compared, Standard Interface, Different Recommended Standards Compared, Software Protocol, Industrial Network. Network Topology, Media Access Methods, Open System Interconnection (OSI), Network Model, Network Components, Control Network Issues, Advantage Of Standardized Industrial Network, Intelligent Devices, Industrial Network Bus Network, Device Bus Network Vs. Process Bus Network, Controller Area Network (CAN), Device net, Control net, Ethernet Protocol , AS-I Interface, FOUNDATION FIELDBUS, Application Of Profibus For Real PLC Communication. **Industrial automation:** Introduction, Utility of Automation, General Structure Of An Automated Process, Examples of Some Simple Automated Systems, Selection of PLC for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of PLC's for skill development to compete with national, and international standards.

CO2: To understand the concept of bit logic instructions for skill development.

CO3: To understand the global concept of PLC timers and counters for skill development.

CO4: To study the types of advanced instructions for skill development.

CO5: To understand the concept of industrial communication and networking for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)

(Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1



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CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. MadhuchhandaMitra and SamarjitSen Gupta, "Programmable Logic Controllers(PLC) and Industrial Automation", Penram International Publishing (India) Pvt. Ltd. 2007. ISBN: 81-87972-17-

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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TMEC047: SOLAR ENERGY SYSTEMS

Objective: The objective of this course is to familiarize the students with to the advanced concepts of solar energy systems. The primary objective of this course is to understand the concept of solar energy systems and to be able to know details about solar energy systems. This will help students to know more about theoretical and practical problem solving techniques to improve skill and provide employability.

Unit I

(08Sessions)

ENERGY RESOURCES AND SOLAR SPECTRUM: World energy resources - Indian energy scenario - Environmental aspects of energy utilization. Renewable energy resources and their importance - Global solar resources. Solar spectrum – Electromagnetic spectrum, basic laws of radiation. Physics of the Sun - Energy balance of the Earth, energy flux, solar constant for Earth, greenhouse effect for skill development.

Unit II

(08Sessions)

SOLAR RADIATION AND MEASUREMENT: Solar radiation on the earth surface – Extra-terrestrial radiation characteristics, Terrestrial radiation, solar isolation, spectral energy distribution of solar radiation. Depletion of solar radiation - Absorption, scattering. Beam radiation, diffuse and Global radiation. Measurement of solar radiation – Pyranometer, pyrheliometer, Sunshine recorder. Solar time - Local apparent time (LAT), equation of time (E) for skill development.

Unit III

(08Sessions)

SOLAR RADIATION GEOMETRY AND CALCULATIONS Solar radiation geometry - Earth-Sun angles – Solar angles. Calculation of angle of incidence - Surface facing due south, horizontal, inclined surface and vertical surface. Solar day length – Sun path diagram – Shadow determination. Estimation of Sunshine hours at different places in India. Calculation of total solar radiation on horizontal and tilted surfaces. Prediction of solar radiation availability for skill development.

Unit IV

(08Sessions)

SOLAR THERMAL ENERGY CONVERSION Thermodynamic cycles – Carnot – Organic, reheat, regeneration and supercritical Rankine cycles - Brayton cycle – Stirling cycle – Binary cycles – Combined cycles. Solar thermal power plants - Parabolic trough system, distributed collector, hybrid solar-gas power plants, solar pond based electric power plant, central tower receiver power plant for skill development.

Unit V

(08Sessions)

SOLAR ELECTRICAL ENERGY CONVERSION Solar photovoltaic energy conversion - Principles - Physics and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants for skill development and employability.

Course Outcomes:

Students completing this course will be able to:

CO1: To study basics of global energy resources and solar spectrum for skill development.

CO2: To understand the concept of solar radiation and measurement for skill development.

CO3: To understand the concept of solar radiation geometry and calculations for skill development to compete with local, national, and international standards.

CO4: To study the solar thermal energy conversion for skill development.



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CO5: To understand the concept of solar electrical energy conversion for skill development and employability.

Mapping Course Outcomes leading to the achievement of Programme Outcomes (Please write 3, 2, 1 wherever required) (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	1	1	1	3	2	1	1	2	1
CO2	1	1	1	3	1	1	1	1	1
CO3	1	1	1	3	1	1	1	2	1
CO4	1	1	1	3	1	1	1	2	1
CO5	1	1	1	3	2	1	1	2	1

CO-Curriculum Enrichment Mapping (Please write 3, 2, 1 wherever required)
 (Note: 3 for highly mapped, 2 for medium mapped and 1 for low mapped)

	Skill Development	Employability	Entrepreneurship Development
CO1	3	1	1
CO2	3	1	1
CO3	3	1	1
CO4	3	1	1
CO5	3	2	1

Reference Books:

1. Foster R., Ghassemi M., Cota A., "Solar Energy", CRC Press, 2010.
2. Duffie J.A., Beckman W.A. "Solar Engineering of Thermal Processes", 3rd ed., Wiley, 2006.
3. De Vos, A., "Thermodynamics of Solar Energy Conversion", WileyVCH, 2008.
4. Garg H.P., Prakash J., "Solar Energy Fundamentals and Applications", Tata McGraw-Hill, 2005.
5. Kalogirou S., "Solar Energy Engineering", Processes and Systems, Elsevier, 2009.
6. Petela, R., "Engineering Thermodynamics of Thermal Radiation for Solar Power", McGraw-Hill Co., 2010

Website sources:

1. www.nptel.ac.in
2. en.wikipedia.org
3. www.sanfoundary.co.in

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