Sharad Institute of Technology College of Engineering
(An Autonomous Institute)
Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur
(Approved by AICTE, New Delhi, Recognized by Government of Maharashtra &
Affiliated to BATU University, Lonere)
NBA Accredited Programs, Accredited By NAAC 'A' Grade,
ISO 9001:2015 Certified

Teaching and Evaluation Scheme for TY B. Tech.

Department of Electronics and Telecommunication Engineering

Semester: VI

Department: Department of Electronics and Telecommunication Engineering

Rev: Course Structure/00/2021-22

Class: T.Y. B.Tech **Semester:** VI

Course Code	Type of Course	Course	Teaching Scheme				Evaluation Scheme					
			L	T	P	Total Hrs	CA1	CA2	MSE	ESE	Total	Credits
ET601	PCC	Digital Image Processing	3	-	-	3	10	10	30	50	100	**3**
ET602	PCC	Antenna and Wave Propagation	3	-	-	3	10	10	30	50	100	**3**
ET603	PCC	Embedded System Design	3	-	-	3	10	10	30	50	100	**3**
ET604	PEC	Elective-III	3	-	-	3	10	10	30	50	100	**3**
OE615	OEC	Open Elective-II	3	-	-	3	10	10	30	50	100	**3**
ET605	PCC	Digital Image Processing Laboratory	-	-	2	2	15	15	-	20	50	**1**
ET606	PCC	Antenna and Wave Propagation Laboratory	-	-	2	2	15	15	-	20	50	**1**
ET607	PCC	Embedded System Design laboratory	-	-	2	2	15	15	-	20	50	**1**
PRJ05	PROJ	Project Phase –I	--	--	4	4	25	25	-	50	100	**2**
IFT02	PROJ	Industrial Training/ Field Training-II	**--**	**-**	-	-	-	-	-	50	50	**Audit**
HSMC	HMS07	Aptitude Skills-IV	1	-	-	1	25	25	-	-	50	**Audit**
HSMC	HMS08	Language Skills-IV	-	-	2	2	25	25	-	-	50	**1**
			16		**12**	**28**	**170**	**170**	**150**	**410**	**900**	**21**

Digital Image Processing

ET601	PCC	Digital Image Processing	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Introduction to Digital Signal Processing

Course Outcomes: At the end of the course, students will be able to:

CO1	List fundamental steps involved in Digital Image Processing & Perform operations on color image processing.
CO2	Apply different image transforms for image enhancement
CO3	Apply different filtering techniques on an image.
CO4	Identify and design image processing techniques for object segmentation and recognition.
CO5	Apply 2-D data compression techniques for digital images
CO6	Analyze and solve image restoration problems.

Course Contents:

Unit 1: Digital Image Fundamentals Fundamentals steps in DIP, components of image processing system, Elements of visual perception, image sensing and acquisition, Image sampling and quantization, basic relations between pixels, Color fundamentals, color models, Pseudo color Image processing, Full color image processing, color transformations	[6]

Unit 2: Image Transform Basic intensity transformation: image negation, Log transformation, power law transformation, Piecewise linear transformation functions, arithmetic and Logic operation, Histogram processing (equalization and matching), sine cosine, Hadamard, Haar, Slant transforms.	[6]
Unit 3: Image filtering Fundamentals of spatial filtering, smoothening in spatial domain, sharpening in spatial domain, smoothening in frequency domain, Sharpening in frequency domain.	[6]
Unit 4: Image segmentation **Detection of discontinuities:** Point detection, line detection, edge detection, (Sobel, Prewitt, Laplacian), Global and adaptive Thresholding, Region based segmentation (region growing, region splitting and merging), **Morphology:** Dilation & erosion, Opening and closing operation, Hit- or –miss transformation Basic morphological algorithms: Boundary extraction, region filling, Thinning and thickening, skeletons.	[6]
Unit 5: Image Compression Fundamentals, Coding redundancy, inter pixel redundancy, fidelity criteria. Image compression model, lossless predictive coding, Lossy predictive coding, DCT based compression, Image compression standards JPEG and JPEG 2000.	[6]
Unit 6: Image Restoration A model of the Image Degradation / Restoration process, Noise Models, Restoration in the Presence of Noise only-spatial filtering, Periodic Nose Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of the Degradation function, Inverse filtering, Minimum Mean square Error (Wiener) filtering, Constrained Lease Squares Filtering, Geometric Mean Filter, Geometric Transformations.	[6]

Text Books:

1. Digital image processing: Rafael C Gonzalez , Richard E. Woods: Pearson Publication Image
2. Iain E. G. Richardson, ―H.264 and MPEG
3. Digital image processing and Analysis- B. Chanda , D. Datta , majnudar.
4. Fundamentals of digital Image Processing- Anil K.Jain.

Reference Books:

1. A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
2. Pratt William K. "Digital Image Processing", John Wiley & sons
3. Digital image processing- S. Jayraman, S Esakkiarajan,Veerakumar: MGH.
4. Fundamentals of Digital Image Processing-S.Annadurai, R. Shanmugalaxmi : PHI
5. Digital Image Processing- S.Shridhar

Antenna & Wave Propagation

ET602	PCC	Antenna & Wave Propagation	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Good knowledge of Engineering Mathematics, Fundamentals of Physics and Electromagnetics ((Maxwell's equations, three basic coordinate systems and polarization).

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the radiation mechanism of antenna and calculate antenna parameters
CO2	Analyze the different types of antenna arrays
CO3	Compare the given wire antenna and its radiation characteristics
CO4	Analyze wave propagation characteristics for ground and ionospheric wave propagation
CO5	Design different types of RADARS systems
CO6	Design Antenna for different application

Course Contents:

Unit 1: Antenna Basics Introduction, radiation mechanism, Omni-directional and isotropic antennas, Basic Antenna parameters: Antenna pattern, Half power beam width, Beam area, Radiation intensity, Beam efficiency, Directivity and Gain, Radiation resistance, Resolution, Antenna aperture, Effective height, Reflection coefficient, Front to Back ratio, Impedance bandwidth, pattern bandwidth, polarization, Antenna Temperature, Fields from oscillating dipole, Antenna field zones.	[6]

Unit 2: Antenna Arrays Arrays of two isotropic point sources: same amplitude and phase, Arrays of two isotropic point sources: same amplitude and opposite phase, Arrays of two isotropic point sources: same amplitude and in phase quadrature, same amplitude and any phase difference, Arrays of two isotropic point sources: Unequal amplitude and any phase difference, Nonisotropic but similar point sources and the principle of pattern multiplication, Nonisotropic and Dissimilar point sources, Linear arrays of n isotropic point source of equal amplitude and spacing, Broadside Array, Endfire Array.	[6]
Unit 3: Wire Antennas Monopole and Dipole Antenna, Short Dipole, Loop Antenna, Yagi-Uda Antenna, V antenna, Helical Antenna- Modes in Helical Antenna, Effect of No. of Turns (n), Biconical Microstrip Antenna, Concept of Smart Antenna.	[6]
Unit 4: Wave Propagation Ground Wave Propagation: Plane earth reflection, space wave and the surface wave, elevated dipole antennas above a plane earth, wave tilt of the surface wave, spherical earth propagation, troposphere wave, Ionospheric Propagation: The ionosphere, reflection and refraction of the waves by the ionosphere, regular and irregular variations of ionosphere, sky wave transmission calculations, wave propagation in ionosphere, other ionosphere phenomenon.	[6]
Unit 5: Radar System Fundamentals, RADAR performance factors, basic pulsed radar system, antennas and scanning, display methods, pulsed radar system, moving target indication, radar becons, CW Doppler radar, frequency modulated Radar,	[6]
Unit 6: Antennas and Applications Structural details, dimensions, radiation pattern, specifications, features and applications of following Antennas: Hertz & Marconi antennas, V- Antenna, Rhombic antenna, TW antennas, Whip antenna, Biconical, Helical, Horn, Slot, Microstrip, Lens antennas, Antennas with parabolic reflectors.	[6]

Text Books:

1.C.A. Balanis, "Antenna Theory - Analysis and Design", John Wiley.
2. Mathew N O Sadiku, "Elements of Electromagnetics" 3rd edition, Oxford University Press.

Reference Books:

1. John D Kraus, Ronald J Marhefka, Ahmad S Khan, Antennas for All Applications, 3rd Edition, The McGraw Hill Companies.
1. K. D. Prasad, "Antenna & Wave Propagation", Satya Prakashan, New Delhi.
2. John D Kraus, "Antenna& Wave Propagation", 4th Edition, McGraw Hill, 2010.

3. Vijay K Garg, Wireless Communications and Netwoking, Morgan Kaufmann Publishers, An Imprint of Elsevier, 2008
4. G. S. N. Raju, "Antennas and Wave Propagation", Pearson Education.

Embedded System Design

ET603	PCC	Embedded System Design	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture:3 hrs/week	CA1 10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Microprocessor and Microcontroller

Course Outcomes: At the end of the course, students will be able to:

CO1	Outline about design issues & components of embedded systems, RISC architecture design philosophy of ARM7.
CO2	Develop embedded C program for interfacing I/O device like LEDs, DC Motors using LPC2148.
CO3	Make use of LPC2148 of extended features of I/Os, Timers, ADC for interfacing peripherals.
CO4	Explain real time operating concepts.
CO5	Explain hardware – software co design issues and testing methodology for embedded system.
CO6	Explain Semaphores, Mutex, Mail Box & Message Queue in μCOSII.

Course Contents:

Unit1: Introduction to Embedded systems & ARM7 architecture Embedded systems (ES) definition, ES components, ES design flow, ES development tools, Characteristics of Embedding Computing, ARM7 registers bank, status registers, pipelining concept, exceptions and vector table, data flow model.	[6]

Unit2: ARM instruction set with assembly & C programming ARM assembly instruction set and programming, ARM C programming, LPC2148 pin layout, Input/ Output programming in C using LPC2148 port pins.	[6]
Unit3: LPC2148 microcontroller architecture & programming: LPC2148 architecture details, SFRs, Interrupts in ARM7 (ref: LPC2148), Timer/Counter module, PWM module, A/D convertor module, Serial communication module (UART), I2C and SPI communication protocols (ref: LPC2148).	[6]
Unit4: Operating System Basic Features of an Operating System, Kernel Features: Real-time Kernels, Polled Loops System, Co-routines, Interrupt-driven System, Multi-rate System Processes and Threads, Context Switching: Cooperative Multi-tasking, Pre-emptive Multi-tasking.	[6]
Unit5: Scheduling and Inter-process Communication Rate-Monotonic Scheduling, Earliest-Deadline First Scheduling, Task Assignment, Fault Tolerant Scheduling Signals, Shared Memory Communication, Message-Based Communication.	[6]
Unit6: Semaphore, Mutex, Mail box, and Message queue in µCOSII Creating and deleting a semaphore, waiting and signaling semaphore, Creating and Deleting Mutex, waiting and signaling mutex, Creating and deleting a mail box, sending and receiving a message using mail box (mail box as a binary semaphore), creating and deleting a message queue, sending and receiving a message using message queue.	[6]

Text Books:

1. Embedded System Design by Peter Marwedel, Springer publication.
2. An Embedded Software Primer, David E. Simon Pearson Education, Asia Publication.
3. ARM System Developers Guide Designing & Optimizing System Software by Andrew N., Dominic Sloss, and Chris Wright.
4. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming, and Applications", Penram Intl, 1996.

Reference Books:

1. Embedded System Design A Unified Hardware/ Software Introduction By Frank Vahid/ Tony Givargis, Wiley publication.
2. Real- Time Systems Design and Analysis by Phillips A. Laplante, Wiley insia Edition.
3. Embedded/ Real-Time Systems: Concepts, Design & Programming By Dr. k V K KPrasad, Dreamtech Press.

Elective- III
Internet of Things

ET604A	PEC	Internet of Things	3-0-0	3Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Course Outcomes: At the end of the course, students will be able to:

CO1	Identify parameters in physical design of IOT
CO2	Elaborate basics of IOT system management
CO3	Illustrate the real time IoT applications to make smartworld
CO4	Make use of data types and data structures to write small code
CO5	Interface and program IOT devices
CO6	Develop small model of smart city, Solve some environmental problems using IOT

Course Contents:

Unit 1: Introduction to Internet of Things Relevance and need of automation, Definition and characteristics of IoT, physical design of IoT based system, logical design of IoT based system, IoT level deployment, IoT enabling technologies, domain specifications IoTs.	[6]
Unit 2: IoT and M2M Introduction, M2M, difference between IoT and M2M, software defined, networking (SDN), network function virtualization (NFV) for IoT, basics of IoT system management, NETCONF-YANG.	[6]

Unit 3: IoT Platforms State of the art introduction, Approach and application of state of are modeling, Architecture Reference models, IOT reference model, IOT architecture	[6]
Unit 4: IoT Design Methodology Logical design using Python, Installing Python, Python data types and data structures, control flow, functions, Modules, Packages, file handling.	[6]
Unit 5: IOT Devices and interfacing with Rasberry Pi Role of controller in IOT, Introduction to Raspberry Pi, interfaces (Serial, SPI, I2C), programming Raspberry PI with Python, Study of different sensors used, Interfacing IOT devices	[6]
Unit 6: IoT Physical Servers and Cloud Offerings Introduction to cloud storage models, communication APIs, WAMP – AutoBahn for IoT, Xively cloud for IoT, case studies illustrating IoT design, smart cities and IOT, Environmental issues and IOT.	[6]

Text Books:

1. Arshdeep Bahga, Vijay Madisetti, "Internet of Things: A Hands-on-Approach", VPT, 1st Edition, 2014.
2. Matt Richardson, Shawn Wallace, "Getting Started with Raspberry Pi", O'Reilly (SPD), 3rd Edition, 2014.
3. E-Text Books: https://mitpress.mit.edu/books/internet-things

Reference Books:

1. 1.Adrian McEwen, Hakim Cassimally, "Designing the Internet of Things", John Wiley andSons2014.
2. 2.Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", Apress Publications,1st Edition2013.

Robotics

ET604B	PEC	Robotics	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Control System, Digital Design, Microprocessor, Microcontroller etc.

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain basic concept in robotics and its industrial applications
CO2	Classify different sensors and electronic system for robot
CO3	Identify different types of grippers and tools
CO4	Apply kinematics and Dynamics concepts for robots
CO5	Relate programming methods for robotic applications
CO6	Develop the robots using the various systems and techniques

Course Contents:

Unit 1: Basic concepts in robotics Definition; anatomy of robot, basic structure of robot, Specifications and Classification of robot, Safety Measures in robotics, Industrial Applications of Robots.	[6]
Unit 2: Robot drivers, Sensors and Vision	[6]

Drives for robots: Electric, hydraulic and pneumatic. **Sensors:** Internal-External, Contact-noncontact, position, velocity, force, torque, proximity and range. **Vision:** Introduction to techniques, Image acquisition and processing.	
Unit 3: End Effectors and Actuators Different types of grippers- Mechanical, Magnetics, vacuum, Adhesive, Gripper force Analysis &Gripper Design, overview of actuators, Power and torque, Acceleration and velocity Specifications and characteristics of Stepper motors, AC motors, DC motors and servomotors.	[6]
Unit 4: Robot Kinematics and Dynamics Direct and inverse kinematics for industrial robots for position and orientation, Redundancy, Manipulator, direct and inverse velocity. Lagrange formulation, Link inertia tensor and manipulator inertia tensor, Newton –Eller formulation for RP and RP manipulators, Trajectory planning, interpolation, static force and moment transformation, solvability, stiffness.	[6]
Unit 5: Programming methods Robot language classification, Robot language structure, elements and its functions. Simple programs on Sensing distance and direction., Line Following Algorithms, Feedback Systems Other topics on advance robotic techniques.	[6]
Unit 6: Developing and building a robot Models of flexible links and joints, Robotic arm – Components and structure, Types of joints and workspace, Design models for mechanic arms and lifting systems Case Study: 1. Robots in material handling and assembly. 2. Human Robot Interaction.	[6]
Text Books: 1. Introduction to Robotics By S.K.Saha , Tata McGraw Hill 2. Robotics Control, Sensing,Vision and Intelligence by K.S. Fu, R.C .Gonzalez, C.S.G.Lee , Tata McGraw Hill	
Reference Books: 1. J. Hirchhorn: Kinematics and Dynamics of Machinery, McGraw Hill book co. 2. Robert J. Schilling, Fundamentals of Robotics- Analysis and Control, Prentics Hall india. 3. Robotics Technology and Flexible Automation by S.R.Deb, S. Deb, Tata McGraw Hill Robot Motion and Control (Recent Developments) by M.Thoma& M. Morari	

Optical Communication

ET604C	PEC	Optical Communication	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Introduction to communication systems and electromagnetic fields and waves, analog and digital communication systems, frequency-division and time-division multiplexing techniques

Course Outcomes: At the end of the course, students will be able to:

CO1	Explain the basic optical communication along with optical fiber structure and light propagating mechanisms in detail.
CO2	Analyze the transmission characteristics associated with dispersion.
CO3	List optical sources and detectors with their use in optical communication system. (L4)/ Explain construction and working of optical sources & detectors.
CO4	Explain fiber optic receiver system(L2)/ Interpret the optical receiver operation(L5)
CO5	Illustrate WDM Concepts and components
CO6	Discuss optical communication systems and its networks.

Course Contents:

Unit 1: Overview of Optical Fiber Communication Basic Network Information Rates, Optic fiber communication system, Basic optical laws and definitions, Ray theory transmission, Optical fiber modes, fiber materials and fabrication	[6]
Unit 2: Transmission Characteristics of Optical Fibers Introduction, Attenuation, absorption, scattering losses, bending loss, dispersion, Intra modal dispersion, Intermodal dispersion, fiber alignment and joint loss, fiber couplers, Cable Design,	[6]
Unit 3: Optical Sources Topics from Semiconductor Physics, Light-Emitting Diodes (LEDs), Laser Diodes, Light Source Linearity, Modal, Partition and Reflection Noise, Reliability Considerations.	[6]
Unit 4:Optical Detectors and Receivers Physical principles of PIN and APD, Detector response time, Temperature effect on Avalanche gain, Comparison of Photo detectors. Optical receiver operation- Fundamental receiver operation, Digital signal transmission, error sources, Receiver configuration.	[6]
Unit 5: WDM Concepts and Components WDM concepts, overview of WDM operation principles, WDM standards, Mach-Zehender interferometer, multiplexer, Isolators and circulators, direct thin film filters, active optical components, MEMS technology, variable optical attenuators, tunable optical fibers, dynamic gain equalizers, optical drop multiplexers, polarization controllers, chromatic dispersion compensators, tunable light sources.	[6]
Unit 6: Optical Amplifiers and Networks optical amplifiers, basic applications and types, semiconductor optical amplifiers, EDFA. Optical Networks: Introduction, SONET / SDH, Optical Interfaces, SONET/SDH rings, Wavelength Routed Networks, Ultrahigh capacity Networks	[6]
Text Books: 1. Optical Fiber Communication – Gerd Keiser. Third Edition (TMH) 2. Optical Fiber Communications– – John M. Senior, Pearson Education. 3 rd Impression, 2007.	
Reference Books: 1. Optical Fiber Communication – Agarwal (Wiley) 2. Optical Fiber Communication - Grover	

3. Optical Networks - Ramaswamy (ELSEVIER INDIA)
4. Fiber optic communication – Joseph C Palais: 4th Edition, Pearson Education.
5.Fiber Optic Communications – D.K. Mynbaev, S.C. Gupta and Lowell L. Scheiner, Pearson Education, 2005. 2.
6. Text Book on Optical Fiber Communication and its Applications – S.C.Gupta, PHI, 2005.

Speech Processing

ET604D	PEC	Speech Processing	3-0-0	3 Credits

Teaching scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	CA1 :10 Marks CA2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Signals and **S**ystems.

Course Outcomes: At the end of the course, students will be able to:

CO1	Model speech production system and describe the fundamentals of speech.
CO2	Determine Cepstral Distances, Weighted Cepstral Distances
CO3	Explain Markov Processes
CO4	Represent Architecture of a large vocabulary
CO5	Explore about Text-to-Speech Synthesis
CO6	Summarize Grammar-based LM, Statistical LM

Course Contents:

Unit 1: Basic Concepts of speech processing Speech Fundamentals: Articulatory Phonetics –Production and Classification of Speech Sounds Acoustic Phonetics – Acoustics of speech production Review of Digital Signal Processing concepts; Short-Time Fourier Transform Filter-Bank and LPC Methods.	[6]
Unit 2:Speech Analysis Features, Feature Extraction and Pattern Comparison Techniques: Speech distortion measures– mathematical and perceptual – Log–Spectral Distance Cepstral Distances, Weighted Cepstral Distances Likelihood Distortions, Spectral Distortion using a Warped	[7]

Frequency Scale LPC, PLP and MFCC Coefficients Warping, Multiple Time – Alignment Paths. Time Alignment and Normalization – Dynamic Time.	
Unit 3:Speech Modeling Hidden Markov Models, Markov Processes, HMMs – Evaluation, Viterbi Search, Baum-Welch, Parameter Re-estimation, Implementation issues.	[6]
Unit 4:Speech Recognition Large Vocabulary Continuous Speech Recognition Architecture of a large vocabulary continuous speech recognition system acoustics and language models – n-grams, context dependent sub-word units, Applications and present status.	[6]
Unit 5: Speech Synthesis Text-to-Speech Synthesis Concatenative waveform synthesis methods, sub-word units for TTS, intelligibility, naturalness – role of prosody, Applications and present status.	[6]
Unit 6:Fundamentals of Natural Language Processing Origins and challenges of NLP – Language Modeling, Language Modeling, Grammar-based LM, Statistical LM – Regular Expressions, Finite-State Automata – English Morphology, Transducers for lexicon and rules, Tokenization, Errors, Minimum Edit Distance.	[7]

Textbooks:

1. Lawrence Rabiner and Biing-Hwang Juang, "Fundamentals of Speech Recognition", Pearson Education, 2003.
2. Daniel Jurafsky and James H Martin, "Speech and Language Processing – An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition", Pearson Education, 2002.
3. . Frederick Jelinek, "Statistical Methods of Speech Recognition", MIT Press, 1997.
4. Daniel Jurafsky, James H. Martin—Speech and Language Processing: An Introduction to Natural Language Processing, Computational Linguistics and Speech, Pearson Publication, 2014.
5. Steven Bird, Ewan Klein and Edward Loper, —Natural Language Processing with Python, First Edition, OReilly Media, 2009.

Digital Image Processing Laboratory

ET605	PCC	Digital Image Processing Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs/Week	CA1:15 Marks CA2:15 Marks End Semester Exam: 20 Marks

Course Outcomes: At the end of the course, students will be able to:

CO1	To understand the types of images, different color Space components.
CO2	Implement the code for different image transformation, image smoothing, Histogram Equalization of an image.
CO3	To understand Edge detection, Morphological Operations, Segmentation using Thresholding, image compression.

Experiment List:

Expt. No.	**Name of the Experiments**
01	To understand the types of images & to implement the code for Reading the image, Display the image, Obtain mirror image, Flip the given image.
02	To understand & retrieve different color Space components.
03	Implement the code for different image transformation.
04	Implement the code for Histogram & Histogram Equalization of an image.

05	To understand & implement code for image smoothing.
06	To understand & implement Edge detection.
07	To understand & implement Morphological Operations.
08	To understand & implement Segmentation using Thresholding.
09	To understand & implement image compression.

Antenna & Wave Propagation Laboratory

ET606	PCC	Antenna & Wave Propagation Laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs/Week	CA1:15 Marks CA2:15 Marks End Semester Exam: 20 Marks

Course Outcomes: At the end of the course, students will be able to:

CO1	Evaluate the performance of different antenna configurations and compare their strengths.
CO2	Analyze the accuracy and precision of time and frequency measurements
CO3	Compare the given antenna and its radiation characteristics

Experiment List:

Expt. No.	**Name of the Experiments.**
01.	To Measure Radiation pattern, Front to back ratio, Impedance, Gain, Beam width for Yagi-Uda Antenna.
02.	To Measure Radiation pattern, Front to back ratio, Impedance, Gain, Beam width for Dipole Antenna.
03.	To Measure Radiation pattern, Front to back ratio, Impedance, Gain, Beam width for Folded Dipole Antenna.

04.	To Measure Radiation pattern, Front to back ratio, Impedance, Gain, Beam width for Microstrip Antenna.
05.	To measure time and frequency of moving pendulum.
06.	To measure time and frequency of FAN.
07.	To measure time and frequency of Transformer.
08.	To measure time and frequency of Buzzer.
09.	Designing of any antenna in group of 3 or 5 members.

Embedded System Design Laboratory

ET607	PCC	Embedded System Design laboratory	0-0-2	1 Credits

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs/Week	CA1:15 Marks CA2:15 Marks End Semester Exam: 20 Marks

Course Outcomes: At the end of the course, students will be able to:

CO1	Use C for reading data from port pins.
CO2	Understand the interfacing of data I/O devices with ARM controller.
CO3	Understand serial communication, port RTOS on ARM controller.

Experiment List:

Expt. No.	**Name of the Experiments.**
01	Introduction to Embedded System
02	Program for turning ON LEDs sequentially.
03	Program for controlling DC Motor.
04	Program for controlling stepper Motor.
05-A	Program for generating saw-tooth wave using DAC.

05-B	Program for generating sine wave using DAC.
06	Program for Polled Loops
07	Program for Rate Monotonic Scheduling
08	Program for Shared Memory Communication

Project Phase-I

PRJ05	PROJ	Project Phase-I	0-0-4	2 Credits

Teaching Scheme:	**Examination Scheme:**
Practical: 4 hrs/week	CA 1: 25 Marks CA 2: 25 Marks End Semester Exam: 50 Marks

Pre-Requisites: All courses

Course Outcomes: At the end of the course, students will be able to:

CO1	State the exact title of the project and problem definition.
CO2	Explain the motivation, objectives and scope of the project.
CO3	Review the literature related to the selected topic of the project.
CO4	Design the mechanism, components of the system and prepare detailed drawings.
CO5	Evaluate the cost considering different materials/manufacturing processes.

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them.
The completion of work, thesubmission of the report and assessment should be done at the end of VII Sem.

The project work should consist of any of the following or appropriate combination:

1. A comprehensive and up-to-date survey of literature related to study of aphenomenon or product.
2. Design of any equipment and / or its fabrication and testing.
3. Critical Analysis of any design or process for optimizing the same.
4. Experimental verification of principles used in applications related to various specializations related to Mechanical Engineering.
5. Software development for particular applications.
6. A combination of the above.

It is expected that the students should complete at least 50% of the total project work in VISemester. The objective is to prepare the students to examine any design or process or phenomenon from all angles, to encourage the process of independent thinking andworking and to expose them to industry. The students may preferably select the project works from their opted elective subjects. The students should submit the report in a prescribed format, before the end of VII semester. The report shall be comprehensive andpresented typed on A4 size sheets and bound. Number of copies to be submitted is numberof students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.

Industrial Training/Field Training /Internship-II

IFT02	PROJ	Industrial Training/Field Training-II	0-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
	End Semester Exam: 50 Marks

Course Description:

Internship / Training is educational and career development opportunity, providing practical experience in a field or discipline. At the end of the Fourth and Fifth semester, every student should undergo practicaltraining in an industry / professional organization / Research laboratory with the prior approval of the HOD/TPO/Principal of the college and submit the report along with the completion certification from the Industry/ Organization. The report will be evaluated during the Sixth semester by the department.

Course Outcomes: After successful completion of the course, students will be able to

CO1	Verify the Technical knowledge in real industrial situations.
CO2	Develop interpersonal communication skills.
CO3	Discuss activities and functions of the industry in which the Internship/training has done.
CO4	Write the technical report.

Prerequisite: - Basics of Computer Science Engineering, Good written and Oral Communication.

Guideline for Students:

01	Arrive at work as per schedule, ready to work and stay for the agreed upon time.
02	Present yourself in a professional manner at all times, including being appropriately dressed at workplace.
03	Communicate any concerns with your supervisor and the internship/Training coordinator in a timely manner and respectfully.
04	Demonstrate enthusiasm and interest in what you are doing, ask questions and take the initiative as appropriate.
05	Complete and submit assigned tasks by designated timelines. Meet all deadlines.

Student's Diary/ Daily Log

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily
training diary the day to day account of the observations, impressions, information gathered and suggestions given, if
any. It should contain the sketches & drawings related to the observations made by the students. The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student
has been working. The diary should also be shown to the Faculty Mentor.

Student's Diary and Internship Report should be submitted by the students along with attendance record and an evaluation sheet duly signed and stamped by the industry to the SITCOE immediately after the completion of the
training.

It will be evaluated on the basis of the following criteria:

- Regularity in maintenance of the diary.

- Adequacy & quality of information recorded.
- Drawings, sketches and data recorded.
- Thought process and recording techniques used.
- Organization of the information.

Internship Report

After completing the internship, the student should prepare a comprehensive report to indicate what he/she has observed and learned in the training period. Daily diary will also help to a great extent in writing the industrial report since much of the information has already been incorporated by the student into the daily diary. The competent authority should sign the training report. The Internship report should be evaluated on the basis of following criteria:

- Originality.
- Adequacy and purposeful write-up.
- Organization, format, drawings, sketches, style, language etc.
- Variety and relevance of learning experience.
- Practical applications, relationships with basic theory and concepts taught in the course.

Evaluation of Internship/Training

- The student should be evaluated based on his training report and presentation, before an expert committee constituted by the concerned department as per norms. The evaluation will be based on the following criteria:
- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

Aptitude Skills- IV
(Numerical Ability)

HSMC	HMS07	Aptitude Skills- IV	1-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 1hr Tutorial: NA Practical: NA	CA1:25 Marks CA2:25 Marks

Pre-Requisites: Aptitude Skills-I/II
Course Outcomes: At the end of the course, students will be able to:

CO1	Solve the problems on system of equation.
CO2	Solve the problems on seating arrangement.
CO3	Solve the logical reasoning problems.
CO4	Solve the critical analysis problems.
CO5	Solve the problems of Data interpretation.
CO6	Solve the problems permutations and combinations.

Course Contents:

Unit 1: System of equations quadratic equations, Surds and indices, solution of equations, Ages.	[2]
Unit 2: Seating Arrangements Linear seating Arrangement, Circular seating arrangement, Complex seating arrangement,	[2]
Unit 3: Logical Reasoning Numerical based on sense of direction, Blood relations, odd man Out	**[2]**

Unit 4: Critical analysis Clocks and Calendar based problems, Cryptarithmetic**,** heights and distances	[2]
Unit 5: Data Interpretation Table form, Bar form, Line for Pi chart form	[2]
Unit 6: Permutation and combination Permutation and combinations	[2]

Text Books:

1. RS Aggarwal, " Quantitative Aptitude for Competitive Examinations ", S. Chand Publisher; 2016 edition
2. Quantitative Aptitude for CAT TMH Publications
3. Vedic Maths Made Easy By Dhaval Bhatiya Jaico Publication House.

Aptitude Skills- IV
(Verbal Ability)

HSMC	HMS07	Aptitude Skills- IV	1-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 1hr Tutorial: NA Practical: NA	CA1:25 Marks CA2:25 Marks

Pre-Requisites: Aptitude Skills-I/II
Course Outcomes: At the end of the course, students will be able to:

CO1	Solve the questions on ordering of words & Parts of Speech.
CO2	Organize contents of Business Communications such as CV, emails and letters.
CO3	Solve the questions based on jumbled paragraphs and reading comprehension.
CO4	Solve the questions on spotting error and sentence correction.
CO5	Summarize proceedings of any event or conference.
CO6	Discuss about current and critical issues during group discussion.

Course Contents:

Unit 1 Parts of Speech, Punctuation,Word Family (Using the same word as different Parts of Speech)	[2]
Unit 2 Analogy, Letter Writing (Formal), E-Mail Writing, CV Writing	[2]
Unit 3 Reading Comprehension, Paragraph Jumbles	[2]

Unit 4 Spotting Errors (in different parts of sentence), Subject-Verb Agreement Sentence Correction, Sentence Completion	[2]
Unit 5 One Word Substitution, Narrating Events/Reports, Summary/Precis Writing	[2]
Unit 6 Dialogue writing Group Discussion, Interview Skills (Using formal notations& gestures etc.)	[2]
Text Books: 1. Raymond Murphy, Essential English Grammar with Answers, Murphy Objective General English by R.S. Aggarwal, S Chand Publishing; Revised edition.	
Reference Books: 1. Rao and ,D,V,Prasada, Wren & Martin High School English Grammar and CompositionBook, S Chand Publishing, 2017 Murphy, Intermediate English Grammar with Answers, Cambridge University Press;Second edition.	

Language Skill- IV

HSMC	HMS08	Language Skill- IV	0-0-2	1Credit

Teaching Scheme:	**Examination Scheme:**
Practical: 2 hrs/week	CA1: 25 Marks CA2: 25 Marks

Pre-Requisites: Language Skill -III

Course Outcomes: At the end of the course, students will be able to:

CO1	Make use of Function in Python Programming.
CO2	Make use of Python collections.
CO3	Make use of classes and its objects in python.
CO4	Make use of file and it's handling functions.

Course Contents:

Unit 1: Function Why we Need Function, Categories of Functions-Predefined, User-define, Parts of FunctionsArguments, Return Value, Definition of Function, Function Calling, Lambda (Introduction).	[6]
Unit 2: Python Collections List, tuple, set, dictionary, constructor, check, change, remove item, list comprehension,Sort, loop through, joining.	[6]
Unit 3: Class and Object	[6]

OOP Characteristics, creating class, _init_() method, creating Object, accessing methods andvariables of class, constructor and destructor, Inheritance, super (), function overloading.	
Unit 4: File handling Path & Directory Settings-Absolute, Relative, File Modes (r, w, a, etc.), Open & Close file Reading File using Python--Read Line by Line readline () function, Read Word, read character(offset), Writing Text File using Python--Write Mode, Append Mode, Exception handling.	[6]
Text Books: 1. Python Projects (Author: Laura Cassell, Alan Gauld) Wrox publication 2. Murach's Python Programming. Author.: Michael Urban, Joel Murach, murach's Publication. 3. Fundamentals of Python (First Program) Cengage MINDTAP Publication 2nd Edition.Author: K.A. Kambert	

Elective –III	
ET604A	IOT
ET604B	Robotics
ET604C	Optical Communication
ET604D	Speech Processing

Open Elective –II	
OE615	Mobile Computing