Teaching and Evaluation Scheme for Final Year B. Tech.

Department of Automation and Robotics

Semester: VII

Department: Automation & Robotics   **Rev:** Course Structure/00/2022-23

Class: B.Tech   **Semester:** VII

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
AR701	PCC	Artificial Intelligence and Machine Learning for Robotics	3	-	-	3	10	10	30	50	100	3
AR702	PCC	Embedded System in Robotics	3	-	-	3	10	10	30	50	100	3
AR703	PEC	Elective-III	3	-	-	3	10	10	30	50	100	3
AR704	PEC	Elective-IV	3	-	-	3	10	10	30	50	100	3
OEXXX	OEC	Open Elective-II	3	-	-	3	10	10	30	50	100	3
AR705	PCC	Machine Learning Laboratory	-	-	2	2	15	15	-	20	50	1
AR706	PCC	Simulation Laboratory	-	-	2	2	15	15	-	20	50	1
AR707	PCC	Industrial Robotics and Material handling Systems Laboratory	-	-	2	2	25	25	-	-	50	1
AR708	MC	Account and Finance Management	1	-	-	1	25	25	-	-	50	Audit
PRJ06	PROJ	Industrial Case Studies (seminar)	-	-	2	2	25	25	-	-	50	1
PRJ07	PROJ	Capstone Project Phase –II	-	-	8	8	25	25	-	50	100	4
		Total	16	-	16	32	180	180	150	340	850	23

Elective –III

    A. Biomedical Instrumentation
    B. Data Analytics
    C. Micro and Nano Electromechanical Systems
    D. Industrial Robotics & Material Handling

Elective –IV

    A. Image Processing and Vision Systems
    B. Wireless sensor Network for Robotics
    C. Neural Network and Fuzzy logic
    D. Autonomous Robotics and Telecherics

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Artificial Intelligence and Machine Learning for Robotics

AR701	PCC	Artificial Intelligence and Machine Learning for Robotics	3-0-0	3 Credits

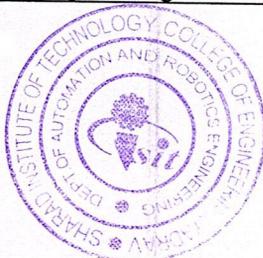| Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Principles of Robotics, Python Programming

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

CO1	Select appropriate artificial intelligence method/algorithm to handle various issues in robotics
CO2	Demonstrate various algorithms used in artificial intelligence
CO3	Apply artificial intelligence algorithms to robotics problems
CO4	Illustrate basic concepts of Machine Learning Environment
CO5	Identify machine learning techniques suitable for a given problem.
CO6	Solve the problems using various machine learning techniques.

Course Contents:

Unit 1: Introduction to artificial intelligent techniques Introduction of AI, Tools for AI such as Mathematical optimization, Probabilistic methods for Bayesian network, Hidden Markov model, statistical learning methods, support vector machines, neural networks, expert systems	[6]
Unit 2: Handling uncertainty and learning Non-monotonic reasoning, probabilistic reasoning, use of certainty factors, fuzzy logic, Concept of learning, learning automation, genetic algorithm, learning by inductions neural network.	[6]
UNIT 3: Search algorithms in AI Algorithms for uninformed and informed search, Heuristics search: hill climbing, branch and bound, best first search, Metaheuristics: Tabu search, ant colony optimization, real coded genetic algorithm.	[6]
Unit 4:Introduction Machine learning Introduction of Machine learning – Learning Input- Output functions: Types of learning – Input Vectors – Outputs. Foundations of Supervised Learning: Decision trees and Inductive bias – Logistic regression – Perceptron – Binary classification	[7]

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Unit 5: Advanced Supervised Learning Linear models and gradient descent – Naïve Bayes models and probabilistic modeling – Model selection and feature selection – Model Complexity and Regularization	[6]
Unit 6: Unsupervised Learning Curse of dimensionality, Dimensionality Reduction, PCA, Clustering – K-means – Expectation Maximization Algorithm – Mixtures of latent variable models – Supervised learning after clustering – Hierarchical clustering	[6]

Text Books:

1. Russell, S and Norvig, P. 2015. Artificial Intelligence-A Modern Approach,3rd edition, PrenticeHall.
2. Poole, D and Mackworth, A. 2010. Artificial Intelligence: Foundations of Computational Agents, Cambridge University Press
3. Tom Mitchell, Machine Learning_, McGraw Hill, 2015.
4. Peter Flach, _Machine Learning: The Art and Science of Algorithms that make sense of data_, Cambridge, 2014.

Reference Books:

1. 1.Steger, Carsten, Markus Ulrich, Christian Wiedemann. Machine Vision Algorithms and Applications (2nd ed.). Wiley, 2018. ISBN 978-3-527-41365-2.
2. Mikell P Groover, Automation, Production System and Computer Integrated Manufacturing, Prentice Hall, Publications, 2016. ISBN 9789332549814
3. Bhattacharya S., Artificial Intelligence, Laxmi Publications, Ltd., 2008, ISBN9788131804896
4. Chopra Rajiv, Artificial Intelligence, S. Chand Publishing, 2012, ISBN9788121939485
5. Pawar P. J., Evolutionary Computations for Manufacturing, Studium Press, 2019, ISBN: 978-93-85046- 52-0
6. Jain N, Artificial Intelligence: making a system intelligent, 2018, ISBN: 9788126579945
7. Hal Daume III, _A course in Machine Learning_, Todo, 2015.
8. EthemAlpaydin,_Introduction to Machine Learning_,The MIT Press, 2004.
9. David MacKay, Information Theory, Inference and Learning Algorithms_, Cambridge, 2003

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Embedded System in Robotics

AR702	PCC	Embedded System in Robotics	3-0-0	3Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Microcontroller and Embedded system

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

CO1	Explain the concept of embedded system, microcontroller, different components of microcontroller and their interactions.
CO2	Explain a computer program to develop embedded solutions
CO3	Apply a Program for the microcontroller to perform various tasks.
CO4	Develop embedded system applications using the key concepts of embedded systems such as I/O, timers, interrupts and interaction with peripheral devices
CO5	Apply knowledge of Real Time Based Operating System
CO6	Apply knowledge of Linux Fundamentals & Device Drivers

Course Contents:

Unit 1: Fundamentals of Embedded System Introduction to embedded systems, Application areas, Categories of embedded system, overview of embedded system architecture, specialities of embedded system: reliability, performance, power consumption, cost, size, limited user interface, software upgradation capability.	[6]
Unit 2: Embedded Hardware Hardware Architecture: CPU, Memory, Clock circuitry, Watchdog timer, Chip select, Input/output devices, power supply; software architecture: services provided by operating system, architecture of embedded operating system, Application software.	[7]
Unit 3: Embedded Communication Interfaces Study of basic communication protocols like, RS232/UART, RS422/RS485USB, Infrared, IEEE 802.11, Ethernet, Bluetooth, Inter-Integrated Circuit bus, Serial Peripheral Interface, Zig-Bee.	[6]
Unit 4: Embedded system programming Embedded C-programming concepts, Constants, Variables and Data Types, Operators,	[6]

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Functions, Softwares, interfacing of LED, LCD, motors, and switches. Serial Communication Programming: Introduction to Serial Communication, Types of Serial Communication, Programming of UART, Interfacing of ADC, sensor interfacing, embedded networking.	
Unit 5: Embedded/Real-Time Based Operating System Need of RTOS in Embedded system software, Architecture of kernel, task, task-scheduler: task states, context switching, scheduling algorithm; ISR, Semaphores, mailbox, message queues, pipes, events, timers and memory management.	[7]
Unit 6: Linux Fundamentals & Device Drivers Linux Fundamentals, Features of Linux, Linux Commands, File manipulation commands, Editors, directory commands, Introduction to Device Driver, The Role of Device Driver, Types of Device Drivers.	[6]

Text Books:
1. Embedded /Real-Time System- black book by Dr K. V. K. K. Prasad, 2nd edition, Dreamtech press.
2. The 8051 Microcontroller and Embedded Systems – using assembly and C, Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; PHI, 2006 / Pearson, 2006.
3. The 8051 Microcontroller, Kenneth J. Ayala, 3rd Edition, Thomson/Cengage Learning.

Reference Books:
1. K. V. Shibu, Introduction to Embedded Systems, TMH, ISBN: 978-9339219680
2. F. Vahid, Embedded System Design – A unified hardware and software introduction, John Wiley, ISBN: 978-0-471- 38678-0
3. Rajkamal, Embedded Systems, TMH.
4. L. B. Das, Embedded Systems and Integrated approach, Pearson, ISBN: 978-81-317-8766- 5. M. Mazidi, PIC Microcontroller and Embedded System, Pearson

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Elective-III
A. Biomedical Instrumentation

AR703A	PEC	Biomedical Instrumentation	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Sensor and Instrumentation

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

CO1	Explain the introduction of an fundamentals of transducers as applicable to physiology
CO2	Illustrate the human body parameter measurements setups
CO3	Illustrate about the basic concepts of forensic techniques
CO4	Explain the importance of Medical Imaging
CO5	Illustrate about the Assisting and therapeutic equipments
CO6	Explain pathological (clinical) test Instruments for medical diagnosis

Course Contents:

Unit 1: Physiology and transducers Cell and its structure, Resting and Action Potential, Nervous system: Functional organization of the nervous system, Structure of nervous system, neurons, synapse, transmitters and neural communication, Cardiovascular system, respiratory system, Basic components of a biomedical system, Transducers, selection criteria, Piezo-electric, ultrasonic transducers, Temperature, measurements - Fiber optic temperature sensors	[7]
Unit 2: Electro – Physiological measurements Electrodes Limb electrodes, floating electrodes, pre-gelled disposable electrodes, Micro -needle and surface electrodes, Amplifiers: Preamplifiers, differential amplifiers, chopper amplifiers, Isolation amplifier. ECG, EEG, EMG, ERG, Lead systems and recording methods, Typical waveforms. Electrical safety in medical environment: shock hazards, leakage current-Instruments for checking safety parameters of biomedical equipment.	[6]
Unit 3: Non-electrical parameter measurements Measurement of blood pressure, Cardiac output, Heart rate, Heart sound Pulmonary function measurements, spirometer, Photo Plethysmography, Body Plethysmography ,Blood Gas analyzers : pH of blood, measurement of blood pCO_2, pO_2, finger-tipoximeter, ESR, GSR, measurements, Standard HL7	[7]

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Unit 4: Medical Imaging Radiographic and fluoroscopic techniques, X rays, Computer tomography , Mammography, MRI, fMRI, Ultrasonography, Endoscopy, Thermography, Different types of biotelemetry systems and patient monitoring	[7]
Unit5: Assisting and therapeutic equipments Pacemakers, Defibrillators, Ventilators, Nerve and muscle stimulators, Diathermy, HeartLung machine, Audio meters, Dialyzers, Lithotripsy	[7]
Unit6: Medical Laboratory Instruments Types of test Blood cell,Bio chemistry, Blood Cell Counter ,Bio chemistry analyzer., Auto analyzer, Blood gas analyzer.	[6]

Text Books:

1. R.S.Khandpur, 'Hand Book of Bio-Medical instrumentation', Tata McGrawHill PublishingCoLtd., 2003.
2. Leslie Cromwell, Fred J.Weibell, Erich A.Pfeiffer, 'Bio-Medical InstrumentationandMeasurements', II edition, Pearson Education, 2002 / PHI.
3. J.Webster, 'Medical Instrumentation', John Wiley & Sons, 1995.
4. L.A. Geddes and L.E.Baker, 'Principles of Applied Bio-Medical Instrumentation', JohnWiley&Sons, 1975.

Reference Books:

1. Joseph Bronzio, "Biomedical Engineering and Instrumentation" ,PWS Engg. Bostan
2. J.Webster "Bioinstrumentation ",Wiley and Sons
3. Joseph Bronzi "Biomedical Engineering handbook",CRC Press

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Elective-III
B. Data Analytics

AR703B	PEC	Data Analytics	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mathematics III

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

CO1	Explain the effectively visualize and interpret the data
CO2	Apply the Descriptive analytics
CO3	Make use of Predictive analytics
CO4	Make use of Classification techniques
CO5	Apply the prescriptive analytics
CO6	Use data analysis for Reinforcement learning

Course Contents:

Unit I: Introduction to data analytics Significance & applications of data analytics, Data collection, data processing, data transformation, data integration, data visualization, basic statistics, inferential statistics	[6]
Unit 2 Descriptive analytics Uni-variate/multi-variate statistics, bi-variate associations, correlations, covariance, analysis of variance (ANOVA)	[6]
Unit 3 Predictive analytics Multiple regression, conjoint analysis, neural networks, data clustering, Data mining	[6]
Unit 4 Classification techniques Linear classifiers, Quadratic classifiers, Support vector machines, Random forests.	[7]
Unit 5 Prescriptive analytics Decision tree analysis, Expert system, principal component analysis, genetic algorithms	[7]
Unit 6 Reinforcement learning Markov chain analysis, Monte Carlo simulation, Q learning, State action reward state action (SARSA) learning	[6]

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Text Books:

1. Bhattacherjee Vandana, Bishnu Partha Sarathi, Data Analysis : Using Statistics And Probability With R Language, Phi Learning, ISBN: 9789387472655.
2. Bharti Motwarni Data Analytics with R, 2019, Wiley, ISBN: 9788126576463

Reference Books:

1. Acharya Seema and Chellappan, Big Data and Analytics, Willey India Pvt. Ltd. (2015), ISBN: 9788126554782
2. Data Science and Big Data Analytics: Discovering, Analyzing, Visualizing and Presenting Data, EMC Education Services, Willey India Pvt. Ltd. (2016), ISBN: 978-1-118-87622-0
3. Michael Minelli, Michale Chambers, Ambiga Dhiraj, Big Data Analytics: Emerging Business Intelligence and analytics trends for today's business, Willey India Pvt. Ltd. (2015)

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Elective-III
C .Micro and Nano Electromechanical Systems

AR703C	PEC	Micro and Nano Electromechnaical System	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Solid Mechanics , Basic Physics

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

CO1	Explain knowledge of Nano science and nanotechnology including theory & practical application
CO2	Explain the Potentially apply the concepts of Quantum Dots and Synthesis of Nanostructure Materials in research projects.
CO3	Illustrate about the scaling of Electronic components for producing MEMS switches
CO4	Make use of novel ideas using the concepts of characterization and Nanotechnology application.
CO5	Explain about Nanotechnology Applications
CO6	Select an appropriate micro sensor and micro actuator in a given application.

Course Contents:

Unit 1: Nanoscale Systems Length, energy, and time scales - Quantum confinement of electrons in semiconductor nanostructures: Quantum confinement in 3D, 2D, 1D and zero dimensional structures -Size effect and properties of nanostructures- Landauer - Buttiker formalism for conduction in confined geometries - Top down and Bottom up approach.	[6]
Unit 2 Quantum Dots Excitons and excitonic Bohr radius – difference between nanoparticles and quantum dots - Preparation through colloidal methods - Epitaxial methods- MOCVD and MBE growth of quantum dots - current-voltage characteristics - magneto tunneling measurements - spectroscopy of Quantum Dots: Absorption and emission spectra - photo luminescence spectrum - optical spectroscopy - linear and nonlinear optical spectroscopy.	[6]
Unit 3: Introduction to MEMS And NEMS Working principles as micro sensors (acoustic wave sensor, biomedical and biosensor, chemical sensor, optical sensor, capacitive sensor, pressure sensor and thermal sensor), micro actuation (thermal actuation, piezoelectric actuation and electrostatic actuation–micro	[6]

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gripers, motors, valves, pumps, accelerometers, fluidics and capillary electrophoresis, active and passive micro fluidic devices, Pizoresistivity, Pizoelectricity and thermoelectricity, MEMS/NEMS design, processing, Oxidation, Sputter deposition, Evaporation, Chemical vapor deposition etc.	[6]
Unit 4:Introduction Electronic Scaling Scaling of physical systems – Geometric scaling & Electrical system scaling. The SingleElectron Transistor: The Single- Electron Transistor Single-Electron Transistor Logic, Other SET and FET Structures, Carbon Nanotube Transistors (FETs and SETs), Semiconductor Nanowire FETs and SETs,Coulomb Blockade in a Nanocapacitor, Molecular SETs and Molecular Electronics.	[6]
Unit 5: Nanotechnology Applications Applications of nanoparticles, quantum dots, nanotubes and nanowires for nano device fabrication – Single electron transistors, coulomb blockade effects in ultra-small metallic tunnel junctions - nanoparticles based solar cells and quantum dots based white LEDs – CNT based transistors – principle of dippenlithography	[6]
Unit 6: Micro sensors and Micro actuators Smart Sensor, Actuator and Transducer Technologies, Smart Sensors: Accelerometers; Force Sensors; Load Cells; Torque Sensors; Pressure Sensors; Microphones; Sensor Arrays Smart Actuators: Displacement Actuators; Force Actuators; Power Actuators; Vibration Dampers; Shakers; micro Fluidic Pumps; micro Motors Smart Transducers: Ultrasonic Transducers; Sonic Transducers	

Text Books:
1. G. Timp, Nanotechnology. Editor, AIP press, Springer-Verlag, New York, 2007
2. Stephen D. Senturia, Microsystem Design, Kluwer Academic Press, 2005. 3. Marc Madou, Fundamentals of microfabrication & Nanofabrication, 2013, March 30.

Reference Books:
1. Hand book of Nanostructured Materials and Technology, Vol.1-5, Editor:- Hari Singh Nalwa; Academic Press, USA(2000). Hand book of Nanoscience, Engineering and Technology (The Electrical Engineering handbook series), Kluwer Publishers,2002
2. C.J. Brinker, G.W. Scherrer and Sol-Gel Science, Academic Press, Boston, Dec 11, 2016.
3. Nanoscale characterization of surfaces & interfaces, N John Dinardo, Weinheim Cambridge: Wiley-VCH, 2nd ed.,2000.
4. T. Fukada&W.Mens, Micro Mechanical system Principle & Technology, Elsevier, 2012.
5. Julian W.Gardnes, Vijay K. Varda, Micro sensors MEMS & Smart Devices, 2001.

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Elective-III

D. Industrial Robotics and Material Handling

AR703D	PEC	Industrial Robotics and Material Handling	3-0-0	3 Credits

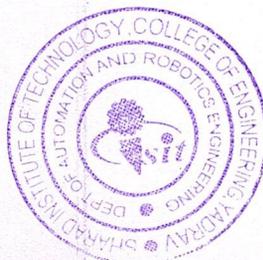| Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Principles of Robotics, Factory Automation, Computer Integrated Manufacturing

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

CO1	Explain about material handling system
CO2	Illustrate about storage and data capturing system
CO3	Interpret the basic concepts, parts of robots and types of robots
CO4	Select the robots according to its usage
CO5	Describe various applications of robots, justification and implementation of robot.
CO6	Explain about the applications of Robots in Manufacturing

Course Contents:

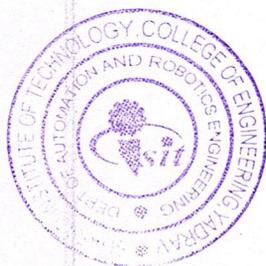| Unit 1: Introduction to Material handling Principles of Material Handling, Unit load concept, Material Handling equipment, Material transport systems: AGVs, Monorails, Conveyor systems, Cranes and hoists, Analysis of material transport systems: Charting technique, analysis of vehicle based systems, Conveyor analysis	[7]
Unit 2: Storage and Data capturing systems Conventional storage methods and equipments Storage system performance, Analysis of Automated storage/retrieval systems (ASRS) and Carousel Storage system. Automatic data capturing system (ADC), Bar coding, Radio frequency identification (RFID), Optical character recognition, Magnetic stripes	[6]
Unit 3: Introduction Industrial Robots Types of industrial robots, Load handling capacity, general considerations in Robotic material handling, material transfer, machine loading and unloading, CNC machine tool loading, Robot centered cell.	[7]
Unit 4: End Effectors Classification	[7]

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Design consideration, Materials for hostile operation. Cylindrical Cam type; Grippers using pneumatic, hydraulic and electrical motor for transmission; Vacuum Grippers, Ultrasonic grippers. Gripper force analysis and gripper design, design of multiple degrees of freedom, active and passive grippers. Selection of Robot: Factors influencing the choice of a robot, robot performance testing, economics of robotisation, Impact of robot on industry and society	
Unit5: Applications of Robots in Manufacturing Pick and place Robot, Application of Robots in Arc Welding Robots, Assembly and mega-assembly Robots continuous arc welding, Spot welding, Spray painting, assembly operation, Other industrial applications: Coating, Deburring, cleaning, Die Casting, Moulding, Material handling, Picking, Palletizing, Packaging Robots For Inspection : Robotic vision systems, image representation, object recognition and categorization, depth measurement	[7]
Unit6: Advanced Applications of robots Military and medical applications, robot for underwater applications Robots, Climbing Robots, Machine mounted Robots. Interfacing Robots with computers. Obstacle Avoidance: Lee's Algorithm; Counter Path Defining using 'via' point, blending	[6]

Text Books:
1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGrawHill Singapore, 1996.

Reference Books:
1. Groover M. P., "Automation, Production Sysytems, and Computer –Integrated Manufacturing",Pearson Education,ISBN-81-7808-511-9
2. Deb S.R., "Robotics", Tata McGraw Hill Publications, New Delhi. ISBN 13: 9780070077911
3. Yoram Koren, & quot; Robotics for Engineers", McGraw Hill Book Co. ISBN-10: 0070353999, ISBN-13: 978-0070353992
4. Groover M.P., Weiss M., Nagel R.N., Odrey N.G., "Industrial Robotics Technology - Programming and Applications & McGraw Hill Book Co. ISBN-10: 1259006212, ISBN-13: 978-1259006210
5. Fu K.S., Gonzalex R.C., Lee C.S.G., "Robotics Control Sensing, Vision and intelligence", McGraw Hill Book Co. ISBN 10: 0070226253 / ISBN 13: 9780070226258 7.
6. Hall A.S. Kinematics and Linkage Design", Prentice Hall. ISBN-10: 0881332720, ISBN-13: 978- 0881332728

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Elective-IV
A. Image Processing and Vision Systems

AR704A	PEC	Image Processing and Vision Systems	3-0-0	3 Credits

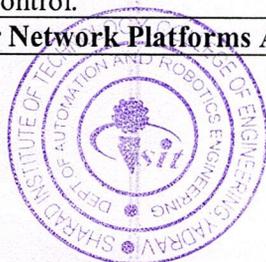| Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Python Programming

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

CO1	Identify the geometric relationship of pixels.
CO2	Apply different image transforms and filtering techniques on an image.
CO3	Apply the knowledge of simple codes for improving image quality
CO4	Performs operations on color image processing.
CO5	Demonstrate applications based on image processing.
CO6	Identify the Machine vision in robotics

Course Contents:

Unit 1: Vision System Basic Components Fundamental steps in DIP, Components of image processing system, Elements of visual perception: structure of human eye, Image formation Image formation model –Image sensing and Acquisition– Basic relationship between pixels	[6]
Unit 2: Low-Level Vision Image representation – Gray level transformations- Image Negation, log transformation, power law transformation, piecewise linear transformation functions, Histogram equalization, Filters: Smoothing spatial filters, sharpening spatial filters smoothing frequency domain filters, sharpening frequency domain filters.	[7]
Unit 3: Higher-Level Vision Segmentation: Detection of discontinuities- Point detection, line detection, edge detection, Thresholding, Region-oriented segmentation: region growing, region splitting and merging.	[6]
Unit 4: Color Image Processing Color Fundamentals, color models, pseudocolor image processing Morphological image processing: Dilation & erosion, opening and closing operation, Hit-or-miss transformations.	[7]
Unit 5: Applications K-means Clustering, Road condition monitoring, Cancer detection using computer vision,	[7]

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Traffic flow analysis, Computer vision in healthcare, Computer vision in sports, Computer vision in security sector, Computer vision in education.	
Unit 6: Robot and Machine Vision Basic introduction to Robotic operating System (ROS), Object detection and tracking, Object recognition, motion detection	[6]

Text Books

1. K.S.Fu, R.C.Gonzalez, CSG. Lee, —Robotics control, sensing, vision and Intelligence‖, McGraw Hill Education Pvt. Ltd., 2013.
2. Richard D Klafter, Thomas A Chmielewski, Michael Negin, —Robotics Engineering: An Integrated Approach‖, PHI Learning, New Delhi, 2009.

Reference Books:

1. Damian M Lyons,—Cluster Computing for Robotics and Computer Vision‖, World Scientific, Singapore, 2011
2. RafelC.Gonzalez, Richard E.Woods, Steven L.Eddins,‖Digital ImageProcessing using MATLAB‖,2nd edition, Tata McGraw Hill, 2010.
3. Carsten Steger, Markus Ulrich, Christian Wiedemann, —Machine Vision Algorithms and Applications‖, WILEY-VCH, Weinheim, 2008.
4. Kenneth Dawson-Howe, —A Practical Introduction to Computer Vision with OpenCV‖, Wiley, Singapore, 2014.

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Elective-IV
B. Wireless Sensor Network for Robotics

AR704B	PEC	Wireless Sensor Network for Robotics	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

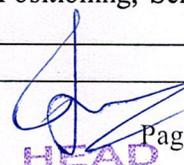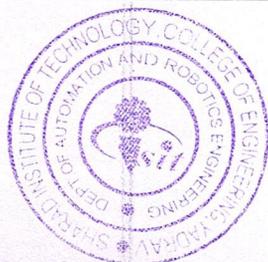**Pre-Requisites**: Basic Electronics and Circuits, Control System

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

CO1	Explain the know about the different techniques used in networking
CO2	Interpret about basic knowledge about wireless sensor networks
CO3	Interpret know about the tools in networking
CO4	Apply the basic in wireless architecture
CO5	Extend the Know about the protocols used in networking
CO6	Illustrate about Mobile Ad-hoc network

Course Contents:

Unit 1: Overview of Wireless Sensor Networks Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks.	[7]
Unit 2: Architecture Single-Node Architecture - Hardware Components, Energy Consumption of Sensor Nodes , Operating Systems and Execution Environments, Network Architecture -Sensor Network Scenarios, Optimization Goals and Figures of Merit, Gateway Concepts.	[6]
Unit 3: Networking Sensors Physical Layer and Transreceiver Design Considerations, MAC Protocols for Wireless Sensor Networks, Low Duty Cycle Protocols And Wakeup Concepts - S-MAC, The Mediation Device Protocol, Wakeup Radio Concepts, Address and Name Management, Assignment of MAC Addresses, Rout ing Protocols- Energy-Efficient Routing, Geographic Routing	[7]
Unit 4: Infrastructure Establishment Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.	[7]
Unit5: Sensor Network Platforms And Tools	[7]

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Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.	
Unit6:Mobile Ad hoc Network Introduction, Routing Protocol ,Dynamic source routing ,Distination sequence,distance vector, Overview ad-hoc rotuting protocol ,Application RFID,Bluetooth,Zigbee	[6]

Text Books:

1. Holger Karl & Andreas Willig, "Protocols And Architectures for Wireless Sensor Networks", John Wiley, 2005..
2. Feng Zhao & Leonidas J. Guibas, —Wireless Sensor Networks- An Information Processing Approach", Elsevier, 2007

Reference Books:

1. Joseph Bronzio, "Biomedical Engineering and Instrumentation" ,PWS Engg. Bostan
2. J.Webster "Bioinstrumentation ",Wiley and Sons
3. Joseph Bronzi "Biomedical Engineering handbook",CRC Press

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Elective-IV
C .Neural Network and Fuzzy logic

AR704C	PEC	Neural Network and Fuzzy logic	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Mathematics, Python Programming

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

CO1	Identify and describe Fuzzy Inference Systems and their roles in building intelligent machines
CO2	Make use of the feasibility of applying Neural Networks and Fuzzy systems for a particular problem
CO3	Apply fuzzy logic and reasoning to handle uncertainty and solve engineering problems
CO4	Apply neural networks to pattern classification and regression problems
CO5	Make use of use existing software tools to solve real problems using Neural Networks and Fuzzy Systems
CO6	Evaluate and compare solutions by Neural Networks and Fuzzy systems for given problems.

Course Contents:

| Unit 1: :Neural Networks Introduction Humans and Computers, Organization of the Brain, Biological Neuron, Biological and Artificial Neuron Models, Hodgkin-Huxley Neuron Model, Integrate-and-Fire Neuron Model, Spiking Neuron Model, Characteristics of ANN, McCulloch-Pitts Model, Historical Developments, Potential Applications of ANN. Neuron, Nerve structure and synapse, Artificial Neuron and its model, activation functions,	[7]
Unit 2: Essentials of Artificial Neural Networks Artificial Neuron Model, Operations of Artificial Neuron, Types of Neuron Activation Function, ANN Architectures, Classification Taxonomy of ANN – Connectivity, Neural Dynamics (Activation and Synaptic), Learning Strategy (Supervised, Unsupervised, Reinforcement), Learning Rules, Types of Application	[6]
Unit 3: Neural Networks Architecture Single layer and multilayer feed forward networks, recurrent networks. Various learning techniques; perception and convergence rule, Auto-associative and hetro-associative memory, perceptron model, solution, single layer artificial neural network, multilayer	[7]

perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications	
Unit 4: Fuzzy Logic Introduction Basic concepts of fuzzy logic, Fuzzy sets and Crisp sets, Fuzzy set theory and operations, Properties of fuzzy sets, Fuzzy and Crisp relations, Fuzzy to Crisp conversion	[7]
Unit5: Fuzzy Logic: Fuzzy Membership, Rules Membership functions, interference in fuzzy logic, fuzzy if-then rules, Fuzzy implications and Fuzzy algorithms, Fuzzyfications & Defuzzificataions, Fuzzy Controller, Industrial applications.	[7]
Unit6: Fuzzy Logic Applications Operations of Fuzzy relation, Defuzzification, Fuzzy rule base and approximate reasoning, Fuzzy Inference Systems, Design a fuzzy logic controller: Mamdani and Sugeno Architecture	[6]
Text Books: 1. S. Rajsekaran & G.A. Vijayalakshmi Pai, "Neural Networks,Fuzzy Logic and Genetic Algorithm:Synthesis and Applications" Prentice Hall of India. 2. N.P.Padhy,"Artificial Intelligence and Intelligent Systems" Oxford University Press.	
Reference Books: 1. Siman Haykin,"Neural Netowrks"Prentice Hall of India 2. Timothy J. Ross, "Fuzzy Logic with Engineering Applications" Wiley India. 3. Kumar Satish, "Neural Networks" Tata Mc Graw Hill 4. Neural Networks and Fuzzy Logic System by Bart Kosko, PHI Publications.	
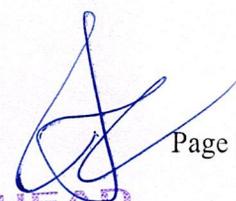
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Elective-IV
D. Autonomous Robotics and Telecherics

AR704D	PEC	Autonomous Robotics and Telecherics	3-0-0	3 Credits

Teaching Scheme	Evaluation Scheme
Lecture: 3 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Field and Robotics

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

CO1	Explain the concept of principles of working of autonomous robots
CO2	Demonstrate the sensing, perception, and cognition of autonomous robots
CO3	Make use of anatomy of autonomous robots
CO4	Identify the autonomy of Mobile robot
CO5	Utilize principles of operation of telecheric robot
CO6	Explain the implementation of Micro-robots

Course Contents:

Unit 1: : Introduction Fundamentals of mobile robotics, basic principles of locomotion, Kinematics and Mobility, Classification of mobile robots, AI for Robot Navigation.	[7]
Unit 2: Introduction to modern mobile robots Swarm robots, cooperative and collaborative robots, mobile manipulators, Current challenges in mobile robotics.	[6]
Unit 3: Autonomous Mobile Robots –I Need and applications, sensing, localization, mapping, navigation and control.	[7]
Unit 4: Autonomous Mobile Robots –II The Basics of Autonomy (Motion, Vision and PID), Programming Complex Behaviors (reactive, deliberative, FSM), Robot Navigation (path planning), Robot Navigation (localization), Robot Navigation (mapping), Embedded electronics, kinematics, sensing, perception, and cognition,	[7]
Unit5: Telecheric robots Concepts of teleoperations, Need and applications of Telecheric robots, Humanoid Robots, Swarm Robotics, Robot Applications and Ethics.	[7]
Unit6: Implementation of Micro-robots Arrayed actuator principles for micro-robotic applications – Micro-robotic actuators - Design of locomotive micro-robot devices based on arrayed actuators Micro-robotics	[6]

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devices: Micro-grippers and other micro-tools - Micro-conveyors - Walking MEMS Micro-robots – Multi-robot system: Micro-robot powering, Micro-robot communication.

Text Books:

1. Peter Corke, Robotics Vision and Control, Springer 2011.
2. Mikell Groover, Mitchell Weiss, Roger N. Nagel, Nicholas Odrey, Ashish Dutta, Industrial Robotics 2nd edition, SIE , McGraw Hill Education (India) Pvt Ltd (2012)

Reference Books:

1. Designing Autonomous Mobile Robots, John M Holland, Elsevier, 2004
2. Morgan Quigley , Brian Gerkey, Programming Robots with ROS, Quigley et al, O'Rielly Publishers, Murphy 2000.
3. Autonomous Mobile Robots, Edited by Shuzhi Sam Ge, Frank L Lewis, Taylor and Francis, 2006
4. Roland Siegwart, Illah Reza Nourbakhsh, Davide Scaramuzza, Introduction to Autonomous Mobile Robots", MIT Press, 2nd Edition, 2011.

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Machine Learning Laboratory

AR705	PCC	Machine Learning Laboratory	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hrs/week	Continuous Assessment –I :15 Marks Continuous Assessment –II :15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Python Programming

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

CO1	Apply various AI search algorithms (uninformed, informed, heuristic, constraint satisfaction,)
CO2	Demonstrate working knowledge of reasoning in the presence of incomplete and/or uncertain information
CO3	Analyze, design and create AI platforms and solutions for the real life problems.
CO4	Explain the fundamentals of knowledge representation, inference

List of Experiments:

At least minimum 10 experiment should be performed from the following List

1. Develop a python program to learn different libraries NumPy.
2. Develop a python program to import and export data using Pandas library functions
3. Demonstrate various data pre-processing techniques for a given dataset.
4. Develop a Python program to demonstrate various Data Visualization Techniques.
5. Develop a python program to implement linear regression Algorithm.
6. Develop Logistic Regression Model for a given dataset.
7. Develop Decision Tree Classification model for a given dataset and use it to classify a new sample.
8. Implement Naïve Bayes Classification in Python.
9. Build KNN Classification model for a given dataset.
    a) Implement Random forest ensemble method on a given dataset.
    b) Implement Boosting ensemble method on a given dataset.
10. Write a python program to implement K-Means clustering Algorithm.
11. Build Artificial Neural Network model with back propagation on a given dataset.

Text Books:

1. Tom Mitchell, Machine Learning_, McGraw Hill, 2015.
2. . Peter Flach, _Machine Learning: The Art and Science of Algorithms that make sense of
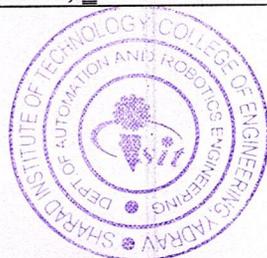
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data_, Cambridge, 201

Reference Books:

1. Hal Daume III, _A course in Machine Learning_, Todo, 2015.
2. EthemAlpaydin,_Introduction to Machine Learning_,The MIT Press, 2004
3. David MacKay, Information Theory, Inference and Learning Algorithms_, Cambridge, 2003

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Simulation Laboratory

AR706	PCC	Simulation Laboratory	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hrs/week	Continuous Assessment –I :15 Marks Continuous Assessment –II :15 Marks End Semester Exam: :20 Mark

Pre-Requisites: CAD-CAM Automation.

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

CO1	Develop skills in CAE analysis for structural and thermal problems, optimizing designs
CO2	Plan for advanced CAD/CAM techniques, including part modeling, complex tool path generation, and CNC machining capabilities.
CO3	Build generative design optimization and investigate laser engraving depth through practical experiments

List of Experiments:

At least minimum 5 experiment should be performed from the following List

1. Part modeling using 3 D software
2. Stuctural analysis problem to be solved using a CAE tools
3. Thermal analysis problem to be solved using CAE tools
4. Investigate the cutting capabilities of the CNC module
5. Evaluate the strength of 3D-printed parts with varying infill densities
6. Explore the software's advanced features for generating complex tool paths and designs.
7. To investigate the relationship between laser power settings and engraving depth on a specific material
8. Generative design optimization using any suitable software

Text Books:
1. Ibrahim Zeid —Mastering CAD CAM‖ Tata McGraw-Hill Publishing Co.2007
2. Rao, S.S., —The Finite Element Method in Engineering‖, 5th Edition, Butterworth Heinemann, 2010

Reference Books:
1. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, —Concepts and Applications of Finite Element Analysis‖, 4th Edition, Wiley Student Edition, 2002.
2. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson, 3 rd edition, 2013..

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Industrial Robotics and Material Handling Systems Laboratory

AR707	PCC	Industrial Robotics and Material Handling Systems Laboratory	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hrs/week	Continuous Assessment –I :25 Marks
	Continuous Assessment –II :25 Marks

Pre-Requisites: Factory Automation, Field and Service Robotics

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

CO1	Analyze and implement storage solutions and data capturing systems
CO2	Develop proficiency in configuring and programming robot manipulators for tasks
CO3	Analyze and implement storage solutions and data capturing systems to enhance inventory management, supply chain visibility, and operational control.

List of Experiments:

1. Investigate Demonstrate of Material handling systems

2. Analysis of Storage and Data capturing systems

3. Analysis of configuration of robots and motion of robot manipulator

4. Investigate of pick and place industrial robot

5. Study and analysis of robot grippers (includes the problems based on gripper force)

6. Case Study on advanced industrial applications of robots

Text Books:
1. R.K.Mittal and I.J.Nagrath, Robotics and Control, Tata McGraw Hill, New Delhi,4th Reprint, 2005.
2. JohnJ.Craig ,Introduction to Robotics Mechanics and Control, Third edition, Pearson Education, 2009.
3. M.P.Groover, M.Weiss, R.N. Nageland N. G.Odrej, Industrial Robotics, McGrawHill Singapore, 1996.

Reference Books:
1. Groover M. P., "Automation, Production Sysytems, and Computer –Integrated Manufacturing",Pearson Education,ISBN-81-7808-511-9

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2. Deb S.R., "Robotics", Tata McGraw Hill Publications, New Delhi. ISBN 13: 9780070077911

3. Yoram Koren, & quot; Robotics for Engineers", McGraw Hill Book Co. ISBN-10: 0070353999, ISBN-13: 978-0070353992

4. Groover M.P., Weiss M., Nagel R.N., Odrey N.G., "Industrial Robotics Technology - Programming and Applications & McGraw Hill Book Co. ISBN-10: 1259006212, ISBN-13: 978-1259006210

5. Fu K.S., Gonzalex R.C., Lee C.S.G., "Robotics Control Sensing, Vision and intelligence", McGraw Hill Book Co. ISBN 10: 0070226253 / ISBN 13: 9780070226258 7.

6. Hall A.S. Kinematics and Linkage Design", Prentice Hall. ISBN-10: 0881332720, ISBN-13: 978- 0881332728

7. Todd D.J., "Fundamentals of Robot Technology", Wiley Publications, ISBN:978-0-470-20301-9

Account and Finance Management

AR708	MC	Account and Finance Management	1-0-0	Audit

Teaching Scheme:	Evaluation Scheme:
Lecture: 1 hrs/week	CA-I: 25 Marks
	CA-II: 25 Marks

Pre-Requisites: NA

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

CO1	Explain basic terminology used in finance and accounts
CO2	Prepare and appraise Financial Statements and evaluate company in the light of different
CO3	Analyze the risk and return of alternative sources of financing.
CO4	Estimate cash flows from a project, including operating, net working capital, and capital spending
CO5	Estimate the required return on projects of differing risk ,to estimate the cash flows from an investment project, calculate the appropriate discount rate, determine the value added from the project, and make a recommendation to accept or reject the project
CO6	Describe and illustrate the important elements in project finance Using financial calculator and Excel in a variety of problems.

Course Contents:

Unit 1: Introduction to Financial Accounting, Book keeping and Recording Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger , Cash book and Trial balance. (Practical application on tally)	[2]
Unit 2: Financial Statement Preparation, analysis and Interpretation Preparation of financial statement and Profit and Loss Account, Balance Sheet, Ratio Analysis -classification of various ratios. (Calculation on Excel)	[2]
Unit 3: Introduction To Financial Management Concept of business finance, Goals and objectives of financial management, Sources of financing - LONG TERM: shares, debentures, term loans, lease and hire purchase, retained earnings, public deposits, bonds (Types, features and utility), SHORT TERM: bank finance, commercial paper, trade credit and bills discounting, INTERNAL: Retained earnings	[2]
Unit 4: Working Capital Management Concept of working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, Financing approaches for working capital, Methods of forecasting working capital requirements, meaning and importance of accounts receivable.(Excel)	[2]

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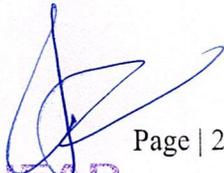Dept. Of Automation And
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Unit 5: Time Value of Money and Capital Budgeting Concept of time value of money, Compounding and discounting; Future value of single amount and annuity, present value of single amount and annuity; Practical application of time value technique. Capital budgeting - Nature and significance, techniques of capital budgeting –Pay Back Method, Accounting rate of return, Internal Rate of Return, DCF, Net Present Value and profitability index. (Application on Excel)	[2]
Unit 6: Project Financing Details of the company, its promoters, and project finances required, profitability etc., Loan documentation-Appraisal of terms loans by financial institutions. Basic components of project finance.(Excel Based)	[2]
Text Books: 1. Financial, Cost and Management Accounting by Dr. P. Pariasamy, HH Publication. 2. Financial Management by Khan and Jain, Tata McGraw Hill. 3. Financial Management by Dr. P. C. Tulsian, S.Chand. 4. Financial Management by Ravi Kishore,Taxmann	
Reference Books: 1. "Book Keeping and Accountancy" Choudhari, Chopde. 2. "Cost Accounting": Choudhari, Chopde. 3. "Financial Management" Text and Problems: M.Y.Khan, P.K. Jain. 4. "Financial Management Theory & Practice" Prasanna Chandra Tata McGraw Hill. 5. Managerial Economics & Financial Analysis, Siddiqui S.A. Siddiqui A.S. New Age.	

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Industrial Case Studies (Seminar)

PRJO6	PROJ	Industrial Case Studies (Seminar)	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hrs./week	Continuous Assessment 1: 25 Marks
	Continuous Assessment 2: 25 Marks

Pre-Requisites:

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

CO1	Identify technical and practical issues related to the area of course specialization
CO2	Plan a well-organized case studies report employing elements of technical writing and critical
CO3	Demonstrate the ability to describe, interpret and analyze technical issues and develop competence in presenting

Course Contents

The Automation and Robotics Cases group believes that through industrial case studies, students will improve their ability to learn and retain concepts in their courses, on work terms and in their professional lives. One of the best means to create case studies is by converting them from student-generated work reports. As a result, it is in our best interest to ensure that work reports submitted to our group contain an adequate design process and topics that align with topics that professors have suggested would benefit from case studies. We also believe that students will benefit by having suggestions for work term report topics. The student has to select a Seminar topic/Case Studies work based on topic of interest. Periodically the implementation will be evaluated by the project guide. The work starts after sixth semester and evaluated in the seventh semester. The end of each semester student will be evaluated by departmental committee/faculty assigned by HOD. Students are suggested to choose seminar/ case study areas in following semester. The end of each semester student will be evaluated by departmental committee/faculty assigned by HOD.

Students are suggested to choose seminar/ case study areas in following areas

i. Manufacturing / Fabrication of a prototype Robotic / Automated system including selection, concept, design, material, manufacturing the components, assembly of components, testing and performance evaluation.
ii. Improvement of existing Robotic / Automated system.
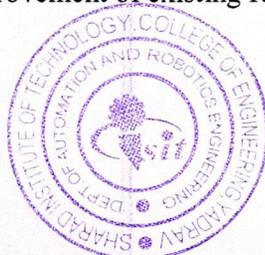
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iii. Design and fabrication of end effectors for robot

iv. Computer aided design, analysis of components such as stress analysis.

v. Modeling and Simulation of Robotic and Automation systems

vi. Robot Kinematics and Dynamic analysis

vii. Low cost automation, Computer Aided Automation in Manufacturing.

viii. Ergonomics and safety aspects of robotic systems

ix. Management Information System.

x. Product design and development

xi. Jigs and Fixtures, dies, tools, special purpose equipment, inspection gauges, measuring instruments for machine tools.

xii. Problems related to Productivity improvements / Value Engineering / Automated Material Handling Systems

xiii. Use of Industry 4.0 by visiting any industry

xiv. Foundry problems and its analysis by visiting any foundry

Apart from this students can choose any relevant topic which is relevant to industry

Capstone Project Phase –II

PRJO7	PROJ	Capstone Project Phase –II	0-0-8	4 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 8 hrs/week	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks End Semester Evaluation: 50 Marks

Pre-Requisites: Basic Knowledge of Core Automation and Robotics Subjects

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

CO1	Identify real life problem and feasibility of solution to the problem
CO2	Analyze and optimize solutions to real life problems with individual and team work
CO3	Improve professional ethics and communication skill and engage with environment

Term Work:

1. At the end of third year, student have to form project batch of minimum 3 and maximum 5 students
2. At the end of semester student have to submit project phase-II report for POE

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Teaching and Evaluation Scheme for Final Year B. Tech.

Department of Automation and Robotics

Semester: VIII

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Department: Automation & Robotics   **Rev:** Course Structure/00/2022-23
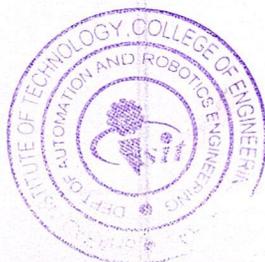
Class: B. Tech   **Semester:** VIII

Course Code	Type of Course	Name of the course	Teaching Scheme				Evaluation scheme					Credit
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
AR801	HSMC	Self Learning Course 1*	-	-	-	-	10	10	30	50	100	3
AR802	PEC	Self Learning Course 2*	-	-	-	-	10	10	30	50	100	3
IFT03	PROJ	Internship**	-	-	-	-	50	50	-	100	200	10
Total			-	-	-	-	70	70	60	200	400	16

Self-Learning Course-1-Finance and Entrepreneurship

AR801A   Fundamentals of Accounting and Finance

AR801B   Organizational Behavior: Individual Dynamics in Organization

AR803C   Leadership and Team Effectiveness

AR804D   Entrepreneurship Essentials

Self-Learning Course-2-Multidisciplinary

AR 802A   Computer Networks and Internet Protocol

AR 802B   Introduction to Industry 4.0 and Industrial Internet of Things

AR 802C   Computer Integrated Manufacturing

AR 802D   Computer Vision and Image Processing-Fundamentals and Applications

*Important Note: * indicates that the same course or title may not be available in Laboratory in NPTEL SWAYAMcatalogue, then course from same domain or category whichever avail Laboratory on NPTEL SWAYAM catalogue will be offered.*

**For Internship student has to go Industry for Internship for 16-18 weeks
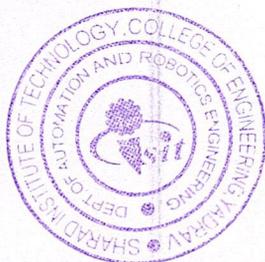
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Fundamentals of Accounting and Finance

AR801A	HSMC	Fundamentals of Accounting and Finance	0-0-0	3 Credits(For 12 Weeks)

Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

**Pre-Requisites**: Account and Finance Management

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

CO1	Identify basic concepts and statements in financial accounting.
CO2	Analyze financial statements using ratios and interpretation tools.
CO3	Construct cost statements using classification and costing techniques.
CO4	Apply CVP and marginal costing to solve decision-making problems.
CO5	Organize budgets and analyze variances for performance evaluation.
CO6	Utilize corporate finance concepts to evaluate investments and valuations.

Course Contents:

Week 1: Terminologies in Financial Accounting
Week 2: • Financial Statements: Balance sheet • Financial Statements: Income Statement Financial Statements: Cash flow Statement
Week 3: • Financial Statement Analysis • Reading financial statements • Financial Ratios
Week 4: • Conceptual basis of Cost Accounting, • Cost behaviour, • Elements of cost and preparation of cost statement • Cost Classification • Direct & Indirect cost • Overhead allocation / absorption • Traditional Method, Primary and Secondary Distribution • Activity Based Costing
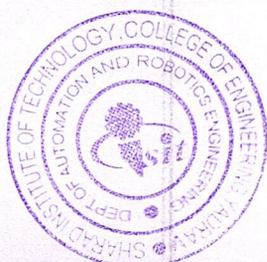
Week 5:
- Cost-Volume-Profit Analysis
- Contribution Margin,
- Break-Even Point
- Marginal Costing,
- Operating Leverage
- Decision making using Marginal Costing

Week 6:
- Performance Evaluation
- Budgeting
- Flexible Budget
- Production Budget
- Sales Budget
- Master Budget
- Variance Analysis

Week 7:
- Introduction to Corporate Finance
- Time Value of Money
- Discounted Cash Flows

Week 8:
- Valuing Bonds
- Valuation of Stocks as Investments

Week 9:
- Valuing Projects NPV and IRR
- Valuing Projects Risk Analysis

Week 10:
Risk, Return and the Capital Asset Pricing Model

Week 11:
- Cost of Debt, Equity, WACC
- Capital Budgeting,
- Capital Market Efficiency
- Capital Structure and Cost of Capital

Week 12:
- Dividends and other Payouts
- Course Summary

Reference Books:
1. Accounting: Text and Cases; Robert N Anthony, David F Hawkins and Kenneth A Merchant, McGraw Hill Education.
2. Cost Accounting; Horngren, Foster & Dattar; PHI Publication
3. Corporate Finance by Ross, Westerfield, Jaffe, Jordan and Kakani, McGraw Hill Education.
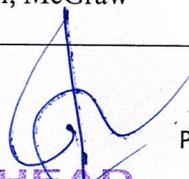
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Organizational Behaviour: Individual Dynamics in Organization

AR801B	HSMC	Organizational Behaviour: Individual Dynamics in Organization	0-0-0	3 Credits(For 12 Weeks)

Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

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

CO1	Identify key concepts of organizational behaviour and individual differences.
CO2	Analyze the effects of diversity, perception, and decision-making in organizations.
CO3	Apply emotional intelligence and stress management at the workplace.
CO4	Develop motivation strategies using classic and modern theories.
CO5	Compare learning theories and model learning in organizations.
CO6	Plan actions to foster knowledge sharing and employee voice.

Course Contents:

| |
|---|
| **Week 1: Understanding organizational behaviour**
Lecture 1: Understanding organizational behavior: Tracing the evolution-1
Lecture 2: Understanding organizational behavior: Tracing the evolution-2
Lecture 3: Individual in the organization: The building blocks
Lecture 4: Understanding individual differences-1
Lecture 5: Understanding individual differences -2 |
| **Week 2: Diversity and inclusion in organization**
Lecture 1: Diverse workforce, inclusive mindset- 1
Lecture 2: Diverse workforce, inclusive mindset- 2
Lecture 3: Perception of diversity and inclusion
Lecture 4: Ableism and inclusion
Lecture 5: Diversity management |
| **Week 3: Perception and decision making**
Lecture 1: The perceptual process
Lecture 2: Factors that influence perception
Lecture 3: Perception and decision making
Lecture 4: What affects decisions?
Lecture 5: Ethical decision making |

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Week 4: Affect and emotions
Lecture 1: Affect and emotions
Lecture 2: Affective events theory
Lecture 3: emotional intelligence
Lecture 4: Understanding stress
Lecture 5: Emotions and moods: Application at workplace

Week 5: Personality
Lecture 1: Understanding self and personality
Lecture 2: Types and theories of personality
Lecture 3: Measuring personality
Lecture 4: Personality traits relevant to organization
Lecture 5: Assessing personality: caveats and concerns

Week 6: Values at workplace
Lecture 1: Values and its importance
Lecture 2: Sources and types of values
Lecture 3: Values that cut across cultures
Lecture 4: Person-job fit
Lecture 5: Person-organization fit

Week 7: Motivational differences in individuals
Lecture 1: Motivation: Basic understanding and definition
Lecture 2: Tracing the roots: Early theories-1
Lecture 3: Tracing the roots: Early theories-1
Lecture 4: Keeping up with times: Contemporary theories- 1
Lecture 5: Keeping up with times: Contemporary theories- 2

Week 8: Motivation: Application at workplace
Lecture 1: Job Design and job characteristics model
Lecture 2: Employee involvement
Lecture 3: Motivating the employees: Strategies for organization-1
Lecture 4: Motivating the employees: Strategies for organization-2
Lecture 5: Organizational justice and employee motivation

Week 9: Learning in organization
Lecture 1: Defining learning
Lecture 2: How do individuals learn?
Lecture 3: Theories of learning- 1
Lecture 4:Theories of learning- 2
Lecture 5: Learning in an organizational setting

Week 10: Learning in organization
Lecture 1: Defining learning
Lecture 2: How do individuals learn?
Lecture 3: Theories of learning- 1
Lecture 4:Theories of learning- 2
Lecture 5: Learning in an organizational setting

Week 11: Knowledge sharing and hiding
Lecture 1: Understanding knowledge sharing
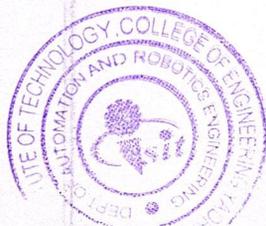
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Lecture 2: Understanding knowledge hiding- what it is and what it is not
Lecture 3: Individual factors affecting knowledge hiding
Lecture 4: Integrating knowledge sharing and hiding behavior
Lecture 5: Strategies for individuals to foster knowledge sharing

Week 12: Employee voice and silence
Lecture 1: Understanding employee voice and silence
Lecture 2: Individual factors affecting voice behavior
Lecture 3: Individual factors affecting silence
Lecture 4: Can silence be strategic?
Lecture 5: Strategies for fostering safe environment at work

Reference Books:
1. Stephen P. Robbins, Timothy A. Judge and Neharika Vohra (2022). Organizational Behavior (18th Edition). Noida: Pearson Education.
2. Steven L. McShane and Mary Ann Von Glinow (2022). Organizational Behavior (9th Edition). Noida: McGraw Hill.
3. Fred Luthans (2013). Organizational Behavior. New Delhi: McGraw Hill.

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Leadership and Team Effectiveness

AR801C	HSMC	Leadership and Team Effectiveness	0-0-0	3 Credits(For 12 Weeks)

Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

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

CO1	Identify key leadership theories, models, and traits for effective leadership.
CO2	Analyze the role of power, ethics, and emotional intelligence in leadership.
CO3	Apply leadership skills in managing teams
CO4	Develop strategies for delegation
CO5	Construct team processes through decision-making
CO6	Plan leadership development using feedback

Course Contents:

| **Week 1:**
Introduction to Leadership & Team Management; Leadership Myths; Interactional Framework for analyzing leadership; Leadership Development: The First 90 Days as a Leader; Leader Development- The Action-Observation-Reflection Model |
|---|
| **Week 2:**
LMX Theory and Normative Decision Model; Situational Leadership Model; Contingency Model and Path Goal Theory; Emotional Approach Charismatic and Transformational Leadership; Leadership for Tomorrow |
| **Week 3:**
Leadership Attributes; Personality Traits and Leadership; Personality Types and Leadership; Intelligence and Leadership; Emotional Intelligence and Leadership |
| **Week 4:**
Power and Leadership; The art of influence in leadership; Leadership and "Doing the Right Things; Character-Based Approach to Leadership; Role of Ethics and Values in Organisational Leadership |
| **Week 5:**
Leadership Behaviour; Leadership Pipeline; Assessing Leadership Behaviors: Multi-rater Feedback Instruments; The Dark Side of; Leadership- Destructive Leadership; Managerial Incompetence and Derailment Conflict Management |

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Week 6:
Negotiation and Leadership; Leadership under a crisis situation; The Situation and the Environment; Culture and Leadership; Global Leadership
Week 7:
Motivation and Leadership; Introduction to Groups and Teams; Characteristics of Leader, Follower and Situation; Group Dynamics; Team Formation
Week 8:
Delegation and Empowerment; Leading teams: Enhancing teamwork within a group; The leader's role in team-based organizations; Leader actions that foster Teamwork Effectiveness; Offsite training and team development
Week 9:
Understanding Team processes and Team Coaching; Team decision making and conflict management; Virtual teams; Managing Multicultural teams; Building great teams
Week 10:
Experiential Learning; Action Learning; Development Planning: GAP Analysis; Coaching and Mentoring; Women in Leadership Roles
Week 11:
Building Effective Relationship with subordinates and peers; Fostering Followers satisfaction; The Art of Communication; Setting Goals and Providing Constructive Feedback; Enhancing Creativity problem solving skills
Week 12:
Building High-Performance Teams: The Rocket Model; Building Credibility and Trust; Skills for Developing.Others; Team Building at the Top; Community Leadership
Reference Books:
1. Leadership: Enhancing the lessons of experience by Hughes, R.L., Ginnett, R.C., & Curphy, G.J. (2019), 9th Edition, McGraw Hill Education, Chennai, India.
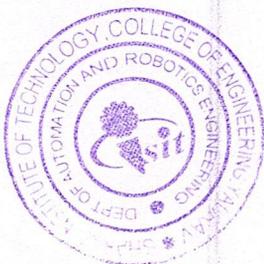
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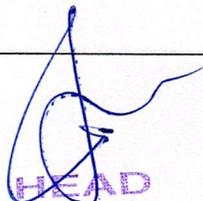Robotics Engineering
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Entrepreneurship Essentials

AR801D	HSMC	Entrepreneurship Essentials	0-0-0	3 Credits(For 12 Weeks)

Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

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

CO1	Identify entrepreneurial qualities, startup myths, and causes of startup failures.
CO2	Develop business models and value propositions using tools like BMC and lean startup.
CO3	Analyze market strategies, financial statements, and capital budgeting for startups.
CO4	Apply innovation frameworks and design thinking to startup ideation and growth.
CO5	Plan funding, legal compliance, and go-to-market strategies for new ventures.
CO6	Evaluate startup risks, HR practices, and strategies for sustainable business success.

Course Contents:

Week 1: Introduction
• Dhirubhai Ambani & Sofia • Myths & Realities about entrepreneurship • entrepreneurial qualities • Why start-ups fail?
Week 2: Mission, vision, entrepreneurial qualities – I
• Mission, vision, entrepreneurial qualities – II • Value proposition • Business Model canvas • Business model generation
Week 3: Competitive advantage
• Lean start-up – 1 • Lean start-up – 2 • Team and early recruit • Legal forms of business
Week 4: Marketing management 1
• Marketing management 2 • Market research – I

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- Market research –II
- Market research –Example

Week 5: Introduction to financial statements

- Profit & Loss statement
- Balance sheet
- Cash flow
- Example – 1
- Example – 2
- Cost-volume-profit & Bread-Even analysis
- Capital budgeting

Week 6: Business plan-I

- Business plan-II
- Pitching
- Go-to-market strategies
- Does & Don'ts

Week 7: How to innovate

- Design Thinking
- Design-Driven Innovation, Systems thinking
- Open innovation, TRIZ
- How to start a start-up?

Week 8: Government incentives for entrepreneurship (1 lecture)

- Incubation, acceleration
- Funding new ventures – bootstrapping, crowd sourcing,
- angel investors, VCs, debt financing (3), due diligence
- Legal aspects of business (IPR, GST, Labour law)

Week 9: Cost, volume, profit and break-even analysis

- Margin of safety and degree of operating leverage
- Capital budgeting for comparing projects or opportunities
- Product costing
- Product pricing

Week 10: Funding new ventures – bootstrapping, crowd sourcing,

- Angel investors, VCs, debt financing (3), and due diligence
- Incubation and acceleration
- Government incentives for entrepreneurship
- Project cost and Financial Closure

Week 11: Dos & Don'ts in entrepreneurship

- Growth Hacking
- Growth Strategy
- Legal aspects of business (IPR, GST, Labor law)
- Negotiation skill

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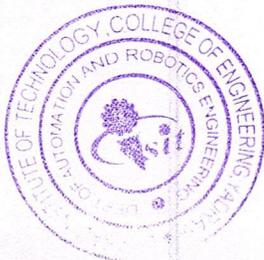## (An Autonomous Institute)
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Week 12: Human Resource management in startups
- Pivoting Entrepreneurial cases
- Risk assessment and analysis
- Strategy management for entrepreneurial ventures
- Factors driving success and failure of ventures
- Concluding remarks

Reference Books:
1. Effective Entrepreneurial Management: Strategy, Planning, RiskManagement, and Organization - Robert D. Hisrich • VelandRamadani, Springer (2017)
2. Entrepreneurship- Theory, Process Practice –by Kuratko &Hodgetts, Thompson South-Western Publication
3. Entrepreneurship –by Robert D. Hisrich (Edition-9)

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Computer Networks and Internet Protocol

AR802A	HSMC	Computer Networks and Internet Protocol	0-0-0	3 Credits(For 12 Weeks)

| Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Programming Fundamentals (C/C++ or Python)

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

CO1	Identify fundamental concepts of computer networks, switching techniques, and protocol architectures.
CO2	Analyze the roles of application, transport, and network layer protocols in data communication.
CO3	Apply flow and congestion control mechanisms in TCP/IP networks.
CO4	Construct IP addressing schemes and evaluate routing protocols for efficient data delivery.
CO5	Inspect data link layer services and compare MAC protocols for error and flow control.
CO6	Utilize network management tools and examine end-to-end communication principles.

Course Contents:

Week 1 : Introduction to Computer Networks – History, Circuit Switching and Packet Switching
Week 2 : TCP/IP Protocol Stack – Basic Overview
Week 3 : Application Layer Services (HTTP, FTP, Email, DNS)
Week 4 : Transport Layer Primitives – Connection Establishment and Closure
Week 5 : Flow Control and Congestion Control at the Transport Layer
Week 6 : Transmission Control Protocol – Basic Features, TCP Congestion Control
Week 7 : Network Layer Primitives – IP Addressing
Week 8 : IP Routing – Intra Domain Routing Protocols, Inter Domain Routing Protocols (BGP)
Week 9 : IP Services – SNMP, ARP
Week 10 : Data Link Layer Service Primitives – Forwarding, Flow Control, Error Control
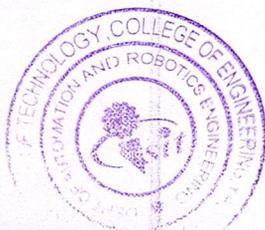
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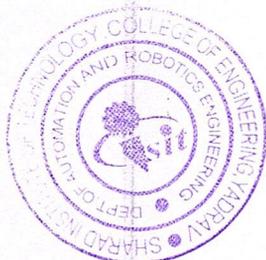# Sharad Institute of Technology College of Engineering
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Week 11 : Media Access Control - Channel Access Protocols, Framing
Week 12 : End to End Principles of Computer Networks

Reference Books:
1. Computer Networking: A Top - Down Approach, by Ames Kurose, Keith Ross
2. Computer Networks - Andrew S Tanenbaum
3. Computer Networks: A Systems Approach Book by Bruce S. Davie and Larry L. Peterson

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Introduction to Industry 4.0 and Industrial Internet of Things

AR802B	HSMC	Introduction to Industry 4.0 and Industrial Internet of Things	0-0-0	3 Credits(For 12 Weeks)

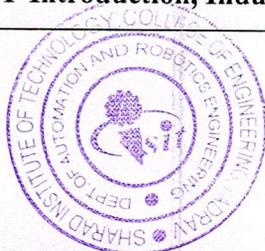| Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Internet of Things

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

CO1	Apply the principles of sensing, actuation, and communication protocols to construct smart and connected industrial systems.
CO2	Analyze the components of Industry 4.0 including cyber-physical systems, AI, and big data to identify their role in modern manufacturing environments.
CO3	Develop secure and scalable Industrial IoT architectures by utilizing multi-layered IIoT frameworks and networking strategies.
CO4	Experiment with data analytics tools and machine learning algorithms to inspect and interpret large-scale industrial data for process optimization.
CO5	Construct IIoT solutions for real-world domains such as healthcare, power, food, and chemical industries by modeling case-specific requirements.
CO6	Plan and organize IIoT implementation strategies considering cybersecurity, fog computing, and cloud integration to enhance industrial automation and management.

Course Contents:

Week 1: Introduction
Sensing & actuation, Communication-Part I, Part II, Networking-Part I, Part II
Week 2: Industry 4.0
Globalization and Emerging Issues, The Fourth Revolution, LEAN Production Systems, Smart and Connected Business Perspective, Smart Factories
Week 3: Industry 4.0
Cyber Physical Systems and Next Generation Sensors, Collaborative Platform and Product Lifecycle Management, Augmented Reality and Virtual Reality, Artificial Intelligence, Big Data and Advanced Analysis
Week 4: Cybersecurity in Industry 4.0, Basics of Industrial IoT:
Industrial Processes-Part I, Part II, Industrial Sensing & Actuation, Industrial Internet Systems.
Week 5: IIoT-Introduction, Industrial IoT: Business Model and Referece Architerture: IIoT-

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Business Models-Part I, Part II, IIoT Reference Architecture-Part I, Part II.
Week 6: Industrial IoT- Layers: IIoT Sensing-Part I, Part II, IIoT Processing-Part I, Part II, IIoT Communication-Part I.
Week 7: Industrial IoT- Layers: IIoT Communication-Part II, Part III, IIoT Networking-Part I, Part II, Part III.
Week 8: Industrial IoT: Big Data Analytics and Software Defined Networks: IIoT Analytics - Introduction, Machine Learning and Data Science - Part I, Part II, R and Julia Programming, Data Management with Hadoop.
Week 9: Industrial IoT: Big Data Analytics and Software Defined Networks: SDN in IIoT-Part I, Part II, Data Center Networks, Industrial IoT: Security and Fog Computing: Cloud Computing in IIoT-Part I, Part II.
Week 10: Industrial IoT: Security and Fog Computing - Fog Computing in IIoT, Security in IIoT-Part I, Part II, Industrial IoT- Application Domains: Factories and Assembly Line, Food Industry.
Week 11: Industrial IoT- Application Domains: Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), Facility Management.
Week 12: Industrial IoT- Application Domains: Oil, chemical and pharmaceutical industry, Applications of UAVs in Industries, Real case studies : Case study - I : Milk Processing and Packaging Industries Case study - II: Manufacturing Industries - Part I Case study - III : Manufacturing Industries - Part II Case study - IV : Student Projects - Part I Case study - V : Student Projects - Part II Case study - VI : Virtual Reality Lab Case study - VII : Steel Technology Lab
Reference Books: 1. Misra, A. Mukherjee, and A. Roy, 2020. Introduction to IoT. Cambridge University Press. Availability: 2. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

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Computer Integrated Manufacturing

AR802C	HSMC	Computer Integrated Manufacturing	0-0-0	3 Credits(For 12 Weeks)

Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

**Pre-Requisites**: CAD/CAM

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

CO1	Identify the components and evolution of Computer Integrated Manufacturing systems.
CO2	Apply CAD and CAM tools in the design and manufacturing process.
CO3	Develop CNC and CAPP-based solutions for automated manufacturing.
CO4	Analyze CIM interfaces and data flow between CAD, CAM, and other systems.
CO5	Simulate manufacturing systems and plan computer-aided maintenance strategies.
CO6	Utilize additive manufacturing and explore advanced CIM techniques for modern production.

Course Contents:

Week 1 : Introduction to Computer Integrated Manufacturing (CIM)
Week 2 : Computer Aided Design
Week 3 : Computer Aided Manufacturing
Week 4 : Computer Numerical Control
Week 5 : Computer Aided Process Planning (CAPP)
Week 6 : CIM interfaces: CAD vs CAM
Week 7 : Data and information in CIM
Week 8 : Manufacturing Systems and their design
Week 9 : Simulation of Manufacturing Systems
Week 10 : Computer Aided Maintenance
Week 11 : Computer Integrated Additive Manufacturing
Week 12 : Advanced CIM techniques
Reference Books:
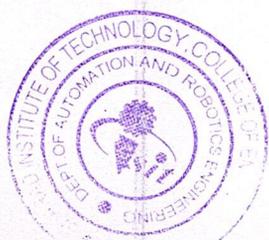
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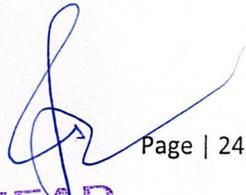Dept. Of Automation And
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1. Chang, T.C. and Wysk, R.A., 1997. Computer-aided manufacturing. Prentice Hall PTR.
2. Xu, X., 2009. Integrating Advanced Computer-Aided Design, Manufacturing, and Numerical Control. Information Science Reference.
3. Groover, M.P., 2007. Automation, production systems, and computer-integrated manufacturing. Prentice Hall Press.
4. Weatherall, A., 2013. Computer integrated manufacturing: from fundamentals to implementation. Butterworth-Heinemann..

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Computer Vision and Image Processing-Fundamentals and Applications

AR801D	HSMC	Computer Vision and Image Processing-Fundamentals and Applications	0-0-0	3 Credits(For 12 Weeks)

Teaching Scheme	Evaluation scheme
	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

**Pre-Requisites: Programming in Python / MATLAB / C++**

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

CO1	Identify basic concepts of image formation, radiometry, and geometric transformations in computer vision.
CO2	Apply image processing techniques such as filtering, enhancement, and segmentation.
CO3	Analyze features using texture, edges, shape descriptors, and keypoint detection methods.
CO4	Construct image representations using object boundaries, histograms, and invariant descriptors.
CO5	Utilize machine learning techniques for image classification and dimensionality reduction.
CO6	Develop computer vision applications like gesture recognition, object tracking, and motion estimation.

Course Contents:

Week 1: Introduction to Computer Vision and Basic Concepts of Image Formation: Introduction and Goals of Computer Vision and Image Processing, Image Formation Concepts.
Week 2: Fundamental Concepts of Image Formation: Radiometry, Geometric Transformations, Geometric Camera Models.
Week 3: Fundamental Concepts of Image Formation: Camera Calibration, Image Formation in a Stereo Vision Setup, Image Reconstruction from a Series of Projections.
Week 4: Image Processing Concepts: Image Transforms.
Week 5:Image Processing Concepts: Image Transforms, Image Enhancement.
Week 6: Image Processing Concepts: Image Filtering, Colour Image Processing, Image Segmentation
Week 7: Image Descriptors and Features: Texture Descriptors, Colour Features, Edges/Boundaries.
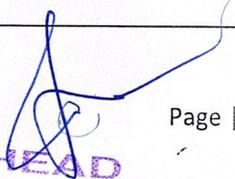
Week 8: Image Descriptors and Features:
Object Boundary and Shape Representations.

Week 9: Image Descriptors and Features:
Interest or Corner Point Detectors, Histogram of Oriented Gradients, Scale Invariant Feature Transform, Speeded up Robust Features, Saliency

Week 10: Fundamentals of Machine Learning:
Linear Regression, Basic Concepts of Decision Functions, Elementary Statistical Decision Theory, Parameter Estimation, Clustering for Knowledge Representation, Dimension Reduction, Linear Discriminant Analysis.

Week 11: Applications of Computer Vision:
Artificial Neural Network for Pattern Classification, Convolutional Neural Networks, Autoencoders.

Week 12: Applications of Computer Vision:
Gesture Recognition, Motion Estimation and Object Tracking, Programming Assignments.

Reference Books:
1. Forsyth & Ponce, "Computer Vision-A Modern Approach", Pearson Education.
2. M.K. Bhuyan , " Computer Vision and Image Processing: Fundamentals and Applications", CRC Press, USA, ISBN 9780815370840 - CAT# K338147.
3. Richard Szeliski, "Computer Vision- Algorithms & Applications", Springer.

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Internship

IFT03	PROJ	Internship	0-0-0	10 Credits

Teaching Scheme	Evaluation scheme
	CA-I: 50 Marks
	CA-II: 50 Marks
	End Semester Exam: 100 Marks

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

CO1	Apply foundational engineering knowledge to effectively address real-world industrial challenges during the internship.
CO2	Demonstrate heightened interpersonal communication skills by interpreting and expressing ideas effectively within various professional environments.
CO3	Apply a comprehensive understanding of industry activities and functions, showcasing the ability to navigate and contribute effectively in professional engineering settings.
CO4	Analyze and synthesize experiences, observations, and learned concepts from the internship to compose technically proficient reports for effective communication.
CO5	Apply professionalism, punctuality, and responsible task completion as manifestations of a strong work ethic within the internship.
CO6	Synthesize initiative, curiosity, and active engagement, creating a mindset conducive to meaningful contributions to assigned tasks during the internship period.

Description:

An essential step in bridging the knowledge gap between academic study and practical application for engineering students is the internship program. Minimum eighteen-week internship program begins at the end of the seventh semester and allows students to interact with industries, associations for professionals, or research facilities. Strong communication skills and a basic comprehension of technical topics are essential qualities. The course outcomes place a strong emphasis on developing interpersonal communication skills, confirming technical knowledge in real-world situations, comprehending industry processes in depth, and writing thorough technical reports. It is encouraged of students to be on time, act professionally, and take initiative in their internships.

Guidelines emphasize the need of communication and call on students to promptly and politely discuss any problems they may have with coordinators and supervisors. Additionally stressed are initiative, enthusiasm, and timely execution of duties assigned. After the internship, students must put together a thorough report that is an invaluable tool. This report is evaluated according to standards including uniqueness, sufficiency, structure, and real-world application of principles learnt. In addition, a panel of experts evaluates the quality, efficiency, and organization of students'

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content delivery when assessing their presenting abilities.

A comprehensive assessment of the students' performance is provided by the overall evaluation, which also includes departmental reports and attendance records. The internship program's all-encompassing strategy attempts to promote engineering students' overall growth as they enter the workforce by instilling practical skills, industry understanding, and good communication.

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