Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's
Sharad Institute of Technology College of Engineering
(An Autonomous Institute)
Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Teaching and Evaluation Scheme for Final Year B. Tech.

Department of Automation and Robotics

Semester: VII

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

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	1	15	15	-	20	50	1
AR706	PCC	Simulation Laboratory	-	-	2	1	15	15	-	20	50	1
AR707	PCC	Industrial Robotics and Material handling Systems Laboratory	-	-	2	1	25	25	-	-	50	1
AR708	PCC	Industrial Case Studies (seminar)	-	-	2	1	25	25	-	-	50	1
AR709	MC	Account and Finance Management	1	-	-		25	25	-	-	50	Audit
PRJ06	PROJ	Capstone Project Phase –II	-	-	8	8	25	25	-	50	100	4
		Total	**17**		**16**	**33**	**245**	**245**	**150**	**410**	**1050**	**23**

Elective –III

A. Image Processing and Vision Systems
B. Data analysis
C. Micro and Nano Electromechanical Systems
D. Industrial Robotics & Material Handling

Elective –IV

A. Biomedical Instrumentation
B. Wireless sensor Network for Robotics
C. Neural Network and Fuzzy logic
D. Autonomous Robotics and Telecherics

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Embedded System in Robotics

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

Teaching Scheme	**Examination 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 ARM 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 Driver Programming

Course Contents:

Unit 1: Fundamentals of Embedded System Basic structure of embedded systems: Power-supply, Sensors, A-D/D-A converters, processor and ASICs and Actuators, memory. Communication Interface, Real time operating systems, Safety and reliability, environmental issues. Ethical practice. Characteristics, advantages and disadvantages of embedded systems	[6]
Unit 2: Embedded Hardware and Design Microcontroller Unit (MCU) 48, A Popular 8-bit MCU, Memory for Embedded Systems, Low Power Design, Pull up and Pull down Resistors, Introduction to ARM-v7-M (Cortex-M3), ARM-v7-R (CortexR4) and comparison in between them.Embedded Product development life cycle, Program modeling concepts: DFG, FSM, Petri-net, UML	[7]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Unit 3: Embedded system programming Embedded C-programming concepts, Constants, Variables & Data Types, Operators, Functions, Softwares, interfacing of LED, LCD, motors, and switches. Serial Communication Programming: Introduction to Serial Communication, Types of Serial Communication, and Description of SFR associated with Serial Communication, Programming of UART, Interfacing of ADC, sensor interfacing, embedded networking	[6]
Unit 4: Embedded Serial Communication Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, 10 CAN, Field-bus (Profibus), USB (v2.0), Bluetooth, Zig-Bee, Wireless sensor network	[6]
Unit 5: Real Time Based Operating System(RTOS) POSIX Compliance, Need of RTOS in Embedded system software, Foreground/Background systems, multitasking, context switching, IPC, Scheduler policies, Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, pipes, events, timers, memory management, RTOS services in contrast with traditional OS.	[7]
Unit 6: Linux Fundamentals & Device Driver Programming Linux Fundamentals, Linux Commands, VI Editors, Introduction to Device Driver, The Role of Device Driver, Kernel Module Vs Application, Types of Device Driver, Character Driver, Block Driver & network Driver.	[7]
Text Books: 1. 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. 2. "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	

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

A. Image Processing and Vision Systems

AR703A	PCC	Image Processing and Vision Systems	3-0-0	3 Credits

Teaching Scheme	**Examination 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	Interpret image in its numeric and graphical form
CO2	Identify the geometric relationship of pixels
CO3	Apply the knowledge of simple codes for improving image quality
CO4	Explain the extract useful information from image contents through processing
CO5	Explain the document needs for specific machine vision system
CO6	Identify the Machine vision in robotics

Course Contents:

Unit 1: Vision System Basic Components Elements of visual perception: structure of human eye, Image formation in the eye – pinhole cameras - color cameras – Image formation model – Imaging components and illumination techniques - Picture coding – Basic relationship between pixels - Camera-Computer interfaces	[6]
Unit 2: Low-Level Vision Image representation – Gray level transformations, Histogram equalization, Image subtraction, Image averaging – Filters: Smoothing spatial filters, sharpening spatial filters, smoothing frequency domain filters, sharpening frequency domain filters - Edge detection	[6]
Unit 3: Higher-Level Vision Segmentation: Edge linking and Boundary Detection, Thresholding, Region-oriented segmentation, the use of motion – Description: Boundary Descriptors, Regional Descriptors, Recognition: Decision-Theoretic methods, structural methods.	[7]
Unit 4: Applications Camera Calibration - Stereo Imaging - Transforming sensor reading, Mapping Sonar Data, Aligning laser scan measurements - Vision and Tracking: Following the road,	[7]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Iconic Image processing, Multiscale image processing, Video Tracking - Learning landmarks: Landmark spatiograms, K-means Clustering, EM Clustering, Kalman Filtering.	
Unit 5: Robot Vision Basic introduction to Robotic operating System (ROS) - Installing and testing ROS camera Drivers, ROS to OpenCV - The cv bridge Package.Introduction to OpenCV image processing library and MATLAB programming	[7]
Unit 6: Machine vision in robotics Machine vision algorithms, Imaging based automatic sorting and inspection, image processing, imaging based robot guidance	[6]

Text Books

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

Reference Books:

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

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

B. Data Analytics

AR703B	PCC	Data Analytics	3-0-0	3 Credits

Teaching Scheme	**Examination 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]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Unit 6 Reinforcement learning Markov chain analysis, Monte Carlo simulation, Q learning, State action reward state action (SARSA) learning	[6]

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)

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

C .Micro and Nano Electroechanical Systems

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

Teaching Scheme	**Examination 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:

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 microsensor and microactuator 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]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

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 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	[6]

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

HEAD
Dept. Of Automation And
Robotics Engineering

D. Industrial Robotics and Material handling Systems

AR703D	PEC	Industrial Robotics and Material handling Systems	3-0-0	3 Credits

Teaching Scheme	**Examination 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	[7]

HEAD
Dept. Of Automation And Robotics Engineering

loading, Robot centered cell.	
Unit 4: End Effectors Classification 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	[7]
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
7. Todd D.J., "Fundamentals of Robot Technology", Wiley Publications, ISBN:978-0-470-20301-9

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

A. Biomedical Instrumentation

AR704A	PEC	Biomedical Instrumentation	3-0-0	3 Credits

Teaching Scheme	**Examination 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: Functionalorganization of the nervous system, Structure of nervous system, neurons, synapse,transmitters and neural communication, Cardiovascular system, respiratory system, Basiccomponents 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	[7]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

measurements, spirometer, Photo Plethysmography, Body Plethysmography ,Blood Gas analyzers : pH of blood, measurement of blood pCO2, pO2, finger-tipoximeter, ESR, GSR, measurements, Standard HL7	
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

HEAD
Dept. Of Automation And Robotics Engineering
SITCOE Yadrav

B. Wireless Sensor Networks for Robotics

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

Teaching Scheme	**Examination 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 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]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Unit 4: Infrastructure Establishment Topology Control, Clustering, Time Synchronization, Localization and Positioning, Sensor Tasking and Control.	[7]
Unit5: Sensor Network Platforms And Tools Sensor Node Hardware – Berkeley Motes, Programming Challenges, Node-level software platforms, Node-level Simulators, State-centric programming.	[7]
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

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

C .Neural Network and Fuzzy logic

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

Teaching Scheme	**Examination 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	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]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

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 perception model; back propagation learning methods, effect of learning rule co-efficient ;back propagation algorithm, factors affecting back propagation training, applications	[7]
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.	

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

D . Autonomous Robotics and Telecherics

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

Teaching Scheme	**Examination 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]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

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 devices: Micro-grippers and other micro-tools - Micro-conveyors - Walking MEMS Micro-robots – Multi-robot system: Micro-robot powering, Micro-robot communication.	[6]
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.	

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's
Sharad Institute of Technology College of Engineering
(An Autonomous Institute)
Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Machine Learning Laboratory

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

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hours/week/batch	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 import and export data using Pandas library functions
2. Demonstrate various data pre-processing techniques for a given dataset
3. Develop and Implement Dimensionality reduction using Principle Component Analysis (PCA) method.
4. Develop a Python program to demonstrate various Data Visualization Techniques
5. Develop a python program to implement K-Means clustering Algorithm. a python program to implement K-Means clustering Algorithm. a Python program to demonstrate various Data Visualization Techniques
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.
10. Build Artificial Neural Network model with back propagation on a given dataset.

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

11. a) Implement Random forest ensemble method on a given dataset. b) Implement Boosting ensemble method on a given dataset.
12. Write a python program to implement K-Means clustering Algorithm.

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 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

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Simulation Laboratory

AR706	PCC	Simulation Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Basic knowledge of Semiconductor Physics and Basic Electronics.

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 optimisation using any suitable software

Text Books:

1. Ibrahim Zeid —Mastering CAD CAMl Tata McGraw-Hill Publishing Co.2007
2. Rao, S.S., —The Finite Element Method in Engineeringl, 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 Analysisl, 4th Edition, Wiley Student Edition, 2002.
2. Foley, Wan Dam, Feiner and Hughes - "Computer graphics principles & practice" Pearson, 3rd edition, 2013.

HEAD
Dept. Of Automation And Robotics Engineering

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's
Sharad Institute of Technology College of Engineering
(An Autonomous Institute)
Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Industrial Robotics and Material handling Systems Laboratory

MT707	PCC	Control System Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Mathematics system

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.

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

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

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Account and Finance Management

23AR2308	HSSM	Account and Finance Management	1-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 hrs/week	CA-I: 25 Marks CA-II:25 Marks

Pre-Requisites: None

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	

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

affecting working capital needs, Financing approaches for working capital, Methods of forecasting working capital requirements, meaning and importance of accounts receivable.(Excel)	[2]
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.	

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

HEAD
Dept. Of Automation And
Robotics Engineering

HEAD
Dept. Of Automation And