Teaching and Evaluation Scheme for S Y B. Tech.

Department of Automation and Robotics

Semester: III

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: S.Y. B.Tech **Semester:** III

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
AR301	PCC	Sensor and Instrumentation	3	-	-	3	10	10	30	50	100	3
AR302	PCC	Principles of Robotics	3	-	-	3	10	10	30	50	100	3
AR303	PCC	Solid Mechanics	3	-	-	3	10	10	30	50	100	3
AR304	PCC	Digital Electronics and Microprocessor	3	-	-	3	10	10	30	50	100	3
AR305	ESC	Manufacturing Technology	3	-	-	3	10	10	30	50	100	3
AR306	PCC	Sensor and Instrumentation Laboratory		-	2	2	15	15	--	20	50	1
AR307	PCC	Manufacturing Technology Laboratory	-	-	2	2	15	15	--	20	50	1
AR308	PCC	Solid Mechanics Laboratory	-	-	2	2	15	15	--	20	50	1
AR309	PCC	Digital Electronics and Microprocessor Laboratory	-	-	2	2	15	15	--	20	50	1
AR310	ESC	Object oriented programming Using C++ Laboratory	-	-	2	2	15	15	--	20	50	1
MDC01	MC	Constitution of India	1	-	-	1	25	25	-	-	50	Audit
HMS01	HSMC	Aptitude Skills-I	1	-	-	1	25	25	-	-	50	1
HMS02	HSMC	Language Skills-I	-	-	2	2	25	25	-	-	50	Audit
PRJ02	PROJ	Mini Project-II	-	-	2	2	25	25	-	-	50	Audit
		Total	**17**	**-**	**14**	**31**	**225**	**225**	**150**	**350**	**950**	**21**

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HEAD
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Sensor and Instrumentation

AR301	PCC	Senor and 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: Basic knowledge of Semiconductor Physics and Basic Electronics

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

CO1	Select different types of transducers and sensors for given application.
CO2	Illustrate Signal Conditioning Systems.
CO3	Identify and use data acquisition System.
CO4	Select relevant instrument for temperature measurement.
CO5	Identify different instruments used for displacement, Strain, Flow, Pressure & Speed Measurement.
CO6	Explain different types of Optical sensors.

Course Contents:

Unit 1: Introduction to Instrumentation and Sensors. Introduction to measurement, Static & Dynamic Characteristics of measurement, Instrumentation systems architecture, Definition-Sensors, Transducers, Classification of transducers -Resistive, Capacitive and inductive, Specifications of sensors/Transducers, Sensor networks architecture.	[6]
Unit 2: Analog Signals Principles of analog signal conditioning, Signal-Level and Bias Changes, Linearization, Conversions, Filtering and Impedance Matching, Concept of Loading, Passive circuits: Voltage Divider, Bridge Circuits, Bridge Resolution, Wheatstone Bridge.	[6]
Unit 3: Digital Signal Conditioning. Digital Electronics Circuits: comparator, converter, Digital-to-Analog Converters (DACs), Analog-to-Digital Converters (ADCs) : Flash, SAR, Dual Slope, Data-	[6]

HEAD
Dept. Of Automation And
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Acquisition Systems: Hardware and Software of Data Acquisition System (DAS), Characteristics of digital data: Digitized Value, Sampled Data Systems, Linearization	
Unit 4: Thermal Sensors. Electrical Methods: RTD, Thermistors, Thermocouples, Thermoelectric Effects, Laws of Thermocouple, Thermocouple characteristics, Non Electrical thermal sensor: Bimetallic Strip, Vapor Pressure Thermometers, Liquid-Expansion Thermometers, Solid-State Temperature Sensors.	[6]
Unit 5: Mechanical Sensors Displacement Sensors: LVDT, Potentiometer, Strain measurement- Metal Strain Gauges and Semiconductor Strain Gauges (SGs), Load Cell, Flow sensors: Obstruction type flow meter-Venturimeter, Orifice plate, Pitot tube, Rotameter, Electromagnetic flow meter, Pressure sensors: Pirani Gauge, Thermocouple vacuum gauge, Photoelectric, Piezoelectric pressure transducer. Speed Sensors: Eddy current generation tachometer, Stroboscope.	[7]
Unit 6:Optical Sensors Fundamentals of EM radiation, Nature of EM Radiation, Characteristics of Light, Photometry, Photo detectors: Characteristics, Photoconductive Detectors, Photovoltaic Detectors, Photodiode Detectors, Photo emissive Detectors, Pyrometry: Radiation pyrometer, Optical Pyrometer.	[6]
Text Books: 1. A course in Electrical, Electronics measurement and Instrumentation, A.K.Sawhney 2. Mechanical & Industrial measurements, Jain R.K., Khanna Publications, New Delhi. 3. Mechanical measurements & instrumentation, Rajput.R.K., S.K.Kataria and sons, New Delhi. 4. Electronic Instrumentation, H. S. Kalsi, MGH, 3rd Edition	
Reference Books: 1. Electronic Instrumentation and Measurement Techniques, Welfrick Cooper. 2. Instrumentation for Engineers And Scientists , John Turner ,II Edition , Wiley 3. Electronic Instrumentation and Measurements, David A Bell, Third Edition, Oxford. 4. Instrumentation for Engineering Measurements, James W Dally, II Edition , Wiley India	

HEAD
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Principles of Robotics

AR302	PCC	Principles of 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: Basic Physics, Fundamentals of Robotics

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

CO1	Illustrate the basic knowledge on robotics.
CO2	Explain robot programming and languages.
CO3	Illustrate Kinematics of Robotic Manipulators
CO4	Compare and select robot and end effectors as per application different types of sensor used in robot systems.
CO5	Select appropriate Control Components and Sensors used for robot as per application
CO6	Select appropriate drive for Robotic Systems and illustrate the Robot Applications

Course Contents:

Unit 1: Introduction: Definitions of Industrial Robot, Type and Classification of Robots, Asimov's laws of robotics, Robot configurations, Robot Components, Robot Degrees of Freedom, Work volume and work envelope, Robot Joints and symbols, Robot Coordinates, Robot Reference Frames, Resolution, accuracy and precision of Robot, Work cell control	[6]
Unit 2: Robot Programming and Languages: Methods of Robot Programming Lead through Programming Methods , A Robot Program as a Path in Space ,Motion Interpolation ,Wait, Signal, and Delay Commands ,Branching, Capabilities and Limitations of Lead through Methods, The Textual Robot Languages Generations of Robot Programming Languages,, Robot Language Structure, Constants, Variables, and Other Data Objects, Motion Commands, End Effectors and Sensor Commands, PROGRAM CONTROL AND SUBROUTINES	[7]
Unit 3: Kinematics of Robotic Manipulators: Introduction to manipulator kinematics, Homogeneous transformations and robot kinematics, Denavit-Hartenberg (D-H) representation Generations of Robot Programming Languages on, Concept of forward and inverse kinematics.	[6]
Unit 4 End Effectors Grippers, Mechanical Grippers, Pneumatic and Hydraulic- Grippers, Magnetic Grippers,	[6]

HEAD
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Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Advance Grippers- Adaptive grippers, Soft Robotics Grippers, Tactile Sensor Grippers; Various process tools as end effectors; Robot end effectors interface, Active and passive compliance, Selection and Design Considerations	
Unit 5: Control Components and Sensors: Mechanical control by stops and cams, Solenoids, Relays; Internal Sensors, potentiometers, resolvers and encoders; External sensing: Simple touch sensing, strain sensing, tactile sensing, acoustic sensing, magnetic sensing, capacitive sensing, laser sensing & machine vision	[7]
Unit 6: Robot Drive Systems and Robot Applications:- Pneumatic Drives, Hydraulic Drives, Mechanical Drives, Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors, BLDC-Salient Features, Micro actuators, selection of drive, Power transmission systems for robot Examples such as Palletizing, Loading a Machine Etc. Robots in manufacturing and nonmanufacturing applications, a robot-based manufacturing system, robot cell design considerations and selection of robot, Functional Safety in Robotic Application	[7]

Text Books:

1. K.S Fu, R.C. Gonzalez, C.S.G. Lee, Robotics, McGraw Hill, 1987.
2. Y. Koren, Robotics for Engineers, McGraw Hill, 1985
3. J.J. Craig, Robotics, Addison-Wesley, 1986.
4. Saeed B. Niku, "Introduction to Robotics – Analysis, Systems and Application" : PHI 2006.
5. Richard D, Klafter, Thomason A ChmielOwski, Michel Nagin "Robotics Engg-an Integrated Approach" PHI 2005.
6. R.K. Mittal & I.J. Nagrath, "Robotics & Control" TMH-2007.
7. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
8. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.
9. S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015.
10. Mikell P. Groover, Automation, Production Systems & Computer Integrated Manufacturing, PHI Learning Pvt. Ltd. , New Delhi, ISBN:987-81-203-3418-2, 2012
11. John Craig, Introduction to Robotics, Mechanics and Control, 3rd Edition, Pearson Education, 2009
12.. R K Mittal & I. J. Nagrath, Robotics and Control, McGraw Hill Publication, 2015.
13. Mike Wilson, Implementation of Robotic Systems, ISBN: 978-0-124-04733-4

Reference Books:

1. AshitavaGhoshal, Robotics-Fundamental Concepts and Analysis', Oxford University Press, Sixth impression, 2010.
2. K. K.AppuKuttan, Robotics, I K International, 2007.
3. Edwin Wise, Applied Robotics, Cengage Learning, 2003.
4. R.D.Klafter,T.A.Chimielewski and M.Negin, Robotic Engineering–An Integrated Approach, Prentice Hall of India, New Delhi, 1994.

HEAD
Dept. Of Automation And Robotics Engineering
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5. B.K.Ghosh, Control in Robotics and Automation: Sensor Based Integration, Allied Publishers,Chennai, 1998.
6. S.Ghoshal, — Embedded Systems & Robotics‖ – Projects using the 8051 Microcontroller‖, Cengage Learning, 2009.

Solid Mechanics

AR303	PCC	Solid Mechanics	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 Mechanics

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

CO1	Explain various types of loading and stresses induced in components.
CO2	Develop SFD and BMD for different types of loads and support conditions.
CO3	Analyze bending and shear stresses induced in mechanical components
CO4	Analyze principal stresses & strains by analytical and graphical method.
CO5	Evaluate torsional shear stress in shaft and strain energy in beams
CO6	Evaluate Buckling on Column

Course Contents:

Unit 1: Review of stress, strain & Elastic Constants: Concept of Stress and Strain, (Linear, Lateral, Shear and Volumetric), Hooke's Law, Poisson's ratio, Modulus of Elasticity, Modulus of Rigidity, Stress-strain diagram for ductile and brittle material, Factor of safety, Working stress, Normal and shear stresses, Thermal stresses and strains . Concept, Numerical problems	[6]
Unit 2: Bending moment and shear force in Mechanical Elements Introduction, Types of beams, Loads and Reactions, Shear forces and bending moments, Rate of loading, Sign conventions, Relationship between shear force and bending moments, Shear force and bending moment diagrams subjected to concentrated loads, uniform distributed load (UDL) for different types of beams.(UVL not included)	[7]
Unit 3: Stresses in Mechanical Elements **Bending Stresses:** Symmetric pure bending of beams, Flexure formula, moment of resistance of cross-sections, Simple built-up section, Design of rectangular and circular(solid and hollow) sections; L, I and T sections **Shear Stresses**: Distribution of shear stresses in beams of various commonly used sections such as circular. I, T, and angles.	[7]
Unit 4: Principal Stresses and Strains Normal and shear stresses on any oblique planes, Concept of Principal planes,	[7]

HEAD
Dept. Of Automation And
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SITCOE, Yadrav

Derivation of expression for Principal stresses and maximum shear stress, Positions of principal planes and planes of maximum shear, Graphical solutions using Mohr's circle of stresses, Combined effect of shear and bending in Beam,	
Unit 5:Torsion& Energy Methods Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at ends Energy Methods: Concept of strain energy, Resilience, Proof resilience, Modulus of resilience, derivation for deformation of axially loaded members under gradual, sudden and impact loads	[6]
Unit 6: Buckling of Column Concept of buckling of columns, derivation of Euler's formula for buckling load for column with hinged ends, concept of equivalent length for various end conditions, limitations of Euler's formula, Rankine's formula, safe load on columns.	[7]

Text Books:

1. Strength of Materials, S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2. Strength of Materials, R. K. Bansal, Laxmi Publication, 4th Edition.
3. Strength of Materials, Khurmi Gupta, S. Chand Publication.
4. Strength of Materials, R.K. Rajput, S. Chad Publication
5. Mechanics of structure, S.B Junnerkar,Charotar Publication House
6. Strength of Materials, S. S. Bhavikatti, Vikas Publication House
7. Strength of Materials, Timoshenko and Young, CBS Publication
8. Mechanics of Materials, S. S. Ratan, Tata McGraw Hill Publication, 2009
9. Strength of Materials,B. K. Sarkar, McGraw Hill Publication, 2003.

Reference Books:

1. Strength of Materials, Beer and Johnson, CBS Publication
2. Strength of Materials, G.H. Rider,MacMillan India Ltd
3. Strength of Materials, Nag and Chanda, Willey India Publication
4. Advanced Mechanics of Materials, Boresi, Willey India Publication
5. Strength of Materials, Den Hartong, McGraw Hill Publication

Digital Electronics and Microprocessor

AR 304	PCC	Digital Electronics and Microprocessor	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

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

CO1	Design and optimize combinational logic circuits
CO2	Design Decoders, Encoders, Digital multiplexers, Adders and Subtractors, Binary comparators, Latches and Master-Slave Flip-Flops.
CO3	Design and Analyze Synchronous and Asynchronous Sequential logic circuits
CO4	Explain representation, Implementation of Moore/Mealy machines
CO5	Explain architecture & Pin diagram of 8085 microprocessor.
CO6	Explain the addressing modes of 8085 & build assembly language programs

Course Contents:

Unit1:Fundamentals of Digital Electronics **Number Systems**: binary, signed binary, octal, hexadecimal number, binary arithmetic, ones and two's complements arithmetic **Introduction of Boolean algebra**, Concept of Min terms-Max terms, SOP-POS forms, Reduction Techniques, K- Map, K-map with Don't Care Condition	[6]
Unit2: Combinational Circuits Design Combinational Logic : Adder, look ahead carry generator, Sub Tractor, Sub tractor using 1's complement & 2's Complement, BCD Adder,serial adder, ALU, elementary ALU design, Magnitude Comparator, Parity generators/checkers, Code converters, Design of Multiplexers and Demultiplexers, Encoders, Decoders, BCD - to - 7 segment decoder.	[6]
Unit3:Sequential Circuits 1-bit memory cell, latches and Flip-Flops (S-R, D, J-K &T), Use of preset and clear inputs, Excitation table for Flip-Flops, Conversion of Flip-Flops Applications of Flip-Flops: Shift Registers, Counters-Ripple counters, Synchronous Counters, Ring Counters, and Johnson Counter	[6]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Unit4:Finite State Machine FSM, Representation, Implementation of Moore/Mealy machines, state diagram, state table, state assignment, state reduction, sequence detector	[7]
Unit5: Fundamentals of Microprocessor Basic 8085 microprocessor architecture and its functional blocks, 8085 microprocessor IC pin outs and signals. Addressing Modes of 8085.	[6]
Unit6: Instruction Set & Programming with 8085 Assembly Language Programming Basics, Instruction set of microprocessor, Instruction timing diagram. Writing, Assembling & Executing Assembly Language Programs	[6]
Text Books: 1. A course in Electrical, Electronics measurement and Instrumentation, A.K.Sawhney 2. Electronic Instrumentation, H. S. Kalsi, MGH, 3rd Edition	
Reference Books: 1.Fundamentals of Digital Circuits by Anand Kumar, TMH publication. 2.Microprocessor Architecture, Programming, and Applications with the 8085, 3.Ramesh Gaonkar, Penram International Publishing (India) LTD. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008	

HEAD
Dept. Of Automation And
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SITCOE, Yadrav

Manufacturing Technology

AR305	ESC	Manufacturing Technology	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 Physics, Basic Mechanical Engineering

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

CO1	Explain suitable material for different engineering applications
CO2	Explain different casting processes for manufacturing
CO3	Explain Engineering forming process like Extrusion and Drawing Processes
CO4	Illustrate and identify main parts of machine tools for metal cutting operations
CO5	Explain unconventional machining processes and various applications.
CO6	Illustrate advanced material with its applications

Course Contents:

Unit 1:Properties of Engineering materials and Smart Material: Historical Perspective, Importance of Engineering Materials, Classification of Materials, for Chemical, Electrical and magnetic materials, Material selection criteria Design considerations, Needs of Modern Materials, Composite materials: advantages and application of composites. Smart materials: Shape Memory Alloy, Piezoelectric and Magnetostrictive	[7]
Unit 2: Casting: Definition, classification of manufacturing processes. Casting: Introduction to casting, patterns, types, pattern materials, allowances, molding sand, Gating and riser , Cores & Core making Special Casting Process- Shell, Investment, Die casting, Centrifugal Casting, Melting furnaces- -crucibles oil fired furnaces-electric furnaces, cupola, and selection of furnace.	[6]
Unit 3:Extrusion and Drawing Processes Classification of extrusion processes-tool, equipment, and principle of these processes, influence on Friction-Extrusion -defects and rod/wire drawing-tool, equipment and principle of processes. **Powder Metallurgy**:-Introduction to Powder Metallurgy process, preparation of powders, types & function of binders, application of powder metallurgy products,	[7]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

advantages of powder metallurgy products.	
Unit 4: Theory of Metal Cutting & Total Productive Maintenance Cutting tools and tool geometry ,tool materials-HSS ceramics, tool nomenclature, selection of tool materials and tool life, tool wear and machinability Mechanics of clip formation, types of chips and conditions Orthogonal vs. oblique cutting- merchant's force circle diagram. **Total Productive maintenance;** Maintenance concepts, Preventive maintenance, breakdown maintenance, Zero Defects, Human factors in maintenance, Condition Monitoring Techniques	[7]
Unit 5:Modern machining processes: Classification according to type of energy used for machining, basic principles, machines and applications of, Electrical discharge machining (EDM), Laser beam machining (LBM), Electrochemical machining (ECM), Ultrasonic machining (USM). **Additive Manufacturing:** Fundamentals of rapid prototyping, stereo lithography, laminated object manufacturing, fused deposition modeling,	[7]
Unit6: Nano Materials & PCB manufacturing **Nano - materials**–History, Classification of nano materials, Properties thermal, mechanical, chemical, optical and applications of nano-materials automotive, electronic, food ,textile industry **Electronic assembly and packaging:** PCB structure, types and materials. Processes used in PCB fabrication, PCB assembly.	[6]

Text Books:

1.V.D. Kodgire and S.V. Kodgire, —Material Science and Metallurgy for Engineers, Everst publishing house, pune, 2008

Reference Books:

1. Elements of Workshop Technology (Volume -1 & 2) by S. K. HajraChoudhary, A. K. HajraChoudhary, Nirjhar Roy, Media promoters (2010).
2. A Course in Workshop Technology (Vol. I & II) by B. S. Raghuwanshi, DhanpatRai& CO. (2001).
3. Workshop Technology Part 1, 2 and 3. By W. A. J. Chapman, Taylor & Francis (1972).
4. Production Technology – HMT, Tata McGraw-Hill (1980).
5. Manufacturing, Engineering and Technology, 4th Edition, by SeropeKalpakjian, Steven R. Schmid, published by Pearson (2005).
6. Fundamentals of Modern Manufacturing- Materials, Processes and Systems, 3rd Edition by Mikell P. Groover, Wiley India (2002).
7.Terry Wireman, "Total Productive Maintenance", 2nd Edition, Industrial Press, 2004
8. Manufacturing Processes for Engineering Materials, 4th Edition, by SeropeKalpakjian, Steven R. Schmid, published by Pearson (2007).
9. V.D. Kodgire and S.V. Kodgire, —Material Science and Metallurgy for Engineers, Everst publishing house, pune, 2008
10.Raghavan V., —Materials science and Engineering- A first course,‖ 5th edition, ISBN: 978-81-203-2445-8, 2011
11. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-

HEAD
Dept. Of Automation And Robotics Engineering
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Pearson India, 2014.
12. Kalpakjian and Schmid, Manufacturing Engineering and Technology, 6 ed., Pearson.
13. Lindberg, Processes & Materials of Manufacture, Prentice Hall India.
14. Kumar & Gupta, Manufacturing Processes, Prentice Hall India.

HEAD
Dept. Of Automation And
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Sensor and Instrumentation Laboratory

AR306	PCC	Sensor and Instrumentation 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: Basic knowledge of Semiconductor Physics and Basic Electronics.

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

CO1	Distinguish contact & Non contact type Instruments
CO2	Select appropriate sensor for given application.
CO3	Illustrate various smart sensors with their applications.

List of Experiments:

At least minimum 8 experiments should be performed from the following list.

1. Identify contact & Non contact type Instruments.
2. Experiment with LVDT for Displacement.
3. Make use of temperature sensors.
4. Make use of Vibration Meter for Measuring vibration of Machine
5. Measure strain using strain gauge.
6. Measure Pressure using pressure cell.
7. Measure flow using Rotameter.
8. Measure of sound using sound meter.
9. Measure of Speed using tachometer/stroboscope.
10. Summarize the smart sensors.
11. Measurement of Liquid Level Using Capacitance Type Transducer
12. Categorize different Sensor from Catalogue

HEAD
Dept. Of Automation And
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Text Books:

1. A course in Electrical, Electronics measurement and Instrumentation, A.K.Sawhney
2. Mechanical & Industrial measurements, Jain R.K., Khanna Publications, New Delhi.
3. Mechanical measurements & instrumentation, Rajput.R.K., S.K.Kataria and sons, New Delhi.
4. Electronic Instrumentation, H. S. Kalsi, MGH, 3rd Edition

Reference Books:

1. Electronic Instrumentation and Measurement Techniques, Welfrick Cooper.
2.Instrumentation for Engineers And Scientists , John Turner ,II Edition , Wiley
3. Electronic Instrumentation and Measurements, David A Bell, Third Edition, Oxford.
4.Instrumentation for Engineering Measurements, James W Dally, II Edition , Wiley India

Manufacturing Technology Laboratory

AR307	PCC	Manufacturing Technology 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: Workshop Practice -I

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

CO1	Perform wood and metal working operations.
CO2	Inspect various properties of molding sand.
CO3	Demonstrate the various Machining Process like turning, drilling and milling
CO4	Develop general machining skills in the students.

List of Experiments:

At least minimum 8 experiments should be performed from the following list.

1. Carpentry shop: one Job of Pattern Making
2. Different Sand Testing Properties like Permeability test and Moisture content etc.
3. One job of plain turning, taper Turning, external threading and knurling operation.
4. Demonstration of Destructive Testing/ non-destructive testing
5. Demonstration on Drilling Machine.
6. Demonstration on milling machine.
7. Demonstration on CNC Machine.
8. Industrial visit to study manufacturing practices.
   a. Visit to foundry – study of automation processes, Layout, Material handling equipment & other processes with preparation of report.

OR

b. Study of the extrusion and drawing process – visit to industry with report presentation.

9. Development of physical 3D Model using any one of Slicing Software.
10. Demonstration on PCB Manufacturing
11. Manufacturing of simple sheet metal components using shearing and bending operations.

Text Books:

1. Raghuwanshi B.S., Workshop Technology Vol. I & II, DhanpathRai& Sons.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
4. JeyapoovanT.andPranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2

Reference Books:

1. Elements of Workshop Technology (Volume -1 & 2) by S. K. HajraChoudhary, A. K. HajraChoudhary, Nirjhar Roy, Media promoters (2010).
2. A Course in Workshop Technology (Vol. I & II) by B. S. Raghuwanshi, DhanpatRai& CO. (2001).
3. Workshop Technology Part 1, 2 and 3. By W. A. J. Chapman, Taylor & Francis (1972).
4. Production Technology – HMT, Tata McGraw-Hill (1980).
5. Manufacturing, Engineering and Technology, 4th Edition, by SeropeKalpakjian, Steven R. Schmid, published by Pearson (2005).
6. Fundamentals of Modern Manufacturing- Materials, Processes and Systems, 3rd Edition by Mikell P. Groover, Wiley India (2002).
7. Manufacturing Processes for Engineering Materials, 4th Edition, by SeropeKalpakjian, Steven R. Schmid, published by Pearson (2007).

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

Solid Mechanics Laboratory

AR308	PCC	Solid Mechanics 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: Engineering Mechanics, Engineering Mathematics, Engineering Physics

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

CO1	Perform tensile, compression, shear, flexure, torsion, thermal, deflection and impact test on a material to understand the behavior of stresses and strains respectively.
CO2	Demonstrate the graphical solution method for principal stresses.
CO3	Demonstrate of stress distribution pattern using Polariscope for Plastic/Acrylic.
CO4	Analyze the stress and strain for different loading conditions

List of Experiments:

At least minimum 8 experiments should be performed from the following list.

1. Tensile test for Ductile and Brittle Material using Universal Testing machine
2. Compression test of Mild Steel, Cast iron on Universal Testing Machine
3. Torsion test on Mild Steel circular sections using Torsion Testing Machine
4. Bending Test of Wood Material on Universal Testing Machine
5. Shear test of ductile material on Universal Testing Machine.
6. Experiment on Thermal stresses.
7. Impact test on mild steel, brass, aluminum, and cast iron specimens
8. Demonstrate the graphical solution method for principal
9. Demonstrate of stress distribution pattern using Polariscope for Plastic/Acrylic.
10. Analyze the stress and strain for different loading condition in ANSYS.

HEAD
Dept. Of Automation And
Robotics Engineering

Text Books:

1. Strength of Materials, S. Ramamruthum, DhanpatRai and Sons, New Delhi.
2. Strength of Materials, R. K. Bansal, Laxmi Publication, 4th Edition.
3. Strength of Materials, Khurmi Gupta, S. Chand Publication.
4. Strength of Materials, R.K. Rajput, S. Chad Publication
5. Mechanics of structure, S.B Junnerkar,Charotar Publication House
6. Strength of Materials, S. S. Bhavikatti, Vikas Publication House
7. Strength of Materials, Timoshenko and Young, CBS Publication
8. Mechanics of Materials, S. S. Ratan, Tata McGraw Hill Publication, 2009
9. Strength of Materials,B. K. Sarkar, McGraw Hill Publication, 2003.

Reference Books:

1. Egor P. Popov, Engineering Mechanics of Solids, Prentice Hall of India, New Delhi, 2001.
2. D.S. Bedi, Strength of Materials, Khanna Book Publishing Company, 2018.
3. R. Subramanian, Strength of Materials, Oxford University Press, 2007.
4. Ferdinand P. Been, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005

Digital Electronics and Microprocessor Laboratory

AR309	PCC	Digital Electronics and Microprocessor 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: Basic Electronics.

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

CO1	Demonstrate the truth table of various expressions and combinational circuits using logic gates.
CO2	Design, test and evaluate various combinational circuits such as adders, Subtractors, comparators, multiplexers and demultiplexers.
CO3	Construct flips-flops, counters and shift registers.
CO4	Perform basic Programming and implementation on 8085 Microprocessor.

List of Experiments:

1. Implementation of Boolean Logic Functions using logic gates and combinational circuits
2. Design and implement Half adder, Full Adder, Half Subtractor, Full Subtractor using basic gates.
3. Given any 4-variable logic expression, simplify using Entered 16 Variable Map and realize the simplified logic expression using 8:1 multiplexer IC.
4. Design and implement code converter I) Binary to Gray II) Gray to Binary Code using basic gates.
5. Design and verify the Truth Table of 3-bit Parity Generator and 4-bit Parity Checker using basic logic gates with an even parity bit.
6. Realize a J-K Master/Slave Flip-Flop using NAND gates and verify its truth table.

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SITCOE, Yadrav

7. Verify flip-flop, registers and counters using digital ICs.
8. Addition and Subtraction using 8085.
9. Multiplication and Division using 8085.
10. Block Transfer and Block Exchange using 8085.
11. Data Conversion using 8085.
12. Even and Odd numbers counting using 8085.
13. Find the largest and smallest number using 8085

Note: Minimum 8 experiments from above list out of which at least 3 should be on 8085 Microprocessor.

Text Books:

1. Fundamentals of Digital Circuits by Anand Kumar, TMH publication.
2. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, Penram International Publishing (India) LTD.
3. M Morris Mano: Digital Logic and Computer Design, 10th Edition, Pearson, 2008

Reference Books:

1. William Kleitz, Digital Electronics, Prentice Hall International Inc.
2. Stewart J,"Microprocessor Systems- Hardware,Software and Programming", Prentice HallInternational Edition,1990
3. Short K. L."Microprocessors and Programmed Logic", 2nd Ed.Pearson Education, 2008

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Object oriented programming Using C++ Laboratory

AR310	ESC	Object oriented programming Using C++ 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: Computer Programming in C

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

CO1	Make use of Class, Object and Constructor-Destructor features of OOP.
CO2	Experiment with Inheritance, Virtual Function and Polymorphism operations in OOPs.
CO3	Develop code to illustrate File Handling and Exception Handling.
CO4	Demonstrate use of Friend Function, Data Abstraction and Data Encapsulation with suitable example.

List of Experiments:

1. Write a C++ program to demonstrate classes.

2. Class Templates
C++ programs using class templates to implement the following using an array.
a) Stack ADT b) Queue ADT

3. Write a C++ program to demonstrate on constructors (default, parameterized and copy Constructor) and destructors

4. Write a C++ program to demonstrate Function Overloading.

5. Write a C++ program to demonstrate operator '+' overloading to find the addition of two complex numbers.

6. Write a C++ program to demonstrate
i) single level inheritance
ii) multilevel inheritance
iii) multiple inheritance
iv) Hierarchical inheritance
v) Hybrid inheritance

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7. Write a C++ program to demonstrate Friend Function.

8. Write a C++ program to demonstrate Polymorphism (Virtual Function).

9. Write a C++ program to demonstrate Data Abstraction.

10. Write a C++ program to demonstrate Data Encapsulation.

11. Write a C++ program to demonstrate Exception Handling.

12. Write a C++ program to demonstrate different operations in Files & Streams:
A. Opening a File
B. Closing a File
C. Writing to a File
D. Reading from a File

Text Books:

1. Data structures a pseudo code approach with c++, Indian edition, R.F.Gilberg and B.A.Forouzan Cengage Learning.

2. Programming Prinicples and Practice using C++, B.Stroustrup, Addition-Wiesly (Pearson Education)

3. Data Structures and STL, W.J.Collins, mcGrawHill, Inter nationational Edition.

4. Data Structures and Algorithms with OODesign patterns in C++, B.R.Priess, JohnWiley&sons.

5. The Art, Philosophy and Science of OOP with C++, Rick Miller,SPD.

6. C++ for Programmers , P.J.Deitel and H.M.Deitel,PHI/Pearson.

Constitution of India

MDC01	MC	Constitution of India	1-0-0	Audit

Teaching Scheme	**Evaluation Scheme**
Lecture: 1hrs/week	Continuous Assessment –I :25 Marks Continuous Assessment –II :25 Marks

Pre-Requisites: NA

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

CO1	Define the meaning and features of Indian constitution.
CO2	Interpret right to life and fundamental rights to certain freedom under article 19 and 21.
CO3	Outline the federal structure of power and directive principles of state policy.

Course Contents:

Course Contents:	
Unit 1:Introduction Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India	[2]
Unit 2: Fundamental Duties and its legal status Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights , The scheme of the Fundamental Duties and its legal status	[2]
Unit 3: Principles of State and National Policy The Directive Principles of State Policy – Its importance and implementation , Federal structure and distribution of legislative and financial powers between the Union and the States , Parliamentary Form of Government in India – The constitution powers and status of the President of India	[2]
Unit 4: Constitutional Powers Amendment of the Constitutional Powers and Procedure , The historical perspectives of	[2]

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SITCOE, Yadrav

the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency	
Unit 5: Fundamental Right Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.	[2]

Books:

1. Constitution of India Published by Government of India Ministry of Law and Justice (Legislative Department), 2020
2. Textbook on The Constitution of India by S R Bhansali
3. Constitution of India by Bakshi P M,January 2014

Aptitude Skills-I

HMS01	HSMC	Aptitude Skill I	1-0-0	1 Credit

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

Pre-Requisites: Communication Skills

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

CO1	Understand speed math techniques to solve aptitude problems
CO2	Summarize number systems in detail.
CO3	Explain basic aptitude techniques related to Percentage, Average, Ratio Proportion and Fraction
CO4	Understand speed, time and distance concepts
CO5	Summarize the concepts of Business aptitude using basic aptitude
CO6	Solve the aptitude problems on Geometry and Venn Diagram

Unit 1: Speed Math Techniques Multiplication, Squares, Square roots, Cubes, Cube roots	[1]
Unit 2: Number System Types of Number System, Last Digit Method, BODMAS Calculation, HCF and LCM, Progressions	[2]
Unit 3: Basic Aptitude Percentage, Average, Ratio and Proportion, Fraction, Partnership	[3]
Unit 4: Speed- Time- Distance Speed, Time, and Distance, Trains, Boats, Streams, Races	[2]
Unit 5: Business Aptitude Profit & Loss, Simple Interest, Compound Interest	[2]
Unit 6: Geometry and Venn Diagram 2D and 3D Mensuration, Venn diagram	[2]

Text Books:

1. ArunShrama - Quantitative aptitude for CAT.
2. RS Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning,S.Chand Publisher; 2016 edition
3. RS Aggarwal, Quantitative Aptitude for Competitive Evaluations, S.Chand Publisher;

2016 edition
Reference Books: 1. Fast Track Objective Arithmetic Paperback, by Rajesh Verma – 2018 2. Teach Yourself Quantitative Aptitude, Arun Sharma 3. The Pearson Guide to Quantitative Aptitude for Competitive Evaluation by Dinesh Khattar

Language Skill- I

HMS02	HSMC	Language Skill- I	0-0-2	Audit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 hrs/week	CA-I: 25 Marks CA-II: 25 Marks

Pre-Requisites: Communication Skills

Languages (Any One)

C Programming (Technical Language) (24Hrs)

Syllabus for C Programming

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

1	Explain fundamentals & essentials of C programming.
2	Illustrate Types, Operators and Expressions.
3	Make use of Decision Making and Looping Statements
4	Make use of Arrays in C programming.

Course Contents:

Unit 1: Basics of C Editing, Compiling, Error Checking, executing, testing and debugging of Programs, Flowcharts, Algorithms, Structure of C Program.	[6]
Unit 2: Types, Operators and Expressions Variable names, Data types, sizes, constants, declarations, arithmetic operators, relational and logical operators, type conversions, increment and decrement operators, bitwise operators, assignment operators and expressions, conditional expressions precedence and order of evaluation	[6]
Unit 3: Decision Making and Looping Statements Statements and Blocks. If-else, else-if switch Loops while and for, do-while break and continue go to and Labels.	[6]

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SITCOE, Yadrav

Unit 4: Arrays Initializing arrays, Initializing character arrays ,two dimensional and multidimensional arrays.	[6]
Text Books 1. C Programming Absolute Beginner's Guide, Publishing; 3rd edition (22 August 2013) 2. C Programming Language 2nd Edition, Pearson Publication	
Reference Books 1. C: The Complete Reference, McGraw Hill Education; 4th edition (1 July 2017) 2. C Programming in easy steps, 5th Edition, In Easy Steps Limited 3. The C Programming Language, Second Edition, By PearsonEducation India(1 January 2015)	

Japanese Language Course I (24Hrs)

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

CO1	Explain the history and scripts used in Japanese
CO2	Translate simple English words into Japanese
CO3	Express themselves by using simple sentences and responses to questions.
CO4	Demonstrate Japanese scripts through oral and written communication.

Unit 1: Introduction Brief history of Japan, Japanese Language, Introduction of three scripts in Japanese, viz.Hiragana, Katakana, and Kanji, Days of the week, Basic Numerals, and months of the year,	[6]
Unit 2: Simple Word forming Demonstratives in Japanese, Writing simple words in Hiragana, Writing all types of words, and simple sentences in Hiragana, Verbs in Japanese,	[6]
Unit 3: Simple sentence forming Introduction of Katakana, Formation of simple sentences involving asking and answering questions, Basic Conversational skills. Asking and answering questions based on the topics studied, Introduction of few simple Kanji, and their use in sentences based on the pattern "---ni--- gaarimasu".	[6]
Unit 4: Simple interactions Translations from, and into Japanese, Reading an unseen paragraph, and answering questions based thereon, General revision	[6]
Text Book: 1. NihongoShoho I (Japan Foundation Publ.) 2. GENKI I: An Integrated Course in Elementary Japanese (English and Japanese Edition)	

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3. Japanese for Busy People I: Kana Version (Japanese for Busy People Series) 3rd Edition	
Reference Book: 1. Minna No Nihongo I (3A Corporation, Japan) 2. Japanese from Zero! 1: Proven Techniques to Learn Japanese for Students and Professionals 6th Edition by George Trombl	

Foreign Languages (Any One)

German Language Course I (24Hrs)

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

1	Summarize the simple German words used for daily used words
2	Translate simple English words into German
3	Express themselves by using simple sentences and responses to questions.
4	Demonstrate German scripts through oral and written communication.

Unit 1: Introduction Introduction of the language, Greetings, Introduce oneself, speaking about yourself and others, numbers, E-mail address, Alphabets, speaking about countries and languages, Speaking about Hobbies, to have an informal appointment, learning weekdays, months and seasons	[6]
Unit 2: Simple Word forming Speaking about professions, work and wartimes, learning to fill up a profile in German, Learning to name the famous places, buildings in a city, learning definite/ indefinite and negative articles in German, to name the modes of transportation, To learn to describe the way, to understand the texts with international words.	[6]
Unit 3: Simple sentence forming To speak about food, to plan a shopping, conversation with the shopkeeper, Conversation about the food, about likes and dislikes, to understand the "w" questions, To understand the watch timings , giving information about time, speaking about the families, to plan a date	[6]
Unit 4: Simple interactions Learning about punctuality in Germany and how to excuse for delay, telephonic conversation about the appointments, to plan something together, speaking about birthday, to understand invitation and to write an invitation, to order and to pay in restaurant, to speak about own experiences, to understand particular information from the texts, to understand about different events and events related information in Radio	[6]
Text Books 1. Netzwerk Arbetisbuch A1 Goyal Publisher.	

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2. "The Everything Learning German Book: Speak, Write and Understand Basic German in No Time" by Ed Swick
3. "German Made Simple: Learn to Speak and Understand German Quickly and Easily" by Eugene Jackson and Adolph Geiger

Reference Books

1. "Hammer's German Grammar and Usage" (Fifth Edition) by Professor Martin Durrell
2. "Learn German with Stories: Café in Berlin" by André Klein

Mini Project -II

PRJ02	PROJ	Mini Project -II	0-0-2	Audit

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

Pre-Requisites: NA

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

1	Identify the problems related to technical, social importance.
2	Convert open-ended problem statements into the statement of work
3	Identify the literature gap with the help of available literature and survey
4	Inculcate problem-solving skills and critically analyze the options available to solve the problem.
5	Conceive the importance of documentation and report writing

An engineering graduate must pay attention to societal concerns to alleviate some of the real-life societal challenges by delivering reasonable technology solutions. The mini project concept is based on the same theme. The mini project attempts to discover societal problems and develop answers utilizing science and technology for the betterment of society or human life. This will assist students in understanding the product/project development process, best practices and encouraging their creativity to tackle real-world problems. While developing the application/product, students will learn effective team building, designing, budgeting, planning, engineering skills and processes, and safety norms and standards. Students will recognize the need for documentation and professional ethics.

Guidelines

1. Every student shall undertake the Minor Project in semester III and continue for semester IV.
2. A group of a minimum of 3 and a maximum of 5 students shall be allotted for each mini project.
3. The students have to identify the problem by a discussion with various stakeholders, site visits, expertopinions and various research articles in consultation with the project guide.

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4. Collect sufficient data and survey to establish the criticality of the problem to be solved.
5. Apply various tools for project planning and design.
6. Critically analyze various solutions/techniques to solve real-world problems.
7. Select and justify one of the solutions identified based on the feasibility, affordability, ease of use and environmental concern.
8. Learn and apply standards of engineering ethics and professional behavior

The committee of senior faculty members and a guide will be appointed to monitor the progress and continuous evaluation of each project. The assessment shall be done jointly by the guide and committee members.

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Teaching and Evaluation Scheme for S Y B. Tech.

Department of Automation and Robotics

Semester: IV

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Department: Automation & Robotics

Rev: Course Structure/00/2022-23

Class: S.Y. B.Tech

Semester: IV

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
AR401	BSC	Engineering Mathematics-III	3	-	-	3	10	10	30	50	100	3
AR402	PCC	Kinematics and Theory of Machines	3	-	-	3	10	10	30	50	100	3
AR403	PCC	Microcontrollers and Embedded system	3	-	-	3	10	10	30	50	100	3
AR404	PCC	CAD CAM and Automation	3	-	-	3	10	10	30	50	100	3
AR405	PCC	Python Programming	3	-	-	3	10	10	30	50	100	3
AR406	PCC	Kinematics and Theory of Machines Laboratory	-	-	2	2	15	15	-	20	50	1
AR407	PCC	Microcontrollers and Embedded System Laboratory	-	-	2	2	15	15	-	20	50	1
AR408	PCC	CAD CAM and Automation Laboratory	-	-	2	2	15	15	-	20	50	1
AR409	PCC	Python Programming Laboratory	-	-	2	2	15	15	-	20	50	1
AR410	PCC	Principles of Robotics Laboratory	-	-	2	2	15	15	--	20	50	1
MDC02	MC	Environmental Sciences	2	-	-	2	25	25	-	-	50	Audit
HMS03	HSMC	Aptitude Skills-II	1	-	-	1	25	25	-	-	50	Audit
HMS04	HSMC	Language Skills-II	-	-	2	2	25	25	-	-	50	1
PRJ03	PROJ	Mini Project-III	-	-	2	2	25	25	-	-	50	1
IFT01	PROJ	Industrial Training/Field Training – I	-	-	-	-	-	-	-	50	50	Audit
		Total	**18**	**-**	**14**	**32**	**225**	**225**	**150**	**400**	**1000**	**22**

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

Engineering Mathematics-III

AR401	BSC	Engineering Mathematics-III	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-I & II

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

CO1	Apply the definition & properties of Laplace Transform to evaluate the integral & to find Laplace transform of elementary functions and special functions like periodic function, Dirac-delta function & unit step function.
CO2	Apply the knowledge of Laplace transformation to find solution of linear differentiation equations with constant coefficient.
CO3	Solve partial differential equations & use of separation of variable method to solve heat and Laplace equations.
CO4	Develop the concept of Fourier series expansion of different periodic functions so as to use them in harmonic analysis.
CO5	Solve problems related to Fourier transform and inverse Fourier transform.
CO6	Solve finite difference equation using Z- transform.

Course Contents:

Unit 1: Laplace Transform Definition-condition for existence; Transform of elementary functions; Properties of Laplace Transforms-Linearity property, First shifting property, transforms of functions multiplied by t^n , transforms of function divided by t, transform of derivatives.	[8]
Unit 2: Inverse Laplace Transform Introductory remarks; Inverse Laplace transform of some elementary functions; General method of finding Inverse transforms; Partial fraction method and Convolution theorem for finding inverse Laplace transform. Application to find solution of linear differential equation.	[7]
Unit 3- Z-Transform: Definition; Z-transform of basic sequences $(a^n, n, \frac{a^n}{n!}, n^2 \ \ for\ n \geq 0)$, properties of Z-transform. Z-transform of some standard discrete function, Inverse Z- transform by	[8]

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binomial expansion method, partial fraction method and convolution method	
Unit 4: Interpolation and Numerical Integration Finite differences: Interpolation/extrapolation using Newton's forward and backward differences, Newton's divided differences and Lagrange's formulae, Numerical Integration: Simpson's (1/3) th rule, Simpson's (3/8) th rule, Weddle's rule	[7]
Unit 5: Correlation Introduction, Type of correlation, method of studying correlation, Karl Pearson's correlation, Spearman's rank correlation	[6]
Unit 6: Linear Regression Analysis Introduction, Linear and non- linear regression, Coefficient of regression, Lines of regression: X on Y and Y on X.	[6]
Text Books: 1.P. N. Wartikar& J. N. Wartikar, A Text Book of Applied Mathematics (Vol I & II), PuneVidyarthiGrihaPrakashan, Pune. 2. N. P. Bali, A Text Book of Engineering Mathematics, Laxmi Publications, New Delhi.	
Reference Books: 1. C. R. Wylie & L. C. Barrett, Advanced Engineering Mathematics, McGraw Hill Publishing Company Ltd. 2. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publications, New Delhi. 3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers. 4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. 5. Peter O" Neil, A Text Book of Engineering Mathematics, Thomson Asia Pvt. Ltd., Singapore.	

Kinematics and Theory of Machines

AR402	PCC	Kinematics and Theory of Machines	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 Physics

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

CO1	Identify Various links in popular mechanism.
CO2	Analyze graphically velocity and acceleration of planer mechanism.
CO3	Construct cam contour for given motion.
CO4	Recommend relevant belts and dynamometers for different applications.
CO5	Use principles of friction in designing clutch and bearings.
CO6	Explain the basics of Gear, Gear Geometry and types of gear profiles.

Course Contents:

Unit 1:Fundamentals of Kinematics and Mechanisms Classification of mechanisms, Basic kinematic concepts and definitions – Kinematic Link, Pair, Chain and its types, Types of constrained motion, Machine & Mechanism, Structure, Degrees of freedom for planer mechanism, Kutzbach and Grublers criteria, Four bar Chain mechanism, Single Slider crank chain , Double slider chain mechanism and its Kinematic inversions, Steering gear mechanisms and condition of correct steering-Davis and Ackerman Steering gear.	[8]
Unit 2: Velocity and Acceleration Analysis Concept of relative Velocity and acceleration of a point on link, angular acceleration, inter-relation between linear and angular velocity and acceleration, Velocity and acceleration diagrams using relative velocity method for four bar pin jointed linkages and four bar single slider crank linkages, Velocity and acceleration of single slider crank mechanism by Klein's construction.	[7]
Unit 3:Cams and Followers Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, simple harmonic motion uniform acceleration and retardation, cycloidal. Determination of cam profile based on given motion of	[8]

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reciprocating knife edge and roller follower with and without offset.	
Unit 4: Belts and Dynamometers Types of belt drives, Materials used for belts, advantages of V belt drive over flat beltdrive, Velocity ratio of belt drive, Slip and creep of belt, length of belt-open belt drive and cross belt drive, Power transmitted by belt, Angle of lap. Classification of dynamometers, Study of rope brake absorption dynamometer and belt transmission dynamometer.	[7]
Unit 5:Friction Introduction to friction, Types of friction, Coefficient of friction, Inclined plane, friction between nut and screw, Friction of pivot and collars, Classification of Clutches, torque transmitting capacity of plate clutch.	[6]
Unit 6: Toothed Gearing Classification of gears, Introduction to gear types- Spur, Helical, Spiral gears. Gear geometry, Theory of Spur gear in detail, Interference in involute tooth gears Path of contact, Contact ratio. Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Numerical on simple gear train for finding the speeds of elements in gear train, Torques in gear train.	[6]
Text Books: 1. Thomas Bevan, Theory of Machines, 3rdedition, CBS Publishers & Distributors,2005. 2. Cleghorn W.L., Mechanisms of Machines, Oxford University Press,2005. 3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill,2009. 4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East- West Pvt. Ltd, New Delhi	
Reference Books:	
1 .J. E. Shigely, J. J. Uicker, "Theory of Machines and Mechanisms", Tata McGraw Hill Publications, New York, International Student Edition, 1995. 2.Thomas Beven, "Theory of Machines", CBS Publishers and Distributors, Delhi 3..Shigley, Theory of Machines and Mechanism, McGraw Hill, New York 4. G.S. Rao and R.V. Dukipatti, Theory of Machines and Mechanism, "New Age Int. Publications Ltd. New Delhi. 5.Abdullah Shariff, Theory of Machines, McGraw Hill, New Delhi 6.Shah and Jadhawani, Theory of Machines, DhanpatRai& Sons	

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Microcontrollers and Embedded system

AR403	PCC	Microcontrollers and Embedded 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: Basic Electronics Engineering

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

CO1	Explain architecture and addressing modes of 8051.
`CO2	Explain instructions set for assembly language programs using 8051.
CO3	Develop code in Embedded to illustrate concepts of serial communication, timers, interrupts and I/O ports.
CO4	Make use of 8051 for interfacing External Peripherals.
CO5	Design 8051 Microcontroller based systems for measuring electrical and physical quantities & Motor control.
CO6	Explain Embedded Systems and Architecture of Arm Processor.

Course Contents:

Unit 1:8051 Microcontroller Functional block diagram and pin diagram of 8051, Power supply, clock and reset circuit, Program Counter and ROM space in 8051, Program and Data Memory organization, addressing modes.	[8]
Unit 2: Instruction Set Instruction Set of 8051: data transfer, arithmetic and logical, program branching instructions, single bit manipulation, shift and Boolean variable manipulation, Interrupt of 8051.	[7]
Unit 3: On-Chip Peripherals And Programming Embedded Programming: Data Types, Operators Embedded Programming: Data Conversion, I/O Programming Timer/Counter: Operating Modes, Programming. UART: Operating Modes, Programming.	[7]

HEAD
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Unit 4: Off-Chip Peripheral Interfacing And Programming Interfacing with 8051: LED, LED pattern display, traffic light display, Switches and Matrix Keyboard, LCD, ADC 0808 with Analog Sensor, DAC and their applications	[7]
Unit 5:Design of Microcontroller Based System Voltage, Current and Frequency Measurement - DC Motor Control - Stepper Motor control - Case Studies: Arduino Board Overview - Arduino IDE - Temperature Control	[6]
Unit 6: Embedded Systems & Architecture of Arm Processor Processor Embedded into a system - Embedded Hardware units and devices in a system - Embedded Software in a System -Classification of Embedded Systems - Embedded Design Life Cycle - Design Example: Model Train Controller. ARM Embedded System - CISC and RISC Processors - ARM Architecture - Programming Model - Operating Modes.	[6]

Text Books:

1. Mazidi, "8051 microcontroller & embedded system" 3rd Edition ,Pearson
2. Mazidi, "PIC microcontroller & embedded system" 3rd Edition ,Pearson

Reference Books:

1. Soumitra Kumar Mandal "Microprocessors and Microcontrollers Architecture Programming and Interfacing using 8085, 8086 & 8051" Tata McGraw Hill Publishing Co Ltd, 1st Edition, 2011.
2. Myke Predko, "Programming and Customizing the 8051 Microcontroller", 1st Edition, 2012.
3. Chris Braith, "8051 Microcontroller Application based Introduction", Elsevier 2004.
4. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems "Tata McGraw Hill Publishing Co Ltd, Ist Edition, 2014.
5. Jonathan W Valvano, "Embedded Systems: Introduction to Arm® Cortex TM-M Microcontrollers", 5th Edition, 2015.
6. Shibu K.V, "Introduction to Embedded Systems", Tata Mc Graw Hill, 1st Edition, 2009.
7. Jean J.Labrosse, "Embedded Systems Building Blocks", CMP Books, 2nd Edition, 2010.

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

CAD/CAM-Automation

AR404	PCC	CAD/CAM-Automation	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: Engineering Graphics

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

CO1	Explain engineering design process and its role in graphic communication process
CO2	Explain about Geometric Modeling Techniques
CO3	Illustrate the fundamentals of Numerical Control and Computer Numerical Control
CO4	Generate CNC program for Turning / Milling and generate tool path using CAM software
CO5	Explain components of different Automation strategies, FMS and robotics.
CO6	Describe the basic Finite Element procedure

Course Contents:

Unit 1: Computer Aided Design (CAD) Computer Aided Design (CAD) Hardware required for CAD: Interactive input output devices, Graphics software: general requirements and ground rules, 2-D curves like Line, Circle, etc. and their algorithms, 2-D and 3-D transformations such as Translation, Scaling, Rotation and Mirror	[6]
Unit 2: Geometric Modelling Introduction , Geometric modeling techniques ,Classification of Modelling **Wire Frame Modelling**-Cubic Splines, Bezeir Curves ,B-Splines, Wire frame model with linear edges, Wire frame model with curvilinear edges ,Merits& Demerits **Surface Modelling**-Plane Surface Curved Surface ,Types of Surface Modelling , Application of Surface Modelling ,Merits& Demerits **Solid Modelling** -Solid Modelling Primitives ,Application of Solid Modelling Merits& Demerits CSG using Boolean operations -Constructive Solid Geometry (CSG) or C-rep, Boundary Representation (B-rep) ,Comparison of CSG and B-rep ,Comparison of wire frame, surface and solid modeling	[7]
Unit 3: Fundamentals of Numerical Control and Computer Numerical Control	[6]

HEAD
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SITCOE, Yadrav

Elements of NC machine tools, classification of NC machine tools, Advantages, suitability and limitations of NC machine tools, Application of NC system. Definition and designation of control axes, Constructional details of Numerical Control Machine Tools, MCU structure and functions, Methods of improving accuracy and productivity using NC. Computer Numerical Control (CNC): Features of CNC, Elements of CNC machines, the machine control Module for CNC, Direct Numerical Control (DNC) and Adaptive Controls.	
Unit 4: Computer Aided Manufacturing (CAM) Introduction to Computer Aided Manufacturing (CAM), Coordinate system, Basic CNC Principles, G and M codes, Steps in developing CNC part program, Tool and geometric compensations, subroutine and Do loop using canned cycle. [Only theory – 2 hrs] *CNC Lathe part programming* : Linear and circular interpolation, Canned cycles for facing, threading, grooving, etc. [Theory + Program] *CNC Milling part programming* Linear and circular interpolation, Pocketing, contouring and drilling cycles. [Theory + Program]	[6]
Unit 5: Automation Automation: Introduction, Automation strategies, Types of Automation - Hard and Soft Automation, Flexible Manufacturing System, Group Technology: Introduction, Coding Methods, Concepts of Computer Integrated Manufacturing (CIM) and Computer Aided Process Planning (CAPP), Variant & Generative methods of CAPP, advantages of CAPP. [Only theory] Introduction to Material handling system, principles of material handling components of an AGVS, types of AGVS, AGVS guidance system, advantages of AGVSs over other Material handling systems	[6]
Unit 6: Finite Element Methods Introduction, Types of elements, Degrees of freedom, Field variable, Shape function, Boundary conditions, Meshing, Nodal displacements,1-D problems, Static and thermal analysis, Preprocessors – solvers – postprocessor	[7]

Text Books:

1. Ibrahim Zeid, "CAD/CAM Theory and Practice", Tata McGraw Hill Publication,
2. M. P. Grover, Zimmer, "CAD/CAM/CIM", Prentice Hall India.

Reference Books:

1. Rogers D. F. and Adams A., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989.
2. Faux I. D. and Pratt M. J., Computational Geometry for Design and Manufacture, John Wiley & sons, NY, 1979
3. Mortenson M. E., Geometric Modeling, John Wiley &sons, NY, 1985
4. Choi B.K., Surface Modeling for CAD/CAM, John Wiley & Sons, NY, 1991.
5. Mikell P. Grover, Automation, Production System and Computer Integrated Manufacturing,Prentice Hall of India Pvt Ltd, 1995.
6. C. Ray Astaihe, Robots of Manufacturing automation, John Wiley and Sons, New York

7. Jon Stenerson and Kelly Curran "Computer Numerical Control", Prentice-Hall of India Pvt. Ltd.New Delhi, 2008
8. P. N. Rao "CAD/CAM " principles and operations", Tata McGraw Hill
9. Reference Manuals of FANUC, Siemens, Mazak, etc.
10. Thomas M. Crandell "CNC Machining and Programming, Industrial Press ISBN- 0-8311-3118-7

HEAD
Dept. Of Automation And
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SITCOE, Yadrav

Python Programming

AR405	PCC	Python Programming	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: Object Oriented Programming

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

CO1	Develop algorithmic solutions to simple computational problems.
CO2	Explain and use Python data types and statements
CO3	Make use of control flow statements to develop python programs
CO4	Illustrate compound data typed of Python
CO5	Organize data from/to files in Python programs
CO6	Make use of Python Modules and Packages

Course Contents:

Unit 1: Algorithmic Problem Solving Algorithms, building blocks of algorithms (statements, state, control flow, functions), notation (pseudo code, flow chart, programming language), algorithmic problem solving, simple strategies for developing algorithms (iteration, recursion). Illustrative problems.	[8]
Unit 2: Data Types, Expressions, Statements Python interpreter and interactive mode; values and types: int, float, boolean, string, and list; variables, expressions, statements, precedence of operators, comments; Illustrative programs	[7]
Unit 3: Control Flow Statements Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs	[8]
Unit 4: Lists, Tuples And Dictionaries Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists,	[7]

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing — list comprehension; Illustrative programs	
Unit 5: File Handling Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs	[6]
Unit 6: Python Modules and Packages Modules and functions, function definition and use, flow of execution, parameters and arguments Standard packages: Mathematics, Internet Access, Dates and Times, Data compression, Multithreading, GUI Programming	[6]
Text Books: 1. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013. 2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/).	
Reference Books: 1.Anita Goel, Ajay Mittal, Computer Fundamentals and programming in C, Pearson India Publisher, First edition, 2013. 2. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013 3.RobertSedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016. 4.Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd. 2015 5.Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012	

HEAD
Dept. Of Automation And
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Kinematics and Theory of Machines Laboratory

AR406	PCC	Kinematics and Theory of Machines 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: Basic Physics

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

CO1	Select Suitable mechanism for various applications.
CO2	Analyze graphically velocity and acceleration of planer mechanism using relative velocity method.
CO3	Draw Cam profile for specific motion.
CO4	Examine effect of slip on power transmission of belt.
CO5	Determine the torque transmitted in epicyclic gear train.

List of Experiments:

1. Identify and study of inversions of four bar chain mechanisms.
2. Study of inversions of single/double slider crank mechanisms.
3. Determine velocity and acceleration of various links in given mechanism by relative velocity method for analysis of motions of links. (Use drawing sheet)
4. Klien's construction for slider crank mechanism. (Use drawing sheet)
5. To construct cam profile for various types of follower motion. (Use drawing sheet)
6. Experiment on Slip of belt.
7. Experiment on Epicyclic Gear train.

Text Books:

1. Thomas Bevan, Theory of Machines, 3rdedition, CBS Publishers & Distributors,2005.
2. Cleghorn W.L., Mechanisms of Machines, Oxford University Press,2005.

3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill,2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East- West Pvt. Ltd, New Delhi

Reference Books:

1 .J. E. Shigely, J. J. Uicker, "Theory of Machines and Mechanisms", Tata McGraw Hill Publications, New York, International Student Edition, 1995.
2.Thomas Beven, "Theory of Machines", CBS Publishers and Distributors, Delhi
3..Shigley, Theory of Machines and Mechanism, McGraw Hill, New York
4. G.S. Rao and R.V. Dukipatti, Theory of Machines and Mechanism, "New Age Int. Publications Ltd. New Delhi.
5.Abdullah Shariff, Theory of Machines, McGraw Hill, New Delhi
6.Shah and Jadhawani, Theory of Machines, DhanpatRai& Sons

HEAD
Dept. Of Automation And
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Microcontroller and Embedded System Laboratory

AR407	PCC	Microcontroller and Embedded System 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: Basic Electronics

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

CO1	Develop 8051 Assembly Language Programs for Arithmetic, Logic, Bit manipulation, String operations.
CO2	Demonstrate an application for 8051 microcontroller using Traffic light controller, ADC & DAC interfacing boards
CO3	Demonstrate 8051 Embedded C Coding for Programming the GPIO, Timer, Interrupts & Serial Port and a system for temperature monitoring using Ardiuno target Board
CO4	Develop communication skills and capability to work in team

List of Experiments:

At least minimum 10 experiments should be performed from the following list.

Microcontroller Lab: Developing Assembly Language Programs using 8051 Microcontroller Keil simulator or Kits

- Arithmetic and Logical operations using 8051Microcontroller
- Data manipulating Operations and Delay Routines
- LED pattern display
- String operations
- Interfacing Traffic light controller
- Interfacing AC
- Interfacing DAC

Embedded Laboratory

1. Keyboard Interfacing to 8051Microcontroller.

HEAD
Dept. Of Automation And
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SITCOE, Yadrav

2. Stepper Motor Interfacing to 8051Microcontroller

3. Voltage Measurement with display Designing a voltmeter to measure voltage from 0 to 5 volts and displaying the measured value using 7 segment displays

4. Design of Water Pump Controller to sense the water level in a tank

5. Digital Clock with LCD display

64. Temperature Measurement with 7 segment display

7. PC Communication Interfacing the microcontroller to a PC through RS232 interface and displaying the messages sent by the microcontroller on the PC using Visual Basic program running in PC

8. Remote Control through FM Link Establishing an FM link between two microcontrollers for data transfer.

9. Hot Chamber Controller to maintain the temperature at the set point.

10. Obstacle Detector using ultrasonic transmitter- receiver

11. Moisture sensor and sprinkler controller design

12. Designing a lamp controller having a light sensor and a timer

Text Books:

1. Krishna Kant, —Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096‖, PHI, 2014.

2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems Using Assembly and C ", 2nd Edition, Pearson Education 2013.

3. Kenneth J. Ayala, "The 8051 Microcontroller. Architecture, Programming and Applications", 3rd Edition, West publishing company 2014

4. Andrew N.Sloss, Dominic Symes and Chris Wright, "ARM System Developer's Guide: Designing and Optimizing System Software", Morgan Kaufmann Publishers, 1st Edition, 2004.

5. Raj Kamal, "Embedded Systems Architecture, Programming and Design", Tata McGraw Hill, 2nd Edition, 2009

Reference Books:

1. Soumitra Kumar Mandal "Microprocessors and Microcontrollers Architecture Programming and Interfacing using 8085, 8086 & 8051" Tata McGraw Hill Publishing Co Ltd, 1st Edition, 2011.
2. Myke Predko, "Programming and Customizing the 8051 Microcontroller", 1st Edition, 2012.
3. Chris Braith, "8051 Microcontroller Application based Introduction", Elsevier 2004.

HEAD
Dept. Of Automation And
Robotics Engineering
SITCOE, Yadrav

4. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems "Tata McGraw Hill Publishing Co Ltd, Ist Edition, 2014.
5. Jonathan W Valvano, "Embedded Systems: Introduction to Arm® Cortex TM-M Microcontrollers", 5th Edition, 2015.
6. Shibu K.V, "Introduction to Embedded Systems", Tata Mc Graw Hill, 1st Edition, 2009.
7. Jean J.Labrosse, "Embedded Systems Building Blocks", CMP Books, 2nd Edition, 2010.

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CAD CAM and Automation Laboratory

AR408	PCC	CAD CAM and Automation 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: Engg. Graphics

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

CO1	Demonstrate Computer Aided Design methods and procedures
CO2	Illustrate various creating and editing commands in 3D software
CO3	Model machine parts using 3D software.
CO4	Generate Shape optimization of any mechanical component
CO5	Develop physical 3D mechanical structure using any one of the rapid prototyping
CO6	Explain concepts of finite element analysis procedures

List of Experiments:

1. Part modeling using any 3D modeling software
2. Assembly modeling of assembly or sub-assembly of engineering products using software
3. Minimum 2 Jobs (Programs) on CNC Turning operations
4. Minimum 2 Jobs (programs) on CNC Milling operation
5. Shape optimization of any mechanical component using Software
6. Write a program to generate a curve/surface
7. Development of physical 3D mechanical structure using any one of the rapid prototyping processes.
8. Minimum 2 structural analysis problems to be solved using any CAE software

Text Books:

1. Basu, S. K. and Pal, D.K., Design of Machine Tools, Allied Publishers (2008).
2. Acherkhan, N.S., Machine Tool Design, University Press of the Pacific, (2000).
3. Boothroyd G and Knight Wiston A., Fundamentals of Machining and Machine Tools,

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CRC Press (2005).
4. Sharma, P. C., A Text Book of Machine Tools & Tool Design, S. Chand Limited, (2005).

Reference Books:

1. Rogers D. F. and Adams A., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989.
2. Faux I. D. and Pratt M. J., Computational Geometry for Design and Manufacture, John Wiley & sons, NY, 1979
3. Mortenson M. E., Geometric Modeling, John Wiley &sons, NY, 1985
4. Choi B.K., Surface Modeling for CAD/CAM, John Wiley & Sons, NY, 1991.
5. Mikell P. Grover, Automation, Production System and Computer Integrated Manufacturing,Prentice Hall of India Pvt Ltd, 1995.
6. C. Ray Astaihe, Robots of Manufacturing automation, John Wiley and Sons, New York.
7. Jon Stenerson and Kelly Curran "Computer Numerical Control", Prentice-Hall of India Pvt. Ltd.New Delhi, 2008
8. P. N. Rao "CAD/Cam principles and operations", Tata McGraw Hill
9. Reference Manuals of FANUC, Siemens, Mazak, etc.
10. Thomas M. Crandell "CNC Machining and Programming, Industrial Press ISBN- 0-8311-3118-7

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Python Programming Laboratory

AR409	PCC	Python Programming 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: Object Oriented Programming

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

CO1	Test and debug simple Python programs.
CO2	Make use of conditionals in Python programs
CO3	Develop Python programs step-wise by using functions, packages, modules.
CO4	Apply Python lists, tuples, dictionaries for representing compound data.

List of Experiments:

1 Syntax basics, Arithmetic/String Operations, Input/Output

2. Control Flow constructs: If-else, Relational and Logical Operators

3. Iteration: While loop, For loop

4. Collections: Lits, Tuples

5. Collections: Sets, Dictionary

6. Functions and Modules:sys, math, time

7. File Handling: Data streams, Access modes, Read/Write/Seek

8. Exception handling: hierarchy, raise, assert

Text Books:

1.Exploring Python, Timothy Budd, Mc Graw Hill Publication, ISBN:9780073523378, August 2010

HEAD
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2. Beginning Python, Peter C. Norton, Alex Samuel, Dave Aitel, Eric Foster-Johnson, Leonard Richardson, Jason Diamond, Aleatha Parker, Michael Roberts, ISBN: 978- 0-7645-9654-4, August 2005.

Reference Books:

1. Python: Create - Modify - Reuse, James O. Knowlton, Wrox Publication, ISBN: 978-0-470-25932-0, July 2008.

2. Professional Python Frameworks: Web 2.0 Programming, Dana Moore, Raymond Budd, William Wright, Wrox Publication, ISBN: 978-0-470-13809-0, October 2007.

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Principle of Robotics Laboratory

AR410	PCC	Principle of Robotics 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: Engineering Mechanics, Basic Physics

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

CO1	Demonstrate analysis of robot manipulators.
CO2	Illustrate the functionality and limitations of robot actuators.
CO3	Develop program a robot to perform a specified task in a target environment and solve problems in areas such as robot control and navigation.

List of Experiments:

At least minimum 8 experiments should be performed from the following list

1. Determination of maximum and minimum position of links.
2. Verification of transformation (Position and orientation) with respect to gripper and world coordinate system (simulate different motion commands for given system)
3. Estimation of accuracy, repeatability and resolution.
4. Robot programming and simulation for pick and place
5. Robot programming and simulation for specific movement of the tool
6. Robot programming and simulation for palletizing the object
7. Robot programming and simulation for identification color and shape
8. Robot programming and simulation for any industrial process (Packaging, Assembly)
10. Demonstration of various robotic configurations using industrial robot
11. Demonstration components of a real robot and its DH parameters.
12. simulate different end effectors for given system

HEAD
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12 One Industrial visit for Industrial robotic application or Case study for robots in automobile Industry
Text Books: 1. Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd. New Delhi 2. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill. 3. Groover M.P.-Automation, production systems and computer integrated manufacturing-Prentice Hall of India.
Reference Books: 1. S B Niku, Introduction to Robotics, Analysis, Control, Applications, 2nd Edition, Wiley Publication, 2015. 2. Mikell P. Groover, Automation, Production Systems & Computer Integrated Manufacturing, PHI Learning Pvt. Ltd. , New Delhi, ISBN:987-81-203-3418-2, 2012 3. John Craig, Introduction to Robotics, Mechanics and Control, 3rd Edition, Pearson Education, 2009 4. R K Mittal & I. J. Nagrath, Robotics and Control, McGraw Hill Publication, 2015. 5. Mike Wilson, Implementation of Robotic Systems, ISBN: 978-0-124-04733-4

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Environmental Sciences

MDC02	MC	Environmental Sciences	2-0-0	Audit

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 2 hrs/week	Continues Assessment 1: 25 Marks Continues Assessment 2: 25 Marks

Pre-Requisites: NA

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

CO1	Explain various natural resources and associated Problems
CO2	Summarize various ecosystems
CO3	Explain the importance of conservation of biodiversity and its importance in balancing the earth.
CO4	Recognize various causes of environmental pollution along with various protection acts in India to limit the pollution
CO5	Extract the information based of field study and prepare a report.

Course Contents:

Unit 1: Nature of Environmental Studies: Definition, scope and importance, Multidisciplinary nature of environmental studies. Need for public awareness.	[2]
Unit 2: Natural Resources and Associated Problems: a) Forest resources: Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's benefits and problems. c) Mineral resources: Usage and exploitation. Environmental effects of extracting and using mineral resources. d) Energy resources: Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. e) Land resources: Solar energy, Biomass energy, Nuclear energy, Land as a resource, land degradation, man induced landslides, soil erosion and desertification. f) Role of individuals in conservation of natural resources	[6]
Unit 3: Ecosystems: Concept of an eco-system. Structure and function of an ecosystem. Producers, consumers and de composers. Energy flow in the eco system. Ecological succession. Food chain etc. in concern with forest ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chain etc. in concern with Grassland ecosystem, Producers, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chain etc. in concern with Desert ecosystem, Producers,	[4]

HEAD
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SITCOE, Yadrav

consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chain etc. in concern with various aquatic ecosystems	
Unit 4: Biodiversity: Introduction- Definition: genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values. Various approaches for the conservation of biodiversity.	[4]
Unit 5: Environmental Pollution and Environmental Protection: Definition: Causes, effects and control measures of various types of pollution. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Concept of sustainable development: From Unsustainable to Sustainable development, Various environmental Protection Acts and their scope.	[4]
Unit 6: Field Work: The student should Visit to a local area to document environmental Assets-River/Forest/Grassland/Hill/Mountain. Or Visit to a local polluted site - Urban / Rural / Industrial /Agricultural. Or Study of common plants, insects, birds. or Study of simple ecosystems - ponds, river, hill slopes, etc. **The student should expect to do this activity in a group size of 4-5 and prepare and submit a report on it.**	[4]

Text/Reference Books:

1. Agarwal, K.C.2001, Environmental Biology, Nidi Pub. Ltd., Bikaner.
2. BharuchaErach, The Biodiversity of India, Mapin Publishing Pvt. Ltd., Ahmedabad 380013, India, Email:mapin@icenet.net
3. Brunner R.C.,1989, Hazardous Waste Incineration, McGraw Hill Inc.480p

HEAD
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Aptitude Skills–II

HMS03	HSMC	Aptitude Skills- II	1-0-0	Audit

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 1 hrs/week	Continues Assessment 1: 25 Marks Continues Assessment 2: 25 Marks

Pre-Requisites: Communication Skills, Aptitude Skills- I

Verbal Ability (12Hrs) (Compulsory)

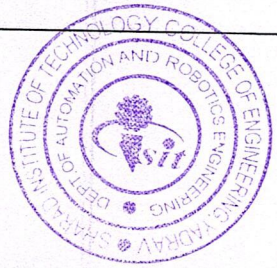
Course Outcomes: At the end of the course, students will be able to:

CO1	Understand basic concepts of sentences and its structure
CO2	Understand the tenses and its use in daily life
CO3	Explain basic uses of speeches and voices in day to day life
CO4	Understand the use of modal verbs in sentence construction
CO5	Summarize various Phrases, Idioms and Proverbs
CO6	Summarize different words used in daily life

Unit 1: English Grammar Structure and Types of Sentence, Conditional Sentences	[2]
Unit 2: Tenses Present tense, Past tense, Future tense, Use of Tenses in Sentence forming	[2]
Unit 3: Speeches and Voices Direct and Indirect Speech, Active and Passive Voice	[2]
Unit 4: Modal Use of Modal verbs in Sentence Forming, Substitution and Elimination	[2]
Unit 5: Proverbs, Idioms and Phrases Use of Proverbs, Idioms and Phrases in Sentence Construction, Judgment and Inference Sentence	[2]
Unit 6: Vocabulary Vocabulary Building in Various Situations	[2]

Text Books:

1. Raymond Murphy, Essential English Grammar with Answers, Murphy
2. Objective General English by R.S. Aggarwal, S Chand Publishing; Revised edition (15 March 2017)



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Reference Books:

1. Rao N, D, V,Prasada, Wren & Martin High School English Grammar and Composition Book, S Chand Publishing, 2017
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press;Second edition

Language Skills- II

HMS04	HSMC	Language Skills- II	0-0-2	1 Credit

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

Pre-Requisites: Communication Skills, Language Skills- I

Languages (Any One)

C Programming (Technical Language) (24Hrs)

Syllabus for C Programming

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

CO1	Illustrate the concept of Function Types, and its type
CO2	Make use of Structures and Unions.
CO3	Make use of Pointers
CO4	Illustrate the concept of File handling in C programming.

Unit 1: Function Editing, Basic of functions, Types of functions, returning non-integers external variables, scope rules, Recursion Function.	[6]
Unit 2: Structures and Unions Variable Defining a Structure, Advantage of Structure, Size of Structure, Arrays of Structures, Structures and Functions, Defining Unions.	[6]
Unit 3: Pointers Pointers to integers, characters, floats, arrays, structures.	[6]
Unit 4: File handling Initializing Introduction to dynamic memory allocation- Malloc, Calloc, Realloc, Introduction to file management, Opening/Closing a file, Input/ Output operations on Files, Error handling during I/O Operations.	[6]
Text Books 1. C Programming Absolute Beginner's Guide, Que Publishing; 3rd edition (22 August 2013) 2. C Programming Language 2nd Edition, Pearson Publication	
Reference Books	

HEAD
Dept. Of Automation And Robotics Engineering
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1. C: The Complete Reference, McGraw Hill Education; 4th edition (1 July 2017)
2. C Programming in easy steps, 5th Edition, In Easy Steps Limited
3. The C Programming Language, Second Edition, By PearsonEducation India(1 January 2015)

Foreign Languages (Any One)

Japanese Language Course I (12Hrs)

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

CO1	Converse in Standard Japanese to perform basic communicative tasks (e.g., exchange greetings/personal information, give time/directions/daily activities)
CO2	Make use of Japanese vocabulary effectively.
CO3	Demonstrate reading comprehension.

Course Contents:

Unit 1: Basic communicative tasks Learning expressions involving "---ni---gaimasu" pattern, Introduction of counters, simple translations, Communicative situations—shopping, Grammar: Introduction of adjectives, na-adjectives	[4]
Unit 2: Communicative situations Time relations, Communicative situations-confirming schedules etc, Particles and their functional use in Japanese sentences, Reading comprehension—a story	[4]
Unit 3: Easy conversation Introduction of past tense aspect in r/o verbs, and adjectives, Communicative situation: asking questions and answering, Easy conversation, Overall revision, and discussion	[4]
Text Book: 1. NetzwerkArbetisbuch A1 Goyal Publisher. 2. "The Everything Learning German Book: Speak, Write and Understand Basic German in No Time" by Ed Swick 3. "German Made Simple: Learn to Speak and Understand German Quickly and Easily" by Eugene Jackson and Adolph Geiger	
Reference Books 1. "Hammer's German Grammar and Usage" (Fifth Edition) by Professor Martin Durrell 2. "Learn German with Stories: Café in Berlin" by André Klein	

Foreign Languages

German Language Course I (12Hrs)

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

CO1	Introduce herself or himself in German.
CO2	Understand alphabets, numbers in German language
CO3	Make basic and easy sentences required in day to day situations
CO4	Read, write, speak and listen basic and simple text in German.

Unit 1: Introduce oneself Introduction, Greetings, German Alphabets, Numbers (1 -100), Giving and asking Information related to numbers	[3]
Unit 2: Formal and Informal form Difference between Formal and Informal form, Personal Pronouns, verb conjugation	[3]
Unit 3: Everyday situations Learning about the things in the classroom, Definite, indefinite, negative articles, Possessive Articles of all the nouns	[3]
Unit 4: Simple activities Watch timings learning, Routine activities	[3]
Text Books 1. NetzwerkArbetisbuch A1 Goyal Publisher 2. "The Everything Learning German Book: Speak, Write and Understand Basic German in No Time" by Ed Swick 3. "German Made Simple: Learn to Speak and Understand German Quickly and Easily" by Eugene Jackson and Adolph Geiger	
Reference Books 1. "Hammer's German Grammar and Usage" (Fifth Edition) by Professor Martin Durrell 2. "Learn German with Stories: Café in Berlin" by André Klein	

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Dept. Of Automation And
Robotics Engineering
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Mini Project -III

PRJ03	PROJ	Mini Project III	0-0-2	1 Credit

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

Pre-Requisites: NA

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

CO1	Select the appropriate method for solving the problem
CO2	Make use of various engineering techniques and tools to give a solution
CO3	Justify the method/tools used to develop the solution.
CO4	Demonstrate tangible solutions to the problem
CO5	Describe the solution with the help of a project report and presentation.

The project is a part of addressing societal and industrial needs. Mini project is one of the platforms that students will use to solve real-world challenges. This course focuses on the selection of methods/engineering tools/analytical techniques for problem-solving. Through this course, students gain a thorough understanding of engineering basics and ideas, gain practical experience, have the opportunity to display their skills and learn about teamwork, financial management, communication skills, and responsibility.

Guidelines

1. Every student shall undertake the Mini project activity for semester IV.
2. The same group of minimum three and maximum of five students who were working for mini project II should work together in Mini project III
3. The students have to work on different approaches and finalize the best methodology to solve the problem in consultation with the project guide.
4. The students should use different tools /Techniques for the development of the solution to the problem.
5. While developing solutions, the student can take care of effective use of resources, follow ethical practices, finance management,
6. The solution should be optimal, affordable, user-friendly and environment friendly.
7. Critically analysis and testing of the solution provided.

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8. By using IPR, students should reserve their rights of innovations as well as communicate new findings to society with the help of research papers.

The committee of senior faculty members and a project guide will be appointed to monitor the progress and continuous evaluation of each project. The assessment shall be done jointly by the guide and committee members.

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Field Training /Industrial Training

IFT01	PROJ	Field training /Industrial training	0-0-0	Audit

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

Course Description:-

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

Course Outcomes: Students will be able to

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

Prerequisite: - Basics of (Programme) Engineering, Good written and Oral Communication.

Guideline for Students:-

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

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Student's Diary/ Daily Log

The main purpose of writing daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students should record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any. It should contain the sketches & drawings related to the observations made by the students.

The daily training diary should be signed after every day by the supervisor/ in charge of the section where the student has been working. The diary should also be shown to the Faculty Mentor.

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

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

Internship Report

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

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

Evaluation of Internship/Training

The student should be evaluated based on his training report and presentation, before an expert committee constituted by the concerned department as per norms. The evaluation will be based on the following criteria:

- Quality of content presented.
- Proper planning for presentation.

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SITCOE, Yadrav

- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance record, daily diary, departmental reports shall also be analyzed along with the Internship Report.

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