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

Teaching and Evaluation Scheme for S.Y B. Tech.

Department of Mechatronics Engineering

Semester: III &IV

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Department: Mechatronics Engineering | Rev: Course Structure/00/2021-22

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	
MT301	BSC	Engineering Mathematics-III	3	1	-	4	10	10	30	50	100	4
MT302	PCC	Fluid Mechanics& machinery	3	-	-	3	10	10	30	50	100	3
MT303	PCC	Sensor & Instrumentation	3	-	-	3	10	10	30	50	100	3
MT304	PCC	Digital Electronics and Microprocessor	3	-	-	3	10	10	30	50	100	3
MT305	PCC	Material and Manufacturing Processes	3	-	-	3	10	10	30	50	100	3
MT306	PCC	Fluid Mechanics& machinery Laboratory	-	-	2	2	15	15	--	20	50	1
MT307	PCC	Sensor & Instrumentation Laboratory	-	-	2	2	15	15	--	20	50	1
MT308	PCC	Digital Electronics &Microprocessor Laboratory	-	-	2	2	15	15	--	20	50	1
MT309	PCC	Manufacturing Technology Laboratory	-	-	2	2	15	15	--	20	50	1
MT310	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	1	14	32	225	225	150	350	950	22

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Engineering Mathematics-III

MT301	BSC	Engineering Mathematics-III	3-1-0	4 Credits

Teaching Scheme	Examination Scheme
Lecture: 3 hrs/week Tutorial: 1hr/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 – conditions for existence ; Transforms of elementary functions; Properties of Laplace transforms - Linearity property, first shifting property, second shifting property, transforms of functions multiplied by t^n, scale change property, transforms of functions divided by t, transforms of derivatives ; Evaluation of integrals by using Laplace transform; Transforms of some special functions- periodic function, Heaviside-unit step function, Dirac delta function.	[8]

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Unit 2: Inverse Laplace Transform Introductory remarks; Inverse transforms of some elementary functions; General methods of finding inverse transforms; Partial fraction method and Convolution Theorem for finding inverse Laplace transforms; Applications to find the solutions of linear differential equations and simultaneous linear differential equations with constant coefficients.	[7]
Unit 3: Partial Differential Equations and Their Applications Formation of Partial differential equations by eliminating arbitrary constants and functions; Equations solvable by direct integration; Linear equations of first order (Lagrange's linear equations); Method of separation of variables – applications to find solutions of one dimensional heat flow equation ($\frac{\partial u}{\partial t} = c^2 \frac{\partial^2 u}{\partial x^2}$), and two dimensional heat flow equation (i.e., Laplace equation: $\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} = 0$).	[8]
Unit 4: Fourier Series Definition, Euler's formulae, Conditions for a Fourier expansion, Functionshaving points of discontinuity, change of interval, expansions of odd andeven periodic functions and half range series.	[7]
Unit 5: Fourier Transforms Fourier Transforms, Fourier Sine and Cosine Transforms, Complex form ofFourier Integral, Finite Fourier Sine and Cosine Transform.	[6]
Unit 6: Z Transform Definition, properties of z transform, Z Transform of basic sequences, Z transform of some standard discrete function inverse Z transform.	[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.	

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Fluid Mechanics and Machinery

MT302	PCC	Fluid Mechanics and Machinery	3-0-0	3Credits

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

Pre-Requisites: Engineering Mathematics-I & II

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

CO1	Explain various properties of fluids and their SI units and determine hydrostatic forces on the plane and curved surfaces and explain stability of floating bodies.
CO2	Classify various types of flows and determine velocity, acceleration of fluid particle & apply Bernoulli's Equation to simple problems in Fluid mechanics.
CO3	Identify losses in flow through pipes, make use of dimensional analysis to simple problems in fluid mechanics and explain drag and lift.
CO4	Explain construction and working principle of Fluid and Turbo- machinery
CO5	Explain air Compressor
CO6	Explain working principle of Gas Turbine

Course Contents:

Unit 1: Fundamentals of Fluid Mechanics **Properties of Fluids:-** Physical properties of fluids: Introduction, Types of fluids and Properties of fluids, viscosity, surface tension, vapor pressure and cavitation. **Fluid Statics:** Total pressure and center of pressure on submerged plane surfaces; horizontal, vertical and inclined plane surfaces submerged in liquid.	[6]
Unit 2: Fluid Kinematics& Fluid Dynamics **Introduction to Fluid Kinematics:-** Introduction, Types of Flow, & Flow Lines. Streamline, Path line,	[7]

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Streak line, Stream Tube, Stream Function ,Continuity Equation in Cartesian Co-Ordinates System, Velocity & Acceleration of fluid particles. **Introduction to Fluid Dynamics:-** Introduction, Equation of Motion, Bernoulli's equation, discharge measurement, **Momentum Equation-** Introduction & Derivation, Application of Momentum Equation	
Unit 3: Flow through pipes **Flow Through Pipe-** Introduction, Losses of Energy, Darcy's Equation Chezy's Equation, Minor Losses. Flow Through Series Pipes, Parallels Pipes, Equivalent Pipes, Siphon Pipe **Forces on ImmersedBodies-** Drag & Lift forces. **Dimensional analysis & model Testing-**Buckingham's theorem, dimensionless numbers, model laws, model testing	[6]
Unit 4: Introduction to fluid machines **Hydraulic Turbines-** Classification, construction, working, velocity triangles, Hydraulic design, work done, various efficiencies of impulse & reaction turbines, selection of turbine. **Hydraulic Pumps-** Classification, various heads, construction & working of centrifugal pump, reciprocating pump, and gear pump, vane pump, selection of pump. Centrifugal pump-velocity triangles, hydraulic design, power required to drive pump, various efficiencies	[6]
Unit 5: Introduction to Compressor Difference between centrifugal and axial compressor and applications, Construction, velocity diagram, flow process on T-S Diagram, Euler's work, actual work input, performance characteristics, Various losses in centrifugal compressor.**Axial Compressor:** Construction, Stage velocity triangles and its analysis, enthalpy entropy diagram, Stage losses and efficiencies, performance characteristics	[7]
Unit 6: Gas Turbine Simple Gas Turbine, Open cycle, closed cycles, single-shaft and twin-shaft arrangements, Combined and cogeneration cycle, Introduction to Aircraft propulsion, Introduction to Rocket Propulsion, Gas turbine design procedure, Numerical treatment on performance, Environmental issues, Industrial applications	[7]

Text Books:

1.Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley.

2.Hydraulics and Fluid Mechanics, - Modi P. N. and Seth S. M -Standard Book House

Turbomachines, B. U. Pai, Wiley India

3.S.M.Yahya Turbine, Compressors and Fans, Tata Mc-Graw Hill Publishing Company, 1996

4.R. K. Rajput, Fluid Mechanics and Hydraulic Machines S. Chand

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Reference Books:

1.Introduction to Fluid Mechanics-Edward Shaughnessy, Ira Katz James Schaffer- OXFORD University Press

2.Fluid Mechanics – ChaimGutfinger David Pnueli-Cambridge University press.

3.Fluid Mechanics and Machinery, Modi P N & Seth S N, Standard Book House, New Delhi

4. Steam & gas Turbines by V. Ganeshan

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Sensor and Instrumentation

MT303	PCC	Senor and Instrumentation	3-0-0	3 Credits

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

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

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

CO1	Explain Instruments and Sensors
CO2	Illustrate Analog signal conditioning
CO3	Explain Digital signal conditioning
CO4	Explain different thermal sensor with their application
CO5	Explain different mechanical sensor with their application
CO6	Explain different optical sensor with their application

Course Contents:

Unit1: Introduction to Instruments and Sensors Instrumentation systems architecture - Sensor networks architecture - Data transfer and power supply needs of instrumentation and sensor systems - General considerations about instrumentation and sensor system specification and verification	[6]
Unit2: 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 , Bridge ,Applications	[6]

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Unit3: Digital Signals Digital Electronics Circuits: comparator, converter, Digital-to-Analog Converters (DACs), Analog-to-Digital Converters (ADCs) : Flash-, SAR, Dual Slop Sensor-to-Frequency Conversion, Data-Acquisition Systems: Hardware and Software of Data Acquisition System (DAS), Characteristics of digital data: Digitized Value, Sampled Data Systems, Linearization	[6]
Unit4: Thermal Sensors Thermistors: Semiconductor Resistance versus Temperature, Thermistors Characteristics, THERMOCOUPLES: Thermoelectric Effects, Thermocouple Characteristics, Thermocouple Sensors, Other thermal sensor: Bimetal Strips, Gas Thermometers, Vapor Pressure Thermometers, Liquid-Expansion Thermometers Solid-State Temperature Sensors, Design considerations	[7]
Unit5: Mechanical Sensors Displacement, Location, or Position Sensors: Resistive-, Capacitive-, and Inductive Sensors, Variable-Reluctance Sensors, LVDT, Level Sensors, Metal Strain Gauges and Semiconductor Strain Gauges (SGs) ,Load Cell, Motion sensors: Types of Motion, Accelerometer Principles, Types of Accelerometers Pressure sensors: Pressure Principles, Pressure Sensors (p > 1 atmosphere), Pressure Sensors (p < 1 atmosphere) Flow sensors: Solid-Flow – and Liquid Flow Measurement Pipe Flow Principles, Restriction Flow Sensors, Obstruction Flow Sensor Magnetic Flow Meter	[6]
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: Thermal Radiation, Broadband Pyrometers, Narrowband Pyrometers	[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. 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	

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Digital Electronics and Microprocessor

MT304	PCC	Digital Electronics and Microprocessor	3-0-0	3 Credits

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

Pre-Requisites: 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	[6]

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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	
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	

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Material and Manufacturing Processes

MT305	PCC	Material and Manufacturing Processes	3-0-0	3 Credits

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

Pre-Requisites: Engineering 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	Explainthe Processing of Integrated Circuits

Course Contents:

Unit 1:Properties of Engineering materials and Smart Material: Historical Perspective, Importance of Engineering Materials, Classification of Materials, Chemical, Electrical and magnetic materials, Material selection criteria Design considerations, Needs of Modern Materials, Composite materials: Definition, classification, type of matrix materials and reinforcements, advantages and application of composites. Smart materials: Shape Memory Alloy, Piezoelectric and Magnetostrictive Actuators: Materials, Static and dynamic characteristics, illustrative examples for positioning, vibration isolation, etc.	[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]

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Unit 3:Extrusion and Drawing Processes Classification of extrusion processes-tool, equipment, and principle of these processes, influence on Friction-Extrusion force calculation-defects and analysis-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, advantages of powder metallurgy products.	[7]
Unit 4: Theory of Metal Cutting: Cutting tools and tool geometry 8 Types of cutting tools, tool materials-HSS (including heat treatment) ceramics, cements, CBN & PCD, tool geometry and nomenclature, selection of tool materials and tool life, tool wear and machinability Mechanics of clip formation, types of chips and conditions conducive for the formation of each type Built-up edge, its effects Orthogonal vs. oblique cutting- merchant's force circle diagram. Force and velocity relationship, shear plane angle. Energy consideration in Machining-Ernst Merchant theory of shear angle, relationship-original assumptions and modification made.	[7]
Unit5:Unconventional machining processes: classification according to type of energy used for machining, basic principles, machines and applications of, Electrical discharge machining (EDM), Electron beam machining (EBM) , Plasma arc machining (PAM), Laser beam machining (LBM), Electrochemical machining (ECM), Chemical machining (CHM), Ultrasonic machining (USM). **Additive Manufacturing:** Fundamentals of rapid prototyping, stereo lithography, laminated object manufacturing, fused deposition modeling, 3D printing, selective laser sintering	[7]
Unit6: Processing of Integrated Circuits: Processing sequence, silicon processing, photolithography, layer processes used in IC fabrication, IC packaging. **Electronic assembly and packaging:** PCB structure, types and materials. Processes used in PCB fabrication, PCB assembly.	[6]

Text Books:
I.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 -I & 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).

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7. Manufacturing Processes for Engineering Materials, 4th Edition, by SeropeKalpakjian, Steven R. Schmid, published by Pearson (2007).
8. V.D. Kodgire and S.V. Kodgire, —Material Science and Metallurgy for Engineers, Everst publishing house, pune, 2008
9.Raghavan V., —Materials science and Engineering- A first course,I 5th edition, ISBN: 978-81-203-2445-8, 2011
10. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014.
11. Kalpakjian and Schmid, Manufacturing Engineering and Technology, 6 ed., Pearson.
12. Lindberg, Processes & Materials of Manufacture, Prentice Hall India.
13. Kumar & Gupta, Manufacturing Processes, Prentice Hall India.

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Fluid Mechanics and Machinery Laboratory

MT306	PCC	Fluid Mechanics and Machinery Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Engineering Physics.

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

CO1	Demonstrate laminar and Turbulent flow and determine Critical Reynolds number using Reynolds Apparatus.
CO2	Experiment with Bernoulli's theorem.
CO3	Test for selected flow measuring devices and demonstrate these instruments in Lab
CO4	Explain construction and working principle of Fluid and Turbo- machinery
CO5	Explain use of CFD in fluid analysis

List of Experiments:

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

1. Visualization by Plotting of Streamlines (Heleshaw's Apparatus)
2. Verification of Bernoulli's Equation.
3. Reynolds Experiment.
4. Calibration of Venturimeter and Orifice meter
5. Determination of major losses /minor losses in pipe fittings Apparatus
6. Demonstrate Pressure Measuring Devices
7. Pelton wheel test rig.
8. Centrifugal Blower rig
9. Kaplan turbine test rig
10. Centrifugal pump test rig.
11. Reciprocating pumps test rig.
12. Industrial Visit

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13. Introduction to CFD
Text Books: 1. Introduction to Fluid Mechanics- Fox, Pichard , McDonald- Wiley. 2. Hydraulics and Fluid Mechanics, - Modi P. N. and Seth S. M -Standard Book House Turbomachines, B. U. Pai, Wiley India 3. S.M.Yahya Turbine, Compressors and Fans, Tata Mc-Graw Hill Publishing Company, 1996 4. R. K. Rajput, Fluid Mechanics and Hydraulic Machines S. Chand
Reference Books: 1. Introduction to Fluid Mechanics-Edward Shaughnessy, Ira Katz James Schaffer-OXFORD University Press 2. Fluid Mechanics – ChaimGutfinger David Pnueli-Cambridge University press.Hydraulics, 3. Fluid Mechanics and Machinery, Modi P N & Seth S N, Standard Book House ,New Delhi 4. Steam & gas Turbines by V. GaneshanShepherd, D.G., Principles of Turbomachinery, Macmillan, 1969

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Sensor and Instrumentation Laboratory

MT307	PCC	Sensor and Instrumentation Laboratory	0-0-2	1 Credits

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

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

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

CO1	Select an appropriate sensor for a given application Use
CO2	Use test bench for calibration
CO3	Explain measurement system and measuring instruments.
CO4	Perform physical parameters measurement and control using respective sensor

List of Experiments:

1. Introduction to Instrumentation
2. Measurement of strain using strain gauge
3. Characteristics of temperature sensors
4. Study of Characteristics of LVDT
5. Measurement of Natural frequency and damping ratio of the given system
6. Loading effects of Potentiometer and Characteristics of Opto-coupler
7. Level Measurement using proximity sensors
8. Effect of Modifying and Interfering input for the given measurement system
9. Characteristics of Hall effect sensor
10. Accelerometer sensor

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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. 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

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Digital Electronics and Microprocessor Laboratory

MT308	PCC	Digital Electronics and Microprocessor Laboratory	0-0-2	1 Credits

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

Pre-Requisites: 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 convertor 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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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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Manufacturing Technology Laboratory

MT309	PCC	Manufacturing Technology Laboratory	0-0-2	1 Credits

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

Pre-Requisites: 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.

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Demonstration on PCB Manufacturing

9. Development of physical 3D Model using any one of Slicing Software.

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).

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Object oriented programming Using C++ Laboratory

MT310	PCC	Object oriented programming Using C++ Laboratory	0-0-2	1 Credits

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

Pre-Requisites: 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 Principles and Practice using C++, B.Stroustrup, Addition-Wiesly (Pearson Education)
3. Data Structures and STL,W.J.Collins,mcGrawHill,Internationational Edition.
4. Data Structores 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.

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Constitution of India

MDC01	MC	Constitution of India	2-0-0	Audit

Teaching Scheme	Examination Scheme
Lecture: 1hr/week	Continuous Assessment –I :25 Marks Continuous Assessment –II :25 Marks

Pre-Requisites: Engineering Mathematics-I & II

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: Meaning of the constitution law and constitutionalism. Historical perspective of the Constitution of India	[2]
Unit 2: 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: 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]

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Unit 4: Amendment of the Constitutional Powers and Procedure , The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency	[2]
Unit 6: Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.	[3]

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

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Aptitude Skills-I

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

Teaching Scheme:	Examination Scheme:
Lecture: 1 hrs/week Tutorial: NA Practical: NA	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. ArunSharma - Quantitative aptitude for CAT.
2. RS Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning,S.Chand Publisher; 2016 edition

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3. RS Aggarwal, Quantitative Aptitude for Competitive Examinations, 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 Examination by Dinesh Khattar

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Language Skill- I

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

Teaching Scheme:	Examination Scheme:
Lecture: NA Tutorial: NA 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]
Unit 4: Arrays	[6]

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Initializing arrays, Initializing character arrays ,two dimensional and multidimensional arrays.	
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 Editionby 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 howto 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 relatedinformation in Radio	[6]
Text Books 1. NetzwerkArbeitsbuch 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

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Mini Project -II

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

Teaching Scheme:	Examination 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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Shri Shamrao Patil (Yadravkar) Educational & Charitable Trust's

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Department: Mechatronics Engineering **Rev:** Course Structure/00/2021-22

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	
MT401	PCC	CAD/CAM/CAE	3	-	-	3	10	10	30	50	100	3
MT402	ESC	Strength of Materials	3	-	-	3	10	10	30	50	100	3
MT403	PCC	Electrical Machines and Drives	3	-	-	3	10	10	30	50	100	3
MT404	PCC	Microcontrollers &Interfacing	3	-	-	3	10	10	30	50	100	3
MT405	PCC	Thermodynamics& Heat Transfer	3	-	-	3	10	10	30	50	100	3
MT406	PCC	CAD/CAM/CAE Laboratory	-	-	2	2	15	15	-	20	50	1
MT407	ESC	Strength of Materials Laboratory	-	-	2	2	15	15	-	20	50	1
MT408	PCC	Electrical Machines and Drives Laboratory	-	-	2	2	15	15	-	20	50	1
MT409	PCC	Microcontrollers &Interfacing Laboratory	-	-	2	2	15	15	-	20	50	1
MT410	PCC	Thermodynamics& Heat Transfer 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	MSMC	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	350	1000	22

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CAD/CAM/CAE

MT401	PCC	CAD/CAM/CAE	3-0-0	3Credits

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

Pre-Requisites: 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	Explain 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	[7]

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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	
Unit 3: Fundamentals of Numerical Control and Computer Numerical Control 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.	[6]
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] Robotics: RIA definition of Robot, Laws of robotics, Classification of robots, robot anatomy, Point to point and continuous path robotic systems, Joints, End Effectors, Grippers - Mechanical, Magnetic and Pneumatic, Applications. [Only theory]	[6]
Unit 6: Finite Element Methods Introduction, Types of elements, Degrees of freedom, Field variable, Shape function, Boundary conditions, Meshing, Nodal displacements, Plain stress and plain strain problems, 1-D, 2-D and 3-D problems, Static, dynamic 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:	

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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 Astalhe, 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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Strength of Materials

MT402	ESC	Strength of Materials	3-0-0	3 Credits

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

Pre-Requisites: Engineering Mechanics

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

CO1	To explain various types of loading and stresses induced in components.
CO2	To develop SFD and BMD for different types of loads and support conditions.
CO3	To analyze bending and shear stresses induced in mechanical components
CO4	To analyze deflection in beams by Double integration method, Area moment method
CO5	To analyze principal stresses & strains by analytical and graphical method.
CO6	To recognize various types of loads applied on machine components of simple geometry and understand the nature of internal stresses that will develop within the components

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 streases, 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	[7]

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moments, Shear force and bending moment diagrams subjected to concentrated loads, uniform distributed load (UDL) for different types of beams.(UVL not included)	
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: Deflection of Mechanical Elements Concept of deflection, Slope and deflection by double integration method(Macaulay's method). Slope and deflection for simply supported, cantilever and statically determinate elements	[7]
Unit 5: Principal Stresses and Strains Normal and shear stresses on any oblique planes, Concept of Principal planes, 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, Theories of elastic failure (Without derivation).	[6]
Unit 6: Torsion, Axial and hoop stresses Torsion, stresses and deformation in circular and hollow shafts, stepped shafts, deflection of shafts fixed at ends, stresses and deflection of helical springs, Axial and hoop stresses in cylinders subjected to internal pressure, deformation of thick and thin cylinders; deformation in spherical shells subjected to internal pressure	[7]

Text Books:

1. Strength of Materials, S. Ramamrutham, 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

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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

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Electrical Machine and Drives

MT403	PCC	Electric Machines and Drives	3-0-0	3 Credits

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

Pre-Requisites: Basic Electrical Engineering

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

CO1	Demonstrate construction and working principle of various electric machine
CO2	Illustrate laws of electromagnetic and electro-mechanics, constructional features of Transformer and DC Machines, Characteristics and their operations.
CO3	Design and model DC machines
CO4	Explain the implications of those parameters are on performance of system operating those machines.
CO5	Explain the Synchronous Machines and Special Machines: Stepper Motor and Servo Motor
CO6	Explain basic of selection of drive for a given application

Course Contents:

Unit 1 :Introduction to Electric Machine Basic Principle, Types and constructional Features of Electric machines, Recent Trends in Research and Development in Electrical Machines, Magnetic circuit, Magnetic Materials and their properties ,Magnetically Induced EMF and Force, AC operation of Magnetic circuit, Hysteresis and Eddy-Current Losses Permanent Magnet ,Application of Permanent Magnet Materials	[7]
Unit 2: Transformers Introduction, Transformer Construction and Practical Considerations, Transformer load, Ideal Transformer, Real Transformer and Equivalent Circuit ,Transformer Losses, Transformer Testing, Efficiency and Voltage Regulation, Excitation Phenomenon in Transformers, Autotransformers, Variable Frequency Transformer	[6]

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Unit 3 : Principle of Rotating Machines Introduction, Energy in Magnetic System, Field Energy and Mechanical Force, Multiply-Excited Magnetic Field Systems, Forces/Torques in Systems with Permanent Magnets, Energy Conversion via Electric Field, Dynamical Equations of Electromechanical Systems **DC Machines** Basic principles of electromagnetic energy conversion, Construction, operation, characteristics, performance of dc generators and motors, testing of dc machines, applications	[7]
Unit 4 : Induction machines Construction, working principle, equivalent circuit, torque-slip curves, performance calculation, starting, speed control of three-phase inductionmotors.CoggingandCrawling.Highforque-cagemotors.Inductiongenerator	[7]
Unit 5: Synchronous Machines Construction, basic principles and theory of cylindrical and salient pole synchronous machines. Equivalent circuit, Working principle, starting, Operation and applications of synchronous motors **Special Machines: Stepper Motor and Servo Motor** Stepper motor general construction, working principle, electric circuit and applications Servo motor general construction, working principle, electric circuit and applications	[7]
Unit 6:Electrical Drives Type of Electrical Drives – Selection & factors influencing the selection – heating and cooling curves – loading condition and classes of duty – determination of power rating – simple problems Solid State Drives -Advantages of solid state drives – D.C. motor control using rectifiers and choppers – control of induction motor by V, V/f and slip power recovery scheme using inverters and A.C. power regulators	[6]

Text Books:

1. Stephen J. Chapman, ElectricMachineryFundamentals'4thedition,McGrawHillEducationPvt.Ltd, 2010.
2. P.C.Sen Principles of Electric Machines and power Electronics John Wiley&Sons;3rdEdition 2013
3. Nagrath,I.J.andKothari,D.P.,ElectricMachines,McGraw-HillEducation,2004

Reference Books:

1. Theodore Wildi, -Electrical Machines, Drives, and Power Systems ,Pearson Education.,(5th Edition), 2002.
2. B.R. Gupta , 'Fundamental of Electric Machines' New age InternationalPublishers,3rd Edition ,Reprint 2015.
3. Surinder Pal Bali ,Electrical Technology-Machines& easurements,Vol.II,Pearson,2013
4. Fitzgerald,A.E.,CharlesKingsely Jr,StephenD.Umans,_ElectricMachinery',Sixth edition McGraw Hill Books Company, 2003.

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Microcontrollers and Interfacing

MT404	PCC	Microcontrollers and Interfacing	3-0-0	3 Credits

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

Pre-Requisites: Digital Electronics

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

CO1	Explain 8051 architecture, addressing modes & instruction set.
CO2	Make use of 8051 to interface stepper motor, keyboard, ADC using programmable peripheral
CO3	Develop assembly language program for arithmetic & logical operations using 8051
CO4	Explain PIC architecture, addressing modes & instruction set.
CO5	Interpret internal peripherals of PIC, such as ADC, Timers etc.
CO6	Explain the Configuration and Features of PIC

Course Contents:

Unit 1 Introduction to MCS 51 Introduction to MCS 51 Family, Architecture, Functional Pin out diagram, Programming Model, Memory Organization, Addressing Modes, Instruction Set: Classification, Reset Circuit, Oscillator Circuit, Introduction to Assembly Language Programming	[6]
Unit 2 Hardware overview Input/output Ports, Counters & Timers, Serial Communication, Interrupt Input/output Ports, Counters & Timers, Serial Communication, Interrupt **Note:** Structure of Above, Related S.F.R, Instruction, Associated Program	[7]
Unit 3 Interfacing & Application Interfacing: LCD, ADC, DAC, Key board, Minimum System Design & Application: Interfacing of Temperature Sensor (LM 35) 8051 Connection to RS 232. **Note:** Assembly Language Programming to be done using Keil or Pinnacle Simulator	[6]

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Unit 4 PIC Hardware Overview CPU Architecture: Harvard architecture & pipelining, program memory considerations Register file structure, Instruction set, addressing modes: Immediate, Direct, Indirect CPU Registers: Status, W, FSR, INDF, PCLATH, PCL, Programming of above	[6]
Unit 5 PIC Internal Peripherals I/O ports &TRIS registers. External Interrupts, Timers, CCP Module: Programmable period scalar, Event Counter, Sleep Mode, PWM mode, ADC: Features, ADC use. [Note: Structure related to above, SFR's, Simple programs]	[7]
Unit 6 Special features: Configuration word, Oscillator configuration, Reset alternatives, low power operation, concept if I2 C & associated Hardware.	[7]
Text Books: 1. The 8051 Microcontroller By Ayala 3rd Edition 2. The 8051 Microcontroller & Embedded Systems By Muhammad Ali Mazidi& Janice GillispieMazidi Pearson Edition L.P.E. 3. Design with PIC Microcontroller by John B. Peatman, Person Education. 4. Microchip PIC 16FX family microcontroller data sheet	
Reference Books: 1. Architecture Programming, Interfacing & System design By Rajkamal Pearson edition. 2. Programming the PIC microcontroller with MBASIC By Jack R. Smith	

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Thermodynamics and Heat Transfer

MT405	PCC	Thermodynamics and Heat Transfer	3-0-0	3 Credits

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

Pre-Requisites: Engineering Physics, Engineering Chemistry

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

CO1	Explain Fundamentals of thermodynamics and thermodynamic laws
CO2	Explain steam generators, principles of operation of impulse and reaction steam turbine
CO3	Explain I C engine working principle and various systems used in I C Engine
CO4	Explain the basic laws of heat transfer, various modes of heat transfer and fundamentals of heat transfer
CO5	Make use of fins for heat transfer applications and explain convection heat transfer
CO6	Formulate and solve the heat exchanger rating and sizing problems

Course Contents:

Unit 1: Fundamental of thermodynamics and laws Thermodynamic systems; properties, processes and cycles, Thermodynamic equilibrium; Quasi-static process, Macroscopic vs. Microscopic view point, Work Transfer: Work transferred and other types of work, specific heat and latent heat, Point function, path function and equilibrium, second law of thermodynamics and Equivalence between Kelvin- Plank and Clausius statements	[6]
Unit 2: Steam generators &Steam Turbines [8] Carnot cycle using steam, limitations of Carnot cycle, Rankine cycle, effect of steam supply pressure and temperature, condenser pressure on the performance, Reheat regenerative steam power cycles, Classification and Applications of Steam Generators; Working and constructional details of fire-tube and water-tube boilers, boiler mounting and accessories.	[7]

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Principles of operation, classification, impulse and reaction steam turbine, compounding of steam turbines, Flow through impulse turbine blades, velocity diagrams, work done, efficiencies Flow through impulse reaction blades, velocity diagram, and degree of reaction, parson's reaction turbine	
Unit 3: I.C. Engines Working principles, Otto cycle, Diesel cycle, Dual cycle for combustion, classification of I C engines ,valve and port timing diagrams, Fuels used, fuel supply systems, fuel injectors, ignition, cooling and lubrication systems	[6]
Unit 4: Introduction to Heat Transfer Modes of heat transfer, basic laws of heat transfer, introduction to combined modes of heat transfer, Thermal conductivity for various engineering materials, Derivation of generalized differential equation of heat conduction, one dimensional steady state heat conduction without heat generation: heat conduction through plane wall, cylinder, sphere, Electrical analogy, concept of thermal resistance and conductance, Composite slab, composite cylinder and composite sphere, Critical radiis of insulation	[7]
Unit 5: Heat Transfer through Extended Surfaces and convection Types and applications of fins, Heat transfer from rectangular and pin fins, Fin effectiveness and efficiency, physical significance of the dimensionless numbers related to free and forced convection, empirical correlations for free and forced convection for heat transfer in laminar and turbulent flow over a flat plate and through a duct	[7]
Unit 6: Heat Exchangers Classification and types of heat exchangers, fouling factor, and overall heat transfer coefficient, heat exchanger analysis using LMTD and NTU methods for parallel and counter flow, Heat pipe component and working principle, cooling of electronic components.	[7]

Text Books:

1. P.K.Nag, " Engineering Thermodynamics", Tata McGraw Hill, New Delhi, 3rd Edition, 2005.
2. Y. A.Cengel, M. A. Boles, "Thermodynamics - An Engineering Approach", Tata McGraw Hill, 5thedition, 2006
3. M. J. Moran, H. N. Shapiro, "Fundamentals of Engineering Thermodynamics", John Wiley and Sons, 4th edition, 2004
4. R.K.Rajput, Thermodynamics
5. Engineering Thermodynamics by C P Arora.
6. Engineering Heat and Mass Transfer", Mahesh M. Rathore, Laxmi Publications Pvt Limited, 2006.
7. P.K. Nag, "Heat Transfer", Tata McGraw Hill Publishing, 5th edition, 2008

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Reference Books:

1. Thermodynamics/Holman/ McGraw Hill.
2. Kumar and Vasandani, Thermal Engineering, Metropolitan Book Co., Delhi,
3. Engineering Thermodynamics, Gupta &Prakash, Nemichand& Sons Hydraulic Machines by V.P. Vasandani
4. Mathur and Mehta, Thermal Engineering, Jain Bros. Publishers, Delhi.

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CAD/CAM/CAE Laboratory

MT406	PCC	CAD/CAM/CAE Laboratory	0-0-2	1 Credits

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

Pre-Requisites: 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
CCO5	Develop physical 3D mechanical structure using any one of the rapid prototyping
CCO6	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. Case Study of an Industrial Robot
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 a 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).

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3. Boothroyd G and Knight Winston A., Fundamentals of Machining and Machine Tools, 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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Strength of Material Laboratory

MT407	PCC	Strength of Materials Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Engineering Mechanics, Engineering Mathematics, Engineering Physics

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

CO1	Analyze and design structural members subjected to tension, compression, torsion, bending and combined stresses using the fundamental concepts of stress, strain and elastic behavior of materials.
CO2	Utilize appropriate materials in design considering engineering properties, sustainability, cost and weight.
CO3	Perform engineering work in accordance with ethical and economic constraints related to the design of structures and machine parts.

List of Experiments:

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

1. Tensile test for Ductile and Brittle Material
2. Compression test of Mild Steel, Cast iron.
3. Torsion test on Mild Steel circular sections
4. Bending Test on Wood Material
5. Shear Test on Mild steel.
6. Strain Measurement in stress analysis by using Photoelasticity
7. Thermal stress measurement
8. Impact Test
9. Analyze the stress and strain for different loading condition in ANSYS.

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10. Hardness Test
11. Tests on closely coiled and open coiled springs

Text Books:

1. Strength of Materials, S. Ramamrutham, 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. Beer, Russel Johnson Jr and John J. Dewole, Mechanics of Materials, Tata McGrawHill Publishing Co. Ltd., New Delhi 2005

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Electric Machines and Drives Laboratory

MT408	PCC	Electric Machines and Drives Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Basic Electrical Engineering

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

CO1	To obtain performance characteristics of a D.C. Shunt motor.
CO2	To analyze speed control of dc shunt motor by varying armature circuit and field circuit method
CO3	To perform an open circuit test and block rotor test on a 3 phase IM to draw equivalent circuit
CO4	To perform load test on a universal motor and determine the performance with dc/ac supply voltage
CO5	To Determine the performance characteristics of a three-phase induction motor by load test
CO6	To obtain a circle diagram of the given three-phase induction motor by conducting no-load and blocked motor test and to determine the maximum torque, maximum power output.

Text Books:

List of Experiments:

1. Swinburne method using No load method for Shunt motor.
2. Speed control of dc shunt motor by varying armature voltage and field circuit method.
3. Load test of D.C. shunt motor.
4. Perform an open circuit test and block rotor test on a 3 phase IM circuit.
5. Perform load test on single phase transformer.
6. Perform Turns ratio on Single Phase Transformer.
7. Determination of the performance characteristics of a three-phase induction motor by load .
8. To perform open circuit characteristic (OCC) of DC generator.
9. Study Speed control of 3 phases Induction Motor.

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1. Stephen J. Chapman, ElectricMachinery Fundamentals' 4thedition,McGraw Hill Education Pvt.Ltd, 2010.
2. P.C.Sen Principles of Elecaric Machines and power Electronics John Wiley&Sons,3rd Edition 2013
3. Nagrath,I.J.andKothari,D.P.,ElectricMachines',McGraw-HillEducation,2004

Reference Books:

1. Theodore Wildi, -Electrical Machines, Drives, and Power Systems ,Pearson Education.,(5th Edition), 2002.
2. B.R. Gupta ,'Fundamental of Electric Machines' New age InternationalPublishers,3rd Edition ,Reprint 2015.
3. Surinder Pal Bali ,Electrical Technology Machines& easurements,Vol.II,Pearson,2013
4. Fitzgerald.A.E.,CharlesKingsleyJr,StephenD.Umans,,ElectricMachinery',Sixth edition McGraw Hill Books Company, 2003.
5. A. E. Fitzgerald and C. Kingsley, "Electric Machinery", McGraw Hill Education, 2013.
6. M. G. Say, "Performance and design of AC machines", CBS Publishers, 2002.
7. P. S. Bhimbhra, "Electrical Machinery", Khanna Publishers, 2011.
8. I. J. nagrath and D. P. Kothari, "Electric Machines", McGraw Hill Education, 2010.
9. A. S. Langsdorf, "Alternating current Machines", McGraw Hill Education, 1984.
10. P. C. Sen, "Principles of Electric Machines and Power Electronics", John Wiley & Sons, 2007.

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Microcontrollers and Interfacing Laboratory

MT409	PCC	Microcontrollers and Interfacing Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Mathematics-III ,Digital electronics

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

CO1	Explain 8051 architecture, addressing modes & instruction set.
CO2	Make use of 8051 to interface stepper motor, keyboard, ADC using programmable peripheral.
CO3	Develop assembly language program for arithmetic & logical operations using 8051
CO4	Explain PIC architecture, addressing modes & instruction set.
CO5	Interpret internal peripherals of PIC, such as ADC, Timers etc
CO6	Explain the Configuration and Features of PIC.

List of Experiments:

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

1. Arithmetic operations using 8051.
2. Data transfer and data exchange using 8051.
3. Data conversion using 8051.
4. Conditional Operations using 8051.
5. I/O operations using 8051.
6. Hardware Interrupt programming using 8051.
7. Timer Operation for square wave generation using 8051.

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8. LCD Interfacing using 8051.
9. Arithmetic operations using PIC16F877A.
10. Logical operations using PIC.
11. Switch and relay operation using PIC.
12. LED Programming using PIC.
13. Macro Projects:-a) Arduino Programming b) Raspberry Pi

Text Books:

1. The 8051 Microcontroller By Ayala 3rd Edition
2. The 8051 Microcontroller & Embedded Systems By Muhammad Ali Mazidi& Janice GillispieMazidi Pearson Edition L.P.E.
3. Design with PIC Microcontroller by John B. Peatman, Person Education.
4. Microchip PIC 16PX family microcontroller data sheet

Reference Books:

1. M E Van Valkenburg, "Network Analysis", Prentice-Hall of India Pvt Ltd, New Delhi
2. Donald A. Neamen, Electronic Circuit Analysis and Design, TATA McGraw Hill, 2nd Edition,New Delhi
3. Bimbhra P.S., Electric Machinery ,Khanna Publisher, New Delhi
4. M. A. Mazadi and J. C. Mazadi, "The 8051 Microcontroller and Embedded Systems", PearsonEducation, New Delhi

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Thermodynamics and Heat Transfer Laboratory

MT410	PCC	Thermodynamics and Heat Transfer Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Engineering Physics, Engineering Chemistry

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

CO1	Demonstrate boiler models, mounting &accessories.
CO2	Explain I C engine working principle and various systems used in I C Engine
CO3	Explain the basic laws of heat transfer, various modes of heat transfer and fundamentals of heat transfer
CO4	Make use of fins for heat transfer applications and explain convection heat transfer
CO5	Formulate and solve the heat exchanger rating and sizing problems

List of Experiments:

1. Demonstration of boiler models, mounting &accessories.
2. Dismantling and assembly of I C Engines
3. Performance Test on Variable Compression Ratio Engines
4. I.C. Engines Performance Test of 4 stroke single cylinder Diesel Engine
5. Industrial Visit
6. Determination of thermal resistance and temperature distribution in a Composite wall.
7. Determination of Heat Transfer Coefficient under forced convection to air from a heated pipe.
8. Determination of overall heat transfer coefficient and effectiveness in a Parallel flow and Counter flow Heat Exchanger
9. Performance analysis of extended surfaces

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10. Thermal analysis of Heat conduction Problem Using Autodesk Fusion 360

Text Books:

1. P.K.Nag, "Engineering Thermodynamics", Tata McGraw Hill, New Delhi, 3rd Edition, 2005.
2. Y. A.Cengel, M. A. Boles, "Thermodynamics - An Engineering Approach", Tata McGraw Hill, 5thedition, 2006
3. M. J. Moran, H. N. Shapiro, "Fundamentals of Engineering Thermodynamics", John Wiley and Sons, 4th edition, 2004
4. R.K.Rajput, Thermodynamics
5. Engineering Thermodynamics by C P Arora.
6. Engineering Heat and Mass Transfer", Mahesh M. Rathore, Laxmi Publications Pvt Limited, 2006.
7. P.K. Nag, "Heat Transfer", Tata McGraw Hill Publishing, 5th edition, 2008.

Reference Books:

1. Thermodynamics/Holman/ McGraw Hill.
2. Kumar and Vasandani, Thermal Engineering, Metropolitan Book Co., Delhi,
3. Engineering Thermodynamics, Gupta &Prakash, Nemichand& Sons Hydraulic Machines by V.P. Vasandani
4. Mathur and Mehta, Thermal Engineering, Jain Bros. Publishers, Delhi.
5. Yunus A. Cengel, "Heat Transfer: A Practical Approach", McGraw-Hill Higher Education, 2002
6. J.P. Holman: Heat Transfer; McGraw-Hill, 1996

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Environmental Sciences

MDC02	MC	Environmental Sciences	2-0-0	Audit

Teaching Scheme:	Examination 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]

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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, consumers and decomposers. Energy flow in the ecosystem. Ecological succession. Food chain etc. in concern with various aquatic ecosystems	[4]
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

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Aptitude Skills–II

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

Teaching Scheme:	Examination 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	

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2. Objective General English by R.S. Aggarwal, S Chand Publishing; Revised edition (15 March 2017)

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

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Language Skills- II

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

Teaching Scheme:	Examination 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]

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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

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,Communicativesituations-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. NetzwerkArbeitsbuch 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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Foreign Languages

German Language Course 1 (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. NetzwerkArbeitsbuch 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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Mini Project -III

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

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

Course Description:-

Internship / Training is educational and career development opportunity, providing practical experience in a field or discipline. At the end of the fourth 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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- 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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