Teaching and Evaluation Scheme for TY B. Tech.

Department of Mechatronics Engineering

Semester: V

Department: Mechatronics Engineering **Rev:** Course Structure/01/2022-23

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

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
MT501	PCC	Kinematics and Theory of Machines	3	-	-	3	10	10	30	50	100	3
MT502	PCC	Signals and Systems	3	-	-	3	10	10	30	50	100	3
MT503	PEC	Elective -I	3	-	-	3	10	10	30	50	100	3
MT504	PCC	Embedded system	3	-	-	3	10	10	30	50	100	3
MT505	PCC	Industrial Automation and Robotics	3	-	-	3	10	10	30	50	100	3
MT506	PCC	Computer organization	2	-	-	2	25	25	-	-	50	Audit
MT507	PCC	Kinematics and Theory of Machines Laboratory	-	-	2	2	25	25	-	-	50	1
MT508	PCC	Industrial Automation and Robotics Laboratory	-	-	2	2	25	25	-	-	50	1
MT509	PEC	Metrology and Quality Control Laboratory	-	-	2	2	15	15	-	20	50	1
MT510	PCC	Embedded system Laboratory	-	-	2	2	15	15	-	20	50	1
MT511	PCC	Python Programming Laboratory	-	-	2	2	15	15	-	20	50	1
HMS05	HSMC	Aptitude Skills-III	1	-	-	1	25	25	-	-	50	1
HMS06	HSMC	Language Skills-III	-	-	2	2	25	25	-	-	50	Audit
PRJ04	PROJ	Mini Project-IV	-	-	2	2	25	25	-	-	50	Audit
		Total	**18**		**14**	**32**	**245**	**245**	**150**	**310**	**950**	**21**

Elective –I
A. Finite Element Analysis
B. Factory Automation
C. Computer Integrated Manufacturing
D. Rapid Prototyping

Kinematics and Theory of Machines

MT501	PCC	Kinematics and Theory of Machines	3-0-0	3 Credits

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

Pre-Requisites: Engineering Mathematics-I & II

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

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

Course Contents:

Unit 1:Fundamentals of Kinematics and Mechanisms Classification of mechanisms, Basic kinematic concepts and definitions – Kinematic Link, Pair, Chain and its types, Types of constrained motion, Machine & Mechanism, Structure, Degrees of freedom for planer mechanism, Kutzbach and Grublers criteria, Four bar Chain mechanism, Single Slider crank chain , Double slider chain mechanism and its Kinematic inversions, Steering gear mechanisms and condition of correct steering-Davis and Ackerman Steering gear.	[8]

Unit 2: Velocity and Acceleration Analysis Concept of relative Velocity and acceleration of a point on link, angular acceleration, inter-relation between linear and angular velocity and acceleration, Rubbing velocity at Pin joints, Velocity and acceleration diagrams using relative velocity method for four bar pin jointed linkages and four bar single slider crank linkages, Velocity and acceleration of single slider crank mechanism by Klein's construction	[7]
Unit 3:Cams and Followers Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, simple harmonic motion uniform acceleration and retardation, Cycloidal. Determination of cam profile based on given motion of reciprocating knife edge and roller follower with and without offset.	[7]
Unit 4: Belts and Dynamometers Types of belt drives, Materials used for belts, advantages of V belt drive over flat belt drive, Velocity ratio of belt drive, Slip and creep of belt, length of belt-open belt drive and cross belt drive, Power transmitted by belt, Angle of lap. Classification of dynamometers, Study of rope brake absorption dynamometer and belt transmission dynamometer (No numericals)	[7]
Unit 5:Friction Introduction to friction, Types of friction, Coefficient of friction, Inclined plane, friction between nut and screw, Friction Circle, Friction of flat pivot bearing and flat collar bearing, Classification of Clutches, torque transmitting capacity of single plate clutch.	[6]
Unit 6: Toothed Gearing Classification of gears, Introduction to gear types- Spur, Helical, Spiral gears. Gear geometry, Theory of Spur gear in detail, Interference in involute tooth gears and methods for its prevention, Path of contact, Contact ratio. Types of Gear trains - Simple, Compound, Reverted, Epicyclic gear train, Numericals on simple gear train for finding the speeds of elements in gear train, Torques in gear train.	[7]

Text Books:

1. S.S.Ratan,Theory of machines, Theory of Machines, McGraw Hill Education,1986.
2. Khurmi R.S, Gupta J.K, Theory of Machines, S.Chand Publications, New Delhi,2015.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill,2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East- West Pvt. Ltd, New Delhi.

Reference Books:

1 .J. E. Shigely, J. J. Uicker, "Theory of Machines and Mechanisms", Tata McGraw Hill Publications, New York, International Student Edition, 1995.
2.Thomas Beven, "Theory of Machines", CBS Publishers and Distributors, Delhi
3.Shigley, Theory of Machines and Mechanism, McGraw Hill, New York
4. G.S. Rao and R.V. Dukipatti, Theory of Machines and Mechanism, "New Age Int. Publications Ltd. New Delhi.
5.Ballaney P.L, Theory of machines & mechanisms, Khanna Publishers, New Delhi,2003.

Signals and Systems

MT502	PCC	Signal and Systems	3-0-0	3 Credits

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

Pre-Requisites: Mathematics

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

CO1	Illustrate and analyze CT and DT signals and systems.
CO2	Analyze CT systems in Time domain using convolution integral
CO2	Analyze DT systems in Time domain using convolution sum.
CO4	Apply analysis tool Fourier series to analyze signals.
CO5	Apply analysis tool Fourier Transform to analyze signals.
CO6	Analyze DT systems using Z-Transform.

Course Contents:

Unit 1:Introduction to Signals and Systems Basic definitions, Classification of signals. Basic continuous time signals, Signal operations and properties. Signal sampling and quantization, discretization of continuous time signals, basic discrete time signals. Classification of systems. Basic system properties. Case study of different signals forms communication and biomedical field.	[8]
Unit 2: Time – Domain Representations for CT- LTI Systems Impulse response characterization and convolution integral for CT- LTI system, signal responses to CT-LTI system, properties of convolution, LTI system response properties from impulse response.	[7]
Unit 3: Time – Domain Representations for DT - LTI Systems Impulse response characterization and convolution sum, Causal signal response to DT-LTI systems. Properties of convolution summation, Impulse response of DT-LTI system. DT-LTI system properties from Impulse response. System analysis from difference equation model	[8]

Unit 4:Fourier series: Fourier series representation of periodic signal both in continuous time and discrete time domains (Trigonometric and Exponential Fourier series). Existence of Fourier series. Properties of FS (both in CT and DT domains)	
Unit 5:Fourier Transform Representation of periodic functions, Frequency spectrum of a periodic signals, Fourier Transform, Convergence of FT, Properties of CTFT and their applications in solving problems with emphasis on signal transmission through LTI systems. Relation between Laplace Transform and Fourier Transform.	[7]
Unit 6:Z- Transforms: The z-Transform, Convergence of z-Transform, Basic z-Transform, Properties of z-Transform, Inverse z-Transform and Solving difference equation using z-Transform.	[6]
	[6]

Text Books:

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall.
2. Signals and Systems by K. Gopalan, Cengage Learning (India Edition).
3. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications.
4. Linear Systems and Signals by B.P.Lathi, Oxford University Press.
5. **Signals & Systems by K. Rameshbabu Scietech.**

Reference Books:

1. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications.
2. Signal and Systems by Anand Kumar, 3rd Edition, PHI.
3. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education.
4. Internet of Things: Technologies, Applications, Challenges and Solutions by B. K. Tripathy & J. Anuradha, CRC Press, 2017.

A. Finite Element Analysis

MT503A	PCC	Finite Element Analysis	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: Mathematics

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

CO1	Explain the basic principle of Finite element methods and its application
CO2	Explain matrix algebra and mathematical techniques in FEA.
CO3	Identify mathematical model for solution of common engineering problem.
CO4	Solve structural , thermal problems using FEA
CO5	Derive the element stiffness matrix using different methods by applying basic mechanics laws.
CO6	Explain the formulation for two and three dimensional problems

Course Contents:

Unit 1: Introduction Finite element analysis and its need, Advantages and limitations of finite element analysis (FEA), FEA procedure.	[8]
Unit 2: Elements of Elasticity Stress at a point, Stress equation of equilibrium, 2-D state of stress, Strains and displacements, Stress-strain relationship for 2-D state of stress, Plane stress and plane strain approach	[7]
Unit 3: Relevant Matrix Algebra Addition, subtraction and multiplication of matrices, Differentiation and integration of matrices, Inverse of a matrix, Eigen values and eigen vectors, Positive definite matrix, Gauss elimination	[8]
Unit 4: One-Dimensional Problems Introduction, FE modeling, Bar element, Shape functions, Potential energy approach, Global stiffness matrix, Boundary conditions and their treatments, Examples. Unit 5: Trusses and Frames	[7]
Unit 5: Trusses and Frames Introduction, Plane trusses, Element stiffness matrix, Stress calculations, Plane frames, examples	[6]
Unit 6: Two-dimensional Problems Introduction and scope of 2-D FEA, FE modeling of 2-D problem, Constant strain triangle, other finite elements (no mathematical treatment included), Boundary conditions.	[6]

Text Books:

1. T. R. Chandrupatla, A.D. Belegundu, "Introduction to Finite Elements in Engineering", Prentice Hall of India Pvt. Ltd., 3rd edition, New Delhi, 2004.
2. P. Seshu, "A Textbook of Finite Element Analysis", Prentice Hall of India Pvt. Ltd., New Delhi, 2003.
3. R. D. Cook, D. S. Malkus, M. E. Plesha, R. J. Witt, "Concepts and Applications of Finite Element Analysis", John Wiley & Sons, Inc.

Reference Books:

1. K. J. Bathe, "Finite Element Procedures", Prentice Hall of India Pvt. Ltd., 2006.

B. Factory Automation

MT503B	PCC	Factory Automation	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Explain various automation components and systems
CO2	Develop block diagram of industrial automation and control system
CO3	Choose proper Assembly Automation system
CO4	Measure industrial parameters like temperature, pressure, force, displacement, speed, flow, level, humidity and pH.
CO5	Design Computer aided measurement and control systems
CO6	Apply the industrial robotics applications.

Course Contents:

Unit 1 Introduction to Automation Automated manufacturing systems, Fixed /programmable/ flexible, Automation, Need of Automation, Basic elements of automated systems- Power, program and control. Low cost Automation, Economic and social aspects of automation, Advanced automation functions, Levels of automation.	[8]
Unit 2 Industrial Control and Transfer Line A. Industrial control systems in process and discrete manufacturing industries, Continuous and discrete control; Computer process control. B. Fundamentals of transfer lines, Configurations, Transfer mechanisms, Storage buffers,	[7]

Control, Applications; Analysis of transfer lines with and without storage buffers.	
Unit 3 Assembly Automation Assembly Automation: Types and configurations, Parts delivery at workstations, Various vibratory and non-vibratory devices for feeding and orientation, Product design for automated assembly, Quantitative analysis of assembly system	[8]
Unit 4 Automation components Sensors for temperature, pressure, Force, displacement, speed, flow, level, humidity and pH measurement. Actuators, process control valves, power electronics devices DIAC, TRIAC, power MOSFET and IGBT. Introduction of DC and AC servo drives for motion control	[7]
Unit 5 Computer aided measurement and control systems Role of computers in measurement and control, Elements of computer aided measurement and control, man-machine interface, computer aided process control hardware, process related interfaces, Communication and networking, Industrial communication systems, Data transfer techniques, Computer aided process control software, Computer based data acquisition system, Internet of things (IoT) for plant automation	[6]
Unit 6 Fundamentals of Industrial Robots Specifications and Characteristics, Criteria for selection, Robotic Control Systems: Drives, Robot Motions, Actuators, Power transmission systems, Robot controllers, Dynamic properties of robots-stability, Control resolution, Spatial resolution, Accuracy, Repeatability, Compliance, Work cell control, Interlocks	[6]
Text Books: 1"Automation, Production Systems and Computer Integrated Manufacturing", Groover, M.P. Pearson Education, ISBN: 81-7808-511-9 2nd Edition (2004). 2. Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies 3. "Introduction to Robotics, Analysis, Control and Applications", Niku, Saeed B., Willey Publication, ISBN 9788126533121, 2nd Edition.	
Reference Books:	
1. Industrial control handbook, Parr, Newnem 2. Process Control Instrumentation Technology By. C.D. Johnson, PHI.	

C. Computer Integrated Manufacturing

MT503C	PCC	Computer Integrated Manufacturing	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Explain the basic concepts of CAD, CAM and computer integrated manufacturing system
CO2	Summarize the production planning and control and computerized process planning
CO3	Differentiate the different coding systems used in group technology
CO4	Explain the concepts of flexible manufacturing system (FMS) and automated guided vehicle (AGV) system
CO5	Illustrate automated material handling and storage systems for a typical production system
CO6	Apply the industrial robotics applications.

Course Contents:

Unit 1 Introduction Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control-Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerized elements of CIM system – Types of production -– Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.	[6]
Unit 2 Production Planning And Control And Computerized Process Planning Process planning – Computer Aided Process Planning (CAPP) – Logical steps in Computer Aided Process Planning – Aggregate Production Planning and the Master Production Schedule – Material Requirement planning – Capacity Planning- Control Systems-Shop Floor Control-Inventory Control – Brief on Manufacturing Resource Planning-II (MRP-II) & Enterprise Resource Planning (ERP) - Simple Problems.	[8]

Unit 3 Cellular Manufacturing Group Technology(GT), Part Families – Parts Classification and coding –Production flow Analysis – Cellular Manufacturing – Composite part concept – Machine cell design and layout – Quantitative analysis in Cellular Manufacturing – Rank Order Clustering Method - Arranging Machines in a GT cell – Hollier Method	[6]
Unit 4 Flexible Manufacturing System (FMS) and Automated Guided Vehicle System (AGVS) Types of Flexibility - FMS – FMS Components – FMS Application & Benefits – FMS Planning and Control– Automated Guided Vehicle System (AGVS) – AGVS Application – Vehicle Guidance technology – Vehicle Management & Safety.	[7]
Unit 5 Automatic Material Handling and Storage system Design Considerations in Material Handling, Material Transport Equipment-Industrial Trucks-Monorails and Other Rail-Guided Vehicles, Conveyors, Cranes and Hoists, Analysis of Vehicle Based Systems, Conveyor Analysis. Automated Storage/Retrieval Systems, Carousel Storage Systems, Engineering Analysis of AS/RS and Carousel Systems.	[7]
Unit 6 Smart Manufacturing Introduction to additive manufacturing, IoT, Smart Sensing, Smart Machines, Data Visualization and Analysis, Augmented Reality, Cyber-security for manufacturing.	[6]
Text Books: 1"Automation, Production Systems and Computer Integrated Manufacturing", Groover, M.P. Pearson Education, ISBN: 81-7808-511-9 2nd Edition (2004). 2. Industrial Instrumentation and Control By. S.K. Singh The McGraw Hill Companies	
Reference Books:	
1. Mikell P Groover, Automation, production Systems and Computer Integrated Manufacturing, 3 rdEdition, Prentice Hall Inc., New Delhi, 2012. 2. Nanua Singh, System Approach to Computer Integrated Manufacturing, Wiley & Sons Inc., 1996. 3. Andrew Kusiak, Intelligent Manufacturing System, Prentice Hall Inc., New Jersey, 1992PHI	

D. Rapid Prototyping

MT503D	PCC	Rapid Prototyping	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Explain the fundamentals of rapid prototyping techniques
CO2	Explain the techniques of Liquid Based and Solid Based Rapid Prototyping Systems
CO3	Explain the techniques of Powder Based Rapid Prototyping Systems
CO4	Use appropriate tooling for rapid prototyping process
CO5	Use rapid prototyping techniques for reverse engineering.
CO6	Make use of the RP Applications.

Course Contents:

Unit 1 Introduction History – Development of RP systems – Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle – Fundamental – File format Other translators – medical applications of RP – On demand manufacturing – Direct material deposition – Shape Deposition Manufacturing.	[8]
Unit 2 Liquid Based and Solid Based Rapid Prototyping Systems Classification – Liquid based system – Stereo Lithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based	[7]

system – Fused Deposition Modelling, principle, process, products, advantages, applications and uses – Laminated Object Manufacturing	
Unit 3 Powder Based Rapid Prototyping Systems Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing – Laser Engineered Net Shaping (LENS).	[8]
Unit 4 Rapid Tooling Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods	[7]
Unit 5 Reverse Engineering Basic concept, Digitization techniques, Model Reconstruction, Data Processing for Rapid Prototyping, Reverse Engineering (RE) Methodologies and Techniques, Selection of RE systems, RE software, RE hardware, RE in product development.	[6]
Unit 6 RP Applications Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.	[6]

Text Books:

1.Chua Chee Kai, Leong Kah Fai, "Rapid Prototyping: Principles and Applications", World Scientific, 2003.
2. Ian Gibson, David W. Rosen, Brent Stucker, "Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing", Springer, 2nd edition, 2010.

Reference Books:

1. Chua C K, Leong K F, Chu S L, Rapid Prototyping: Principles and Applications in Manufacturing, World Scientific.
2. Gibson D W Rosen, Brent Stucker., Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Springer.
3. Noorani R, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons.
4. Hilton P, Jacobs P F, Rapid Tooling: Technologies and Industrial Applications, CRC press.
5. Liou W L, Liou F W, Rapid Prototyping and Engineering applications: A tool box for prototype development, CRC Press.
6. Ali K. Kamrani, Emand Abouel Nasr, "Rapid Prototyping: Theory and Practice", Springer, 2006

Embedded System

MT504	PCC	Embedded System	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Explain the Embedded Systems and its constituents.
CO2	Explain the knowledge of design process of hardware for Embedded Systems
CO3	Explain the Embedded Serial Communication
CO4	Interface Embedded Software, Firmware Concepts and Design
CO5	Design, analyze and implement Embedded system
CO6	Use and design real time operating system for various applications.

Course Contents:

Unit 1:Fundamentals of Embedded System Core of the embedded system, Sensors (resistive, optical, position, thermal) and Actuators (solenoid valves, relay/switch, opto-couplers), Communication Interface, Embedded firmware (RTOS, Drivers, Application programs), Power-supply (Battery technology, Solar), PCB and Passive components, Safety and reliability, Characteristics and quality attributes (Design Metric) of embedded system. Real time system's requirements, real time issues, interrupt latency	[8]

Unit 2: Embedded Hardware and Design Architecture of ARM-v7-M (Cortex-M3), ARM-v7-R (CortexR4) and comparison in between them, SFRs, Ports, Interrupts, ADC, DAC, Timers, PWM.	[7]
Unit 3: Embedded Serial Communication Study of basic communication protocols like SPI, SCI (RS232, RS485), I2C, 10 CAN, Field-bus (Profibus), USB (v2.0), Bluetooth, Zig-Bee, Wireless sensor network	[8]
Unit 4:Embedded Software, Firmware Concepts and Design-I Embedded C-programming concepts (from embedded system point of view): Optimizing forSpeed/Memory needs, Interrupt service routines, macros, functions, modifiers, data types, device drivers, Multithreading programming	[7]
Unit 5: Embedded Software, Firmware Concepts and Design-II Basic embedded C programs/applications for ARM-v7, using ARM-GCC tool-chain, Emulation of ARM-v7 (e.g. using QEMU), and Linux porting on ARM-v7 (emulation) board CASE STUDY: 1) Medical monitoring systems, 2) Process control system (temp, pressure) 3) Soft real time: Automated vending machines, 4) Communication: Wireless (sensor) network	[6]
Unit 6:Real time operating system POSIX Compliance , Need of RTOS in Embedded system software, Foreground/Background systems, multitasking, context switching, IPC, Scheduler policies, Architecture of kernel, task scheduler, ISR, Semaphores, mailbox, message queues, pipes, events, timers, memory management, RTOS services in contrast with traditional OS	[6]

Text Books:

1. J.W. Valvano, "Embedded Microcomputer System: Real Time Interfacing", Brooks/Cole, 2000.
2. Jack Ganssle, "The Art of Designing Embedded Systems", Newness, 1999.
3. V.K. Madisetti, "VLSI Digital Signal Processing", IEEE Press (NY, USA), 1995.
4. David Simon, "An Embedded Software Primer", Addison Wesley, 2000.
5. K.J. Ayala, "The 8051 Microcontroller: Architecture, Programming and Applications", Penram Intl, 1996.

Reference Books:

1. Introduction to Embedded Systems : Shibu K. V. (TMH)
2. Embedded System Design – A unified hardware and software introduction: F. Vahid (John Wiley)
3. Embedded Systems : Rajkamal (TMH) 4. Embedded Systems : L. B. Das (Pearson)
5. Embedded System design : S. Heath (Elsevier)
6. Embedded microcontroller and processor design: G. Osborn (Pearson)
7. Embedded Systems: Frank Vahid , Wiley India, 2002
8. Embedded Microcomputer Systems – Real Time Interfacing – Jonathan W. Valvano; Cengage Learning; Third or later edition.

Industrial Automation and Robotics

MT505	PCC	Industrial Automation and Robotics	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Explain automation technologies and control systems
CO2	To illustrate the Hydraulics and Pneumatics circuits used for automatic process controls of industrial systems.
CO3	To illustrate the Electro-Pneumatic circuits used for automatic process controls of industrial systems.
CO4	Explain basic knowledge on robotics
CO5	Illustrate different type of robot programming & distinguish between them
CO6	Make use of various types of linkage mechanism for obtaining specific motion and control techniques related to robot system

Course Contents:

Unit 1: Factory Automation and Integration and Control system Basic concepts, types of automation, automation strategies, automation technologies, applications around us and in manufacturing industries. Introduction to Programmable Logic Controllers (PLC), Human Machine Interface (HMI) & Supervisory Control and Data Acquisition System (SCADA); motion controller, applications of RFID technology and machine	[8]
Unit 2: Design and Operation of Logic Control Circuits for Hydraulics and Pneumatics Basic elements of hydraulics/pneumatics, fluid power control elements and standard	[7]

graphical symbols for them, hydraulic & pneumatic cylinders, hydraulic & pneumatic valves for pressure, flow & direction control, Circuit design approach and real time examples; sequence operation of two/more than two cylinders as per the design requirement to automate the systems. Hydraulics/pneumatic safety and their applications to clamping, traversing and releasing operations.	
Unit 3: Design and Operation of Electro-Pneumatic Logic Control Circuits Electro-pneumatic systems, solenoid valves, different sensors, factory automation sensors, electrical sensors, process automation sensors and their interfaces as per application criteria. Circuit design approach using relay logic circuits and real time examples; sequence operation of two/more than two cylinders as per the design requirement to automate the systems. Electro pneumatic & electro hydraulic systems using relay logic circuits.	[8]
Unit 4: Introduction to Robotics: Definition, Classification of Robot – Industrial Robot & Service Robot, Anatomy, Spatial coordinates, Geometric configurations and work envelope, Machine intelligence, Criteria for robot selection, Safety standards for Industrial Robot, Economic justification, Robot Applications-Material handling, Machine loading and unloading, Assembly, Inspection, Welding, Spray painting, Medical Industry, Future of Robotics	[7]
Unit 5: Robot Programming: Introduction, On-line programming: Manual input, Lead through -programming, Teach pendant programming, Off-line programming language, Simulation, Introduction to ROS Concept	[6]
Unit 6: Kinematics and Control of Robotic Manipulators: Introduction to manipulator kinematics, Homogeneous transformations and robot kinematics, Denavit- Hartenberg (D-H) representation, Concept of forward and inverse kinematics. Open and closed loop control system, Control system concepts, Linear control schemes, PID control system, Types of motion control, drives and control, Planning of trajectories, Human Robot Collaboration	[6]

Text Books:

1. Groover, M. P., Automation, Production System & Computer Integrated Manufacturing, Pearson Education Asia (2009).
2. Esposito, A., Fluid Power with Applications, Sixth Edition, Pearson Education (2009).
3. Majumdar, S. R., Pneumatic Systems, McGraw Hill (2005).
4. Nakra, B. C., Theory and Applications of Automatic Controls, Revised 2nd Edition, New Age International Publishers (2014).
5. Morriss, S. B., Automated Manufacturing Systems, McGraw Hill (2006).
6. Auslander, D. M. and Kempf, C. J., Mechatronics: Mechanical System Interfacing.
7. Garry Dunning Programmable Logic Controller.
8. Programmable Logic Controllers by Frank Petruzella.
9.YoremKoren, "Robotics for Engineers"
10. J. F. Engelberger, "Robotics in Practice"
11. Ulrich Rembolds, ChristialBlume, "Computer Integrated Manufacturing Technology and Systems"

12. Ramamurthy, "Computer Aided Design in Mechanical Engineering"
13. Mark Spong, "Robot Dynamics and Control", Wiley India

Reference Books:

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2. Fluid Power with Applications by Anthony Esposito - Pearson Education 2000.
3. Power Hydraulics by Michael J, Prinches and Ashby J. G, - Prentice Hall, 1989
4. Industrial Hydraulics: Pippenger
5. Vickers Manual on Hydraulics
6. Fluid Mechanics and Fluid Power Engineering by Dr.D S Kumar , Kataria Publishers 2014
7. Fluid Mechanics and Hydraulic machines by Modi & Seth, Standard Publishers Distributors
8. Pneumatic Controls by Joji P, Wiley India Pvt.Ltd
9. Pneumatic Circuits and Low Cos by Fawcett J.R.
10. Fundamentals of pneumatics: Festo series
11. Fundamentals of hydraulics: Festo series
12. Mechatronics, A. Smaili, F. Mrad, OXFORD
13.Saeed B. Niku, "Introduction to Robotics – Analysis, Systems and Application" : PHI 2006.
14. Richard D, Klafter, Thomason A ChmielOwski, Michel Nagin "Robotics Engg-an Integrated Approach" PHI 2005.
15. R.K. Mittal & I.J. Nagrath, "Robotics & Control" TMH-2007.
16. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
17. Ghosal, A., "Robotics", Oxford, New Delhi, 2006.

Computer Organization

MT506	PCC	Computer Organization	2-0-0	2 Credits

Teaching Scheme	**Examination Scheme**
Lecture: 3 hrs/week	Continuous Assessment –I :25Marks 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	Describe single bus architecture of a computer and the function of the instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set.
CO2	Write assembly language program for specified microprocessor for computing 16-bit multiplication, division and I/O device interface (ADC, Control circuit, serial port
CO3	Predict flowchart for Concurrent access to memory and cache coherency in Parallel Processors and describe the process.
CO4	Explain Memory Module and analyze its operation by interfacing with the CPU.

Course Contents:

Unit 1: Functional blocks of a computer CPU, memory, input-output subsystems, controls Module. Instruction set architecture of a CPU – registers, instruction execution cycle, RTL interpretation of instructions, addressing modes, instruction set. Case study – instruction sets of some common CPUs. **Data representation:** signed number representation, fixed and floating-point representations, character representation. Computer arithmetic – integer addition and subtraction, ripple carry adder, carry look-ahead adder, etc. multiplication – shift-and add, Booth multiplier, carry save multiplier, etc. Division restoring and non-restoring techniques, floating point arithmetic.	[8]

Unit 2: Introduction to x86 architecture. **CPU control Module design:** hardwired and micro-programmed design approaches, Case study – design of a simple hypothetical CPU. **Memory system design:** semiconductor memory technologies, memory organization. **Peripheral devices and their characteristics:** Input-output subsystems, I/O device interface, I/O transfers program controlled, interrupt driven and DMA, privileged and non-privileged instructions, software interrupts and exceptions.	[7]
Unit 3:Pipelining: Basic concepts of pipelining, throughput and speedup, pipeline hazards. **Parallel Processors**: Introduction to parallel processors, Concurrent access to memory and cache coherency.	[8]
Unit 4: Memory organization: Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, replacement algorithms, write policies.	[7]
Reference Books:	
1. "Computer Organization and Design: The Hardware/Software Interface" 5thEdition by David A. Patterson and John L. Hennessy, Elsevier. 2. Computer Organization and Embedded Systems, 6thEdition by Carl Hamacher, McGraw Hill Higher Education. 3. "Computer Architecture and Organization", 3rdEdition by John P. Hayes, WCB/McGraw-Hill.	

Kinematics and Theory of Machines Laboratory

MT507	PCC	Kinematics and Theory of Machines Laboratory	0-0-2	1 Credits

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

Pre-Requisites:

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

CO1	Select Suitable mechanism for various applications.
CO2	Analyze graphically velocity and acceleration of planer mechanism.
CO3	Construct Cam profile for specific motion.
CO4	Examine effect of slip on power transmission of belt & study of torque transmitted in epicyclic Gear Train

List of Experiments:
At least minimum 6 experiments should be performed from the following list

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

Text Books:

1. S.S.Ratan,Theory of machines, Theory of Machines, McGraw Hill Education,1986.
2. Khurmi R.S, Gupta J.K, Theory of Machines, S.Chand Publications, New Delhi,2015.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill,2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East- West Pvt. Ltd, New Delhi.

Reference Books:

1 .J. E. Shigely, J. J. Uicker, "Theory of Machines and Mechanisms", Tata McGraw Hill Publications, New York, International Student Edition, 1995.
2.Thomas Beven, "Theory of Machines", CBS Publishers and Distributors, Delhi
3.Shigley, Theory of Machines and Mechanism, McGraw Hill, New York
4. G.S. Rao and R.V. Dukipatti, Theory of Machines and Mechanism, "New Age Int. Publications Ltd. New Delhi.
5.Ballaney P.L, Theory of machines & mechanisms, Khanna Publishers, New Delhi,2003.

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Industrial Automation and Robotics Laboratory

MT508	PCC	Industrial Automation and Robotics Laboratory	0-0-2	1 Credits

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

Pre-Requisites:

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

CO1	Demonstrate the structure and layouts of hydraulic and pneumatic systems.
CO2	Demonstrate construction and working of various types of control valves used in hydraulic and pneumatic system
CO3	Illustrate different types of robotics and demonstrate them to identify different parts and components
CO4	Develop Robot programming for Industrial Process

List of Experiments:

At least minimum 6 experiments should be performed from the following list

1 Minimum two circuits on Pneumatics to be developed on Pneumatic trainer kit

2. Minimum two circuits on Electro-Pneumatics to be developed on Electro Pneumatic trainer kit

3. Minimum two circuits on Hydraulics to be developed on Hydraulic trainer kit

4. Demonstration of different types of control valves used in hydraulic and pneumatic system.

5. Study components of a real robot and its DH parameters. (**Experiments that May Be Performed Through Virtual Labs)**

6. Integration of assorted sensors (IR, Potentiometer, strain gages etc.), micro controllers and ROS (Robot Operating System) in a robotic system.

7.Exercise on any Robotic Simulation Software

a. Determination of maximum and minimum position of links.
b. Study Forward kinematics and validation.

8. Robot programming for Industrial Process (Any two).

9. Study of ISO/JIC Symbols for hydraulic and pneumatic systems.

Text Books:

1. Saha, S.K., "Introduction to Robotics, 2nd Edition, McGraw-Hill Higher Education, New Delhi, 2014.
2. Richard D, Klafter, Thomason A ChmielOwski, Michel Nagin "Robotics Engg-an Integrated Approach" PHI 2005.
3. R.K. Mittal & I.J. Nagrath, "Robotics & Control" TMH-2007
4. "Hydraulics and Pneumatics", Shaikh and Khan, R.K. Publication.
5. "Fluid Power with Application", Esposito, Pearson Education, 7th Edition.
6. "Basic Hydraulic – Festo Manual"
7. "Basic Pneumatic – Festo Manual"

Reference Books:

1. Deb.S.R., Robotics technology and flexible Automation, John Wiley, USA 1992.
2. Asfahl C.R., Robots and manufacturing Automation, John Wiley, USA 1992.
3. Klafter R.D., Chimielewski T.A., Negin M., Robotic Engineering – An integrated approach, Prentice Hall of India, New Delhi, 1994.
4. Mc Kerrow P.J. Introduction to Robotics, Addison Wesley, USA, 1991.
5. Issac Asimov I Robot, Ballantine Books, New York, 1986
6. "Hydraulic and Pneumatic",H.L.Stewart,Industrial Press. 7. "Industrial Hydraulic", J. J. Pipenger, Tata McGraw Hill.
8. "Power Hydraulics", Goodwin 1st Edition. 4. "Introduction to Hydraulic and Pneumatics",S. Ilango and V Soundararajan, Prentice Hall of India, 2nd Edition.

Metrology and Quality Control Laboratory

MT509	PCC	Metrology and Quality Control 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 Practical and Oral Exam: 20 Marks

Pre-Requisites: Engineering Physics

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

CO1	Explain and justify the knowledge associated with various linear and angle measuring instruments.
CO2	Illustrate the methods used for the measurement of screw threads, gear parameters and flatness of given component
CO3	Collect measurement data, investigate and analyze problems related to quality, select appropriate control tool, evaluate results and devise and communicate corrective action.

List of Experiments:

The MQC Lab consists of any 8 experiments to be conducted from the list where minimum two experiments should be related to quality

1. Study and use of Linear Measuring Instruments
2. Study and use of various Comparators
3. Study and use of Angle Measuring Instruments
4. Understand Screw Thread Measurement
5. Study and Measurement of Thread parameters using Profile Projector.
6. Study of Spur Gear Measurement
7. Study and use of Optical Flat
8. Study of Normal Distribution Curve
9. Study and Use of Control Charts
10. Study of Operating Characteristics Curves

Text Books:

1. R.K. Jain, "Engineering Metrology", Khanna Publisher,

2. I.C. Gupta, "Engineering Metrology", Dhanpat Rai Publications.

3. N Sidheshwar,P Kannaiah,"Machie Drawing",TATA Magraw hill,2009.

4. Anand Bewoor, Vinay Kulkarni, " Metrology & Measurement" The McGraw-Hill Comp.

5. B.C. Nakara & K. K. Choudhari , "Instrumentation Measurement & Analysis", TATAMagraw hill,2012. 6. Quality Control by Anand Beoor & Vinay Kulkarni Wiley India PVT.Ltd

Reference Books:

1. "Engineering Metrology", I.C. GUPTA, DhanpatRai and Sons, 1988, 2nd Edition.

2. "Practical Engineering Metrology", Sharp K.W.B. Pitman, London, 1973, 1st Edition.

3. Beckwith T.G, and N. Lewis Buck, Mechanical Measurements, Addison Wesley, 1991,5th edition

4. N.V Raghavendra and L. Krishnamurthy, Engineering Metrology and Measurements, Oxford University Press, 2014.

5. Serope Kalpakjian and Steven R. Schmid, Manufacturing, Engineering & Technology, Pearson, Sixth Edition

Embedded System Laboratory

MT510	PCC	Embedded System 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:

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

CO1	Develop programs in ARM for a specific Application.
CO2	Interface memory and Write programs related to memory operations.
CO3	Make use of e A/D and D/A convertors with ARM system.
CO4	Develop programme for interfacing keyboard, display, motor and sensor.

List of Experiments:

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

1. Study of Fundamental Embedded System and ARM evaluation system.
2. Program for input / output Operations with Port
3. Program for Interfacing LED.
4. Program for Interfacing DC Motor.
5. Program for Interfacing Stepper Motor.
6. Program for 7-Segment Display.
7. Program for 16X2 LCD
8. Program for 16X2 LCD & Keypad
9. Program for Internal DAC for Waveform Generation.
10. Program for Internal ADC.

Text Books:

1. Embedded Systems Architecture Programming and Design by Raj Kamal, II edition, Tata MC Graw-Hill.
2. Designing Embedded Systems with PIC Microcontrollers: principles and applications by Tim Wilmshurst, Elsevier.

Reference Books:

1. Embedded Systems Design by Steve Heath, II edition, Newnes publications
2. Embedded Systems Architecture: A Comprehensive Guide for Engineers and Programmers by Tammy Noergaard, Elsevier.
3. Embedded Systems, Rajkamal, TataMcGraw-Hill8. "Power Hydraulics", Goodwin 1st Edition.
4. "Introduction to Hydraulic and Pneumatics",S. Ilango and V Soundararajan, Prentice Hall of India, 2nd Edition.

Python Programming Laboratory

MT511	PCC	Python Programming 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:

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

CO1	Explain and apply essentials and fundamentals of Python Programming
CO2	Make use of Decision making and Looping statements
CO3	Apply the concepts of functions, modules.
CO4	Build code using O.O.P. and Standard library.

List of Experiments:

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

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

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

3. Iteration: While loop, For loop

4. Collections: Lists, Tuples

5. Collections: Sets, Dictionary

6. Functions and Modules: sys, math, time

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

8. Exception handling: hierarchy, raise, assert

9. OOP: Classes, Objects

10. GUI programming: tkinter

Text Books:

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

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

Reference Books:

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

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

Aptitude Skills-III

HMS03	HSMC	Aptitude Skills-III	0-0-2	1

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

Pre-Requisites:

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

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

Course Contents:

Unit 1: System of equations quadratic equations, Surds and indices, solution of equations, Ages	**[2]**
Unit 2: Seating Arrangements Linear seating Arrangement, Circular seating arrangement, Complex seating arrangement	**[2]**
Unit 3: Logical Reasoning Numerical based on sense of direction, Blood relations,Odd man Out	**[2]**
Unit 4: Critical analysis Clocks and Calendar based problems, Cryptarithmetic, heights and distances	**[2]**
Unit 4: Critical analysis Clocks and Calendar based problems, Cryptarithmetic, heights and distances	**[2]**
Unit 6:Mensurations 2D mensurations and 3D mensurations, ven diagram	**[2]**
Text Books: 1. RS Aggarwal "A Modern Approach to Verbal & Non-Verbal Reasoning ",S. Chand Publisher; 2016 edition 2. RS Aggarwal, " Quantitative Aptitude for Competitive Examinations ", S. Chand Publisher; 2016 edition 3. Raymond Murphy "Essential English Grammar with Answers", Murphy	
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
3. RS Aggarwal, Objective General English, S. Chand Publisher; 2016 edition

Group B

Verbal Ability (12Hrs) (Compulsory)

Pre-Requisites: Communication Skills Aptitude Skills I,II

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

1	Understand basic concepts of sentences and its structure
2	Understand the tenses and its use in daily life
3	Explain basic uses of speeches and voices in day to day life
4	Understand the use of modal verbs in sentence construction
5	Summarize various Phrases, Idioms and Proverbs
6	Summarize different words used in daily life

Course Contents:

Unit 1: Parts of Speech Word Family (Using the same word as different Parts of Speech) Punctuation	**[2]**
Unit 2: Punctuation Letter Writing (Formal) E-Mail Writing CV Writing	**[2]**
Unit 3: Reading Comprehension Paragraph Jumbles	**[2]**
Unit 4: Spotting Errors (in different parts of sentence) Subject-Verb Agreement Sentence Correction	**[2]**

Sentence Completion	
Unit 5: One Word Substitution Narrating Events/Reports Summary/Precis Writing	**[2]**
Unit 6: Dialogue Writing Group Discussion Interview Skills (Using formal notations & gestures etc.)	**[2]**
Text Books: 1. Raymond Murphy, Essential English Grammar with Answers, Murphy 2. Objective General English by R.S. Aggarwal, S Chand Publishing; Revised edition (15 March 2017)	
Reference Books: 1. RaoN,D,V,Prasada, Wren & Martin High School English Grammar and Composition Book, S Chand Publishing, 2017 2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press;Second edition	

Language Skills- III

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)

Python (Technical Language) (24Hrs)

Syllabus for Python

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

CO1	Explain essentials and fundamentals of Python Programming
CO2	Illustrate data types and variables
CO3	Illustrate Operators and Expressions.
CO4	Make a use of Decision making and Looping statements

Unit 1: Introduction What is Python, what can python do, why python, how to use Python, Python indentation, python comments, basic syntax of program ,first program of python	**[6]**
Unit 2: Variable and data types Creating variable ,casting, variable name ,global variable, local variable, built in data types, string, constructor, function of data type , type conversion	**[6]**
Unit 3: Operators in Python Unary Operator ,Binary operator -:(arithmetic operator, logical operator ,assignment operator, ,membership operator ,identity operator ,bitwise operator) , ternary operator	**[6]**
Unit 4: Statements and loops Input & Output Statements ,Conditional Statements ,Simple if Statement ,If-else statement ,Else-if Ladder, Nested if statement, ,while loop ,for loop ,break ,continue ,pass statements	**[6]**

Text Books 1.Exploring Python, Timothy Budd, Mc Graw Hill Publication, ISBN:9780073523378, August 2010 2. Beginning Python, Peter C. Norton, Alex Samuel, Dave Aitel, Eric Foster-Johnson, Leonard Richardson, Jason Diamond, Aleatha Parker, Michael Roberts, ISBN: 978- 0-7645-9654-4, August 2005.	
Reference Books 1. Python: Create - Modify - Reuse, James O. Knowlton, Wrox Publication, ISBN: 978-0-470-25932-0, July 2008. 2. Professional Python Frameworks: Web 2.0 Programming, Dana Moore, Raymond Budd, William Wright, Wrox Publication, ISBN: 978-0-470-13809-0, October 2007.	

Mini Project -IV

PRJ04	PROJ	Mini Project IV	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:

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 V.
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 IV
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.

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.

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

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Teaching and Evaluation Scheme for T Y B. Tech.

Department of Mechatronics Engineering

Semester: VI

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV
DEPT. OF MECHATRONICS ENGINEERING

Head
Dept. of Mechatronics Engineering
SIT COE,Yadrav

Department: Mechatronics Engineering
Class: T.Y. B.Tech

Rev: Course Structure/00/2022-23
Semester: VI

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
MT601	PCC	Design of Machine Elements and Transmission Systems	3	-	-	3	10	10	30	50	100	3
MT602	PCC	Digital Signal Processing	3	-	-	3	10	10	30	50	100	3
MT603	PCC	Control System	3	-	-	3	10	10	30	50	100	3
MT604	PEC	Elective-II	3	-	-	3	10	10	30	50	100	3
OEXXX	OEC	Open Elective-I	3	-	-	3	10	10	30	50	100	3
MT605	PCC	Machine Design Laboratory	-	-	2	2	15	15	-	20	50	1
MT606	PCC	Digital Signal Processing Laboratory	-	-	2	2	25	25	-	-	50	1
MT607	PCC	Control System Laboratory	-	-	2	2	15	15	-	20	50	1
MT608	PEC	Programming Techniques (MATLAB Laboratory)	-	-	2	2	15	15	-	20	50	1
MT609	PCC	Computer Network & Cyber Security Laboratory	-	-	2	2	25	25	-	-	50	1
MT610	ESC	Probability & Statistics	1	-	-	1	25	25	-	-	50	Audit
HMS07	HSMC	Aptitude Skills-IV	1	-	-	1	25	25	-	-	50	1
HMS08	HSMC	Language Skills-IV	-	-	2	2	25	25	-	-	50	Audit
IFT02	PROJ	Internship/Field Training	-	-	-	-	-	-	-	50	50	Audit
PRJ05	PROJ	Mega Project Phase-I	-	-	4	4	25	25	-	50	100	2
		Total	**17**	**0**	**16**	**33**	**245**	**245**	**150**	**410**	**1050**	**23**

Elective-II

A. MEMS

B. Digital Image Processing

C. Industrial Networking

D. Automotive Electronics

SHARAD INSTITUTE OF TECHNOLOGY COLLEGE OF ENGINEERING, YADRAV DEPT. OF MECHATRONICS ENGINEERING

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Dept. of Mechatronics Engineering
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Design of Machine Elements and Transmission Systems

MT601	PCC	Design of Machine Elements and Transmission Systems	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Illustrate the basic concept of machine design and evaluate the various stresses applications in machine parts
CO2	Relate the concept of Detachable and Permanent Joints; and analyze when it is subjected to different loading conditions
CO3	Analyse and design the components for power transmission, like shafts and couplings
CO4	Analyse and design different types of gears and belts for engineering applications
CO5	Analyze and design of sliding contact and rolling contact bearings
CO6	Illustrate the concept of designing Power Screws and analysis of clutches and brakes

COURSE CONTENTS:

Unit 1: Introduction Fundamentals of Machine Design- Phases of design, Design Standards and Codes, Simple stresses in Machine Parts, Design against Static and Dynamic Load –Modes of failure, Factor of safety, Theories of failure, Stress Concentration, Stress Concentration Factors, Variable Stress, Fatigue Failure, Endurance Limit, Design for Finite and Infinite Life- Soderberg, Gerber, and Goodman Criteria	[7]
Unit 2: Detachable and Permanent Joints Design of Keys -Types, Design of Square and Flat Keys, Design of Riveted Joints and Welded Joints, Design of Bolts- Design of Bolts under Static Load, Design of Bolt with Tightening/Initial Stress, Design of Bolts subjected to Fatigue	[7]
Unit 3: Shafts and Coupling **Design of Shaft** – For Static and Varying Loads, For Strength and Rigidity, **Design of Coupling**- Types, Flange Coupling, Muff Coupling, and Flexible Coupling	[7]

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Unit 4: Gears and Belt Drives Design of Spur and Helical Gear drives, Design of Belt Drives-Flat Belt and V Belt drives	[7]
Unit 5: Design of Bearings and Springs **Design of Sliding Contact Bearings-** Classification of Sliding Contact Bearings, Bearing Characteristic Number, Sommerfeld Number, Stribeck curve, **Design of Rolling contact Bearing-** Types, Life of Bearing, Equivalent Load, Dynamic Equivalent Load, **Design of Spring**	[7]
Unit 6: Design of clutches, Design of brakes, Design of power screws	[6]

Text Books:

1. Shigley, Joseph E., and Charles R. Mischke. **Mechanical engineering design** (in SI units). Tata McGraw Hill, 2006.
2. Juvinall, Robert C., and Kurt M. Marshek. **Fundamentals of machine component design**. John Wiley & Sons, 2020.
3. Mahadevan, K., and B., Reddy, "**Design Data Hand Book**", CBS Publishers
4. Bhandari, V. B. **Design of machine elements**. Tata McGraw-Hill Education, 2010.
5. Bhandari, V. B. **Introduction to machine design**. Tata McGraw-Hill Education, 2013.
6. Sidheswar, N., "**Machine Drawing**", McGraw-Hill
7. R. L. Nortan, "Machine Design: An Integrated Approach", Pearson Education Singapore, 2001
8. A Machine Design R.S. Khurmi & J.K.Gupta S. Chand publication.
9. Machine design S G Kulkarni McGraw Hill Education Publications

Reference Books:

1. R. C. Juvinall, K. M. Marshek, " Fundamental of machine component design", John Wiley & Sons Inc., New York, 3rd edition, 2002.
2. J. Hamrock, B. Jacobson and Schmid Sr., " Fundamentals of Machine Elements", International Edition, New York, 2nd edition, 1999.
3. S. Hall, A. R. Holowenko, H. G .Langhlin, "Theory and Problems of Machine Design", Schaum's Outline Series, Tata McGraw Hill book Company, New York, 1982.
4. J. E. Shigley and C. Mischke, "Mechanical Engineering Design", Tata McGraw Hill Publications, 7th edition, 2004.
5. M. F. Spotts, "Design of Machine Elements", Prentice Hall of India, New Delhi. 6. Machine Design by Robert L.Norton, Tata Mc- Graw Hill Publication
6. Fundamentals of Machine Component Design by Junvinall Wiley India
7. Mechanical System Design by Anurag Dixit SCITECH publication
8. Design of Machine Element/Machine Design by Kannaiah SCITECH publication
9. Design of Machine Element by Spotts/Shoup/Hornberger/Jayram/Venketesh PiersonEducation
10. Machine Design by T H WentzellCengage Learning

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Digital Signal Processing

MT602	PCC	Digital Signal Processing	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Explain DSP systems and Discrete-Fourier Transform (DTFT) algorithm.
CO2	Apply DFT and circular convolution as an analytical tool.
CO3	Apply FFT as an analytical tool.
CO4	Design Digital FIR filter and realize the same.
CO5	Design Digital IIR filter and realize the same.
CO6	Explain the knowledge of multi-rate signal processing

Course Contents:

Unit 1: Introduction to DSP System and DTFT: Block diagram of DSP system, Properties of DSP system, Advantages and applications of DSP, Representation of sequences by discrete-time Fourier Transform, (DTFT), and Properties of discrete-time Fourier Transform.	[5]
Unit 2 Discrete Fourier Transform (DFT) Frequency domain sampling (Sampling of DTFT), DFT and its inverse, Properties of DFT, Circular convolution using DFT and IDFT, and Analysis of LTI System using circular convolution. Filtering of long data sequences using DFT: overlap save method overlap-add add method.	[7]
Unit 3: Fast Fourier Transform (FFT) Radix-2 FFT algorithms-Decimation-in-time (DIT-FFT) algorithm, Decimation-in-frequency (DIF-FFT) algorithm. Inverse DFT using FFT algorithms.	[6]

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Unit 4: FIR Filter Design Characteristics of FIR filter, Properties of FIR filters, **FIR Design using Fourier series method, windowing technique [Rectangular Window, Hamming window, Hanning window]** Realization: **FIR realization: direct form-I, direct form-II**	[7]
Unit 5: IIR Filter Design IIR Digital Filter, Analog filters, Butterworth Filter approximation, IIR Filter Designing using Impulse Invariant method and Bilinear Transformation Realization: **IIR realization: direct form-I, direct form-II**	[6]
Unit 6: Multirate Signal Processing Concept of sampling, requirement of changing sampling rate, various methods of sampling rate conversion-decimation, interpolation, benefits of up sampling and down sampling	[5]

Text Books:

1. S.K. Mitra, Digital Signal Processing: A computer-based approach. MH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J. DeFatta, J. G. Lucas and W.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Reference Books:

1. Andreas Antoniou (2006), Digital Signal Processing, Tata McGraw Hill, NewDelhi.
2. M. H. Hayes (2007), Schaums Outlines of Digital Signal Processing, Tata McGraw Hill, India.

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Control System

MT603	PCC	Control System	3-0-0	3 Credits

Teaching Scheme	Examination Scheme
Lecture: 4 hrs/week	Continuous Assessment –I :10 Marks Continuous Assessment –II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites:

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

CO1	Evaluate the transfer function of the system using block diagram reduction techniques and signal flow graph method
CO2	Determine the system response in time-domain
CO3	Determine stability by applying Routh Hurwitz criteria and Root Locus method
CO4	Determine the stability and response by constructing Polar, Nyquist & Bode plot
CO5	Evaluate the effect of P, PI, and PID controllers on system
CO6	Explain control system model using state space model

Course Contents:

Unit 1: Introduction to control problem- Importance of Control Systems, classification of control system, open loop system, closed loop system, Applications. Mathematical representation and Transfer function of mechanical, electrical systems. Block diagram Representation and reduction. Signal flow graph, Mason's gain formula	[8]
Unit 2 Time Domain Analysis- Time Response, Steady state analysis, Transient response analysis, Transient response Specification, Feedback characteristics of Control System	[7]
Unit 3: Stability Analysis, Concept of stability, Routh Hurwitz stability criteria, Special cases of Routh's criteria, Root Locus method, Effect of pole-zero addition on root locus.	[6]
Unit 4: Frequency Domain analysis- Correlation between time domain and frequency domain specification, polar plot, Nyquist plot, Bode plot	[8]

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Unit 5:PID Controller- Introduction to P, I & D controller, individual effect on overall system performance, PI, PID controller and effect on overall system performance	[5]
Unit 6: State Space Analysis Representation of system in state space, converting transfer function model into state space model, Nonuniqueness of stale space model, State space representation, Solution of state equation, State Transition Matrix, Controllability and observability test.	[7]

Text Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi.
5. Ambikapathy A., Control System, Khanna Book Publishing Company, 2018.

Reference Books:

1. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.
2. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
3. John J. D'Azzo& Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.
4. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

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MEMS

MT604A	PEC	MEMS (**Micro-Electro-Mechanical Systems**)	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Explain the concept of MEMS
CO2	Illustrate the Micro Materials used in engineering.
CO3	Discuss different fabrication process.
CO4	Identify different Micro sensors and actuators used in engineering.
CO5	Illustrate Microsystems Design
CO6	Explain Microsystems Design and Packaging.

Course Contents:

Unit 1: Introduction: Overview of microelectronics manufacture and Microsystems technology. Definition - MEMS materials. Laws of scaling, The multi-disciplinary nature of MEMS. Survey of materials central to micro engineering. Applications of MEMS, mechanical MEMS, thermal MEMS, micro-opto electro-mechanical systems, magnetic MEMS, radio frequency (RF) MEMS, microfluidic systems, bio and chemo devices, Nanotechnology – definition, nanoscale, consequences of the nanoscale for technology and society, need and applications of Nano electromechanical systems (NEMS)	[7]
Unit 2 Micro Materials Materials for MEMS – substrate and wafers, silicon as a substrate material, crystal structure, single crystal and polycrystalline, mechanical properties, silicon compounds, silicon piezo resistors, gallium arsenide, quartz, piezo-electric crystals, polymers, packaging materials	[7]

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Unit 3: Fabrication Processes Bulk micro-manufacturing, photolithography, photoresists, structural and sacrificial materials, X-ray and electron beam lithography, Thin film deposition – spin coating, thermal oxidation, chemical vapor deposition (CVD), electron beam evaporation, sputtering; Doping – diffusion, ion implantation; Etching – wet etching, dry etching; Surface micromachining, bulk vs. surface micromachining; Wafer bonding – glass-frit, anodic and fusion bonding; LIGA process and applications	[8]
Unit 4: Microsensors and actuators: Sensing and actuation, Chemical sensors, Optical sensors, Pressure sensors, Thermal sensors – thermopiles, thermistors, micromachined thermocouple probes, thermal flow sensors, MEMS magnetic sensor, Piezoelectric material as sensing and actuating elements – capacitance, piezo-mechanics, Piezo-actuators as grippers, micro grippers, micro motors, microvalves, micro pumps, micro accelerometers, micro-fluidics, shape memory alloy based optical switch, thermally activated MEMS relay, micro spring thermal actuator, data storage cantilever	[7]
Unit 5: Microsystem Design: Design constraints and selection of materials, selection of manufacturing process, selection of signal transduction technique, electromechanical system and packaging.	[6]
Unit 6: Microsystems Design and Packaging Design considerations, Mechanical Design, Process design, Realization of MEMS components using intellisuite. Micro system packaging, Packing Technologies, Assembly of Microsystems, Reliability in MEMS.	[6]

Text Books:

1. "MEMS and Microsystems Design and Manufacture" by Tai-Ran Hsu. Tata McGraw-Hill Publishing Company Ltd.
2. "Foundation of MEMS" by Chang Liu. Pearson Education.
3. Mohamed Gad – el – Hak, "MEMS Handbook", CRC Press, 2002.
4. Rai - Choudhury P. "MEMS and MOEMS Technology and Applications", PHI Learning Private Limited, 2009.
5. Sabrie Solomon, "Sensors Handbook," Mc Graw Hill, 1998.
6. Marc F Madou, "Fundamentals of Micro Fabrication", CRC Press, 2nd Edition, 2002.
7. Stephen D. Senturia, "Microsystem Design", Kluwer Academic Publishers, 1st Ed., 2001

Reference Books:

1. Francis E.H. Tay and Choong .W.O, "Micro fluidics and Bio mems application", IEEE Press New York, 1997.
2. Trimmer William S., Ed., "Micromechanics and MEMS", IEEE Press New York, 1997.
3. Maluf, Nadim, "An introduction to Micro electro mechanical Systems Engineering", AR Tech house, Boston 2000.
4. Julian W.Gardner, Vijay K.Varadan, Osama O. Awadel Karim, "Micro sensors MEMS and Smart Devices", John Wiby & sons Ltd., 2001

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Digital Image Processing

MT604B	PEC	Digital Image Processing	3-0-0	3 Credits

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

Pre-Requisites:

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

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

Course Contents:

Unit 1: Digital Image Fundamentals Fundamentals steps in DIP, components of image processing system, Elements of visual perception, image sensing and acquisition, Image sampling and quantization, basic relations between pixels, Color fundamentals, color models, Pseudo color Image processing, Full-color image processing, color transformations.	[7]
Unit 2 Image Transform Basic intensity transformation: image negation, Log transformation, power law transformation Piecewise linear transformation functions, arithmetic and Logic operation, Histogram processing (equalization and matching), sine cosine, Hadamard, Haar, Slant transforms	[7]
Unit 3: Image filtering Fundamentals of spatial filtering, Smoothening in spatial domain, sharpening in spatial domain, Smoothening in frequency domain, Sharpening in frequency domain	[8]

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Unit 4: Image segmentation **Detection of discontinuities:** Point detection, line detection, edge detection, (Sobel, Prewitt, Laplacian), Global and adaptive Thresholding, Region based segmentation (region growing, region splitting and merging), **Morphology:** Dilation & erosion, Opening and closing operation, Hit- or –miss transformation Basic morphological algorithms: Boundary extraction, region filling,Thinning and thickening, skeletons	[7]
Unit 5: Image Compression Fundamentals, Coding redundancy, interpixel redundancy, fidelity criteria. Image compression model, lossless predictive coding, Lossy predictive coding, DCT based compression, Image compression standards JPEG and JPEG 2000.	[6]
Unit 6: Image Restoration A model of the Image Degradation/Restoration process, Noise Models, Restoration in the Presence of Noise only-spatial filtering,Periodic Nose Reduction by Frequency Domain Filtering, Linear Position-Invariant Degradations, Estimation of the Degradation function, Inverse filtering, Minimum Mean square Error (Wiener) filtering, Constrained Lease Squares Filtering, Geometric Mean Filter, Geometric Transformations	[6]

Text Books:

1. Digital image processing: Rafael C Gonzalez , Richard E. Woods: Pearson Publicati
2. Digital image processing and Analysis- B. Chanda , D. Datta , majnudar.
3. Fundamentals of digital Image Processing- Anil K.Jain.

Reference Books:

1. A. K. Jain, Fundamentals of digital image processing, Prentice Hall of India, 1989.
2. Pratt William K. "Digital Image Processing", John Wiley & sons
3. Digital image processing- S. Jayraman, S Esakkiarajan , Veerakumar:MGH.
4. Digital image processing using MatlabDigital image processing and Analysis-- B. C D. Datta, majnudar:PHIRafael C Gonzalez
5. Fundamentals of Digital Image Processing-S.Annadurai, R. Shanmugalaxmi : PHI 6 Digital Image Processing- S.Shridhar

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Industrial Networking

MT604C	PEC	Industrial Networking	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Apply the concepts of data communications and to design computer networks using subletting and routing concepts.
CO2	Compare the various medium access control techniques.
CO3	Compare and contrast the characteristics of physical layer.
CO4	Analyze the different protocols.
CO5	Compare and contrast the different network components.
CO6	Illustrate about wireless sensor networks

Course Contents:

Unit 1: Introduction Modern instrumentation and control systems – OSI model – Protocols – Standards – Common problems and solutions – Grounding/shielding and noise - EIA-232 interface standard – EIA-485 interface standard – Current loop and EIA-485 converters. FIBRE OPTICS: Introduction – Fibre optic cable components and parameters – Basic cable types – Connection fibres – troubleshooting.	[7]
Unit 2 MODBUS Overview – Protocol structure – Function codes – Modbus plus protocol –Data Highway – AS interface (AS-i) –Device Net: Physical layer – Topology – Device taps – Profibus PA/DP/FMS:Protocol stack – System operation.	[7]
Unit 3: IEEE/ISO standards – Medium access control – frames – Reducing collisions – Auto negotiation –LAN system components – Structured cabling – Industrial Ethernet – Troubleshooting Ethernet. CAN BUS: Concepts of bus access and arbitration – CAN: Protocol-Errors: Properties – detection –processing – Introduction to CAN 2.0B	[8]

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Unit 4: Wireless Communications Radio spectrum – Frequency allocation – Radio modem – Intermodulation – Implementing a radio link,– RFID: Basic principles of radio frequency identification – Transponders – Interrogators	[7]
Unit 5: Applications Automotive communication technologies – Design of automotive X-by-Wire systems, - The LIN standard – The IEC/IEEE Train communication network: Applying train communication network for data communications in electrical substations.	[6]
Unit 6: Overview Of Wireless Sensor Networks Challenges for Wireless Sensor Networks, Enabling Technologies For Wireless Sensor Networks	[6]

Text Books:

1. Steve Mackay, Edwin Wright, Deon Reynders and John Park, "Practical Industrial Data Networks:Design, Installation and Troubleshooting", Newnes (Elsevier), 2004
2. "Practical Filebus, DeviceNet and Ethernet for Industry", IDC Technology, 2006

Reference Books:

1. Richard Zurawski, "The Industrial Communication Technology Handbook", Taylor and Francis, 2005
2. Dominique Paret, "Multiplexed Networks for Embedded Systems", John Wiley & Sons, 2007
3. Albert Lozano-Nieto, "RFID Design Fundamentals and Applications", CRC Press, 2011

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Automotive Electronics

MT604D	PEC	Automotive Electronics	3-0-0	3 Credits

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

Pre-Requisites:

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

CO1	Illustrate the Concepts of Automotive and electronics systems
CO2	Identify the different types of Sensors and actuators used in Automotive electronics system
CO3	Interpret the basics electronics engine control
CO4	Relate the Automotive Instrumentation and Communication
CO5	Explain Vehicle Motion Control and Automotive diagnostics system
CO6	Make use of Future Automotive Electronic Systems for building prototypes

Course Contents:

Unit 1 Automotive Fundamentals Overview: Evolution of Automotive Electronics, Survey of major Automotive Systems, Major Electrical component, Four Stroke Cycle, Engine Control, Ignition System, Spark plug, Spark pulse generation, Ignition Timing, Drive Train, Transmission, Brakes, Steering System, Battery, Starting System. Air/Fuel Systems Fuel Handling, Air Intake System, Air/ Fuel Management.	[7]
Unit 2 Sensors and Actuators in Automotive Electronics systems **Sensors** – Automotive control system, Application of sensor and Actuators, Typical Electronic engine control system, Variables to be measured, Oxygen (02/EGO) Sensors, Throttle Position Sensor (TPS), Engine Crankshaft Angular Position (CKP)Sensors, Hall effect Position Sensor, Shielded Field Sensor, Optical Crankshaft Position Sensor, Manifold Absolute Pressure (MAP) Sensor – Strain gauge and Capacitor capsule, Engine Coolant Temperature (ECT) Sensor, Intake Air Temperature (IAT) Sensor, Knock Sensor, Airflow rate sensor, Throttle angle Sensor. **Actuators:** Fuel Metering Actuator, Fuel Injector, Ignition Actuator. Exhaust After-Treatment Systems, Catalytic Converter, Exhaust Gas Recirculation (EGR), Evaporative Emission System	[7]

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Unit 3: Digital Engine Control Systems Digital Engine control features, Control modes for fuel Control (Seven Modes), EGR Control, Electronic Ignition Control - Closed loop Ignition timing, Spark Advance Correction Scheme, Integrated Engine Control System - Secondary Air Management, Evaporative Emissions Canister Purge, Automatic System Adjustment, System Diagnostics.	[7]
Unit 4: Automotive Instrumentation and Communication Sampling, Measurement & Signal Conversion of various parameters (Speed, fuel, pressure). Serial Data, Communication Systems, Protection, Body and Chassis Electrical Systems, Remote Keyless Entry, GPS	[6]
Unit 5: Vehicle Motion Control Cruise control, Chassis, Power Brakes, Antilock Brake System (ABS), Electronic Steering Control, Power Steering, Traction Control, Electronically controlled suspension. Automotive Diagnostics –Timing Light, Engine Analyzer, On-board diagnostics, Off-board diagnostics, Expert Systems.	[6]
Unit 6: Future Automotive Electronic Systems Alternative Fuel Engines, Electric and Hybrid vehicles, Fuel cell powered cars, Collision Avoidance Radar Warning Systems, Low tire pressure warning systems, Heads Up display, Speech Synthesis, Navigation –Navigation Sensors - Radio Navigation, Signpost navigation, dead reckoning navigation, Voice Recognition Cell Phone dialing, Advanced Cruise Control, Stability Augmentation, Automatic driving Control	[6]

Text Books:

1. Kirpal Singh, "Automobile Engineering Vol 1 & 2 ", Standard Publishers, Seventh Edition, New Delhi
2. Tom Denton, Automobile electrical and electronic systems, BH Publication, Third edition. 2004
3. Judge. A.W., "Modern Electrical Equipment of Automobiles", Chapman & Hall, London, 1992
4. William B. Ribbens "Understanding Automotive Electronics", 5th edition - Butter worth Heinemann Woburn, 1998.
5. Robert Bosch Gmbh (Ed.) Bosch Automotive Electrics and Automotive Electronics Systems and Components, Networking and Hybrid Drive, 5th edition, John Wiley& Sons Inc., 2007.

Reference Books:

1. William Harry Crouse, "Automotive electronics and electrical equipment", , Edition 10, Gregg Division, McGraw-Hill, 1986
2. Tom Denton, "Automobile Electrical & Electronics", 3rd Edition, Elsevier Butterworth-Heinemann, 2004
3. Spreadbury. F.G., "Electrical Ignition Equipment", Constable & Co Ltd., London, 1962
4. Automotive electrical and electronic systems, Volume 2, Harper & Row/Chek-Chart automotive series, Roger Fennema, Chek-Chart (Firm), Edition 2, HarperCollins Canada, Limited, 1987
5. Frank C. Derato, "Automotive electrical and electronic systems", Edition 2, Glencoe, 1994
6. Kohli.P.L "Automotive Electrical Equipment", Tata McGraw-Hill Co., Ltd., New Delhi, 1975

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Machine Design Laboratory

MT605	PCC	Machine Design 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:

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

CO1	Demonstrate understanding of various design considerations.
CO2	Apply basic principles of machine design
CO3	Acquire skill in preparing production drawings of various components designed.
CO4	The design concept of welded & threaded joint, and analysis when it is subjected to the different loading conditions

List of Experiments:

Design exercises in the form of design calculations with sketches and or drawings on the following machine system using 2D/3D software

1. Design of machine components such as knuckle joint, cotter joint, and lever (anyone) using
2. Design of coupling system.
3. Design of screw jack.
4. Design of welded/threaded joints
5. Design of bearings

A design report giving all necessary calculations for the design of components and assembly should be submitted in a separate file

Minimum 2 exercises from the following list

1. To develop Industrial/Real life application demonstration models of different types of Joints. (Cotter joint and Knuckle joint)
2. To observe the system where power transmission occurs through the shaft, keys, and coupling, like the transmission of power from the motor to the pump/generator/lathe machine/drilling machine. By selecting suitable materials, design the shaft, key, and coupling. Prepare design report and assembly

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drawing indicating overall dimensions, tolerances, and surface finish. Also, to prepare a bill of materials

3. To develop a demonstration model of different types of couplings.
4. To develop a demonstration model of different types of key
5. Stress analysis of any machine element mentioned in the syllabus using any application software and programming language
6. Design a Mini-Project to develop and apply the knowledge of Machine Design and drafting software for any mechanical system based on: (a) Idea generation, (b) Creativity, Reliability, and safety, (c) Design parts of the system (d) Ergonomic Considerations (e) Use of International standards

Text Books:

1. V. B. Bhandari, "Design of Machine Elements", Tata McGraw Hill Publications, New Delhi, 2008.
2. R. L. Nortan, "Machine Design: An Integrated Approach", Pearson Education Singapore, 2001
3. A Machine Design R.S. Khurmi & J.K.Gupta S. Chand publication.
4. Machine design S G Kulkarni McGraw Hill Education Publications
5. Introduction to Machine design V B Bhandari McGraw Hill Education Publications.
6. Design Of Machine Elements Vol I, Vol II J.B.K. Das, P.L. Srinivas Murthy Sapna publication
7. Machine Component Design William Orthwein Jaico publication

Reference Books:

1. R. C. Juvinall, K. M. Marshek, "Fundamental of machine component design", John Wiley & Sons Inc., New York, 3rd edition, 2002.
2. J. Hamrock, B. Jacobson and Schmid Sr., "Fundamentals of Machine Elements", International Edition, New York, 2nd edition, 1999.
3. S. Hall, A. R. Holowenko, H. G. Langhlin, "Theory and Problems of Machine Design", Schaum's Outline Series, Tata McGraw Hill book Company, New York, 1982.
4. J. E. Shigley and C. Mischke, "Mechanical Engineering Design", Tata McGraw Hill Publications, 7th edition, 2004.
5. M. F. Spotts, "Design of Machine Elements", Prentice Hall of India, New Delhi. 6. Machine Design by Robert L.Norton, Tata Mc- Graw Hill Publication
6. Fundamentals of Machine Component Design by Junvinall Wiley India
7. Mechanical System Design by Anurag Dixit SCITECH publication
8. Design of Machine Element/Machine Design by Kannaiah SCITECH publication
9. Design of Machine Element by Spotts/Shoup/Hornberger/Jayram/Venketesh PiersonEducation
10. Machine Design by T H WentzellCengage Learning

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Digital signal Processing Laboratory

MT606	PCC	Digital signal Processing Laboratory	0-0-2	1 Credits

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

Pre-Requisites:

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

CO1	Illustrate the handling of discrete/digital signals using MATLAB & related software's.
CO2	Determine the spectrum of a signal using DFT, FFT.
CO3	Design, analyze and observe magnitude and phase characteristics (Frequency response characteristics) of digital IIR filters.
CO4	Design, analyze and observe Magnitude and phase characteristics (Frequency Response Characteristics) of digital FIR filters using window techniques

- Minimum eight experiments based on syllabus.

List of Experiments:

1. Introduction to MATLAB and IDE for processor development.
2. Write a Program for the generation of basic signals such as Module impulse, Module step, ramp, exponential, sinusoidal, and cosine.
3. Compute convolution and correlation of signals.
4. Computation of DFT & IDFT using a standard formula
5. Computation of DFT and IDFT using FFT algorithms
6. To implement the FFT algorithm.
7. Computation of circular convolution using DFT and IDFT.
8. Design of FIR LPF filter using Fourier series method.
9. Design of FIR LPF, HPF filter using windowing method.
10. Design of IIR LPF, HPF filter using BLT and verification using FDA tool.
11. Design of IIR LPF filter using IIM

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Text Books:

1. S.K. Mitra, Digital Signal Processing: A computer based approach.TMH
2. A.V. Oppenheim and Schafer, Discrete Time Signal Processing, Prentice Hall, 1989.
3. John G. Proakis and D.G. Manolakis, Digital Signal Processing: Principles, Algorithms and Applications, Prentice Hall, 1997.
4. L.R. Rabiner and B. Gold, Theory and Application of Digital Signal Processing, Prentice Hall, 1992.
5. J.R. Johnson, Introduction to Digital Signal Processing, Prentice Hall, 1992.
6. D.J. DeFatta, J. G. Lucas and W.S.Hodgkiss, Digital Signal Processing, John Wiley& Sons, 1988.

Reference Books:

1. Andreas Antoniou (2006), Digital Signal Processing, Tata McGraw Hill, NewDelhi.
2. M. H. Hayes (2007), Schaums Outlines of Digital Signal Processing, Tata McGraw Hill, India.

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Control System Laboratory

MT607	PCC	Control System 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:

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

CO1	Evaluate the transfer function of the system using block diagram reduction techniques
CO2	Determine the system response in time domain
CO3	Determine stability by applying Rout Hurwitz criteria and Root Locus method
CO4	Determine the stability and response by constructing Polar, Nyquist & Bode Plot
CO5	Evaluate the effect of P, PI, PD, and PID controllers on system
CO6	Explain control system models using state space models

List of Experiments:

1. Familiarization with MATLAB control system toolbox, MATLAB Simulink toolbox
2. Linear time invariant Systems and representation using MATLAB
3. Block diagram reduction using MATLAB
4. Time response of second order system using MATLAB
5. Simulation of step response & impulse response for type-0, type-1 & type-2 system with unity feedback using MATLAB
6. Determination of stability by using Root locus using MATLAB for 2^{nd} , 3^{rd} , & 4^{th} order system of a Linear time invariant system
7. Determination of stability by using Bode plot using MATLAB for 2^{nd} ,3^{rd} & 4^{th} order system of a Linear time invariant system
8. Determination of stability by using Nyquist plot using MATLAB for 2^{nd} ,3^{rd} & 4^{th} order system of a Linear time invariant system.
9. State Model for classical transfer function & vice-versa using MATLAB

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10. PID controller using MATLAB.

Text Books:

1. Gopal. M., "Control Systems: Principles and Design", Tata McGraw-Hill, 1997.
2. Kuo, B.C., "Automatic Control System", Prentice Hall, sixth edition, 1993.
3. Ogata, K., "Modern Control Engineering", Prentice Hall, second edition, 1991.
4. Nagrath & Gopal, "Modern Control Engineering", New Age International, New Delhi.
5. Ambikapathy A., Control System, Khanna Book Publishing Company, 2018.

Reference Books:

1. Benjamin C. Kuo, "Automatic control systems", Prentice Hall of India, 7th Edition,1995.
2. Schaum's Outline Series, "Feedback and Control Systems" Tata McGraw-Hill, 2007.
3. John J. D'Azzo& Constantine H. Houpis, "Linear Control System Analysis and Design", Tata McGraw-Hill, Inc., 1995.
4. Richard C. Dorf and Robert H. Bishop, "Modern Control Systems", Addison – Wesley, 1999.

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Programming Techniques (MATLAB Laboratory)

MT608	PEC	Programming Techniques (MATLAB Laboratory)	0-0-2	1 Credit

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:

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

CO1	Explain the importance of variables and techniques to create variables
CO2	Solve mathematical problem for graph plotting and array operations
CO3	Identify the importance of if-else and while conditional statement
CO4	Solve MATLAB program related to Graphical User Interface with examples

List of Experiments:

1) Summarize the MATLAB workspace
2) Apply Arithmetic operations and understand the importance of functions
3) Discus the purpose of variables and how to create variables
4) Demonstrate how to plot a graph
5) Apply one-dimensional array operations
6) Define and overview of command sequence controls for, a while
7) Define and overview of command sequence controls for, if-else
8) Create a function M-file
9) Explain the Graphical User Interface with examples
10) Explain the Simulink with examples
11) Study of symbol toolbox
12) Applications of MATLAB

Text Books:

1. Kattan, Peter Issa. MATLAB for Beginners: A Gentle Approach. Albania, Peter I. Kattan, 2008.
2. Driscoll, Tobin A. Learning MATLAB. Italy, Society for Industrial and Applied Mathematics, 2009.
3. Attaway, Stormy. MATLAB: A Practical Introduction to Programming and Problem Solving. Netherlands, Elsevier Science, 2013.

Reference Books:

1. Lenina, S. V. B., and Kumar, S. Swapna. MATLAB: Easy Way of Learning. India, Prentice Hall India Pvt., Limited, 2016.

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Computer Network & Cyber Security Laboratory

MT609	PCC	Computer Network & Cyber Security Laboratory	0-0-2	1 Credits

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

Pre-Requisites:

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

CO1	Extend to explain security principles,
CO2	Evaluate risks faced by computer systems
CO3	Explain how various attacks work
CO4	Describe and generalize various software vulnerabilities

List of Experiments:

1. Study of different wireless network components and features of any one of the Mobile Security Apps.
2. Study of the features of firewall in providing network security and to set Firewall Security in windows.
3. Steps to ensure Security of any one web browser (Mozilla Firefox/Google Chrome)
4. Study of different types of vulnerabilities for hacking websites / Web Applications.
5. Analysis of the Security Vulnerabilities of E-commerce services.
6. Analysis of the security vulnerabilities of E-Mail Application

Text Books:

1. Signals and Systems by Alan V. Oppenheim, Alan S. Wilsky and Nawab, Prentice Hall.
2. Signals and Systems by K. Gopalan, Cengage Learning (India Edition).
3. Signals and Systems by Michal J. Roberts and Govind Sharma, Tata Mc-Graw Hill Publications.
4. Signals and Systems by Simon Haykin and Bary Van Veen, Wiley- India Publications.
5. Linear Systems and Signals by B.P.Lathi, Oxford University Press.

Reference Books:

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1. Signal, Systems and Transforms by Charles L. Philips, J. M. Parr and E. A. Riskin, Pearson Education.
2. Digital Signal Processing Fundamentals and Applications by Li Tan, Elsevier, Academic Press.
3. Signal and Systems by Anand Kumar, 3rd Edition, PHI.
4. Data Communication and Networking, 4th Edition, Behrouz A. Forouzan, McGraw- Hill.
5. Data and Computer Communication, 8th Edition, William Stallings, Pearson Prentice Hall India.
6. Computer Networks, 8th Edition, Andrew S. Tanenbaum, Pearson New International Edition.

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Probability and Statistics

MT610	ESC	Probability and Statistics	1-0-0	Audit

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

Pre-Requisites: Engineering Mathematics-I & II

Course objective:

1	To Provide necessary basic concept in Probability.
2	To understand different probability distributions.
3	Calculate and understand testing of hypothesis.
4	To compute and interpret the correlation coefficient.

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

CO1	Formulate and solve problems involving random variables and apply statistical methods for analyzing experimental data.
CO2	Apply probability distributions for finding probability.
CO3	Apply testing of Hypothesis
CO4	Apply different methods to find the correlation between the variable.

Course Contents:

Unit 1: Basic Probability Probability spaces, Addition theorem on probability, Multiplication theorem (Without proofs), Random variables: Discrete and continuous random variables, Mathematical Expectation of continuous and discrete Random Variables.	[5]
Unit 2: Probability distributions Binomial Probability distribution, Poisson Probability distribution, and Normal Probability distribution, Properties of binomial, Poisson and normal distributions. Relation between	[6]

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Normal and binomial distribution, Relation between Normal and Poisson distribution, Examples.	
Unit 3: Testing of Hypothesis Test of significance: Basic of testing of Hypothesis. Null and alternate Hypothesis, types of errors, level of significance, critical region. Large sample test for single proportion, difference of proportions, single mean, difference of means.	[6]
Unit 4: Correlation Introduction, Type of correlation, method of studying correlation, Karl Pearson's correlation, Spearman's rank correlation.	[5]

Text Books:

1. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2010.
2. Ronald E. Walpole, Raymond H. Myers, Sharon L. Myers, keying Ye, Probability and statistics for engineers and scientists, 9th Edition, Pearson Publications.
3. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.

Reference Books:

1. Fundamentals of Mathematical Statistics, Khanna Publications, S. C. Gupta and V. K. Kapoor.
2. Miller and Freund's, Probability and Statistics for Engineers, 8th Edition, Pearson Educations
3. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.
4. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
5. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.

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Aptitude Skills IV (Numerical Ability)

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

Teaching Scheme:	Examination Scheme:
Lecture: 1 hrs/week	Continuous Assesment-I:25 Continuous Assesment-II:25

Pre-Requisites: Aptitude Skills-I/II

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

1	Solve the problems on system of equation
2	Solve the problems on seating arrangement
3	Solve the logical reasoning problems
4	Solve the critical analysis problems
5	Solve the problems of Data interpretation
6	Solve the problems permutations and combinations

Course Contents:

Unit 1: System of equations [2]

quadratic equations, Surds and indices, solution of equations, Ages,

Unit 2: Seating Arrangements [2]

Linear seating Arrangement, Circular seating arrangement, Complex seating arrangement,

Unit 3: Logical Reasoning

Numerical based on sense of direction, Blood relations, Odd man Out

Unit 4: Critical analysis [2]

Clocks and Calendar based problems, Cryptarithmetic, heights and distances

Unit 5: Data Interpretation [2]

Table form, Bar form, Line for Pi chart form

Unit 6: Permutation and combination [2]

Permutation and combinations

Text Books: [2]

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

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Aptitude Skills IV (Verbal Ability)

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

Teaching Scheme:	Examination Scheme:
Lecture: 1 hrs/week	Continuous Assement-I:25 Continuous Assesment-II:25

Pre-Requisites: Aptitude Skills-I/II

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

1	Solve the questions on ordering of words & Parts of Speech
2	Organize contents of Business Communications such as CV, emails and letters.
3	Solve the questions based on jumbled paragraphs and reading comprehension.
4	Solve the questions on spotting error and sentence correction.
5	Summarize proceedings of any event or conference.
6	Discuss about current and critical issues during group discussion.

Course Contents:

Unit 1	Parts of Speech, Punctuation Word Family (Using the same word as different Parts of Speech)	2 hr
Unit 2	Analogy, Letter Writing (Formal), E-Mail Writing, CV Writing	2 hr
Unit 3	Reading Comprehension, Paragraph Jumbles	2 hr
Unit 4	Spotting Errors (in different parts of sentence), Subject-Verb Agreement Sentence Correction, Sentence Completion	2 hr
Unit 5	One Word Substitution, Narrating Events/Reports, Summary/Precis Writing	2 hr
Unit 6	Dialogue writing Group Discussion, Interview Skills (Using formal notations & gestures, etc.)	2 hr

Text Books:

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

Reference Books:

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

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Language Skill- IV

HMS08	HSMC	Language Skill- IV (Python Programming)	0-0-2	1Credit

Teaching Scheme:	Examination Scheme:
Practical: 2 hrs/week	Continuous Assesment-1: 25 Continuous Assesment-2: 25

Pre-Requisites: Language Skill III

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

1	Make use of Function in Python Programming.
2	Make use of Python collections.
3	Make use of classes and its objects in python.
4	Make use of file and it's handling functions.

Unit 1: Function **[6]**

Why we Need Function, Categories of Functions-Predefined, User-define, Parts of Functions Arguments, Return Value, Definition of Function, Function Calling, Lambda (Introduction)

Unit 2: Python Collections **[6]**

List, tuple, set, dictionary—-> constructor, check, change, remove item, list comprehension, Sort, loop through, joining

Unit 3: Class and Object **[6]**

OOP Characteristics, creating class,_init__() method, creating Object, accessing methods and variables of class, constructor and destructor, inheritance, super(), function overloading

Unit 4: File handling **[6]**

Path & Directory Settings-Absolute, Relative, File Modes (r,w,a, etc), Open & Close file Reading File using Python--Read Line by Line readline () function, Read Word, Read character (offset), Writing Text File using Python--Write Mode, Append Mode, Exception handling

Text Books

1. Python Projects (Author: Laura Cassell, Alan Gauld) Wrox publication
2. Murach's Python Programming. Author.:Michael Urban, Joel Murach, murach's Publication.
3. Fundamentals of Python (First Program) Cengage MINDTAP Publication 2nd Edition. Author: K.A. Kambert

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Internship/Field Training

IFT02	PROJ	Internship/Field Training	0-0-0	Audit

Teaching Scheme:	Examination Scheme:
Lecture: NA Tutorial: NA Practical: NA	End Semester Exam: 50 Marks

Pre-Requisites: Basic knowledge of all courses

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

Course Description: -Internship / Training is educational and career development opportunity, providing practical experience in a field or discipline. At the end of the **Fourth and Fifth semesters**, 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 **Sixth** semester by the department.
Course Learning Outcomes: -
After successful completion of the course, students will be able to
1. Verify the Technical knowledge in real industrial situations.
2. Develop interpersonal communication skills.
3. Discuss activities and functions of the industry in which the Internship/training has done.
4. Write the technical report.
Prerequisite: - Basics of Mechanical 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 the workplace.
3. Communicate any concerns with your supervisor and the internship/Training coordinator in a timely manner and respectfully.

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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.
Student's Diary/ Daily Log
The main purpose of writing a daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the student's thought process and reasoning abilities. The students should record in the daily training diary the day-to-day account of the observations, impressions, and information gathered and suggestions given if any. It should contain 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 the maintenance of the diary.
• Adequacy & quality of information recorded.
• Drawings, sketches, and data recorded.
• Thought process and recording techniques used.
• Organization of the information.
Internship Report
After completing the internship, the student should prepare a comprehensive report to indicate what he/she has observed and learned in the training period. The 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 the 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.

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V.	Practical applications and relationships with basic theory and concepts taught in the course.

Evaluation of Internship/Training

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

- Quality of content presented.
- Proper planning for presentation.
- Effectiveness of presentation.
- Depth of knowledge and skills.
- Attendance records, daily diary, and departmental reports shall also be analyzed along with the Internship Report.

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Mega Project Phase-I

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

Teaching Scheme:	Examination Scheme:
Practical: 4 hours/week/batch	Continuous Assessment 1: 25 Marks Continuous Assessment 2: 25 Marks End Semester Examination: 50 Marks

Pre-Requisites: All courses

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

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

The students in a group of not more than FOUR will work under the guidance of the faculty member on the project work undertaken by them. The completion of work and the submission of the report and assessment should be done at the end of VII Sem. The project work should consist of any of the following or an appropriate combination:

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

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It is expected that the students should complete at least 50% of the total project work in the VI Semester. The objective is to prepare the students to examine any design or process or phenomenon from all angles, to encourage the process of independent thinking and working, and to expose them to industry. The students may preferably select the project works from their opted elective subjects. The students should submit the report in a prescribed format, before the end of the VIIth semester. The report shall be comprehensive and presented typed on A_4 size sheets and bound. The number of copies to be submitted is the number of students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.

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