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 S Y B. Tech.

Department of Automation and Robotics

Semester: IV

Department: Automation & Robotics **Rev:** Course Structure/00/2024-25

Class: S.Y. B. Tech **Semester:** IV

Course Code	Type of Course	Name of the course	Teaching Scheme			Evaluation scheme					Credit
			L	T	P	CA1	CA2	MSE	ESE	Total	
23AR2401	VSEC	Analytical Skill Enhancement (Mathematics-III)	2	0	0	10	10	30	50	100	2
23AR2402	PCC	Internet of Things (IoT)	2	0	0	10	10	30	50	100	2
23AR2403	PCC	CAD- CAM Automation	2	0	0	10	10	30	50	100	2
23AR2404	PCC	Python Programming	2	0	0	25	25	-	-	50	2
23ARMDXX	MDM	Multidisciplinary Minor-II	3	0	0	10	10	30	50	100	3
23OEAR22	OE	Open Elective-II*	3	0	0	10	10	30	50	100	3
23AR2405	PCC	Internet of Things Laboratory	0	0	2	25	25	-	-	50	1
23AR2406	PCC	CAD- CAM Automation Laboratory	0	0	2	15	15	-	20	50	1
23AR2407	PCC	Python Programming Laboratory	0	0	2	15	15	-	20	50	1
23AR2408	PCC	Fluid and Thermal Engineering Laboratory	0	0	2	15	15	-	20	50	1
23AR2409	VEC	Environment Engineering	2	0	0	25	25	-	-	50	2
23HSSM03	VEC	Aptitude Skill-II	2	0	0	25	25	-	-	50	1
23HSSM04	VEC	Language Skill-II	0	0	2	25	25	-	-	50	1
23AR2410	CEP	Mini Project-II	0	0	2	25	25	-	-	50	1
23AR2411	VEC	Constitution of India	1	0	0	25	25	-	-	50	Audit
Total			19	0	12	270	270	150	310	1000	23

Basket of Multidisciplinary Minor-II

Sem.	Basket 1 (A-Defense)	Basket 2 (B-Software)	Basket 3 (C-Space)
Sem. IV	Communication System for Robotics (23ARMDA2)	Database Management Systems (23ARMDB2)	Aerospace Engine System Design (23ARMDC2)

* Indicates Open Elective course will be offered to students of other programs and will not be offered to students of the same program

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Analytical Skill Enhancement (Mathematics-III)

23AR2401	VSEC	Analytical Skill Enhancement (Engineering Mathematics-III)	2-0-0	2 Credits

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

Pre-Requisites: Engineering Mathematics-I & II

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

CO1	Apply the definition & properties of Laplace Transform to find Laplace transform of elementary functions
CO2	Apply the knowledge of Laplace transformation to find solution of linear differentiation equations with constant coefficient.
CO3	Apply the knowledge of partial differential eq in solution of heat and wave
CO4	Apply different methods to find the probability
CO5	Apply the concept of correlation and regression
CO6	Apply the testing of hypothesis.

Course Contents:

Unit 1: Laplace Transform Definition-condition for existence; Transform of elementary functions; Properties of Laplace Transforms-Linearity property, Change of scale property, transforms of functions multiplied by t^n , transforms of function divided by t, transform of derivatives	[4]
Unit 2: Inverse Laplace Transform Introductory remarks; Inverse Laplace transform of some elementary functions; General method of finding Inverse transforms; Partial fraction method, Application to find solution of linear differential equation.	[4]
Unit 3: Partial Differential equation: Partial differential equations with separation of variables, Boundary Value problems, Heat equation, Wave equation	[4]
Unit 4: Probability distributions Binomial Probability distribution, Poisson Probability distribution, and Normal Probability distribution, Properties of binomial, Poisson and normal distributions.	[4]

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Relation between Normal and binomial distribution, Relation between Normal and Poisson distribution, Examples.	
Unit 5: Correlation &Linear Regression Analysis Introduction, Type of correlation, method of studying correlation, Karl Pearson's correlation, Spearman's rank correlation, Introduction of regression , Linear and non-linear regression, Coefficient of regression, Lines of regression: X on Y and Y on X	[4]
Unit 6: Testing of Hypothesis Basic Introduction, Large sample test, Test for mean, Test for equality of mean, Test for proportion, Test for equality of proportion	[4]
Text Books: 1.P. N. Wartikar& J. N. Wartikar, A Text Book of Applied Mathematics (Vol I & II), PuneVidyarthiGrihaPrakashan, Pune. 2. N. P. Bali, A Text Book of Engineering Mathematics, Laxmi Publications, New Delhi.	
Reference Books: 1. C. R. Wylie & L. C. Barrett, Advanced Engineering Mathematics, McGraw Hill Publishing Company Ltd. 2. B. V. Ramana, Higher Engineering Mathematics, McGraw-Hill Publications, New Delhi. 3. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers. 4. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons. 5. Peter O" Neil, A Text Book of Engineering Mathematics, Thomson Asia Pvt. Ltd., Singapore	

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Internet of Things (IoT)

23AR2402	PCC	Internet of Things (IoT)	2-0-0	2 Credits

Teaching Scheme	**Examination Scheme**
Lecture: 2 hrs/week	CA-I:10 Marks CA-II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Basics of Electronics Engineering

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

CO1	Explain basic fundamentals of Internet of Things
CO2	Identify the different hardware and their interfacing
CO3	Apply various protocols for design of Internet of Things systems
CO4	Make use of Various IP protocols for Internet of Things
CO5	Identify Programming concepts and their challenges
CO6	Develop applications based on Internet of Things

Course Contents:

Unit 1: Introduction to IoT Definitions & Characteristics of IoT, IoT Architectures, Physical & Logical Design of IoT, Enabling Technologies in IoT, History of IoT, About Things in IoT, The Identifiers in IoT, About the Internet in IoT, IoT frameworks, IoT and M2M	[4]
Unit 2: Hardware for IoT Definition, Types of Sensors, Types of Actuators, Examples and Working. RFID Principles and components, Wireless Sensor Networks: History and Context, The node, Connecting nodes, Networking Nodes, WSN and IoT.	[4]
Unit 3: Network & Communication aspects in IoT WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.	[4]
Unit 4: IoT Data Protocols Message Queue Telemetry Transport, Constrained Application Protocol, Advanced Message Queuing Protocol Data Distributed Services, Representational State Transfer, Extensible Messaging and Presence Protocol.	[4]
Unit no 5: Challenges in IoT Design Development Challenges, Security Challenges, Other challenges.	[4]
Unit 6: IoT Applications Home Automation, Smart Cities, Energy, Retail Management, Logistics,	[4]

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Agriculture, Health and Lifestyle, Industrial IoT, IoT design Ethics, IoT in Environmental Protection.	
Text Books: 1. Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things key applications and protocols", willey 2. Jeeva Jose, Internet of Things, Khanna Publishing House 3. Michael Miller "The Internet of Things" by Pearson 4. Raj Kamal "INTERNET OF THINGS", McGraw-Hill, 1ST Edition, 2016 5.. Hakima Chaouchi, — The Internet of Things Connecting Objects to the Webl ISBN : 978-1-84821-140-7, Wiley Publications 6. Vijay Madisetti and ArshdeepBahga, —Internet of Things (A Hands-on-Approach)l, 1st Edition,VPT, 2014.	
Reference Books:	
1. Arshdeep Bahga, Vijay Madisetti " Internet of Things(A hands on approach)" 1ST edition, VPI publications,2014 2. Adrian Mc Ewen, Hakin Cassimally "Designing the Internet of Things" Wiley India References 3. Daniel Minoli, —Building the Internet of Things with IPv6 and MIPv6: The Evolving World of M2M Communicationsl, ISBN: 978-1-118-47347-4, Willy Publications 4. Pethuru Raj and Anupama C. Raman, "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", CRC Press	

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CAD/CAM-Automation

23AR2403	PCC	CAD/CAM-Automation	2-0-0	2 Credits

Teaching Scheme	**Examination Scheme**
Lecture: 2 hrs/week	CA-I:10 Marks CA-II :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: Engineering Drawing

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

CO1	Explain engineering design process and its role in graphic communication process
CO2	Explain about Geometric Modeling Techniques
CO3	Utilize the fundamentals of Numerical Control and Computer Numerical Control
CO4	Develop CNC program for Turning / Milling and generate tool path using CAM software
CO5	Make use of different Automation strategies, FMS and robotics.
CO6	Solve the Finite Element Problems using different methods

Course Contents:

Unit 1: Computer Aided Design (CAD) Computer Aided Design (CAD) Hardware required for CAD: Interactive input output devices, Graphics software: general requirements and ground rules, 2-D curves like Line, Circle, etc. and their algorithms, 2-D and 3-D transformations such as Translation, Scaling, Rotation and Mirror	[4]
Unit 2: Geometric Modelling Introduction , Geometric modeling techniques ,Classification of Modelling **Wire Frame Modelling**-Cubic Splines, Bezeir Curves ,B-Splines, Wire frame model with linear edges, Wire frame model with curvilinear edges ,Merits& Demerits **Surface Modelling**-Plane Surface Curved Surface ,Types of Surface Modelling , Application of Surface Modelling ,Merits& Demerits **Solid Modelling** -Solid Modelling Primitives ,Application of Solid Modelling Merits& Demerits CSG using Boolean operations -Constructive Solid Geometry (CSG) or C-rep, Boundary Representation (B-rep) ,Comparison of CSG and B-rep ,Comparison of wire frame, surface and solid modeling	[4]
Unit 3: Fundamentals of Numerical Control and Computer Numerical Control Elements of NC machine tools, classification of NC machine tools. Advantages, suitability and limitations of NC machine tools, Application of NC system. Definition and designation of	[4]

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control axes, Constructional details of Numerical Control Machine Tools, MCU structure and functions, Methods of improving accuracy and productivity using NC. Computer Numerical Control (CNC): Features of CNC, Elements of CNC machines, the machine control Module for CNC, Direct Numerical Control (DNC) and Adaptive Controls.	
Unit 4: Computer Aided Manufacturing (CAM) Introduction to Computer Aided Manufacturing (CAM), Coordinate system, Basic CNC Principles, G and M codes, Steps in developing CNC part program, Tool and geometric compensations, subroutine and Do loop using canned cycle. [Only theory – 2 hrs] *CNC Lathe part programming* : Linear and circular interpolation, Canned cycles for facing, threading, grooving, etc. [Theory + Program] *CNC Milling part programming* Linear and circular interpolation, Pocketing, contouring and drilling cycles. [Theory + Program]	[4]
Unit 5: Automation Automation: Introduction, Automation strategies, Types of Automation - Hard and Soft Automation, Flexible Manufacturing System, Group Technology: Introduction, Coding Methods, Concepts of Computer Integrated Manufacturing (CIM) and Computer Aided Process Planning (CAPP), Variant & Generative methods of CAPP, advantages of CAPP. [Only theory] Introduction to Material handling system, principles of material handling components of an AGVS, types of AGVS, AGVS guidance system, advantages of AGVSs over other Material handling systems	[4]
Unit 6: Finite Element Methods Introduction, Types of elements, Degrees of freedom, Field variable, Shape function, Boundary conditions, Meshing, Nodal displacements,1-D problems, Static, dynamic and thermal analysis, Preprocessors – solvers – postprocessor	[4]
Text Books: 1. Ibrahim Zeid, "CAD/CAM Theory and Practice", Tata McGraw Hill Publication, 2. M. P. Grover, Zimmer, "CAD/CAM/CIM", Prentice Hall India.	
Reference Books: 1.Rogers D. F. and Adams A., Mathematical Elements for Computer Graphics, McGraw Hill Inc, NY, 1989. 2.Mortenson M. E., Geometric Modeling, John Wiley &sons, NY, 1985 3.Choi B.K., Surface Modeling for CAD/CAM, John Wiley & Sons, NY, 1991. 4.Mikell P. Grover, Automation, Production System and Computer Integrated Manufacturing,Prentice Hall of India Pvt Ltd, 1995. 5.C. Ray Astaihe, Robots of Manufacturing automation, John Wiley and Sons, New York 6.Jon Stenerson and Kelly Curran."Computer Numerical Control", Prentice-Hall of India Pvt. Ltd.New Delhi, 2008 7.P. N. Rao "CAD/CAM " principles and operations", Tata McGraw Hill	

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Python Programming

23AR2404	PCC	Python Programming	2-0-0	2 Credits

Teaching Scheme	Examination Scheme
Lecture: 2 hrs/week	CA-I:25 Marks CA-II : 25 Marks

Pre-Requisites: Problem solving using C Languages

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

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

Course Contents:

Unit 1: Introduction and Syntax of Python Program Algorithms, building blocks of algorithms (statements, state, control flow, functions),values and types: int, float, boolean, string, and list; variables, expressions, statements, precedence of operators, comments; Illustrative program	[4]
Unit 2: Control Flow Statements Conditionals: Boolean values and operators, conditional (if), alternative (if-else), chained conditional (if-elif-else); Iteration: state, while, for, break, continue, pass; Fruitful functions: return values, parameters, local and global scope, function composition, recursion; Strings: string slices, immutability, string functions and methods, string module; Lists as arrays. Illustrative programs	[4]
Unit 3: Lists, Tuples And Dictionaries Lists: list operations, list slices, list methods, list loop, mutability, aliasing, cloning lists, list parameters; Tuples: tuple assignment, tuple as return value; Dictionaries: operations and methods; advanced list processing — list comprehension; Illustrative programs	[4]
Unit 4:File Handling Files and exception: text files, reading and writing files, format operator; command line arguments, errors and exceptions, handling exceptions, modules, packages; Illustrative programs	[4]
Unit 5:Python Modules and Packages Modules and functions function definition and use, flow of execution, parameters and	[4]

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arguments. Standard packages: Mathematics, Internet Access, Dates and Times, Data compression, Multithreading, GUI Programming	
Unit 6: Object Oriented Programming in Python Creating Classes and Objects, Method Overloading and Overriding, Data Hiding, Data abstraction, Inheritance and composition classes, Customization via inheritance specializing inherited methods.	[4]
Text Books: 1. Charles Dierbach, Introduction to Computer Science using Python: A Computational Problem-Solving Focus, Wiley India Edition, 2013. 2. Allen B. Downey, Think Python: How to Think Like a Computer Scientist, Second edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016 (http://greenteapress.com/wp/think-python/).	
Reference Books: 1.Anita Goel, Ajay Mittal, Computer Fundamentals and programming in C, Pearson India Publisher, First edition, 2013. 2. John V Guttag, Introduction to Computation and Programming Using Python, Revised and expanded Edition, MIT Press, 2013 3.Robert Sedgewick, Kevin Wayne, Robert Dondero, Introduction to Programming in Python: An Inter-disciplinary Approach, Pearson India Education Services Pvt. Ltd., 2016. 4.Timothy A. Budd, Exploring Python, Mc-Graw Hill Education (India) Private Ltd. 2015 5.Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012	

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Communication System for Robotics

23ARMD2A	PCC	Communication System for Robotics	3-0-0	3 Credits

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

Pre-Requisites: High-Energy Materials Technology

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

CO1	Explain the basic concepts in the analog communication system
CO2	Analyze and compute modulation index, bandwidth and power requirements of amplitude
CO3	Analyze and compute modulation index, bandwidth and power requirements of angle modulation such as FM & PM
CO4	Identify AM and FM detection methods
CO5	Build the different analog pulse modulation and demodulation techniques.
CO6	Analyze the effect of noise on communication system

Course Contents:

Unit 1:Introduction Introduction to communication system, Block schematic of analog communication system, Electromagnetic Spectrum, Classification of communication system, Need of modulation, Types of modulation – AM, FM, PM, Basics of Pulse Modulation. Simplex and duplex systems	[6]
Unit2: Amplitude Modulation Introduction, mathematical description, Time domain and frequency domain representation, Modulation index, Trapezoidal patterns, Power relations in AM, AM Generation: Low level and High Level Modulation, Modulator Circuits, Balanced modulator, SSB Principle, SSB Generation Methods: Filter system, Phase shift & Third method	[6]
Unit3: Frequency Modulation Concept of angle modulation, mathematical description of FM and PM, Modulation Index, frequency spectrum of FM, Narrow band and Wide Band FM, , Bandwidth, Generation of FM using direct and indirect method, Noise triangle, Pre-emphasis and de-emphasis	[6]
Unit4: Radio Receivers: Block diagram of AM and FM receiver, receiver parameters, AM receivers-TRF and	[6]

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superheterodyne receiver. Envelop detector, FM receiver- simple slope detector, balanced slope detector, and phase discriminator.	
Unit 5: Pulse Modulation System: Sampling Theorem, Sampling Types: Natural & Flat Top, Pulse Amplitude Modulation (PAM) & Demodulation, Pulse Width Modulation (PWM) & Demodulation, Pulse Position Modulation (PPM) & Demodulation, TDM and FDM	[6]
Unit 6: Noise Introduction, Sources of noise, Types of noise, Noise calculations, Signal to Noise ratio, Noise figure, Noise Factor, Noise Temperature	[6]
Text Books: 1.George Kennedy, "Electronic Communications", McGraw Hill Kennedy. 2.Wayne Tomasi 'Electronics Communication System' -Fundamentals through Advanced. -Vth Edition- Pearson Education. 3.Principles of Communication Systems – H Taub & D. Schilling, Gautam Sahe. TMH, 2007 3rd Edition.	
Reference Books: 1.B.P. Lathi, "Analog and Digital Communication", OXFORD University press. 2.Simon Haykin, "An introduction to analog & digital communications", John Wiley & Sons 3.R P Singh, S D Sapre 'Communication System-Analog & Digital' IInd Edition –Tata McGraw Hill Publication.	

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Database Management Systems

23ARMD2B	PCC	Database Management Systems	3-0-0	3Credits

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

Pre-Requisites: Computer Architecture and Organization

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

CO1	Explain the basic database concepts of DBMS, applications, data models, schemas and instances.
CO2	Make use of constraints and relational algebra operations for building applications
CO3	Make use of SQL in database creation and interaction.
CO4	Construct different normalization techniques in databases.
CO5	Identify the concepts of indexing and hashing
CO6	Choose different strategies for providing security, privacy, control, backup and recovery of data.

Course Contents:

Unit 1:- Introduction Concept & Overview of DBMS, Database Languages, Database Users, Database Administrator, Three Schema architecture of DBMS ,Data Abstraction levels, database architecture, Data Models, The Entity-Relationship Model-Constraints, keys, E-R Diagrams. Weak Entity Sets, Extended E-R features.	[6]
Unit 2:- Relational Model Structure of relational Databases, Database Schemas, Relational Algebra, Relational Calculus, Extended Relational Algebra Operations, Calculus vs Algebra	[6]
Unit 3:- Introduction to SQL Introduction to SQL, Datatypes in SQL, Basic Structure of SQL Queries, Components of SQL, SQL Operators – Arithmetic operators, Comparison Operators, Logical Operators, Set Operators, pattern Matching operator like, Range searching operator between, Null Values, Aggrate Functions, Nested Sub queries, Modification of the Database, Join Expressions, Views, Integrity Constraints.	[6]

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Unit4:- Relational Database Design The purposes of Normalization, Data Redundancies and Update Anomalies, Functional Dependencies- types of functional dependency, The Process of Normalization, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form, Fifth Normal Form.	[6]
Unit5:- File Organization Indexing and Hashing Overview of File Organization, Organization of Records in Files, Data-Dictionary Storage, Database Buffer. Basic Concepts of Indexing and Hashing, Ordered Indices, B+-Tree Index Files, B-Tree Index Files, Multiple-Key Access, Static Hashing, Query Processing-Overview, and Measures of Query cost, Evaluation of relational algebra operations, Query optimization.	[6]
Unit 6: Transaction management and Concurrency control Transaction concept, A simple transaction model, ACID properties, serializability and, concurrency control, Lock based concurrency control (2PL, Deadlocks),Time stamping model, Recovery systems-Failure Classification, Storage, Recovery and Atomicity, Recovery Algorithm, checkpoint, Shadow paging.	[6]
Text Books: 1 "Database System Concepts", Abraham Silberschatz, Henry F. Korth, S. Sudarshan, 6thedition, McGraw- Hill. 2. "Database Systems - A Practical Approach to Design, Implementation and Management", Thomas Connolly, Carolyn Begg, 4th Edition, Addison Wesley. 3 "MySQL Cookbook", Paul DuBois, 3rd edition, O'REILLY.	
Reference Books: 1."Fundamentals of Database Systems", Ramez, Elmasri, Shamkant B. Navathe, 6thEdition, Addison Wesley. 2."Database Systems – Design, Implementation and Management", Rob & Coronel, 5thEdition, Thomson Course Technology.	

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Aerospace Engine System Design

23ARMD2C	PCC	Aerospace Engine System Design	3-0-0	3Credits

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

Pre-Requisites: Aerospace Engineering Fundamentals

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

CO1	Build Preliminary design parameters for compressors and turbines and characterize their performance based on mean line approach
CO2	Apply the principles of cycle analysis to choose an engine suitable for a given aircraft requirement
CO3	Analyze the operation and Performance of a jet engine based on compressor and turbine maps for different operating conditions
CO4	Build the preliminary design parameters and define key design issues ,constraints and architectures for main combustors in Jet engines
CO5	Develop the Conceptual design of the Jet engines
CO6	Analyze the Engine Component Design :Inlet and Exhaust Nozzles

Course Contents:

Unit 1:The Design Process, Constraints and Mission Analysis Preliminary propulsion design sequence ,Compressible flow relations ,Constraints analysis ,Preliminary estimates for Constraints analysis, Constraints boundary analysis, Mission analysis-Aircraft weight and fuel consumption, Aircraft Engine Efficiency and Thrust Measures	[6]
Unit2:Engine Selection Parametric Cycle Analysis ,Design Tools, Finding promising solution, Component Behavior, Engine Performance Analysis, Sizing the Engine: Installed Performance ,Example Installed Performance and Final Engine Sizing	[6]
Unit3: Engine Component Design: Global and Interface Quantities Concept, Design Tools, Engine System Design, Example Engine Global and Interface Quantities	[6]
Unit4: Engine Component Design :Turbo machinery Axial architectures ,Euler equations and Cascade nomenclature, Mean line design of	[6]

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compressor and compressor performance, Cascade flow angles and Velocity triangles ,Multistage compressors, Mean line design of turbines performance, Stage inlet swirl, solidity losses and other design requirement ,Blade and disk stresses ,Compressor and turbine design point procedures	
Unit 5: Engine Component Design: Combustion Systems Concept, Design tools-Main Burner, After burners, Example Engine component Design, Combustion systems	[6]
Unit 6: Engine Component Design :Inlet and Exhaust Nozzles Concept, Inlet, Exhaust Nozzles, Engine Component Design: Inlet and Exhaust Nozzle	[6]
Text Books: 1.Jack D,Willman H. "Aircraft Engine Design", AIAA Education 3rd Series 2023	
Reference Books: 1.C Jaganathan and S.K. Jain, " Jet Engines :Design Development and Operation",Yes Dec Publishing Pvt.Ltd,1st Edtion ,2017 2. Gordon C.Qates , " Aircraft Prōpulsion system Technology and Design , AIAA Education 1st Series 189	

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Internet of Things Laboratory

23AR2405	PCC	Internet of Things Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Basics of Electronics Engineering

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

CO1	Develop the interfacing of Internet of Things with Ardunio.
CO2	Develop the interfacing of Internet of Things with Rasberry Pi.
CO3	Design utilizing state of the art hardware boards and software's as per industry standards.
CO4	Develop communication skills and capability to work in team

List of Experiments:

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

1. Demonstrate IoT boards (Eg. Arduino, Raspberry Pi and Intel Galileo) with their interfacing peripherals and tools.
2. Develop LED and buzzer based control system using push button (Arduino board).
3. Develop obstacle detection system using ultrasonic sensor (Arduino board).
4. Make use of servo motor application using Arduino board.
5. Develop number display on seven segment using Arduino board.
6. Make use of message display on LCD using Arduino board.
7. Experiment with LED pattern system using Raspberry Pi and Python.
8. Develop obstacle detection system using PIR sensor (Raspberry Pi & Python).
9. Experiment with seven segment display using Raspberry Pi & Pyhton.
10. Create any cloud platform account, explore IoT services and register a thing on the platform.
11. Design a micro project based on Arduino/Raspberry Pi platform.
12. Case study of various IoT platform with their tools and supporting peripherals.

Text Books:

1. Foundational Elements of an IOT Solution - The Edge, Cloud and Application Development. Joe Biron& Jonathan Follett, Oreilly, First Edition, March 2016
2. Designing Connected Products, 1st Edition, Elizabeth Goodman, Alfred Lui, Martin Charlier, Ann Light, Claire Rowland

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3. The Internet of Things (A Look at Real World Use Cases and Concerns). Kindle Edition. 2016, Lucas Darnell
Reference Books:
1.Bahga A, Madisetti V. Internet of Things: A hands-on approach; 2014. 2.Tanenbaum A S. Computer Networks. Fifth Edition, Pearson Education India; 2013. 3. Shriram K Vasudevan, Abhishek SN and Sundaram RMD. Internet of Things, First Edition, Wiley India;2019. 4.Raj P, Raman AC. The Internet of things: Enabling Technologies, Platforms, and Use-cases. Auerbach Publications; 2017.

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CAD-CAM Automation Laboratory

23AR2406	PCC	CAD-CAM Automation Laboratory	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hours/week	CA-I:15 Marks CA-II :15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Engg. Drawing

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

CO1	Develop 3D Models in a Computer Using 3D modeling software
CO2	Develop Part Programs to Perform Various Machining Operations
CO3	Develop Shape optimization of any mechanical component
CO4	Solve the Stresses and Strains in Loaded Mechanical Components Using CAE Software

List of Experiments:

1. Build Part modeling using any 3D modeling software
2. Develop modeling for assembly /sub-assembly of engineering products using software
3. Develop Minimum 2 Industrial Component (Programs) on CNC Turning operations
4. Develop Minimum 2 Industrial Component (programs) on CNC Milling operation
5. Develop Shape optimization of any mechanical component using Software
6. Develop Minimum 2 structural anlaysis problems to be solved using any CAE software

Text Books:

1.Basu, S. K. and Pal, D.K., Design of Machine Tools, Allied Publishers (2008).
2.Acherkhan, N.S., Machine Tool Design, University Press of the Pacific, (2000).
3.Boothroyd G and Knight Wiston A., Fundamentals of Machining and Machine Tools, CRC Press (2005).
4.Sharma, P. C., A Text Book of Machine Tools & Tool Design, S. Chand Limited, (2005).

Reference Books:

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

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

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Python Programming Laboratory

23AR2407	PCC	Python Programming Laboratory	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hours/week	CA-I:15 Marks CA-II :15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Problem solving using C languages

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

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

List of Experiments:

At least minimum 7 experiments should be performed from the following list

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

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

3. Demonstrate about Iteration: While loop, For loop

4. Demonstrate about Collections: Lits, Tuples

5. Demonstrate about Collections: Sets, Dictionary

6. Demonstrate about Functions and Modules:sys, math, time

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

8. Demonstrate about Exception handling: hierarchy, raise, assert

Text Books:

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

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

Reference Books:

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

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

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Fluid and Thermal Engineering Laboratory

23AR2408	PCC	Fluid and Thermal Engineering Laboratory	0-0-2	1 Credits

Teaching Scheme:	Evaluation Scheme:
Practical: 2 hours/week	CA-I:15 Marks CA-II :15 Marks End Semester Exam: 20 Marks

Pre-Requisites: Fluid and Thermal Engineering

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

CO1	Utilize the concept of fluid mechanics for hydraulic machines in Robotics
CO2	Determine the losses in a flow system, flow through pipes.
CO3	Make use of thermal engineering concepts in the design of engineering equipment/ systems.
CO4	Develop communication skills and capability to work in team

List of Experiments:

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

1. Determination of pressure using manometers (minimum two)
2. Determination of fluid viscosity and its variation with temperature.
3. Verification of Bernoulli's equation.
4. Determination of minor/major losses through metal/non-metal pipes.
5. Determination of Meta centric height
6. Experiment with Reciprocating compressor
7. Experiment with Centrifugal blower
8. Determination of Thermal Conductivity of insulating powder.
9. Determination of Thermal Conductivity of metal rod.
10. Experiment with heat pipe
11. Determination of overall heat transfer coefficient and effectiveness in a Parallel flow and Counter flow Heat Exchanger
12. Determination of thermal co-efficient of natural convection
13. Industrial visit report

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Text Books:

1. Sukumar Pati, "Fluid Mechanics and Hydraulics Machines", TATA McGraw Hill.
2. Munson, Young and Okiishi, "Fundamentals of Fluid Mechanics", Wiley India
3. Modi P. N. and Seth S. M, "Hydraulics and Fluid Mechanics", Standard Book House.
4. P.K. Nag, Heat & Mass Transfer, McGraw Hill Education Private Limited
5. M.M. Rathod, Engineering Heat and Mass Transfer, Third Edition, Laxmi Publications.
6. V. M. Domkundwar, Heat Transfer, Dhanpat Rai & Co Ltd.

Reference Books:

1. Kundu, Cohen, Dowling, "Fluid Mechanics", Elsevier India
2. Potter Wiggert, "Fluid Mechanics", Cengage Learning
3. Fox, Pichard, "Introduction to Fluid Mechanics", McDonald- Wiley
4. Bela G. Liptak, Instrument Engineers' Handbook – Process Control and Optimization, Volume I & II, Taylor & Francis
5. Franck P. Incropera, David P. DeWitt – Fundamentals of Heat and Mass Transfer,
6. Y. A. Cengel and A.J. Ghajar, Heat and Mass Transfer – Fundamentals and Applications, Tata McGraw Hill Education Private Limited.
7. S.P. Sukhatme, A Textbook on Heat Transfer, Universities Press.

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Environmental Engineering

23AR2409	VEC	Environmental Engineering	2-0-0	Audit

Teaching Scheme:	**Examination Scheme:**
Lecture: 2 hrs/week	CA-I:25 Marks CA-II :25 Marks

Pre-Requisites: NA

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

CO1	Explain nature of environmental studies
CO2	Explain various natural resources and associated Problems
CO3	Summarize various ecosystems
CO4	Explain the importance of conservation of biodiversity and its importance in balancing the earth.
CO5	Recognize various causes of environmental pollution along with various protection acts in India to limit the pollution
CO6	Interpret the information based on field study and prepare a report.

Course Contents:

Unit 1: Nature of Environmental studies: Definition, scope and importance, Multidisciplinary nature of environmental studies. Need for public awareness.	[3]
Unit 2: Natural Resources and Associated Problems **Forest resources:** Use and over-exploitation, deforestation, dams and their effects on forests and tribal people. **Water resources:** Use and over-utilization of surface and ground water, floods, conflicts over water. **Mineral resources:** Usage and exploitation. Environmental effects of extracting and using mineral resources. **Energy resources:** Growing energy needs, renewable and nonrenewable energy resources, use of alternate energy sources. Solar energy, Biomass energy, Nuclear energy. **Land resources:** land degradation; man induced landslides, soil erosion and desertification. Role of individuals in conservation of natural resources.	[5]
Unit 3: Ecosystems Concept of an ecosystem, types of ecosystem, structure and function of an ecosystem, producers, consumer and decomposers.Energy flow in the ecosystem, food chain, food web and ecological pyramids, ecological succession. Different types of ecosystem	[4]

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a) Forest ecosystem b)Grassland ecosystem c)Desert ecosystem d)Aquatic ecosystem	
Unit 4: Biodiversity Introduction-Definition: genetic, species and ecosystem diversity. Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Western Ghats as a biodiversity region Hot spot of biodiversity. Threats to biodiversity, man and wildlife conflicts .Conservation of biodiversity. In-situ conservation and Ex-situ conservation.	[4]
Unit 5: Environmental Pollution and Environmental Protection Definition: Causes, effects and control measures of various types of pollution. Solid waste Management: Causes, effects and control measures of urban and industrial wastes. Role of an individual in prevention of pollution, Concept of sustainable development : From Unsustainable to Sustainable development. Environmental Protection Act. Air(Prevention and Control of pollution)Act. Water(Prevention and Control of pollution)Act. Forest conservation Act.Wildlife Protection Act.Human Rights.	[4]
Unit 6: Field work Visit to a local area to document Environmental assets-River ,Forest ,Grassland Visit to local polluted site Study of common plants, insects, birds Study of ecosystem river, ponds etc	[4]

Text/Reference Books:

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

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Aptitude Skills–II

23HSSM03	VEC	Aptitude Skills- II	1-0-0	Audit

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

Pre-Requisites: Communication Skills, Aptitude Skills- I

Verbal Ability (12Hrs) (Compulsory)

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

CO1	Make use of multiplications, squares, square roots, cubes and cube roots to solve
CO2	Solve questions based on Number system
CO3	Solve questions based on percentage, average, ratio, proportion, Speed, Time and Distance
CO4	Solve questions based on Profit & Loss and menstruations.

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

Text Books :

1. Arun Shrama - Quantitative aptitude for CAT.
2. RS Aggarwal, A Modern Approach to Verbal & Non-Verbal Reasoning, S. Chand Publisher; 2016 edition

Reference Books:

1. Fast Track Objective Arithmetic Paperback, by Rajesh Verma – 2018
2. Teach Yourself Quantitative Aptitude, Arun Sharma
3. The Pearson Guide To Quantitative Aptitude For Competitive Examination by Dinesh Khattar

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Language Skills- II

23HSSM04	VEC	Language Skills- II	0-0-2	1 Credit

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

Pre-Requisites: Communication Skills, Language Skills- I

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

CO1	Develop programs using Functions.
CO2	Make use of Structures & Unionto develop programs in C language
CO3	Make use of Pointersto develop programs in C language
CO4	Develop programs to perform various operations on files using File Handling.

1. Develop programs on using different built-in functions.	[2]
2. Develop programs on using function without argument and without return category.	[2]
3. Develop programs on using function with argument and without return category.	[2]
4. Develop programs on using function without argument and with return category.	[2]
5. Develop programs on using function with argument and with return category.	[2]
6. Develop programs using more than one used defined functions.	[2]
7. Develop programs on recursion.	[2]
8. Develop programs on Structure using various entities and size of structure.	[2]
9. Develop programs on array of structure.	[2]
10. Develop programs on structures and functions and compare structure and union.	[2]
11.Develop programs to display different data type of data and their addresses using pointer	[2]
12. Develop programs on pointer to array, pointer to structure, pointer to functions and pointer expressions.	[2]

Text Books :

1. C Programming Absolute Beginner's Guide, Que Publishing; 3rd edition (22 August 2013)
2. C Programming Language 2nd Edition, Peasrson Publication

Reference Books:

1. Programming in C Practical Approach by Ajay Mittal, Pearson
2. Let Us C, By Yashwat Kanetkar

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Mini Project -III

23AR2410	CEP	Mini Project III	0-0-2	1 Credit

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

Pre-Requisites: NA

About Ideathon

The project is a part of addressing societal and industrial needs. An ideathon is a brief, intense event where students can work on some of the most important problems that the world is facing today. Ideation's are brainstorming events where people with diverse knowledge backgrounds, skill sets and interests get together to predetermined problems, and come up with substantive, innovative and comprehensive solutions. An ideathon's output might be ideas, a roadmap or an actionable plan. Teams leverage design thinking and cutting-edge techniques to brainstorm and collaborate on potential solutions within a given time frame.

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

CO1	Identify problems based on societal /research needs
CO2	Apply Knowledge and interpersonal skills to solve societal problems in a group.
CO3	Draw the proper inferences from available results through theoretical/ experimental/simulations.
CO4	Analyze the impact of solutions in societal and environmental context for sustainable development.
CO5	Demonstrate capabilities of self-learning in a group, which leads to lifelong learning.
CO6	Demonstrate project management principles during project work.

Course Contents:

Week 1: Higher Education and Case Study Pedagogy • Students shall form a group of 3 to 4 students, while forming a group shall not be allowed less than three or more than four students, as it is a group activity. • Allocation of mentor	[2]

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Week 2: Topic Selection • Briefly interact with students to provide hand-holding for topic selection. • Students should do survey and identify needs, which shall be converted into problem statement for mini project in consultation with faculty supervisor • **Illustrative Examples : Any Industry or Societal Problem** • Finalization of Title.	[2]
Week 3: Case Study Design/Ideathon: Part 1 • If needed, provide hand-holding to students for finalizing objectives. • Review the objectives of thecase study groups. • Identify what can be quantified related toyour topic and how. • Decide objectives for your case study. • Continue reading especially recent workspecific to your topic.	[2]
Week 4: Case Study Design/Ideathon: Part 2 • Prepare a roadmap of your case study; identify what is to be measured on the field. • Ensure student groups have finalized the objectives.	[2]
Week 5: Survey Design • Prepare a questionnaire and try it out with your group members as mock. • Decide sampling strategy.	[2]
Week 6: Analysis Phase-1 • Students in a group shall understand problem effectively, propose multiple solution. • The students have to work on different approaches and search for the different methodology to solve the problem in consultation with the project guide.	[2]
Week 7 Analysis Phase-2 • The students have to finalize the best methodology to solve the problem in consultation with the project guide. • 25% Presentation has to be conducted by mentor/guide based on above activity.	[2]
Week 8: Analysis-3 • Identify appropriate data visualization tools for your case study. • Analyze the data	[2]
Week 9: Analysis-4 • Identify appropriate data visualization tools for your case study. • Analyze the data	[2]
Week 10: Report writing Part:1 • Prepare an outline of the report and start organizing the write-up for the first draft • Prepare and submit the first draft of the report to the course coordinator.	[2]
Week 11: Report writing Part:2 • Make necessary corrections if any as per the suggestions of course coordinator. • Submit the final draft of the case study	[2]
Week 12: Final Presentation • 50% Presentation has to be conducted by mentor/guide based on above activity.	[2]

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Constitution of India

23AR2411	MC	Constitution of India	2-0-0	Audit

Teaching Scheme	**Examination Scheme**
Lecture: 1hr/week	CA-I:25 Marks CA-II :25 Marks

Pre-Requisites: Indian Knowledge system

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

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

Course Contents:

Course Contents:	
Unit 1: Meaning of the constitution law and constitutionalism, Historical perspective of the Constitution of India	[2]
Unit 2: Salient features and characteristics of the Constitution of India, Scheme of the fundamental rights , The scheme of the Fundamental Duties and its legal status	[2]
Unit 3: The Directive Principles of State Policy – Its importance and implementation , Federal structure and distribution of legislative and financial powers between the Union and the States , Parliamentary Form of Government in India – The constitution powers and status of the President of India	[2]
Unit 4: Amendment of the Constitutional Powers and Procedure , The historical perspectives of the constitutional amendments in India, Emergency Provisions: National Emergency, President Rule, Financial Emergency	[2]
Unit 5: Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and Personal Liberty under Article 21.	[2]
Books: 1.Constitution of India Published by Government of India Ministry of Law and Justice (Legislative Department), 2020 2.Textbook on The Constitution of India by S R Bhansali 3.Constitution of India by Bakshi P M,January 2014	

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