Teaching and Evaluation Scheme for S Y B. Tech.

Department of Automation and Robotics

Semester: III

Sharad Institute of Technology College of Engineering

(An Autonomous Institute)

Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

Department: Automation & Robotics   **Rev:** Course Structure/01/NEP/2023-24

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

Course Code	Type of Course	Name of the course	Teaching Scheme			Evaluation scheme					Credit
			L	T	P	CAI	CAII	MSE	ESE	Total	
23AR2301	PCC	Sensors in Automation and Robotics	3	0	0	10	10	30	50	100	3
23AR2302	PCC	Microcontrollers & Microprocessors	3	0	0	10	10	30	50	100	3
23AR2303	PCC	Fluid and Thermal Engineering	3	0	0	10	10	30	50	100	3
23AR2304	PCC	Sensors and Instrumentation Laboratory	0	0	2	15	15	-	20	50	1
23AR2305	PCC	Microcontrollers & Microprocessors Laboratory	0	0	2	15	15	-	20	50	1
23AR2306	PCC	Object Oriented Programming Using C++ Laboratory	0	0	2	15	15	-	20	50	1
23AR2307	CEP	Mini Project-II	0	0	2	25	25	-	-	50	1
23AR2308	HSSM	Account and Finance Management	1	0	0	25	25	-	-	50	1
23MILEXX	AEC	Modern Indian Language	2	0	0	25	25	-	-	50	2
23ARMDXX	MDM	Multidisciplinary Minor-I	2	0	0	10	10	30	50	100	2
23OEAR21	OE	Open Elective-I*	2	0	0	10	10	30	50	100	2
23HSSM01	VEC	Aptitude Skills-I	1	0	0	25	25	-	-	50	1
23HSSM02	VEC	Language Skills-I	0	0	2	25	25	-	-	50	1
Total			17	0	10	220	220	150	310	900	22

Basket of Multidisciplinary Minor-I

Sem.	Basket 1 (A-Defense)	Basket 2 (B-Software)	Basket 3 (C-Space)
Sem. III	High Energy Materials Technology (23ARMDA1)	Computer Architecture and Organization (23ARMDB1)	Aerospace Engineering Fundamentals (23ARMDC1)

*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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Sensors in Automation and Robotics

23AR2301	PCC	Sensors in Automation and 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: Fundamentals of Automation and Robotics, Basic Electronics Engineering

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

CO1	Select different types of transducers and sensors for given application.
CO2	Select Motion, Proximity And Ranging Sensors
CO3	Select Force, Magnetic and Heading Sensors
CO4	Identify the Optical, Pressure and Temperature Sensors
CO5	Select proper sensors for robot as per application requirement
CO6	Select appropriate drive for Robotic applications.

Course Contents:

Unit 1: Introduction Introduction to measurement, Static & Dynamic Characteristics of measurement, Instrumentation systems architecture, Definition-Sensors, Transducers, Classification of transducers -Resistive, Capacitive and inductive, Specifications of sensors/Transducers, Sensor networks architecture.	[6]
Unit2: Motion, Proximity And Ranging Sensors Motion Sensors – Potentiometers, Resolver, Encoders – Optical, Magnetic, Inductive, Capacitive, LVDT – RVDT – Synchro – Microsyn, Accelerometer – GPS, Bluetooth, Range Sensors – RF beacons, Ultrasonic Ranging, Laser Range Sensor (LIDAR).	[6]
Unit3: Force, Magnetic and Heading Sensors Strain Gauge, Load Cell, Magnetic Sensors –types, principle, requirement and Advantages. Magneto resistive – Hall Effect – Current sensor Heading Sensors – Compass, Gyroscope, Inclinometers.	[6]
Unit4: Optical, Pressure And Temperature Sensors Photo conductive cell, photo voltaic, Photo resistive, LDR – Fiber optic sensors – Pressure – Diaphragm, Bellows, Piezoelectric – Tactile sensors, Temperature – IC,	[6]

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Thermistors, RTD, Thermocouple. Acoustic Sensors – flow and level measurement, Radiation Sensors - Smart Sensors - Film sensor, MEMS & Nano Sensors, LASER sensor	
Unit 5: Robot Sensors Transducers and sensors, Sensors in robotics, Principles and applications of the following types of sensors- Proximity Sensors, Photo Electric Sensors, Position sensors – Piezo Electric Sensor, LVDT, Resolvers, Encoders – Absolute and Incremental: - Optical, Magnetic, Capacitive, pneumatic Position Sensors, Range Sensors- Range Finders, Laser Range Meters, Touch Sensors, Force and torque sensors, Safety Sensor: Light Curtain, Laser Area Scanner, Safety Switches, Machine vision	[6]
Unit 6: Robot Drive Systems Pneumatic Drives, Hydraulic Drives, Mechanical Drives, Electrical Drives-D.C. Servo Motors, Stepper Motors, A.C. Servo Motors, BLDC-Salient Features, Applications and Comparison of all these Drives, Micro actuators, selection of drive, Power transmission systems for robot, Motion conversion, Determination of HP of motor, Types of Gearbox: - Planetary, Harmonic, Cycloidal gearbox and gear Ratio, variable speed arrangements	[6]

Text Books:
1. Ernest O Doebelin, ―Measurement Systems – Applications and Designǁ, Tata McGraw-Hill, 2009
2. Sawney A K and Puneet Sawney, ―A Course in Mechanical Measurements and Instrumentation and Controlǁ, 12th edition, Dhanpat Rai & Co, New Delhi, 2013.
3. Groover, M.P. Weiss, M. Nagel, R.N. & Odrey, N.G., Ashish Dutta, Industrial Robotics, Technology, Programming & Applications, Tata McGraw Hill Education Pvt. Ltd. New Delhi
4. S. R. Deb, Robotics Technology and Flexible Automation, Tata McGraw Hill.
5. Groover M.P.-Automation, production systems and computer integrated manufacturingPrentice Hall of India

Reference Books:
1. C. Sujatha , Dyer, S.A., Survey of Instrumentation and Measurement, John Wiley & Sons, Canada, 2001
2. Hans Kurt Tönshoff (Editor), Ichiro , ―Sensors in Manufacturingǁ Volume 1, WileyVCH April 2001.
3. John Turner and Martyn Hill, ―Instrumentation for Engineers and Scientistsǁ, Oxford Science Publications, 1999.
4. Patranabis D, ―Sensors and Transducersǁ, 2nd Edition, PHI, New Delhi, 2011.
5. Richard Zurawski, ―Industrial Communication Technology Handbookǁ 2nd edition, CRC Press, 2015.

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Microcontrollers & Microprocessors

23AR2302	PCC	Microcontrollers & Microprocessors	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: Basic Electronics Engineering

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

CO1	Explain architecture and addressing modes of 8085.
CO2	Explain instructions set for assembly language programs using 8085.
CO3	Explain architecture and addressing modes of 8051.
CO4	Make use of 8051 for interfacing External Peripherals.
CO5	Illustrate the application of 8051 microcontroller on chip peripherals to implement the functions of I/O port, timer/Counter, serial port & interrupts
CO6	Design 8051 Microcontroller based systems for measuring electrical and physical quantities

Course Contents:

Unit 1: 8085 Microprocessor Basics of 8085 microprocessor architecture and its functional block, 8085 microprocessor IC pin outs and signals, addressing modes of 8085.	[6]
Unit2: Instruction Set and programming with 8085 Assembly Language programming basics, Instruction set of microprocessor: Data transfer, Arithmetic, logical, loop, branching etc, timing diagram, writing, assembling and executing assembly language programs.	[6]
Unit3:8051 Microcontroller Functional block diagram and pin diagram of 8051, Power supply, clock and reset circuit, Program Counter and ROM space in 8051, Program and Data Memory organization, addressing modes. Instruction Set of 8051: data transfer, arithmetic and logical, program branching instructions, single bit manipulation, shift and Boolean variable manipulation, Interrupt of 8051.	[6]

Unit4: On-Chip Peripherals And Programming Embedded Programming: Data Types, Operators Embedded Programming: Data Conversion, I/O Programming Timer/Counter: Operating Modes, Programming. UART: Operating Modes, Programming.	[6]
Unit 5: Off-Chip Peripheral Interfacing And Programming Interfacing with 8051: LED, LED pattern display, traffic light display, Switches and Matrix ,Keyboard, LCD, ADC 0808 with Analog Sensor, DAC and their applications.	[6]
Unit 6: Design of Microcontroller Based System Voltage, Current and Frequency Measurement - DC Motor Control - Stepper Motor control - Case Studies: Arduino Board Overview - Arduino IDE - Temperature Control.	[6]

Text Books:

1. Krishna Kant, —Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096l, PHI, 2014.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems Using Assembly and C ", 2nd Edition, Pearson Education 2013.
3. Kenneth J. Ayala, "The 8051 Microcontroller. Architecture, Programming and Applications", 3rd Edition, West publishing company 2014

Reference Books:

1. 1.Soumitra Kumar Mandal "Microprocessors and Microcontrollers Architecture Programming and Interfacing using 8085, 8086 & 8051" Tata McGraw Hill Publishing Co Ltd, 1st Edition, 2011.
2. Myke Predko, "Programming and Customizing the 8051 Microcontroller", 1st Edition, 2012.
3. Chris Braith, "8051 Microcontroller Application based Introduction", Elsevier 2004.
4. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems "Tata McGraw Hill Publishing Co Ltd, 1st Edition, 2014.

Fluid and Thermal Engineering

23AR2303	PCC	Fluid and Thermal Engineering	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: Fundamentals of Mechanical Engineering

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

CO1	Compare various fluid properties in engineering applications
CO2	Apply Bernoulli's equation to fluid flow problems
CO3	Interpret issues related to fluid flow losses in hydraulic circuits
CO4	Explain working air compressors and Use of compressed air in pneumatic circuits
CO5	Analyze importance of dimensional analysis for model and prototype testing
CO6	Make use of sources of heat and remedies of heat removal in electronic circuits

Course Contents:

Unit 1 Properties of Fluids Characteristics of fluids, Mass density, Specific density, specific gravity, Dynamic viscosity, Kinematic viscosity, Surface tension, capillarity, compressibility, Vapour pressure. Fluid Statics: Pascal's law, Pressure at a point, Total pressure, Centre of pressure, Pressure on a plane, Inclined and curved surfaces, Buoyancy, Metacenter and Meta-centric height, stability of submerged and floating bodies	[6]
Unit 2 Introduction of Fluid Kinematics Types of flows, continuity equation (Cartesian coordinate), velocity and acceleration, visualization of flow field (stream, path and streak Line); Stream function and velocity potential function. (Simple numerical). Fluid Dynamics Euler's equation of motion along a stream line, Derivation of Bernoulli's equation, Applications of Bernoulli's equation, Venturimeter, Orifice meter, Notches, pitot tube (No derivation and numerical for notches and pitot tube).	[6]
Unit 3 Flow through Pipes and Internal flow Flow through Pipes: Darcy-Weisbach equation, major and minor losses, Pipes in series Pipes in parallel and concept of Equivalent Pipe, Siphons, Transmission of Power (no derivations for minor losses).	[6]

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Internal flow: Laminar and Turbulent flow physics, Velocity and shear stress distribution for laminar flow in a pipe, fixed parallel plates (simple numerical on velocity, pressure gradient and shear stress).	
Unit 4 Dimensional Analysis and Lift & Drag Dimensional Analysis and modeling: Significance, Buckingham's Pi Theorem, Similitude, types of similitude. Model and prototype testing Lift and Drag: Friction and pressure drag. Drag and lift coefficients of common geometries.	[6]
Unit 5 Air Compressor Uses of compressed air, classification of compressors, Reciprocating compressor constructional details of single and multistage compressor, computation of work done, isothermal work done, isothermal efficiency, effect of clearance, volumetric efficiency, need of multi-staging, intercooling and after-cooling. Rotary Air Compressor: Basic principles, classification, construction, working of roots, vane, scroll, Centrifugal and axial compressors. (Descriptive treatment only).	[6]
Unit 6 Heat Transfer Introduction and Basic Concepts: Application areas of heat transfer, Modes and Laws of heat transfer, Three dimensional heat conduction equation in Cartesian coordinates and its simplified equations, thermal conductivity,Thermal diffusivity, Thermal contact Resistance Thermal Insulation: Types and selection, Economic and cost considerations, Payback period Introduction to heat pipe, Introduction to electronic cooling - Discussion on active and passive methods.	[6]

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. 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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Sensors and Instrumentation Laboratory

23AR2304	PCC	Sensors and Instrumentation Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Fundamentals of Automation and Robotics, Basic Electronics Engineering

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

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

List of Experiments:

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

1. Identify contact & Non contact type Instruments.
2. Experiment with LVDT for Displacement.
3. Make use of temperature sensors.
4. Study of Hall Effect Sensor
5. Measure strain using strain gauge.
6. Measure Pressure using pressure cell.
7. Measure flow using Rotameter.
8. Measure of sound using sound meter.
9. Measure of Speed using tachometer/stroboscope/Proximity Switch.
10. Summarize the smart sensors.
11. Measurement of Liquid Level Using Proximity Sensor

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Text Books:

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

Reference Books:

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

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Microprocessors and Microcontrollers Laboratory

23AR2305	PCC	Microprocessors and Microcontrollers Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Basic Electronics Engineering

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

CO1	Perform basic Programming and implementation on 8085 Microprocessor.
CO2	Develop 8085 Assembly Language Programs for Arithmetic, Logical, data transfer etc.
CO3	Perform basic Programming and implementation on 8051. Microcontroller.
CO4	Demonstrate an application for 8051 microcontroller using Traffic light controller, ADC & DAC interfacing boards.

List of Experiments:

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

Microprocessor Lab (At least 3 experiments): Developing Assembly Language Programs using 8085 Microcontroller Kits:

1. Addition and Subtraction using 8085.
2. Multiplication and Division using 8085.
3. Block Transfer and Block Exchange using 8085.
4. Data Conversion using 8085.
5. Even and Odd numbers counting using 8085.
6. Find the largest and smallest number using 8085

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Microcontroller Lab (At least 7 experiments): Developing Assembly Language Programs using 8051 Microcontroller Kits/Software:

1. Arithmetic and Logical operations using 8051Microcontroller
2. Bit manipulation with switch using 8051Microcontroller
3. Toggling of LED/LEDs using 8051Microcontroller
4. Message display on LCD using 8051Microcontroller
5. Generate square wave using 8051Microcontroller
6. Interfacing Traffic light controller using 8051Microcontroller
7. Interfacing Stepper motor using 8051Microcontroller
8. Keypad interfacing using 8051Microcontroller
9. Interfacing temperature sensor using 8051Microcontroller
10. String operations(Serial communication) using 8051Microcontroller

Text Books:

1. Krishna Kant, ―Microprocessors and Microcontrollers – Architectures, Programming and System Design 8085, 8086, 8051, 8096‖, PHI, 2014.
2. Muhammad Ali Mazidi, Janice Gillispie Mazidi and Rolin D. McKinley, "The 8051 Microcontroller and Embedded Systems Using Assembly and C ", 2nd Edition, Pearson Education 2013.
3. Kenneth J. Ayala, "The 8051 Microcontroller. Architecture, Programming and Applications", 3rd Edition, West publishing company 2014

Reference Books:

1. 1.Soumitra Kumar Mandal "Microprocessors and Microcontrollers Architecture Programming and Interfacing using 8085, 8086 & 8051" Tata McGraw Hill Publishing Co Ltd, 1st Edition, 2011.
2. Myke Predko, "Programming and Customizing the 8051 Microcontroller", 1st Edition, 2012.
3. Chris Braith, "8051 Microcontroller Application based Introduction", Elsevier 2004.
4. Manish K Patel, "The 8051 Microcontroller Based Embedded Systems "Tata McGraw Hill Publishing Co Ltd, 1st Edition, 2014.

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Object Oriented Programming Using C++ Laboratory

23AR2306	PCC	Object Oriented Programming Using C++ Laboratory	0-0-2	1 Credits

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

Pre-Requisites: Computer Programming in C

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

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

List of Experiments:

1. **Write a C++ program to demonstrate classes.**
2. **Class Templates**
    C++ programs using class templates to implement the following using an array.
    a) Stack ADT b) Queue ADT
3. **Write a C++ program to demonstrate on constructors (default, parameterized and copy Constructor) and destructors**
4. **Write a C++ program to demonstrate Function Overloading.**
5. **Write a C++ program to demonstrate operator '+' overloading to find the addition of two complex numbers.**
6. **Write a C++ program to demonstrate**
    i) single level inheritance
    ii) multilevel inheritance
    iii) multiple inheritance
    iv) Hierarchical inheritance
    v) Hybrid inheritance
7. **Write a C++ program to demonstrate Friend Function.**
8. **Write a C++ program to demonstrate Polymorphism (Virtual Function).**
9. **Write a C++ program to demonstrate Data Abstraction.**
10. **Write a C++ program to demonstrate Data Encapsulation.**
11. **Write a C++ program to demonstrate Exception Handling.**

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

Text Books:
   1. Data structures a pseudo code approach with c++, Indian edition, R.F.Gilberg and B.A.ForouzanCengage Learning.
   2. Programming Prinicples and Practice using C++, B.Stroustrup, Addition-Wiesly (Pearson
   3. Education)
   4. Data Structures and STL,W.J.Collins,mcGrawHill,Internationational Edition.
   5. Data Structures and Algorithms with OODesign patterns in C++,B.R.Priess,JohnWiley&sons.
   6. The Art,Philosophy and Science of OOP with C++,Rick Miller,SPD.
   7. C++ for Programmers ,P.J.Deitel and H.M.Deitel,PHI/Pearson.

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

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Mini Project-II

23AR2307	CEP	Mini Project-II	0-0-2	01 credit

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

Pre-Requisites: Mini Project

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. Ideathon'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	Outline 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 the case study groups. • Identify what can be quantified related to your topic and how. • Decide objectives for your case study. • Continue reading especially recent work specific 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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Account and Finance Management

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

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

Pre-Requisites: None

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

CO1	Explain basic terminology used in finance and accounts
CO2	Prepare and appraise Financial Statements and evaluate company in the light of different
CO3	Analyze the risk and return of alternative sources of financing.
CO4	Estimate cash flows from a project, including operating, net working capital, and capital spending
CO5	Estimate the required return on projects of differing risk ,to estimate the cash flows from an investment project, calculate the appropriate discount rate, determine the value added from the project, and make a recommendation to accept or reject the project
CO6	Describe and illustrate the important elements in project finance Using financial calculator and Excel in a variety of problems.

Course Contents:

Unit 1: Introduction to Financial Accounting, Book keeping and Recording Meaning, Scope and importance of Financial Accounting. Financial Accounting - concepts and conventions, classification of accounts, Rules and principles governing Double Entry Book-keeping system, Meaning, Preparation of Journal, Ledger , Cash book and Trial balance. (Practical application on tally)	[2]
Unit 2: Financial Statement Preparation, analysis and Interpretation Preparation of financial statement and Profit and Loss Account, Balance Sheet, Ratio Analysis -classification of various ratios. (Calculation on Excel)	[2]
Unit 3: Introduction To Financial Management Concept of business finance, Goals and objectives of financial management, Sources of financing - LONG TERM: shares, debentures, term loans, lease and hire purchase, retained earnings, public deposits, bonds (Types, features and utility), SHORT TERM: bank finance, commercial paper, trade credit and bills discounting, INTERNAL: Retained earnings	[2]
Unit 4: Working Capital Management Concept of working Capital, significance, types. Adequacy of working capital, Factors affecting working capital needs, Financing approaches for working capital, Methods of forecasting working capital requirements, meaning and importance of accounts receivable.(Excel)	[2]

Unit 5: Time Value of Money and Capital Budgeting Concept of time value of money, Compounding and discounting; Future value of single amount and annuity, present value of single amount and annuity; Practical application of time value technique. Capital budgeting - Nature and significance, techniques of capital budgeting –Pay Back Method, Accounting rate of return, Internal Rate of Return, DCF, Net Present Value and profitability index. (Application on Excel)	[2]
Unit 6: Project Financing Details of the company, its promoters, and project finances required, profitability etc., Loan documentation-Appraisal of terms loans by financial institutions. Basic components of project finance.(Excel Based)	[2]

Text Books:
1. Financial, Cost and Management Accounting by Dr. P. Pariasamy, HH Publication.
2. Financial Management by Khan and Jain, Tata McGraw Hill.
3. Financial Management by Dr. P. C. Tulsian, S.Chand.
4. Financial Management by Ravi Kishore,Taxmann

Reference Books:
1. "Book Keeping and Accountancy" Choudhari, Chopde.
2. "Cost Accounting": Choudhari, Chopde.
3. "Financial Management" Text and Problems: M.Y.Khan, P.K. Jain.
4. "Financial Management Theory & Practice" Prasanna Chandra Tata McGraw Hill.
5. Managerial Economics & Financial Analysis, Siddiqui S.A. Siddiqui A.S. New Age.

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Modern Indian Language

23MILE01	AEC	Marathi	2-0-0	2 Credits

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

Pre-Requisites: Nil

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

CO1	Develop the knowledge of local language/mother tongue and relate the same to daily life and social media.
CO2	Make use of rhetoric and verb to form sentences in Marathi Language
CO3	Identity Infinitive compounds in the given Marathi sentence.
CO4	Make use of Phrases and proverbs and form a sentence and Solve Prose Assessment/Summary Writing
CO5	Model a letter to appropriate end user in Marathi Language
CO6	Identity writing type of Marathi stanza and write appropriate writing.

Course Contents:

अध्याय 01:भाषा परीचय भाषा आणि व्यक्तिमत्वसह संबंध, भाषा, जीवन व्यवहार आणि नवमाध्यमे व समाजमाध्यमे, चिन्हव्यवस्था-विरामचिन्हे, संवादकौशल्य (तोंडीपरीक्षा), सर्वनाम-पुरुषात्मक, दर्शक, संबंधी, प्रश्नार्थक, सामान्यव आत्मवाचकसर्वनाम, विशेषण-गुणविशेषण, संख्याविशेषण, सार्वनामीक विशेषण	[4]
अध्याय 02:मराठी व्याकरण नाम, सर्वनाम, विशेषणे, क्रियापद, क्रियाविशेषणअव्यय, शब्दयोगी अव्यय, उभयान्वयी अव्यय, केवलप्रयोगी अव्यय, विभक्ती व त्याचेप्रकार, काळवप्रकार	[4]

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अध्याय 03: अलंकार व क्रियापदे **अलंकार**-शब्दलंकर- अनुप्रास, यमक, श्लेषउदाहरणे, अर्थालंकार-उपमा, उत्प्रेक्षा, व्यक्तिरेक, अपदुनती, रूपक, व्यक्तिरेक, अननव्य, अतिशयोक्तीउदाहरणेप्रयोग-कर्तरी, कर्मणी, भावेवाक्यप्रकार-केवलवाक्य, मिश्रवाक्य, संयुक्तवाक्यसमास-अव्ययीभाव, तत्पुरुष, द्वंद्व, बहूवृही **क्रियापदे**- कर्तावकर्म, क्रियापदाचेप्रकार- अकर्मक, सकर्मक, उभयविध, संयुक्त, क्रियाविशेषण-कालवाचक, स्थळवाचक, रितीवाचक, संख्यावाचक, प्रश्नार्थक, निषेधार्थक	[4]
अध्याय 04: वाक्प्रचार व म्हणी व गद्य आकलन/सारांशलेखन अर्थसांगूनवाक्यातउपयोगकरणे (कमीतकमी३०वाक्यप्रचारवम्हणी), गद्यआकलन - अपठितगद्यउतारावत्यावरीलप्रश्नउत्तरे (कमीतकमी०५उतारेवत्यावरीलप्रश्नउत्तरे), सारांशआकलन	[5]
अध्याय 05:लेखनप्रकार पत्रलेखनवत्याचेप्रकार-निमंत्रण, आभार, अभिनंदन, मागणी, कोटुंबिक, विनंती, तक्रार संधी -स्वरसंधी, व्यंजनसंधी, विसर्गसंधी, वृत्तलेखन, जाहिरातलेखन, कथालेखन, अहवाललेखन, आवेदनपत्र, अभिप्रायलेखन	[5]
अध्याय 05: कल्पना विस्तार व मुलखात कल्पनाविस्तार, मुलाखत कौशल्ये, मुलाखतीचे वैशिष्ट्ये, मुलाखतीचे स्वरूप, मुलाखत घेताना घ्यावयाची काळजी, मुलाखत देताना आवश्यकबाबी उदा. आत्मविश्वास, व्यक्तिमत्व विकास, भाषा कौशल्ये इ.	[4]

Text Books:
1. व्यावहारिक मराठी, डॉ.ल.रा.नसिराबादकर, फडकेप्रकाशन, कोल्हापूर.
2. व्यावहारिक मराठी, डॉ.लीला गोविलकर, डॉ.जयश्री पाटणकर, स्नेहवर्धन प्रकाशन, पुणे
3. सुगम मराठी व्याकरण लेखन, मो.रा. वाळंबे, नितीन प्रकाशन पुणे

Reference Books:
1. अनिवार्यमराठीव्याकरण, लेखनवआकलन, डॉ. प्रल्हादलुलेकर, केदारकाळवणे, Pearson पब्लिकेशन्स
2. मराठीवइंग्रजीअत्यावश्यकनिबंध, प्रा.विजयकुमारवेधपाठक, K'Sagarपब्लिकेशन
3. उपयोजितलेखन, मराठी, प्राचीशेंडे, सावलीम्हात्रे, टार्गेटपब्लिकेशन्स

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23MILE02	AEC	Hindi	2-0-0	2 Credits

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

Pre-Requisites: Nil

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

CO1	Develop the awareness of Hindi language and relate the same to daily life and social media.
CO2	Identity Infinitive compounds in the given Marathi sentence.
CO3	Make use of Phrases and proverbs and form a sentence in Hindi language.
CO4	Identity the mistakes in grammar of Hindi language and corrections in it
CO5	Make use of rhetoric to form sentences in Hindi Language
CO6	Illustrate the prose and verse in the given literature

Course Contents:

अध्याय 01:हिंदी भाषापरीचय	[5]
हिन्दीभाषाऔरउसकाविकास, हिन्दीसाहित्यकाइतिहास, भाषाकेविभिन्नमौखिकभाषा, लिखितभाषा, रूप-वर्णमाला, विरामचिन्ह, शब्दरचना, अर्थ, वाक्यरचना, वर्णोंकाउच्चारणऔरवर्गीकरण	

अध्याय 02: समास	[5]
समास, क्रियाएँ, अनेकार्थीशब्द, विलोमशब्द, पर्यायवाचीशब्द,	

अध्याय 03: मुहावरेएवंलोकोक्ति	[4]
मुहावरेएवंलोकोक्ति, तत्समएवंतद्भव, देशज, विदेशी, वर्तनी, अर्थबोध	

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अध्याय 04:हिन्दी भाषा में प्रयोगहोनेवालीअशुद्धियाँ हिन्दी भाषा में प्रयोगहोनेवालीअशुद्धियाँ,अनेकशब्दोंकेलिएएकशब्द, रस	[5]
अध्याय 05:अलंकार अलंकार, छन्द, विशेषणऔरविशेष्य, भाषा-विज्ञान	[4]
अध्याय 06: भाषा-विज्ञान भाषा-विज्ञान, हिन्दी पद्य/गद्य रचना व रचनाकार, संज्ञासे अवयव तक, रिक्तस्थानोंकीपूर्ति, क्रमबद्धता.	[4]

Text Books:

1. हिंदी व्याकरण- पंकमताप्रसदगुरु, प्रकाशनसंस्था, नईदिल्ली
2. हिंदी साहित्यिक का विद्यनानिक इतिहास-डॉ गणपति चंद्रगुप्त, लोकभारतीप्रकाशन, नईदिल्ली.

Reference Books:

1. हिंदीभाषाशिक्षण - संपाहिंदीअध्ययनमंडल, सावित्रीबाई फुले पुणे विश्विद्यालय पुणे, राजकमल प्रकाशन

High-Energy Materials Technology

23ARMDA1	PCC	High-Energy Materials Technology	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: Basic Mechanical Engineering

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

CO1	Formulate the basis for evaluating competitive and alternative high energy material systems
CO2	Classify the of Energetic materials
CO3	Explain about Experimental Characterization of Explosives.
CO4	Explain about Synthesis of Energetic Materials
CO5	Explain about design of Novel Energetic Materials
CO6	Explain about Energetic Materials of the Future

Course Contents:

Unit 1: Introduction Historical Overview ,New Developments, Polymer-Bonded Explosives ,New High (Secondary) Explosives , New Primary Explosives , New Oxidizers for Solid Rocket Motors , Definitions , Combustion, Deflagration, Detonation — A Short Introduction - Fire and Combustion , Deflagration and Detonation	[4]
Unit2:Classification of Energetic Materials Primary Explosives , High (Secondary) Explosives , Propellant Charges , Rocket Propellants , Chemical Thermal Propulsion (CTP) , Pyrotechnics , Detonators, Initiators, Delay Compositions and Heat-Generating, Pyrotechnics , Light-Generating Pyrotechnics , Decoy Flares ,Smoke Munitions , Near-Infrared (NIR) Compositions	[4]
Unit3: Experimental Characterization of Explosives Sensitivities , Long-Term Stabilities ,Insensitive Munitions ,Gap Test , Classification	[4]
Unit4: Synthesis of Energetic Materials Molecular Building Blocks ,Nitration Reactions, Processing ,Protective Equipment	[4]

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Unit 5: Design of Novel Energetic Materials Classification ,Polynitrogen Compounds , High-Nitrogen Compounds , Tetrazole and Dinitramide Chemistry , Tetrazole, Tetrazine and Trinitroethyl Chemistry , Ionic Liquids , Dinitroguanidine Derivatives , Co-Crystallization 1	[4]
Unit 6: Energetic Materials of the Future Theoretical Basis, Computational Methods ,Thermodynamics ,Detonation Parameters, Combustion Parameters	[4]

Text Books:
1. "Chemistry of High-Energy Materials", by Thomas M. Klapötke, De Gruyter, 2012
2. "Shock Waves Science and Technology Library, Detonation Dynamics- Vol. 6," by Zhang F. Publisher: Springer.
3. "Physics of Shock Waves" by Zel'dovich & Raizer.

Reference Books:
1. "The Chemistry of Explosives", by Jacqueline Akhavan 2011
2. "High energy materials modeling & simulation", by Andreoni Wanda, Yip Sid-ney. Publisher: Springer, 2020.

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Computer Architecture and Organization

23ARMDB1	PCC	Computer Architecture and Organization	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: Computer Programming

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

CO1	Identify various components of computer and their interconnection.
CO2	Analyze the design of arithmetic & logic unit and understanding of the fixed point and floating point arithmetic operations.
CO3	Explain instruction set architecture and execution cycle and different types of control units.
CO4	Design a pipeline for consistent execution of with minimum hazards.
CO5	Explain memory system design and different types of memories.
CO6	Explain Characteristics of Multiprocessors.

Course Contents:

Unit 1: Introduction 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.	[4]
Unit2: 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	[4]
Unit3: Introduction to x86 architecture. CPU control Module design: hardwired and micro-programmed design approaches. Memory system design: semiconductor memory technologies, Internal memory organization. Peripheral devices and their characteristics: Input-output subsystems, I/O device interface, I/O transfers program controlled, interrupt driven and DMA, I/O device interfaces –SCSI,USB	[4]

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Unit4: Pipelining Basic concepts of pipelining, throughput and speedup, pipeline hazards. Parallel Processors: Introduction to parallel processors, Concurrent access to memory and cache coherency.	[4]
Unit 5: Memory organization Memory interleaving, concept of hierarchical memory organization, cache memory, cache size vs. block size, mapping functions, write policies. Memory Organization Memory Hierarchy, Main Memory, Auxiliary Memory, Associative Memory, Cache Memory, Virtual Memory.	[4]
Unit 6: Multiprocessors Multiprocessors Characteristics of Multiprocessors, Interconnection Structures, Interprocessor Arbitration, Inter-processor Communication and Synchronization, Cache Coherence, Shared Memory Multiprocessors.	[4]

Text 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..

Reference Books:

1. M. Morris Mano, Computer System Architecture, Pearson
2. Andrew S. Tanenbaum and Todd Austin, Structured Computer Organization, Sixth Edition, PHI M. Murdocca & V. Heuring, Computer Architecture & Organization, WILEY
3. John Hayes, Computer Architecture and Organization, McGrawHill

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Aerospace Engineering Fundamentals

23ARMDC1	PCC	Aerospace Engineering Fundamentals	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: Applied Physics

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

CO1	Explain about Basic Anatomy of an aircraft
CO2	Analyze Aircraft Wings and study of Aircraft Power plants
CO3	Build Aircraft Power plants –Gas Turbine Engines
CO4	Explain Aircraft Structures and Materials –Fuselage and Maintenance
CO5	Explain about Manufacturing Techniques –Conventional and Unconventional
CO6	Analyze and Testing of Aircraft Component

Course Contents:

Unit 1:Introduction and Basic Anatomy of an aircraft History of aviation, early concepts and Modern development ,Classification of flying vehicles, study of Cessna 152 Aircraft, Airspeed and Altitude Indicators-Pitot Static Tube, Attitude Indicators	[4]
Unit2: 2 Aircraft Wings and Aircraft Power plants Types of Wing configurations, Aerofoils and Nomenclature, Components and Sub-assemblies of wings **Aircraft Power plants –Piston Engines** Principles of operations, Components of piston engines ,Engine disassembly and assembly	[4]
Unit3: Aircraft Power plants –Gas Turbine Engines Principles of operations, Components of piston engines ,Study of gas turbine engines **Aircraft Structures and Materials** Basic loads acting on aircraft structures, structural members of wing and materials	[4]

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Unit4: Aircraft Structures and Materials –Fuselage Structural members of fuselage and materials, Structural members of Landing gear and materials **Aircraft General Maintenance** :- A,B,C,D Checks ,Flight inspection procedure, Tools used in aircraft maintaince	[4]
Unit 5: Manufacturing Techniques –Conventional and Unconventional Casting ,Machining , welding **Manufacturing techniques –Unconventional** 3D Printing ,Electric Discharge Machining, CNC Machining	[4]
Unit 6: Aircraft Component Testing and Analysis Hands on Testing of Aircraft Components, Analysis of Aircraft Parts Testing Results	[4]

Text Books:

1. Shock Waves Science and Technology Library, Detonation Dynamics- Vol. 6, by Zhang F. Publisher: Springer.
2. Physics of Shock Waves by Zel'dovich & Raizer.

Reference Books:

1. K. G. McConnell and P. S. Varoto, Vibration Testing: Theory and Practice, 2nd ed., John Wiley & Sons, Hoboken, NJ, 2008.
2. Steephen Corda , Introduction to Aerospace Engineering with Flight Test Perspective , John Wiley & Sons,2017
3. Y. M. Timnat, "Diagnostic Techniques for Propulsion Systems," Progress in Aerospace Sciences (Series), Vol. 26, No. 2, 1989, pp. 153–168.
4. K. Yanagawa, T. Fujita, H. Miyajima, and K. Kishimoto, "High Altitude Simulation Tests of LOX-LH2 Engine LE-5," Journal of Propulsion and Power, Vol. 1, No. 3, May–Jun. 1985, pp. 180–186.

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Aptitude Skills-I
(Verbal Ability)

23HSSM01	VEC	Aptitude Skill I	1-0-0	1 Credit

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

Pre-Requisites: Basic Mathematics

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

CO1	Apply sentence formation rules to spot the error
CO2	Solve the questions based on the types of tenses
CO3	Solve the questions based on Direct/Indirect Speech and Passive/active voice and Substitution and Elimination
CO4	Make use of Proverbs, Idioms and phrases in sentence construction and the vocabulary

Course Contents:

Unit 1: Structure and Types of Sentences, Conditional Sentence	[4]
Unit2: Present tense, Past tense, Future tense, Use of Tenses in Sentence forming	[4]
Unit3: Direct and Indirect Speech, Active and Passive Voice, Use of Modal verbs in Sentence Forming, Substitution and Elimination	[4]
Unit4: Use of Proverbs, Idioms and Phrases in Sentence Construction, Judgment and Inference Sentence Vocabulary Building in Various Situations	[4]

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. Rao and D,V,Prasada, Wren & Martin High School English Grammar and Composition
2. Murphy, Intermediate English Grammar with Answers, Cambridge University Press;Second edition

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Language Skill- I

23HSSM02	VEC	Language Skill- 1	0-0-2	Audit

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

Pre-Requisites: Problem Solving using C programming

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

1	Develop flowchart and Algorithm to solve the given problem statements
2	Develops programs using Data Types and Operators
3	Make use of Decision Making and Looping Statements to develop conditional programs
4	Make use of Arrays to develop programs in C language

List of Experiments:

1. Explain basics of C such as Editing, Compiling, Error Checking, executing, testing and debugging of Programs and Design Algorithms and Flowcharts.

2. Explain basics of Variable, Data types and operators and develop programs on arithmetic Operators.

3. Develop programs on Conditional, logical and Bitwise Operators

4. Develop programs on Size of () and typecasting operator.

5. Develop programs on increment and decrement operator.

6. Develop programs on simple if and if-else statement.

7. Develop programs on simple if-else ladder and Nested if-else

8. Develop programs on Switch case statement.

9. Develop programs on For-loop & Nested For-loop.

10. Develop programs on while and do-while loop.

11. Develop programs on one dimensional array.

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12. Develop programs on two dimensional array.

13. Develop programs on string handling functions.

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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Teaching and Evaluation Scheme for S Y B. Tech.

Department of Automation and Robotics

Semester: IV

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

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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Yadrav (Ichalkaranji)-416121, Dist. – Kolhapur

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 computé 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 Propulsion 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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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 analysis problems to be solved using any CAE software

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

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-1:25 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	[2]
• 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	

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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 the case study groups. • Identify what can be quantified related to your topic and how. • Decide objectives for your case study. • Continue reading especially recent work specific 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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