Department: Electronics and Computer Engineering **Rev:** Course Structure/01/NEP/2023-24

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

Course Code	Course Type	Course	Teaching Scheme				Evaluation Scheme					Credits
			L	T	P	Total Hrs.	CA1	CA2	MSE	ESE	Total	
23EC3601	PCC	Electromagnetic Theory and Antenna	3	-	-	3	10	10	30	50	100	3
23EC3602	PCC	Database Management System	3	-	-	3	10	10	30	50	100	3
23EC3603	PCC	Internet of Things	3	-	-	3	10	10	30	50	100	3
23EC3604	PEC	Program Elective Course -II	3	-	-	3	10	10	30	50	100	3
23EC3605	PCC	Internet of Things Laboratory	-	-	2	2	15	15	-	20	50	1
23EC3606	PCC	Database Management System Laboratory	-	-	2	2	15	15	-	20	50	1
23EC3607	VSEC	Android Application Development	-	-	2	2	25	25	-	-	50	1
23EC3608	VEC	Constitution of India	1	-	-	1	25	25	-	-	50	Audit
23EC3609	PROJ	Capstone Project – I	-	-	4	4	25	25	-	50	100	2
23ECMDXX	MDM	Multidisciplinary Minor-IV	3	-	-	3	10	10	30	50	100	3
23HSSM07	VEC	Aptitude Skills – IV	1	-	-	1	25	25	-	-	50	Audit
23HSSM08	VEC	Language Skills – IV	-	-	2	2	25	25	-	-	50	Audit
		Total	**17**	**-**	**12**	**29**	205	205	**150**	**340**	**900**	**20**

Biomedical Engineering (Basket A)	Data Science (Basket B)	Industrial Automation (Basket C)
Biomedical Instrumentation (23ECMDA4)	Data Visualization (23ECMDB4)	SCADA system for Automation (23ECMDC4)

Program Elective Course -I	A. Wireless Communication
	B. Artificial Intelligence
	C. Information Theory and Coding

Note- (OE*) Open Elective-II Course will be offered to students of other programs and will not be offered to the students of the same program.

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COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Electromagnetic Theory and Antenna

23EC3601	PCC	Electromagnetic Theory and Antenna	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Good knowledge of Engineering Fundamentals of Physics and Electromagnetic.

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

CO1	Explain basics of Vector calculus & different laws in steady electric fields.
CO2	Define & derive different laws in magnetic fields.
CO3	Explain Maxwell's equations in different forms.
CO4	Explain the radiation mechanism of an antenna and calculate antenna parameters
CO5	Compare the given wire antenna and its radiation characteristics
CO6	Explain the different types of antenna arrays.

Course Contents:

Unit 1: Vector Algebra and Electrostatics Review of vector Analysis and coordinate systems, Basic vector algebra-Dot product, Cross product, curl, divergence, Gradient. Coulomb's law & electric field, field due to distributed charges density, Gauss's law, divergence theorem, Electrostatic potential, electric dipole, Electrostatic energy density, Boundary conditions for electrostatic field	[6]
Unit 2: Steady Magnetic Field Biot Savart's law, Ampère's circuital law, Stoke's Theorem, Magnetic flux density and vector magnetic potential, Current carrying conductors in magnetic fields, Torque on loop, Energy stored in a magnetic field, Boundary conditions for magnetostatic field.	[6]
Unit 3: Maxwell's Equations Inconsistency of Ampere's law, Faraday's law, Maxwell's equations for static field, time-varying field and harmonically varying fields.	[6]
Unit 4: Antenna Basics Introduction, radiation mechanism, Basic Antenna parameters: Antenna pattern, Half power beam width, Beam area, Beam efficiency, Directivity and Gain, Radiation resistance, Resolution, Antenna aperture, Effective height, Front to Back ratio, polarization, Antenna aperture, Antenna field zones.	[6]
Unit 5: Wire Antennas Monopole and Dipole Antenna, Short Dipole, Loop Antenna, Yagi-Uda Antenna, V- antenna, Helical Antenna, Structural details, dimensions, radiation pattern, specifications, features, and applications.	[6]
Unit 6: Antenna Arrays	[6]

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Arrays of two isotropic point sources: same amplitude and phase, same amplitude and opposite phase, same amplitude and any phase difference, Linear arrays of n isotropic point sources of equal amplitude and spacing, Broadside Array, End fire Array.	

Text Books:

1. Microwave Engineering – Annapurna Das, Sisir K Das TMH Publication, 2nd, 2010
2. Antennas and Wave Propagation, John D. Krauss, Ronald J Marhefka, and Ahmad S Khan, 4th Special Indian Edition, McGraw- Hill Education Pvt. Ltd., 2010.
3. Antennas and Wave Propagation – Harish and Sachidananda: Oxford University Press,2007.
4. G.S.N. Raju, "Antenna and Wave Propagation", Pearson Education.
5. Sadiku, "Elements of Electromagnetics", 4 th edition, Oxford University Press.
6. G.S.N. Raju, "Electromagnetic field theory & Transmission lines", 1st edition, Pearson Education.

Reference Books:

1. Microwave Devices and circuits- Liao / Pearson Education
2. Microwave Engineering – David M Pozar, John Wiley India Pvt. Ltd., 3rdEdn, 2008
3. Microwave Engineering – Sushrut Das, Oxford Higher Education, 2ndEdn, 2015
4. John D. Kraus, "Electromagnetics", Tata McGraw Hill Publication.
5. William Hayt, Buck, "Engineering Electromagnetics", Tata McGraw Hill Publication.
6. Jordan & Balmain, "Electromagnetic Fields & Radiation Systems", 2nd edition, PHI.

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Database Management System

23EC3602	PCC	Database Management System	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Computer Network

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 andinstances.
CO2	Illustrate use of constraints and relational algebra operations for building applications
CO3	Make use of the basics of SQL and construct queries using SQL in database creation andinteraction.
CO4	Construct different normalization techniques in databases.
CO5	Illustrate 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, Data Models, Database Languages, Database Administrator, Database Users, Three Schema architecture of DBMS ,View of Data, Data Models, Database Architecture, , 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 SQL Data Definition Language, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Null Values, Aggregate Functions, Nested Sub queries, Modification of the Database, Join Expressions, Views, Integrity Constraints, and Accessing SQL from a Programming triggers.	[6]
Unit 4: Relational Database Design The purposes of Normalization, Data Redundancies and Update Anomalies, Functional Dependencies- types of functional dependency, closure of set of functional dependency, canonical cover, The Process of Normalization, First Normal Form, Second Normal Form, Third Normal Form, Boyce-Codd Normal Form, Fourth Normal Form, Fifth Normal Form.	[6]
Unit 5: 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]

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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, 6th edition, 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 Du Bois, 3rd edition, O'REILLY.

Reference Books:

1. "Fundamentals of Database Systems", Ramez, Elmasri, Shamkant B. Navathe, 6th Edition, Addison, Wesley.
2. "Database Systems – Design, Implementation and Management", Rob & Coronel, 5th Edition, Thomson Course Technology.

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Internet of Things

23EC3603	PCC	Internet of Things	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Computer Network

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

CO1	Explain the fundamentals of IoT
CO2	Make use of sensors and actuators for design of IoT
CO3	Apply various protocols for design of IoT systems
CO4	Compare Various IP protocols for IoT
CO5	Demonstrate the ability to program Arduino-based systems using IDE, libraries, and emulator tools for IoT applications.
CO6	Develop applications based on IoT.

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.	[6]
Unit 2: Hardware for IoT Digital sensors, actuators, radio frequency identification (RFID) technology, wireless sensor networks, participatory sensing technology. Embedded Platforms for IoT: Embedded computing basics, Overview of IOT supported Hardware platforms such as Arduino, Netduino, Raspberry pi, Beagle Bone, Intel Galileo boards and ARM cortex.	[6]
Unit 3: Network & Communication aspects in IoT WPAN Technologies for IoT: IEEE 802.15.4, Zigbee, HART, NFC, Z-Wave, BLE, Bacnet, Modbus.	[6]
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.	[6]
Unit 5: Programming the Arduino Arduino Platform Boards Anatomy, Arduino IDE, coding, using emulator, using libraries, additions in Arduino, programming the Arduino for IoT.	[6]
Unit 6: Challenges and Applications in IoT	[6]

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Development Challenges, Security Challenges, Other challenges, IoT Applications: Smart Metering, E-health, City Automation, Automotive Applications, home automation, smart cards, communicating data with H/W units, mobiles, tablets, Designing of smart street lights in smart city.	

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.
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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Program Elective Course-II

23EC3604A	PEC	Wireless Communication	3-0-0	3 Credits

Teaching Scheme:	Evaluation Scheme:
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Computer Network

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

CO1	Make use of concepts of wireless communication system and cellular radio system.
CO2	Explain the basics of mobile propagation models with large scale path loss.
CO3	Explain the basics of mobile propagation models with small scale fading.
CO4	List the various multiple access techniques used in wireless communication.
CO5	Explain the emerging trends in Wireless communication and related issues and challenges.

Course Contents:

Unit 1: Introduction to Wireless Communication System Introduction, Mobile Radio System around the world, Examples of Wireless communication System, Comparison of Common wireless system, Third Generation (3G) Wireless Networks, Wireless Local Loop (WLL), Wireless Local Area network (WLAN).	[6]
Unit 2: Cellular Radio Systems Basic cellular system, Components and Operation of cellular systems, Analog & Digital cellular systems, Concept of frequency reuse channels, Co-channel interference, Cell splitting.	[6]
Unit 3: Mobile Radio Propagation Model Large scale path loss:-Free Space Propagation loss equation, Path-loss of LOS systems, Reflection, Diffraction, Scattering, Indoor and outdoor propagation models.	[6]
Unit 4: Mobile Radio Propagation Model, Small Scale Fading Small scale multipath propagation, Impulse model for multipath channel, Types of small scale Fading, Rayleigh and rician distribution	[6]
Unit 5: Multiple Access Techniques Introduction, Frequency Division Multiple Access (FDMA), Time Division Multiple Access (TDMA), Code division Multiple access (CDMA), Spread Spectrum Multiple Access, GSM system architecture, GPRS system architecture.	[6]
Unit 6: Recent Trends Introduction, WiMAX, ZigBee Networks, Wireless Adhoc Network, Security issues and challenges in a Wireless network, 4G & 5G Mobile techniques and Emerging technologies.	[6]
Text Books: 1. Jochen Schiller, Mobile Communications, Pearson, 2008.	

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2. Andreas F Molish, Wireless Communications, 2nd Edition, Wiley India Publications, 2013.
3. Wireless Communication, Theodore S. Rappaport, Prentice Hall.

Reference Books:

1. Jochen Schiller, Mobile Communications, Pearson, 2008
2. Andreas F Molish , Wireless Communications, 2nd Edition, Wiley India Publications,2013
3. Wireless Communication, Theodore S. Rappaport, Prentice Hall
4. Wireless Communications and Networking, Vijay Garg, Elsevier
5. Wireless digital communication, Kamilo Feher, PHI
6. Mobile and personal Communication system and services by Rajpandya, IEEE press (PHI).
7. William C Y Lee, Mobile Cellular Telecommunications, 2nd Edition, MGH, 2004.
8. Raj Pandya, —Mobile and Personal Communication systems and servicesl, Prentice Hall of India, 2001

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Program Elective Course-II

23EC3604B	PEC	Artificial Intelligence	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3 Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Fundamental of Probability and Statistics, Problem Solving and Data Structures

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

CO1	Illustrate history, foundation of AI and the structure of intelligent agents.
CO2	Explain informed and uninformed search strategies by understanding concept of logical agents.
CO3	Make use of the first order logic and its inference.
CO4	Analyze different planning algorithms and knowledge representation

Course Contents:

Unit 1: Introduction Introduction: What is Artificial Intelligence? Foundations of AI, history, the state of art AI today. Intelligent Agents: agents and environment, good behaviour, nature of environment, the structure of agents.	[4]
Unit 2: Searching Solving Problems by Searching: Problem solving agents, examples problems, searching for solutions, uninformed search, informed search strategies, heuristic functions.	[4]
Unit 3: Logical Agents Knowledge base agents, The Wumpus world, logic, propositional logic, propositional theorem proving, effective propositional model checking, agents based on propositional logic.	[4]
Unit 4: First Order Logic First Order Logic: Syntax and semantics, using First Order Logic, Knowledge engineering in First Order Logic. Inference in First Order Logic: propositional vs. First Order, unification and lifting, forward and backward chaining, resolution.	[4]
Unit 5: Planning Definition of Classical Planning, Algorithms for planning as state space search, planning graphs, hierarchical planning.	[4]
Unit 6: Knowledge Representation Categories and Objects, events, mental events and objects, reasoning systems for categories, reasoning with default information, Internet shopping world.	[4]

Text Books:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill-2008
2. Dan W. Patterson," Introduction to AI and ES", Pearson Education, 2007.

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3. Parag Kulkarni, Prachi Joshi, " Artificial Intelligence building intelligent systems", PHI

Reference Books:

1. Stuart Russel and Peter Norvig "AI–A Modern Approach", 2nd Edition, Pearson Education 2007
2. Deepak Khemani "Artificial Intelligence", Tat Mc Graw Hill Education 2013

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Program Elective Course-II

23EC3604C	PEC	Information Theory and Coding	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Understanding of analog and Digital Communication, Theory of Probability

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

CO1	Apply probability theory for PDF and CDF, and assess entropy, information rate, and mutual information.
CO2	Explain the functioning of communication channels, the role of source coding, and the significance of channel capacity
CO3	Apply Coding theory for error detection and correction
CO4	Design generator and parity-check matrices for cyclic codes and Convolutional Codes

Course Contents:

Unit 1: Probability Theory and Random Process Introduction to digital communication system, probability and sample space, Bayes' rule, Joint & conditional Probability, PDF & CDF, Statistical averages, Random Variables, Random Processes, Time average, Ergodicity, Power Spectral density of Stationary random processes.	[6]
Unit 2: information theory Introduction, Concept of amount of information, Entropy-Definition and Properties, Marginal, Joint, and Conditional entropies, relation among entropies, information rate, Mutual Information, and properties. content of symbols in Long dependent sequences, Markov Statistical Model of Information Sources, Entropy and Information rate of Mark off Sources.	[6]
Unit 3: Communication Channels Channel Capacity, Redundancy and Efficiency of channel, Discrete memoryless channel – Classification of channels: Noise-free channel, Symmetric channel, Binary Symmetric Chan nel (BSC), Cascaded Channels and Binary Erasure Channel (BEC), Calculation of channel capacity, Shannon's fundamental theorem, Shannon-Hartley Theorem, Shannon Fano Coding, Huffman's Coding, Coding Efficiency Calculations.	[6]
Unit 4: Error Control Coding Introduction: Need for Error Control Coding, Classification, Error Detection and Error Correction Techniques, Coding Terminology, Matrix Description of Linear Block Code, Generator and Parity Check Matrices, Hamming Codes, Encoder and Syndrome decoder for (n, k) block Code, other Linear Block codes –Single Parity check bit code.	[6]
Unit 5: Cyclic Codes	[6]

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Algebraic structure, Properties, Generator Polynomial, Generation of Code Vector in Nonsystematic and Systematic form, Generator and Parity check matrices, Encoding of Cyclic Code, Syndrome decoding for Cyclic code, Hardware Representation of (n,k) cyclic code.	
Unit 6: Convolutional Codes Introduction, Encoding of Convolutional Codes, Time Domain Approach, Transform Domain Approach, Graphical Approach – Code Tree, State diagram and Trellis Diagram, Decoding of Codes: Maximum Likelihood Decoding-Viterbi Algorithm, Sequential Decoding.	[6]

Text Books:

1. Simon Haykin, "Communication Systems ", John Wiley & Sons, Inc, IVth Edition,
2. R.P Singh & S.D. Sapre," Communication Systems Analog & Digital ",Mc-Graw Hill, 2nd Edition,2001.
3. Ranjan Bose "Information Theory Coding & Cryptography", Tata McGraw- Hill Publishing Company Ltd.

Reference Books:

1. B. P. Lathi; Modern Digital and Analog Communication Systems; Oxford Publication
2. Taub, Schilling, Principles of Communication Engineering (2nd Edition), TMH.
3. Digital Communications- John G. Proakis, 5th ed., TMH 2008.
4. Thomas M. Cover, Joy A. Thomas, Elements of Information Theory, Wiley Inter science.

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Internet of Things Laboratory

23EC3605	PCC	Internet of Things Laboratory	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2Hrs/week	CA-1 :15 Marks CA 2 :15 Marks End Semester Exam: 20 Marks

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

CO1	Develop the interfacing of IoT with Raspberry Pi.
CO2	Design utilizing state of the art hardware boards and software's as per industry standards
CO3	Make use of research activities in different application areas of IoT
CO4	Develop communication skills and capability to work in team

Minimum 08 Experiments should be Conducted.

Sr. No.	**Name of the Experiments.**
1	Demonstrate of At89S52Ultra Development it with Development Tool/ Environment of Keil Software for Microcontroller programming.
2	To familiarize with Intel Galileo Gen2 board and understand procedure of creation and compilation of C source code
3	WiFi module interfacing with Intel Galileo Gen2 board
4	To study of IoT Data Logging using Baeglebone Black and Thingspeak
5	To turn your smart phone into an IoT device using the IBM Watson IoT platform clo;ud -hosted service
6	Exercise on Eclipse IoT Project
7	Experiments on few Eclipse IoT Projects
8	Any experiment on architecture of IoT tool kit
9	Exercise on smart object API Gateway service reference implementation in IoT Toolkit
10	Experiment on HTTP to CoAP sematic mapping Proxy in IoT Toolkit.

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Database Management System Laboratory

23EC3606	PCC	Database Management System Laboratory	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2Hrs/week	CA-1 :15 Marks CA 2 :15 Marks End Semester Exam: 20 Marks

Pre-Requisites: - Basic knowledge on programming and database concepts.

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

CO1	Demonstrate the use of constraints and relational algebra operations for building applications
CO2	Make use of the basics of SQL and construct queries using SQL in database creation andinteraction.
CO3	Construct different normalization techniques in databases.

Minimum 08 Experiments should be Conducted.

Sr. No.	Name of the Experiments.
1	Study the basic concept of Database System and ER Model.
2	Installation of MySQL/Oracle and practice DDL commands. Create table • Alter table • Drop Table
3	Installation of MySQL/Oracle and practice DML commands Insert • Update • Delete
4	Implement Operations using Relational Algebra.
5	Implement Structured Query Language Creating Database • Creating a Database • Creating a Table • SpecifyingRelational Data Types •Specifying Constraints • Creating Indexes
6	Implement Aggregate Functions, Sub queries, Set operators.
7	Perform Nested and Join Queries, Cursors and Triggers, Functions and Procedures.
8	Implement the concept of Normalization.
9	To implement the concept of Indexing and Hashing for data retrieval.
10	Study & Implementation of Database Backup & Recovery command by usingconcurrency control protocols.
11	Data base connectivity techniques.
12	Design and implementation of a Database Application.

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Android Application Development

23EC3607	VSEC	Android Application Development	0-0-2	1 Credit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2 Hrs/week	CA-1 :25 Marks CA -2 :25 Marks

Pre-Requisites: - Basic knowledge on programming and database concepts.

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

CO1	Design user interfaces for mobile apps using basic building blocks, UI components and application structure using Emulator
CO2	Construct a simple program and develop small applications using the concepts of UI design, layouts and preferences
CO3	Develop applications with multiple activities using intents, array adapter, exceptions and options menu.
CO4	Develop mobile applications using SQLite.

Course Contents:

Fundamentals: Basic Building blocks – Activities, Services, Broadcast Receivers and Content providers, UI Components – Views and notifications Components for communication -Intents and Intent Filters
Application Structure: AndroidManifest.xml, user-permission – sdk, Resources and R.java, Assets, Layouts and Drawable Resources, Activities and Activity lifecycle.
Emulator-Android Virtual Device: Launching emulator, Editing emulator settings, Emulator shortcuts, Logcat usage, Introduction to DDMS
Basic UI design: Form widgets, Text Fields, Validation of Edit Text, Layouts, [dip, dp, sip, sp] versus px
Preferences: Shared Preferences, Preferences from xml
Menu: Option menu, Context menu, menu from xml, menu via code
Intents: Explicit Intents, Implicit intents
UI design: Time and Date, Images and media, Android Adapter and List View, Composite, Alert Dialogs and Toast, Popup, Fragments, Navigation drawer
Tabs, Tab Activity Styles & Themes: styles.xml, drawable resources for shapes, gradients (selectors), style attribute in layout file, Applying themes via code and manifest file
Content Providers: SQLite Programming, SQLite Open Helper, SQLite Database, Cursor, Reading and updating Contacts, Reading bookmarks
Reference Books: 1. Joseph Annuzzi Jr, Lauren Darcey, Shane Condor, "Advanced Android Application Development, Developers Library", Pearson Education, 4th Edition (2015) 2. Lauren Darcey, Shane Condor, "Android, Wireless Application Development", Pearson Education, 3rd Edition. 3. Paul Deitel, Harvey Deitel, Alexander Wald, "Android 6 for programmers, An AppDriven Approach", Pearson Education

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4. Rap Payne, "Beginning App Development with Flutter: Create Cross-Platform Mobile Apps", Apress (2019)

Sr. No.	Name of the Experiments.
1	Fundamentals – Basic building blocks
2	Application structure, layout and resources
3	Android Virtual Device, Activity Lifecycle
4	Basic UI Design and Edit Text Validation
5	Shared Preferences, Relative Layout, Frame Layout, Grid Layout and Preferences from xml
6	Array Adapter, List View and Exception handling
7	Various Menu options
8	Explicit and Implicit Intents
9	Images and media, Dialogs, Spinner component, Popups, Fragments, Navigation drawer
10	Applying themes and styles .xml
11	SQLite Programming

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Constitution of India

23EC3608	VEC	Constitution of India	1-0-0	Audit

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 1Hrs/week	CA-1 :25 Marks CA 2 :25 Marks

Pre-Requisites: - Nil

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

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

Course Contents:

Unit 1: Meaning of the constitutional 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: Local Self Government – Constitutional Scheme in India, Scheme of the Fundamental Right to Equality	[2]
Unit 6: Scheme of the Fundamental Right to certain Freedom under Article 19, Scope of the Right to Life and PersonalLibertyunderArticle21.	[2]

Reference Books:

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

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Capstone Project – I

23EC3609	PROJ	Capstone Project – I	0-0-4	2 Credits

Teaching Scheme:	Evaluation Scheme:
Lecture: 4Hrs/week	CA-I: 25 Marks CA -II :25 Marks End Semester Exam: 50 Marks

Pre-Requisites: - All courses

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

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

The students in a group of not more than FOUR will work under the guidance of the faculty member on t project work undertaken by them.
The completion of work, thesubmission of the report and assessment should be done at the end of VII Sem.

The project work should consist of any of the following or appropriate combination:

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

It is expected that the students should complete at least 50% of the total project work in VISemester. The objective is to prepare the students to examine any design or process or phenomenon from all angles, to encourage the process of independent thinking andworking and to expose them to industry. The students may preferably select the project works from their opted elective subjects. The students should submit the report in a prescribed format, before the end of VII semester. The report shall be comprehensive and presented typed on A4 size sheets and bound. Number of copies to be submitted is numberof students plus two. The assessment would be carried out by the panel of examiners for both, term work and oral examinations.

Head of the Department
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COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Multidisciplinary Minor-IV

23ECMDA4	MDM	Biomedical Instrumentation	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: NIL

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

CO1	Outline the basic knowledge of anatomy and physiology of human body.
CO2	Understand & Analyze important vital sign parameters to evaluate certain disease.
CO3	Categorize the differences of bio-potentials and its characteristics
CO4	Design bio-potential fundamental circuits and implement it for demonstration.
CO5	Experiment with various medical bio potentials.
CO6	Analyze safety related to electrical hazards and troubleshooting of biomedical instruments.

Course Contents:

Unit 1: Introduction of Biomedical Instrumentation Medicine and Medical Devices a review, Generalized block diagram of the medical instrumentation system, Classification of Biomedical Instruments. Interference in the measurements and modifying inputs, Compensation techniques.	[6]
Unit 2: Bio-Potentials Human body and Cell structure, Electrical Activity of Excitable Cells, The action and Resting potentials. Introduction of Bio-potentials related to the human body. ECG, EMG, EEG, ERG etc.	[6]
Unit 3: Bioelectrodes -Sensors-Transducers Introduction of resistive, capacitive and inductive sensors, Piezoelectric sensor, displacement and temperature measurement, optical and radiation sensors-transducers, Introduction and Classifications of the Bio-electrodes.	[6]
Unit 4: Cardiovascular system and measurements The anatomy of human heart. Electrocardiogram generation and measurements, The ECG Instrumentation lead techniques and signal conditioning, Measurement of Blood pressure, blood flow, blood volume and heart sound, Special techniques of ECG measurement. Introduction of ECG Bio-signal Processing and Signal Conditioning.	[6]
Unit 5: Biomedical measurements and Equipment's Digital revolution in the biomedical equipment's, EEG and its measurements. 10-20 measurements. Heart Rate and Pace-Makers, Defibrillators, Imaging techniques and its fundamentals, X-Ray, MRI, CT-Scan, Radiography, PET Scan, Ultra sonography, laser and robotics surgery equipment's,	[6]

Head of the Department
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COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

Equipment's in ICU and Patient monitoring systems.	
Unit 6: Electrical Hazards and Patient safety Physiological effect of the electrical current on human, Significance of electrical danger, Micro and Macro shocks, Ground shocks, Hazards and methods of Accident prevention.	[6]

Text Books:

1. Jochen Schiller, Mobile Communications, Pearson, 2008.
2. Andreas F Molish , Wireless Communications, 2nd Edition , Wiley India Publications, 2013.
3. Wireless Communication, Theodore S. Rappaport, Prentice hall.

Reference Books:

1. Leslie Cromwell, Fred J. Weibell, Erich A. Pfeiffer, *"Biomedical Instrumentation and Measurements"*, PHI Private Limited, 2nd Edition, 2012.
2. John G. Webster, *"Medical Instrumentation Application and Design"*, WSE Wiley India Private Limited, 3rd Edition, 2012.
3. Joseph J. Carr, John M. Brown, *"Introduction to Biomedical Equipment Technology"*, Pearson Education, 4th Edition, 2012.
4. R S. Khandpur, *"Handbook of Biomedical Instrumentation"*, Tata McGraw Hill, 2nd Edition,2002.
5. Rangaraj M Rangayyan, "Biomeidcal Signal Analysis: A Case-Study Approach", Wiley India, 2011.

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Multidisciplinary Minor-IV

23ECMDB4	MDM	Data Visualization	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Programable Logic Controller

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

CO1	Define key terms and concepts related to data visualization, including various types of visualizations and their purposes.
CO2	Explain the principles of effective visualization design, including color theory, typography, and the importance of clarity and accuracy in visual representations.
CO3	Demonstrate the ability to clean and prepare datasets for visualization, applying appropriate data transformation techniques to ensure data integrity and usability.
CO4	Analyze different data visualization tools and technologies, evaluating their strengths and weaknesses to specific data types and visualization objectives.
CO5	Explain the effectiveness of visualizations through user testing and feedback, providing constructive critiques based on established design principles and ethical considerations.
CO6	Explain an interactive data visualization.

Course Contents:

Unit 1: Introduction to Data Visualization Definition and importance of data visualization, History and evolution of data visualization, Overview of the data visualization process, Types of data visualizations (charts, graphs, maps, etc.)	[6]
Unit 2: Principles of Effective Visualization Principles of visual perception and cognition, designing for clarity and accuracy, Choosing the right chart types for data representation, Principles of colour theory and typography in visualization	[6]
Unit 3: Data Preparation and Cleaning Understanding data types and structures, Data cleaning methods (handling missing values, outliers, etc.), Data transformation for visualization, Best practices for working with datasets	[6]
Unit 4: Tools and Technologies for Data Visualization Overview of data visualization tools (Tableau, Power BI, D3.js, etc.), Introduction to programming languages for visualization (Python, R), Creating interactive visualizations, Integrating visualizations into web applications	[6]
Unit 5: Advanced Visualization Techniques	[6]

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Multidimensional data visualization techniques (scatter plots, parallel coordinates), Geographic and geospatial visualization, Temporal data visualization (time series, animations), Data storytelling and visualization narratives	
Unit 6: Evaluation and Best Practices Evaluating the effectiveness of visualizations, User testing and feedback, Ethical considerations in data visualization, Future trends and the role of AI/machine learning in visualization.	[6]

Text Books:

1. Jochen Schiller, Mobile Communications, Pearson, 2008.
2. Andreas F Molish , Wireless Communications, 2nd Edition , Wiley India Publications,2013.
3. Wireless Communication, Theodore S. Rappaport, Prentice hall.

Reference Books:

1. *"The Visual Display of Quantitative Information"* by Edward R. Tufte
2. *"Data Visualization: A Practical Introduction"* by Kieran Healy
3. "Information Visualization: Perception for Design" by Colin Ware
4. "Slide:ology: The Art and Science of Creating Great Presentations" by Nancy Duarte
5. Data Wrangling with pandas" by Jacqueline Kazil and Katharine Jarmul
6. "Practical Statistics for Data Scientists" by Peter Bruce and Andrew Bruce
7. "Interactive Data Visualization for the Web" by Scott Murray
8. "Fundamentals of Data Visualization" by Claus Wilke
9. "Storytelling with Data: A Data Visualization Guide for Business Professionals" by Cole Nussbaumer Knaflic.
10. "Visualizing Data" by Ben Fry
11. "The Big Book of Dashboards: Visualizing Your Data Using Real-World Business Scenarios" by Steve Wexler, Jeffrey Shaffer, and Andy Cotgrave
12. "Data Visualization Handbook" by D. W. Hargreaves

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Multidisciplinary Minor-IV

23ECMDC4	MDM	SCADA system for Automation	3-0-0	3 Credits

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 3Hrs/week	CA-1 :10 Marks CA 2 :10 Marks Mid Semester Exam: 30 Marks End Semester Exam: 50 Marks

Pre-Requisites: - Programable Logic Controller

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

CO1	Illustrate the Components and architecture of SCADA system.
CO2	Explain the SCADA communication architecture and protocols.
CO3	Make use of the SCADA software.
CO4	Analyze different applications of SCADA in industrial automation along with security.

Course Contents:

Unit 1: Introduction to SCADA Systems Overview of Industrial Automation and Control, Evolution of SCADA Systems, Components of SCADA: RTU, PLC, HMI, Sensors, Actuators, SCADA vs PLC.	[6]
Unit 2: SCADA Architecture and Components Centralized and Distributed Architectures, Master Terminal Unit (MTU) and Remote Terminal Unit (RTU), Human-Machine Interface (HMI), Data Acquisition and Processing.	[6]
Unit 3: Communication in SCADA Systems SCADA Communication Architectures, Communication Protocols: Modbus (RTU/TCP), DNP3, IEC 60870-5-101/104, OPC (OLE for Process Control), Wireless SCADA: IoT, 5G, and Edge Computing Integration.	[6]
Unit 4: SCADA Software and Programming Introduction to SCADA Software (e.g., Wonderware, Ignition, WinCC, Citect), SCADA System Configuration, Creating and Managing HMI Screens, Alarm Management and Event Logging, Data Logging and Reporting.	[6]
Unit 5: SCADA in Industrial Automation Applications in Power Systems, Water Treatment, Oil & Gas, Manufacturing, Integration of SCADA with PLCs and DCS, Real-time Monitoring and Control.	[6]
Unit 6: SCADA Security and Cybersecurity Issues SCADA Vulnerabilities and Threats, Cybersecurity Strategies for SCADA Systems, Firewall and VPN Implementation, Industrial Network Security Standards (IEC 62443).	[6]
Text Books: 1. Stuart A. Boyer, SCADA: Supervisory Control and Data Acquisition, ISA, 2015.	
Reference Books: 1. Frank Lamb, Industrial Automation: Hands-On, McGraw-Hill, 2013.	

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Aptitude Skills- IV
(Numerical Ability)

23HSSM07	VEC	Aptitude Skills- IV	1-0-0	Audit

Teaching Scheme:	**Evaluation Scheme:**
Lecture: 1Hrs/week	CA-1 :25 Marks CA 2 :25 Marks

Pre-Requisites: - Aptitude Skills-I, II & III

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

CO1	Solve the questions on ordering of words & Parts of Speech
CO2	Organize contents of Business Communications such as CV, emails and letters.
CO3	Solve the questions based on jumbled paragraphs and reading comprehension.
CO4	Solve the questions on spotting error and sentence correction.
CO5	Summarize proceedings of any event or conference.
CO6	Discuss about current and critical issues during group discussion.

Course Contents:

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

Text Books:

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

Reference:

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

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Language Skill- IV

23HSSM08	VEC	Language Skills- IV	0-0-2	Audit

Teaching Scheme:	**Evaluation Scheme:**
Practical: 2Hrs/week	CA-1 :25 Marks CA -2 :25 Marks

Pre-Requisites: - Language Skills-I, II &III

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

CO1	Make use of Function in Python Programming.
CO2	Make use of Python collections.
CO3	Make use of classes and its objects in python.
CO4	Make use of file and it's handling functions.

Course Contents:

1. Write a Python program to define a user-defined function that takes a number as input and returns whether it is even or odd. Call the function and display the result. o Concepts: Function definition, arguments, return value.	[2]
2. Create a Python program to define and call a function with default arguments and keyword arguments. o Concepts: Function calling, argument types.	[2]
3. Write a Python program using a lambda function to compute the square, cube, and factorial of a given number. o Concepts: Lambda function basics	[2]
4. Write a Python program to demonstrate list operations such as creation, adding items, removing an item, slicing, and sorting. o Concepts: List constructor, change, remove, sort, list comprehension	[2]
5. Write a Python program to demonstrate the use of tuples and sets. Perform operations such as checking membership, adding/removing elements (set), and iterating. o Concepts: Tuple immutability, set operations.	[2]
6. Write a Python program to create a dictionary of employees with their ID as key and name as value. Perform operations like adding a new entry, updating existing, and deleting one. o Concepts: Dictionary operations, loop through dictionary.	[2]
7. Write a Python program to create a class Student with attributes name, roll_no, and a method display(). Create an object and access its members. o Concepts: Class, object, method access.	[2]
8. Create a class with an __init__() constructor to initialize data members and a destructor to display a message when the object is deleted. o Concepts: Constructor, destructor.	[2]
9. Write a program to demonstrate single inheritance where a class Vehicle is inherited by a class Car. Use super() to access base class methods. o Concepts: Inheritance, super().	[2]
10. Write a Python program to open a text file in write mode and write your personal information (name, age, department). Then, read and display the content of the file. o Concepts: File open, write, read, file modes.	[2]

Head of the Department
Electronics & Computer Engineering
SHARAD INSTITUTE OF TECHNOLOGY
COLLEGE OF ENGINEERING
Yadrav (Ichalkaranji) Dist.Kolhapur

11. Write a program to read a file line by line using readline() and count the number of characters in each line. o Concepts: File reading, character offset.	[2]
12. Create a program to open a file in append mode and add new content. Use exception handling to manage file not found or access errors. o Concepts: File handling with exception management.	[2]

Text Books:

1. Python Projects (Author: Laura Cassell, Alan Gauld) Wrox publication
2. Murach's Python Programming. Author.:Michael Urban, Joel Murach, Murach's Publication.

Reference Books:

1. Fundamentals of Python (First Program) Cengage MINDTAP Publication 2nd Edition. Author: K.A. Kambert

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