Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2025-26						
Course Information						
Programme	B. Tech. (MDM – Electric Vehicles)					
Class, Semester	Third Year - B. Tech., Sem. V					
Course Code	7MD301					
Course Name	Drives and Control for Electric Vehicles					
Desired Requisites:	Introduction to Electric Vehicles					
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial	-	30	20	50	100	
	-	**Credits: 3**				

Course Objectives	
1	The course aims at providing basic knowledge of electric drives and control for Electric vehicle applications.
2	The course will enable the students to understand, examine and analyze the power converters for electric vehicles.
3	The course will provide the students with the basic knowledge regarding electric motors for EV applications.
4	The course will enable students to understand various batteries and battery management systems for EV applications.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the architecture and features of Electric Vehicles	II	Understand
CO2	Select suitable electric drives for EV applications from characteristics of the machines	III	Apply
CO3	Analyze the Power Electronic Circuits such as rectifier, converter, inverter, choppers, and cyclo-converter and matrix converter circuits.	IV	Analyze
CO4	Analyze the components and working of battery management system	IV	Analyze

Module	**Module Contents**	**Hours**
I	**Introduction to Electric Vehicles** Background of Electric Vehicles, Electric Vehicle System, Components of Electric Vehicles: Power Sources, Power Electronic Converters, Electric Drives, Advantages of Electric Vehicles, Efficiency, Pollution Comparison with conventional vehicles, Fundamentals of Electric Vehicles, EV topologies: Series, Parallel, Series-Parallel, Types of power sources for EV.	6
II	**Power Electronics for EV** Introduction to power semiconductor devices such as power diodes, transistors, MOSFET, IGBT and GTO, Types of Power Converters, Single phase and three phase controlled and uncontrolled rectifiers, DC to DC converters, inverters, modes of operation of inverters and inverter control.	7
III	**Induction motors** Single-Phase Induction Motor: Double revolving field theory and principle of operation, Construction and operation of single-phase IM, Comparison of single-phase motors and applications. Three Phase Induction Motor: Construction, Types, Working, Speed equation, Torque equation, starting torque, Concept of full load torque, torque speed characteristics, Power stages in motor, Speed control methods- Pole changing,	7

	Voltage control, VFD (V/f) control, Block schematic of electronic VFD control, Rotor resistance speed control, Reversal of rotation.	
IV	**PMSM and Other Special Purpose Motors** Synchronous Motor: Equivalent Circuit, Motor on load, Mechanical Power Developed by Motor, Applications of Synchronous Motor, Comparison of Synchronous Motor with Induction Motor. Selection criteria for Special-Purpose Electric Machines: Switched Reluctance Motor, Permanent Magnet D.C. Motor, Brushless D.C. Motor.	7
V	**EV Drive systems** Types of motors used in EV, Requirements of EV drive systems, Series Hybrid Electric Drive Train - Operation Patterns, Control Strategies, Parallel Hybrid Electric Drive Train – Operation Pattern, Control Strategies	6
VI	**Batteries and Battery Management Systems** Introduction to Batteries, Battery Types and Battery Packs, Recent EVs and Battery Chemistries, Battery Parameters and Comparisons, Objectives and functions of the BMS, types of BMS, SOC and DOD, charge controller, sensors in BMS, protection of batteries, CCCV, cell equalization.	6

Text Books	
1	James Larminie, John Lowry, “Electric Vehicle Technology Explained”, Wiley, 2nd edition, 2012.
2	John G Hayes and G. Abas Gudarazi, “Electric Powertrain”, First edition, A John Wiley & Sons Ltd. Publication, 2018.
3	S. J. Chapman, “Electric Machinery Fundamentals”, Tata Mc Graw Hill publication, 4th Edition, 2011, ISBN: 9780071070522
4	M. H. Rashid “Power Electronics, Circuits, Devices and Applications”, Pearson Education Inc., 4th Edition, November 2017.
References	
1	Wakihara, Masataka, and Osamu Yamamoto, “Lithium-ion batteries: fundamentals and performance“, eds. John Wiley & Sons, 2008.
2	J. B. Gupta, “Electrical Machines”, SK Kataria and Sons, 2013, ISBN: 9789350140550
3	B.K. Bose, “Modern Power Electronics and A.C. Drives”, Prentice Hall of India Pvt. Ltd. Publication, 2002.
Useful Links	
1	https://nptel.ac.in/courses/108106170
2	https://archive.nptel.ac.in/courses/108/103/108103009/
3	https://onlinecourses.nptel.ac.in/noc22_ee53/preview

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	3					1	2							
CO2	2	2												2
CO3	2				2									
CO4	2		2	2										2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2025-26						
Course Information						
Programme	B. Tech. (MDM – Electric Vehicles)					
Class, Semester	Third Year - B. Tech., Sem. VI					
Course Code	7MD321					
Course Name	Embedded Systems for Automotive Application					
Desired Requisites:	Introduction to Electric Vehicles, Drive Systems in Electric Vehicles					
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial	-	30	20	50	100	
	-	**Credits: 3**				

Course Objectives	
1	To provide students with a comprehensive understanding of embedded system applications in automotive engineering, emphasizing the design, development, and integration of embedded solutions for vehicle control, safety, and infotainment.
2	To provide the fundamental principles, standards, and protocols governing communication within EV systems

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Discuss the practical skills in designing, programming, and testing embedded systems for vehicle control.	II	Understanding
CO2	Describe various sensors and transducers used in electric vehicles.	II	Understanding
CO3	Explore the standards and protocols for EV communication.	III	Applying
CO4	Analyse case studies and real-world implementations of EV communication protocols.	IV	Analysing

Module	Module Contents	Hours
I	**Introduction to Embedded Systems** Overview of embedded systems and their role in automotive engineering, Architecture of microcontrollers used in automotive applications, architecture, Memory Organization, Internal Peripheral Modules: Digital Input Outputs, ADC, Timer/Counters, Interrupts, UART, PWM Concepts, External Interfaces: LEDs, Switches, , Relay and Motor Driver, DSP Controllers used in EV	**8**
II	**Advanced sensors technologies and their applications in EV** Opto-electronic sensors, Fibre optic sensor, Magnetic sensors, Digital transducers, LASER based instruments, Ultrasonic sensors, Micro sensors, Smart sensor systems and applications General architecture of a smart sensor, Self-calibration of sensors, Wireless sensors, Web based instrumentation-Applications, Vibration measurement in machine tools, Position measurement of end effectors in speed measurement of road wheels in automotive system	**6**
III	**Fundamentals of CAN (Controller Area Network) Protocol** Overview of electric vehicle architecture, Importance of communication protocols in EVs, Evolution of EV communication standards, Controller Area Network (CAN), CAN protocol layers and message structure, Diagnostics and error handling in CAN	**7**
IV	**EV Charging Communication Protocols** Introduction to EV charging infrastructure, OCPP (Open Charge Point Protocol), ISO 15118 (Plug and Charge), Vehicle-to-Grid (V2G) Communication: Concept	

	and significance of V2G communication, Standards and protocols for V2G communication, Applications and challenges of V2G integration.	**7**
V	**Vehicle-to-Vehicle (V2V) and Vehicle-to-Infrastructure (V2I) Communication** Overview of V2V communication in electric vehicles, IEEE 802.11p (Wireless Access for Vehicular, Environments - WAVE), Safety and cooperative driving applications of V2V, Role of V2I communication in smart mobility, DSRC (Dedicated Short-Range Communication), Integration of V2I with traffic management systems.	**6**
VI	**Emerging Technologies and Future Trends in EV** Analysis of real-world implementations of EV communication protocols, Case studies of successful EV communication deployments, Hands on exercises and demonstrations. Threats and vulnerabilities in EV communication, Security protocols and measures for protecting EV systems, Privacy concerns and data protection regulations, limitations of EV infrastructure.	**5**

Text Books	
1	Sumedha Rajakaruna and Nick Jenkins, "Electric Vehicle Integration into Modern Power Networks", Springer (2013).
2	Frank Vahid and Tony Givargis, "Embedded System Design", Wiley
References	
1	Kathiresh, M., & Neelaveni, R., Automotive Embedded Systems. Springer International Publishing (2021).
2	Zurawski, R., Embedded Systems Handbook: Embedded systems design and verification CRC press (2018).
3	Neaimeh, M., Andersen, P.B. Mind the gap- open communication protocols for vehicle grid integration. Energy Inform 3, 1 (2020)
Useful Links	
1	P. K. Tripathi, Handbook on Electric Vehicles Manufacturing, 1 January 2022.
2	https://www.nxp.com/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1		3	3				3	3		1				3
CO2				3		2								
CO3	2				3						2		2	
CO4					3			3						

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2025-26					
Course Information					
Programme	B. Tech. (MDM – Electric Vehicles)				
Class, Semester	Third Year B. Tech., Sem. VI				
Course Code	7MD371				
Course Name	Battery Simulation and BMS Modelling Lab				
Desired Requisites:	Fundamentals of battery systems, knowledge of matlab/simulink				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives	
1	Model Battery Behaviour: To simulate equivalent circuits of Lithium-Ion batteries for understanding their electrical characteristics.
2	Parameter Measurement and Estimation: To develop skills in measuring and estimating key battery parameters such as Voltage, Current, and State of Charge (SoC).
3	Design and Simulate BMS: To design and simulate Battery Management Systems to enhance battery performance and safety.

Course Outcomes (CO)			
CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Enhance Understanding of Battery Technologies	II	Understanding
CO2	Develop proficiency in using simulation tools to model battery behaviour	III	Analyzing
CO3	Analyze and predict performance under various conditions	IV	Analyzing
CO4	Design and implement Battery Management Systems, equipping them with practical skills relevant to industry applications.	V	Evaluating

List of Experiments / Lab Activities

Battery Cell Modelling

1. Characterize individual battery cells and develop accurate models using open-source experimental data

Battery Pack Design

2. Design battery packs with different configurations (series, parallel) and analyze their performance

Battery modelling based on Equivalent Circuits

3. Simulation for Lithium-Ion Batteries to understand their electrical behaviour

Battery Parameter Measurement

4. Estimation for Voltage, Current, and State of Charge (SoC) to enhance monitoring capabilities

Battery Performance Measurement

5. Estimation for Depth of Discharge (DoD), State of Health (SoH), and State of Power (SoP) to assess battery performance, IR measurement for charging and discharging efficiency

Simulation of Battery Charging

6. Charging simulation using Non-Isolated DC-DC Converters to explore efficient charging

methods.

Design of a 2S, 4P Battery Pack

7. with a Passive BMS Circuit to apply theoretical knowledge in a practical setup.

Battery Lifecycle Testing

8. Test can include cycle life testing, battery environmental cycle testing and battery calendar life testing

BMS Algorithm Development

9. Design and test BMS algorithms for state estimation (State of Charge, State of Health) and control.

Modelling BMS in MATLAB Simulink

10. Design, deploy and test a battery management system (BMS) with control logic for voltage, current and temperature using Simulink

Implementation of CAN Protocol

11. For communication in both Passive BMS setups to ensure interoperability.

Text Books	
1	H.J. Bergveld, W.S. Kruijt, P.H.L Notten, Battery Management Systems: Design by Modelling, Philips Research Book Series, 2005
2	Xiaojun Tan, Andrea Vezzini, Yuqian Fan, Neeta Khare, You Xu, Liangliang Wei, Battery Management System and its Applications, 2022
3	Gregory L. Plett, Trimboli, M. Scott, Battery management systems, Norwood: Artech House, 2024
References	
1	Bergveld, H. J., Kruijt, W. S., Notten, P. H. L., Battery Management Systems, Springer Verlag, 2002
2	John Warner, The Handbook of Lithium-Ion Battery Pack Design: Chemistry, Components, Types and Terminology, Elsevier publications, 2015
Useful Links	
1	https://ris.utwente.nl/ws/portalfiles/portal/6087760/thesis_bergveld.pdf
2	https://in.mathworks.com/discovery/battery-models.html
3	https://www.mathworks.com/content/dam/mathworks/mathworks-dot-com/images/events/matlabexpo/in/2020/developing-battery-management-systems-using-simulink.pdf

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1						1	2			2			3	
CO2	3	2	3					1	1					
CO3					2		3	2			3			2
CO4	1		2	2										

The strength of mapping: 1:Low, 2:Medium, 3:High

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities,	Lab Course	During Week 1 to Week 6	30

	attendance, journal	Faculty	Marks Submission at the end of Week 6	
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2026-27

Course Information

Programme	B. Tech. (MDM – Electric Vehicles)
Class, Semester	Final Year - B. Tech., Sem. A/B
Course Code	7MD401
Course Name	Intelligent EV Ecosystems
Desired Requisites:	Basic knowledge of mathematics and statistics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives

1	To educate participants with need of data driven solutions for electric vehicles.
2	To acquaint participants with technologies required to create data craven solutions for electric vehicles.
3	To familiarize participants with specific techniques and approaches in Artificial Intelligence and Machine Learning useful for making smart electric vehicles.
4	To enable participants to use appropriate AI and data driven solutions for electric vehicles.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain use cases in electric vehicles that need intelligent solutions.	II	Understanding
CO2	Explain technologies and techniques required for developing intelligent solutions for electric vehicles.	II	Understanding
CO3	Use techniques for creating intelligent solutions for electric vehicles.	III	Applying
CO4	Analyse impact of techniques used for smart electric vehicles.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction to intelligent EV** Need of intelligence in EV, scenarios requiring smart solutions for EV – Battery Management System, Charging station finding and charging schedule, object detection, automated parking, ADAS braking system, driver monitoring, autonomous driving, Optimization scenarios for EV; Enabling technologies for smart EV, PEAS for EV	4
II	**Sensor technologies and communication protocols** Introduction to IoT, Physical design of IoT, Logical Design of IoT, IoT Enabling Technology, Basics of Networking, Communication Protocols, Sensor Networks, Machine- to- Machine Communications, Interoperability.	7
III	**Data Acquisition and Processing for EVs** Introduction to Data Science: Data Types and Sources, Data Cleaning and Pre-processing, Data Visualization Techniques, Data Acquisition Systems, Sensor Technologies for EVs, Data Logging and Storage, Data Processing Techniques, Feature Engineering, Data Normalization and Standardization	8
IV	**Machine Learning for EV Applications** Supervised Learning: Regression Techniques, Classification Algorithms, Unsupervised Learning: Outlier detection, Clustering Algorithms, Dimensionality Reduction Techniques, Reinforcement Learning: Basic strategy; Federated learning; Deep Learning application in EV, Tools required to implement ML techniques	9

V	**Edge and Cloud Computing for EVs** Introduction to Edge Computing and Cloud Computing, Benefits and challenges for both, architectures for both, Security challenges, analytics and processing techniques.	6
VI	**Case study** Revisiting intelligent solutions for EV, EV models in the market, State of the art Autonomous driving vehicles	5

Text Books	
1	Hamid, Umar Zakir Abdul. *Autonomous, connected, electric and shared vehicles: Disrupting the automotive and mobility sectors*. SAE International, 2022.
2	Wang, Yinhai, and Ziqiang Zeng. *Data-driven solutions to transportation problems*. Elsevier, 2018.
3	Mahmood, Zaigham. "Connected vehicles in the internet of things." *Cham, Switzerland: Springer* (2020).
References	
1	Möller, Dietmar PF, and Roland E. Haas. *Guide to automotive connectivity and cybersecurity*. Springer International Publishing, 2019.
2	Thorgeirsson, Adam Thor. "Probabilistic prediction of energy demand and driving range for electric vehicles with federated learning." (2024): 190.
Useful Links	
1	https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=10559379
2	https://www.mdpi.com/2079-9292/12/4/1044/pdf

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	1	1	1			2			1	2			2	
CO2				2			3	2						
CO3	2		3		1	3					3			
CO4	1	2								2				2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (MDM - Smart Cities)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7MD302
Course Name	Smart Infrastructure
Desired Requisites:	Understanding of urban planning concepts

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives

1	To understand the concept of smart city and associated challenges.
2	To identify latest technologies used in Infrastructural Planning.
3	To realize the foundational principles underlying IoT.
4	To implement various smart techniques used for smart city development.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the concept of smart & sustainable city and associated challenges.	III	Understanding
CO2	Identify the requirements of Smart village concept and corelate with the villages nearby	IV	Applying
CO3	Identify the latest technologies used in smart infrastructural planning.	V	Analysing
CO4	Evaluate the feasibility for infrastructural planning.	V	Creating
CO5	Create and evaluate modern tools to derive meaningful insights in designing smart cities.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction to Smart city** Defining Smart Cities & Classifying them (Greenfield, Retrofitted), Concept, History, Need, Benefits and importance of smart cities in India, Key Features, Components, Scope of a Smart city, Challenges and future trends of Smart City	6
II	**Smart Village Ecosystem** Smart irrigation, weather monitoring and forecasting, precision agriculture, soil health monitoring, Smart Green House, Hydroponics farming, animal tracking, remotely monitoring the health of an animal, Smart Aquaculture	5
III	**Infrastructure Management System** Infrastructure Management in India, Challenges, Objectives, Various types of Infrastructure Services, Applications for Existing Smart City. Implementing smart infrastructure: Some key challenges and policy instruments, Key drivers for Smart Cities Infrastructure, Social and cultural aspects of smart infrastructure.	6
IV	**Smart Technologies for Safety and Disaster Management** Introduction to Disaster Management, Phases of disaster management, Role of technology in disaster management, Drones for Disaster Management, Smart home, Street lighting, Safety and surveillance, Real-world examples of smart technologies in disaster management	6
V	**Smart Technologies for environment management:**	6

	Technologies for - Water Management, Waste Management, Air Quality Management, Energy Management.	
VI	**Intelligent Transport Systems** Smart mobility and transportation, Intelligent transport system and traffic management, Components of ITS, Challenges and opportunities in ITS, Multimodal transportation, Navigation system- GPS, Cellular Technologies for Vehicular Communication, Connected and Autonomous Vehicles Smart parking, Smart Fleet Management System.	7

Text Books	
1	Jo Beall, "A city for all: valuing differences and working with diversity"; Zed books limited, London (ISBN: 1- 85649-477-2), 1997.
2	Rhind and H. Mounsey, Understanding GIS. Taylor and Francis. London, 1989.
3	Arshdeep Bahga, Vijay Madisetti, "Internet of Things – A hands-on approach", Universities Press, 2015
4	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", and Wiley, 2012
5	Amit Kumar Tyagi, Niladuri Srinath, "Intelligent Transportation Systems: Theory and Practice", Springer Nature Publication, 2022.
References	
1	Peter O'Connell, GIS for Urban and Regional Planning"
2	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry, "IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things", 1st Edition, Pearson Education (Cisco Press Indian Reprint).
3	Zaigham Mahmood, Internet of Things for Smart Cities: Technologies, Big Data and Security
4	75+ case studies of Innovative Projects of Smart Cities Mission, National Institute of Urban Affairs, 2023
5	Technical Report on IoT/ICT enablement in Smart Village and Agriculture, TEC, Department of Telecommunications, 2021 (https://www.tec.gov.in/M2M-IoT-technical-reports)
Useful Links	
1	https://tomorrow.city/a/technology-for-smart-cities-the-pillars-of-urban-planning-of-the-future
2	https://www1.nyc.gov/assets/forward/documents/NYC-Smart-Equitable-City-Final.pdf
3	https://smartcity.go.kr/wp-content/uploads/2019/08/Smart-city-broschureENGLISH.pdf
4	http://indiansmartcities.in/downloads/CONCEPT_NOTE_3.12.2014_REVISED_AND_LATEST.pdf

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1		1				1				1	1		3	1
CO2				2									3	1
CO3	3		3			2							3	1
CO4	3	3			3	3							3	1
CO5	1			2		3				3			3	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2025-26						
Course Information						
Programme	B. Tech. (MDM - Smart Cities)					
Class, Semester	Third Year B. Tech., Sem. VI					
Course Code	7MD322					
Course Name	Data Science and Analytics for Smart Cities					
Desired Requisites:	Basics mathematics, statistics and Python programming					
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial	-	30	20	50	100	
	-	**Credits: 3**				

Course Objectives	
1	To introduce concepts, functions and services of IoT system, data handling and cloud computing.
2	To inculcate the concepts of data science, analytics and know-how of the various data processing tools.
3	To acquire the knowledge of data analytics and analysis along with the challenges involved in the implementation.
4	To explore visualization techniques for data analytics.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Understand the fundamentals of IoT system and its relevance in real-world applications, cloud platforms and importance of data security	II	Understanding
CO2	Understand various cloud platforms and its data handling techniques in these platforms	III	Understanding
CO3	Apply appropriate data analytics tools to manage, present, and interpret complex data, enabling generation of meaningful insights.	IV	Analysing
CO4	Integrate and apply data analytics concepts to develop innovative solutions for complex problems related to Smart Cities.	V	Creating

Module	Module Contents	Hours
I	**Fundamentals of IoT, data security and cloud platforms** Introduction, IoT Ecosystem, building blocks, Layers and Architecture, Functions of IoT Devices, Sensors, Actuators and interfaces used in IoT system, Network protocols, Wireless communication, IoT security and privacy, Edge, Fog and Cloud Computing, Introduction to cloud storage models and IoT platforms, Amazon Web Services (AWS), Microsoft Azure, Google Cloud, PTC Thingworx, MATLAB Thingspeak, IBM Watson.	7
II	**Essentials of Data Science and Analytics** Fundamentals of data science, Introduction to big data and analytics, Tools and Technology for big data, Scope and Significance, Structured Versus Unstructured data, Primary and Secondary data, Edge Streaming Analytics, Understanding the various levels of data, dealing with categorical variable, kinds of Data Analytics – Descriptive, Diagnostic, Predictive and Prescriptive, quantifications of opinion and attitude of people,	7
III	**Data Visualization Tools and Techniques** Introduction to Visualization Tools, Basic and Advanced Visualization Tools, Creating Maps and Visualizing Geospatial Data, Control Flow (Conditionals,	6

	Loops), Functions and Modules, Python NUMPY, PANDAS, Data Structures, Data visualization using R/Tableau, Python- matplotlib/ seaborn liabraries for visualization.	
IV	**Machine Learning (ML) Models** ML Fundamentals, Supervised (Linear, Logistic Regression) and Unsupervised Learning, Classification Algorithms (Decision Trees, KNN, Naive Bayes, SVM), Ensemble Methods (Random Forest, Gradient Boosting), Clustering Algorithms (K-means, DBSCAN), Model Evaluation Metrics – Recall, Precision, accuracy etc. Cross-Validation, Hyperparameter Tuning, error, ethical surveillance.	7
V	**Citizen-Centric Urban Analytics** Urban Analytics and Applications, Implications of data collection and analytics on Buildings, Places, and Transport, Utilities, Services and Governance, Proximity and Diversity	6
VI	**Case studies of Data Science Applications for Smart Cities** A Case Study of NEOM City, Saudi Arabia, Indian Smart City – Indore, Nagpur, Allahabad and Dehradun Data analytics for the various use cases in the Smart City.	6

Text Books	
1	Joel Grus "Data Science From Scratch: First Principles with Python", Second Edition (Greyscale Indian Edition) Paperback – 5 May 2019
2	McKinney, W., Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media, 2017.
3	R. Nageswara Rao, ―Core Python Programming, Dreamtech Press, 2nd Edition, 2017
4	Olivier Hersent, David Boswarthick, Omar Elloumi, "The Internet of Things – Key applications and Protocols", and Wiley, 2012
References	
1	Amir Alavi, William G. Buttlar, Data Analytics for Smart Cities, CRC press, 2019
2	Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
3	Jasbir Singh Dhaliwal, Architectural Patterns and Techniques for Developing IoT Solutions, Packt Publishing Ltd, 2023.
Useful Links	
1	vhttps://www.udemy.com/course/python-for-data-analysis visualization/?couponCode=LEARNNOWPLANS
2	https://onlinecourses.nptel.ac.in/noc21_cs45/preview
3	https://onlinecourses.nptel.ac.in/noc22_cs53/preview

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	3				1								2	
CO2	3	1												
CO3		3		2	3		1						2	
CO4		2	2	2	1								1	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (MDM - Smart Cities)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7MD372
Course Name	Smart Infrastructure Testbeds
Desired Requisites:	Fundamentals of IoT, Python programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	The testbed allows students to interact with real-world smart city technologies and applications, fostering a deeper understanding and practical skills.
2	Applications of IoT sensors, wireless communication modules, and data analytics tools in real-world use cases.
3	The testbed mimics real-world urban environments, allowing students to test and refine solutions in a controlled condition

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Identify and select various types of sensors used in Smart City	II	Understand
CO2	Allow for the addition of new applications and components as needed, ensuring it remains relevant to emerging smart city trends.	III	Apply
CO3	To prioritize user experience and resource efficiency, ensuring that smart city solutions are effective and sustainable.	IV	Analyse
CO4	Create a platform for real-world experimentation and innovation in urban environments.	V	Evaluate

List of Experiments / Lab Activities

Total 9 systems to be built out of 15 listed below

Smart Buildings

1. Indoor Air Quality Monitoring System for the Auditorium
2. Motion sensing lights, fans, ACs for Classroom
3. Air temperature and humidity monitoring systems in Campus

Energy Management

4. Energy analytics and creation of dashboard of the energy consumption of various departments
5. Water meter digitization in the campus
6. Integrated Smart Lighting Systems
7. Smart EV charging system

Pollution Monitoring Systems

8. Low-cost air pollutant monitoring systems
9. Non-invasive water quality analysis

Waste management system

10. Separation of metallic and non-metallic waste

11. Smart Compost making systems
12. Food Waste Analytics and Visual Feedback for Benchmarking and Behaviour Changes
13. Computer Vision to Classify Waste
14. Smart vehicle tracking of garbage collection vehicles of municipal corporation

Security & Safety

15. Fire and smoke detection system at Server Rooms
16. Suspicious movement detection and safety systems
17. Facial Recognition for Library Services

Text Books	
1	Joel Grus "Data Science From Scratch: First Principles with Python" , Second Edition (Greyscale Indian Edition) Paperback – 5 May 2019
2	McKinney, W.(2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media.
3	R. Nageswara Rao, ―Core Python Programming, Dreamtech Press, 2nd Edition, 2017
References	
1	Amir Alavi, William G. Buttlar, Data Analytics for Smart Cities, CRC press, 2019
2	Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
3	Jasbir Singh Dhaliwal, Architectural Patterns and Techniques for Developing IoT Solutions, Packt Publishing Ltd, 2023.
Useful Links	
1	vhttps://www.udemy.com/course/python-for-data-analysis visualization/?couponCode=LEARNNOWPLANS
2	https://onlinecourses.nptel.ac.in/noc21_cs45/preview
3	https://onlinecourses.nptel.ac.in/noc22_cs53/preview
4	vhttps://www.udemy.com/course/python-for-data-analysis visualization/?couponCode=LEARNNOWPLANS

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1														1
CO2				3	1		2			2	1			
CO3		3	2					1						
CO4	3					2			3				2	

The strength of mapping: 1:Low, 2:Medium, 3:High

Assessment

There are three components of lab assessment, LA1, LA2, and Lab ESE
IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40

Week 1 indicates the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2026-27					
Course Information					
Programme	B. Tech. (MDM - Smart Cities)				
Class, Semester	Final Year B. Tech., Sem. A/B				
Course Code	7MD402				
Course Name	Green Technology and Sustainability				
Desired Requisites:	Fundamentals of Urban Planning, Renewable energy				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives	
1	To learn about the concept of green technology, its importance, and its impact on society and the environment.
2	To understand the economic benefits associated with green technology adoption, such as cost savings and increased efficiency.
3	To evaluate the environmental impact of products and processes using LCA and other tools.
4	To promote sustainable practices in their personal and professional lives.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Understand various environmental problems and the importance of sustainable practices in mitigating them.	III	Understanding
CO2	Provides knowledge about specific green technologies, such as renewable energy, green building, and sustainable transportation.	V	Applying
CO3	Apply green technology principles in various fields, such as industry, building design, and transportation.	V	Analysing
CO4	Develop green technologies and sustainable solutions to address environmental challenges	V	Creating

Module	Module Contents	Hours
I	**Green Technology** Definition and Concept of Green Technology, Importance, Benefits, Challenges, Key Applications of Green Technologies, Role of Industry, Government and Institutions, Criteria for Selection of Green Technologies, Overview of ISO 14000 (Environmental Management Systems - EMS)	6
II	**Sustainable Development and Green Buildings** Introduction, Concept, Sustainable Building- Housing, Sustainable materials and green building, features of green building rating systems in India: LEED, GRIHA, Indian Green Building Council (IGBC). Energy Saving System, ECBC requirement, Concepts of Overall Thermal Transfer Value (OTTV)	6
III	**Sustainable Energy** Definition, key principles, importance, Examples of Sustainable Energy Sources, Introduction and Fundamental Concepts, Energy Scenario in Modern World, Sustainable Energy Technologies, Energy Policy and Economics, Environmental Impact Assessment, Bioenergy and biofuels, Trends in Energy Storage Types and their Characteristics, Circular Economy in the Energy Sector	7
IV	**Design for Sustainability** Environmental Design for Sustainability, Economic, Environmental Indicators,	6

	Social Performance Indicators, Sustainable Engineering Design Principles and Environmental Cost Analysis.	
V	**Climate Change and ESG (Environmental, Social, and Governance)** Climate change Impacts, Risk, Adaptation and Mitigation, Introduction to ESG regulation, reporting, and accounting, ESG data audit, control and analytics,	6
VI	**Carbon Footprint and Credit** Understanding Carbon Credits and their calculations, carbon footprint, Carbon Markets, The carbon credit certification process, Carbon trading, Carbon Capture, Utilization, and Storage (CCUS), Carbon Capture Technologies, Techno-Economic Aspects of CCUS.	7

Text Books	
1	Ritu Singh, Sanjeev Kumar, Green Technologies and Environmental Sustainability, Springer, 2017
2	Purohit SS, Green Technology: An Approach For Sustainable Environment, M/s AGROBIOS (INDIA), 2021
3	Dr. Shiv Mahendra Singh Dr. Azad Kumar, Dr. Ashok Kumar, Major Mukesh Kumar, Green Technology for the Sustainable Development, Bluerose Publishers, 2023
References	
1	Maulin P Shah, Alok Prasad Das, Advanced Green Technology for Environmental Sustainability and Circular Economy, CRC Press, 2024
2	Bhupinder Dhir, Technology for a Sustainable Environment, Bentham Books, 2023
3	Daren Tang, Green Technology Book 2022 Solutions for climate change adaptation, WIPO, 2022.
4	Dustin Mulvaney, Green Technology An A-to-Z Guide, SAGE Publications, 2013
Useful Links	
1	https://ocw.mit.edu/collections/environment/:
2	https://onlinecourses.nptel.ac.in/noc23_me138/preview
3	https://skillsbuild.org/adult-learners/explore-learning/sustainability:
4	https://www.keaipublishing.com/en/journals/green-technologies-and-sustainability/:

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1		1				3	1			1	1		3	1
CO2				2		2							3	1
CO3	3		3				2						3	1
CO4	3	3			3		3						3	1
CO5			3				1	3		1			1	3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2025-26					
Course Information					
Programme	B. Tech. (MDM – FinTech)				
Class, Semester	Third Year B. Tech., Sem. V				
Course Code	7MD303				
Course Name	Risk Management and Compliance				
Desired Requisites:	Introduction to Financial Markets (Recommended)				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives	
1	To provide an understanding of different types of financial and operational risks.
2	To explore risk management techniques and their application in financial markets and institutions.
3	To introduce students to compliance frameworks and regulatory environments in India.
4	To enhance awareness of enterprise risk management (ERM) and global standards such as Basel norms.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Identify various types of risk faced by businesses and financial institutions.	II	Identify / Understand
CO2	Analyze techniques and tools for risk measurement and mitigation.	III	Analyze
CO3	Evaluate compliance requirements and legal frameworks in the Indian context.	IV	Apply
CO4	Apply risk management strategies in practical financial scenarios.	V	Evaluate

Module	Module Contents	Hours
I	**Business Structures and Legal Compliance** Sole proprietorship, partnership, limited liability partnership (LLP), private limited company, public limited company. Key legal and compliance aspects of each form.	5
II	**Introduction to Risk Management** Definition of risk, types of risk (credit, market, operational, liquidity, legal, reputational). Importance of risk management in finance. Risk vs Uncertainty.	4
III	**Risk Identification and Assessment** Risk measurement tools – Value at Risk (VaR), sensitivity analysis, stress testing. Risk quantification – Exposure, probability, and impact.	6
IV	**Risk Mitigation and Control** Hedging, diversification, insurance, derivatives for risk management (brief intro). Internal controls, audit, and monitoring. Risk appetite and tolerance.	6
V	**Compliance and Regulatory Environment in India** Role of SEBI, RBI, IRDAI.	6

	Overview of key regulations – FEMA, PMLA, Companies Act compliance. AML (Anti-Money Laundering) and KYC norms.	
VI	**Industry-Specific Risk and Compliance** Risk and compliance in Banking, Insurance, Manufacturing, and IT. Case studies of regulatory lapses and corporate failures. Role of internal audit and compliance officers. Practical Component: Analyze a real-life regulatory breach in a sector-specific context and suggest corrective strategies. (Global Financial Crisis – 2008)	6

Text Books	
1	John C. Hull, Risk Management and Financial Institutions, Wiley publications
2	George Rejda, Principles of Risk Management and Insurance: A Managerial Perspective, Pearson publications
References	
1	Abhishek Tripathi, Compliance Management in Financial Industries (Taxmann)
2	James Lam, Enterprise Risk Management: From Incentives to Controls
Useful Links	
1	**SEBI:** https://www.sebi.gov.in
2	**RBI:** https://www.rbi.org.in
3	**IRDAI:** https://www.irdai.gov.in
4	**Investopedia:** https://www.investopedia.com
5	**BIS (Basel):** https://www.bis.org

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1												1	
CO2	2												1	
CO3		2	1										1	
CO4			1	2									1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2025-26						
Course Information						
Programme	B. Tech. (MDM – FinTech)					
Class, Semester	Third Year B. Tech., Sem. VI					
Course Code	7MD323					
Course Name	Financial Modelling					
Desired Requisites:	Basic Excel, mathematics, finance and accounting concepts					
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial	-	30	20	50	100	
	-	**Credits: 3**				

Course Objectives	
1	To introduce concepts, functions and services of IoT, data handling and cloud computing.
2	To inculcate the concepts of data science, analytics and know-how of the various data processing tools.
3	To acquire the knowledge of data analytics and analysis and the challenges involved in the implementation.
4	To explore visualization techniques for data analytics.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Understand the fundamentals of IoT and its relevance in real-world applications, cloud platforms and importance of data security	II	Understanding
CO2	Understand various cloud platforms and how the data is handled in these platforms	III	Applying
CO3	Apply appropriate data analytics tools to manage, present, and interpret complex data, enabling generation of meaningful insights.	IV	Analysing
CO4	Construct a fully parameterized financial model for the enterprise for decision making	V	Creating

Module	Module Contents	Hours
I	**Advanced Excel for Financial Modeling** Goal Seek Data Tables Scenario Manager, Introduction to the look function category, H look application case, Index function and Match function to counter, Logical operator in excel and its use in financial Modeling, Sum if functions, Pivot, Slicer and dashboard using excel, Python add-in for Excel	5
II	**Mathematics and statistics for Finance** Introduction to Time value of money and the concept of compounding, present value, Future Value, Rate, Nper, Beg and End calculations, NPV, Discount rate calculation Introduction to central tendency and application using data, Creating histogram, Frequency polygon and Cumulative frequency chart. Distribution charts and inferences. Dispersion calculations- St Dev, Range, Drawdown and its application. Beta, Co variance calculation and use.	6

III	**Integrated Financial Modeling** Working capital Project cash flows based on historical metrics Create debt, equity, and working capital supporting schedules Review how financial statements tie together and balance the model Integrate the income statement, balance sheet, and cash flow statement in Excel	7
IV	**DCF Modeling and Sensitivity Analysis** Calculate unlevered free cash flow from the integrated model Discount cash flows using the WACC Derive a share price from total company value Scenario Manager analysis in excel, Data Table analysis in excel	7
V	**Stock Data Analysis and Equity Valuation** Stocks Data Analysis, Asset Allocation and Statistical Data Analysis, Predict Future Stock Prices Using Machine/Deep Learning, Perform Sentiment Analysis on Stocks Data Free cash flow calculations, estimation of the cost of equity, calculation of weighted average cost of the capital, valuation using DCF	6
VI	**Fintech for Entrepreneur** Discussion of financial plan for start-up project requirements, exit strategies for startups, different ways for raising funds, financial projection for enterprise, marketing strategies and business plan.	8

Text Books	
1	Smith J., Smith R., and Bliss R. – Entrepreneurial finance, strategy, valuation and deal structure-Stanford university press, 2011
2	Damodaran A., Corporate Finance: theory and practice, John Wiley and Sons, 2001.
3	McKinney, W. Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media, 2017.
4	Mays T.R, Financial Analysis with Microsoft Excel 2016, Cengage Learning, 2017
References	
1	Samonas M. , 2015, Financial Analysis Forecasting and Modelling, A Framework for long-term forecasting, Wiley,
2	Damodaran A., The dark side of valuation, Valuing young, distressed, and complex businesses, FtPress
Useful Links	
1	https://www.udemy.com/course/python-for-data-analysis-visualization/?couponCode=LEARNNOWPLANS
2	https://onlinecourses.nptel.ac.in/noc21_cs45/preview
3	https://onlinecourses.nptel.ac.in/noc22_cs53/preview

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2	3	3				3			2			2	
CO2				3										2
CO3					3				1		2			
CO4					3	3		3						
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be

field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (MDM - FinTech)
Class, Semester	Third Year - B. Tech., Sem. VI
Course Code	7MD373
Course Name	FinTech Entrepreneurship Lab
Desired Requisites:	Basics of Finance, Mathematics and entrepreneurship development

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	Building financials from scratch and evolving them into full blown financial models.
2	To develop a project from idea to business strategy and pitch presentation
3	To learn to translate feasible business ideas into compelling business strategies and successful start-ups.
4	Ability to develop innovative and entrepreneurial mindset.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Understand the Lean Canvas concept for the start-up pitch in FinTech	II	Understanding
CO2	Learn about the venture creation process from founders, and industry experts.	III	Applying
CO3	Gain understanding of investor needs and practice the pitching of ideas	IV	Analyzing
CO4	A hands-on tutorial building financials in Google Sheets or Microsoft Excel.	V	Evaluating

List of Experiments / Lab Activities

Complete any 10 Experiments below (Last 3 are compulsory)

1. Conduct a comprehensive valuation and impact analysis for a VC portfolio company in the renewable energy space
2. Build detailed valuation analysis for any bank
3. Case study of financial analysis of insurance company
4. The Future of Data-Driven Finance – Case studies in Banking, Financial Services, and Insurance
5. Case study on Angel Investor and its portfolio analysis
6. Unit economics for startup projections
7. Case study of IP protection, commercialization process and licensing
8. Study of successful startup from lab to market
9. Technical and fundamental analysis of 5 stocks each in banking and financial sectors
10. Understanding the technology transfer process of the startups
11. Prepare a Business Model Canvas and the Value Proposition Canvas for the startup idea
12. Develop a business and financial model for a start-up company of your own
13. Prepare your own Startup Project pitch

Text Books

1	Ashok Mittal, The Fintech Entrepreneur's Guide, BPB publications, 2022
2	Dave Lisheg, The Founder’s Guide to Financial Modeling, ebook, 2019
3	Loesch Stefan, A Guide to Financial Regulation for Fintech Entrepreneurs, Wiley
4	Gupta CB (Dr), Srinivasan N.P, Entrepreneurial Development in India, Sultan Chand & Sons, 2013
References	
1	Meyer, M. H., & Crane, F. G., Entrepreneurship: An innovator's guide to startups and corporate ventures. SAGE Publications, 2010
2	Ries, E., The lean startup: How today's entrepreneurs use continuous innovation to create radically successful businesses. Random House LLC, 2011
3	Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley, 2016
Useful Links	
1	https://www.youtube.com/watch?v=AMKgcBzK7cg
2	https://www.impactstartupacademy.com/blog/a-guide-to-unit-economics-for-startups
3	http://www.themacro.com/articles/2016/01/how-to-raise-a-seed-round/

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1						1	2			2			3	
CO2	3	2	3					1	1					
CO3					2		3	2			3			2
CO4	1		2	2										
The strength of mapping: 1:Low, 2:Medium, 3:High														

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2026-27					
Course Information					
Programme	B. Tech. (MDM – FinTech)				
Class, Semester	Final Year B. Tech., Sem. A/B				
Course Code	7MD403				
Course Name	Data Science and Analytics for FinTech				
Desired Requisites:	Basic mathematics, statistics and Python programming				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives	
1	To introduce concepts, functions and services of IoT, data handling and cloud computing.
2	To inculcate the concepts of data science, analytics and know-how of the various data processing tools.
3	To acquire the knowledge of data analytics and analysis and the challenges involved in the implementation.
4	To explore visualization techniques for data analytics.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Understand the fundamentals of IoT and its relevance in real-world applications, cloud platforms and importance of data security	II	Understanding
CO2	Understand various cloud platforms and how the data is handled in these platforms	III	Applying
CO3	Apply appropriate data analytics tools to manage, present, and interpret complex data, enabling generation of meaningful insights.	IV	Analysing
CO4	Integrate and apply financial technology (FinTech) and data analytics concepts to develop innovative solutions for complex financial problems.	V	Creating

Module	Module Contents	Hours
I	**Fundamentals of IoT, data security and cloud platforms** Introduction, IoT Ecosystem, Building blocks, Layers and Architecture, Functions of IoT Devices, Benefits/challenges, Sensors, Actuators and interfaces, Network protocols, Wireless communication, IoT security and privacy, Data privacy frameworks and best practices, Edge, Fog and Cloud Computing, Emerging Trends - Role of block chain, 5G Introduction to cloud storage models and IoT platforms, Amazon Web Services (AWS), Microsoft Azure, Google Cloud, PTC Thingworx, MATLAB Thingspeak, IBM Watson.	7
II	**Essentials of Data Science and Analytics** Fundamentals of data science, Introduction to big data and analytics, Tools and Technology for big data, Scope and Significance, Structured Versus Unstructured Primary data and Secondary data, Edge Streaming Analytics, Understanding the	7

	various levels of data, dealing with categorical variable, quantifications of opinion and attitude of people, kinds of Data Analytics – Descriptive, Diagnostic, Predictive and Prescriptive	
III	**Data Visualization Tools and Techniques** Introduction to Visualization Tools, Basic and Advanced Visualization Tools, Creating Maps and Visualizing Geospatial Data, Introduction to Python, Control Flow (Conditionals, Loops), Functions and Modules, Data Structures, Data visualization using R/Tableau, Python- matplotlib:	6
IV	**Machine Learning (ML) Models** ML Fundamentals, Supervised (Linear, Logistic Regression) and Unsupervised Learning, Classification Algorithms (Decision Trees, KNN, Naive Bayes, SVM), Ensemble Methods (Random Forest, Gradient Boosting), Clustering Algorithms (K-means, DBSCAN), Model Evaluation Metrics – Recall, Precision, accuracy etc. Cross-Validation, Hyperparameter Tuning.	7
V	**Financial Data Analysis** Stocks Data Analysis, Asset Allocation and Statistical Data Analysis, Capital Asset Pricing Model (CAPM), Predict Future Stock Prices Using Machine/Deep Learning, Perform Sentiment Analysis on Stocks Data	6
VI	**Scenarios, Applications and Case Studies in FinTech** Case studies covering banking, insurance and financial service companies.	6

Text Books	
1	Joel Grus "Data Science From Scratch: First Principles with Python", Second Edition (Greyscale Indian Edition) Paperback – 5 May 2019
2	McKinney, W., Python for Data Analysis: Data Wrangling with Pandas, NumPy and IPython. 2nd edition. O'Reilly Media, 2017.
3	Jaspal Singh, Financial Technology (FinTech) and Digital Banking in India Hardcover, 2022
4	Frederic de Mariz, Finance with a Purpose, FinTech, Development and Financial Inclusion in the Global Economy, 2022
References	
1	Charles-Albert Lehalle, Amine Raboun, Financial Markets in Practice From Post-Crisis Intermediation to FinTechs, 2022
2	Raj Kamal, "Internet of Things: Architecture and Design Principles", 1st Edition, McGraw Hill Education, 2017.
3	Susanne Chishti, Janos Barberis, The FINTECH Book: The Financial Technology Handbook for Investors, Entrepreneurs and Visionaries, Wiley, 2016
Useful Links	
1	https://nptel.ac.in/courses/110105121
2	https://onlinecourses.nptel.ac.in/noc21_mg93/preview

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1		1				1				1	1		3	1
CO2				2				3	2					2
CO3	3		3			2	2							1
CO4	2	3			3	3								
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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AY 2025-26

Course Information

Programme	B. Tech. (MDM - Artificial Intelligence and Machine Learning)
Class, Semester	Third Year B. Tech., Sem. V
Course Code	7MD305
Course Name	Mathematics for Artificial Intelligence
Desired Requisites:	Basic Mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To grasp foundational principles of probability, statistics, and set theory relevant to AI.
2	To use vector space correctly in solving AI problems
3	To characterize randomness and assess probabilistic behavior.
4	To develop mathematical data-driven decision-making skills in AI.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain fundamental set theory and probability concepts to model problems under uncertainty.	II	Understand
CO2	Interpret linear algebra from Machine Learning point of view.	III	Apply
CO3	Analyze concepts of statistical inference to draw conclusions from data, including estimation and hypothesis testing	IV	Analyse
CO4	Value statistical tools to support evidence-based decision-making in practical contexts.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Set Theory** Fundamentals of Sets: Definition of a set, Methods of describing sets (roster and set-builder), Types of sets: Finite, infinite, equal, singleton, null, universal. Subsets and proper subsets, Venn diagrams and basic set representation Set Operations: Union, intersection, difference, symmetric difference, Complement of a set. Laws of set operations (commutative, associative, distributive). De Morgan's laws.	6
II	**Linear Algebra** Vector space, subspaces, linear dependence and independence of vectors, matrices, projection matrix, orthogonal matrix, idempotent matrix, partition matrix and their properties, quadratic forms.	7
III	**Systems of linear equations and solutions** Gaussian elimination, eigenvalues and eigenvectors, determinant, rank, nullity, projections, LU decomposition, singular value decomposition.	6
IV	**Probability** Counting (permutation and combinations), probability axioms, Sample space, events, independent events, mutually exclusive events, marginal, conditional and joint probability, Bayes Theorem.	6

V	**Statistics** Conditional expectation and variance, mean, median, mode and standard deviation, correlation, and covariance, random variables, discrete random variables and probability mass functions, uniform, Bernoulli, binomial distribution.	6
VI	**Advanced Statistics** Continuous random variables and probability distribution function, uniform, exponential, Poisson, normal, standard normal, t-distribution, chi-squared distributions, cumulative distribution function, Conditional PDF, Central limit theorem, confidence interval, z-test, t-test, chi-squared test, A/B Test.	7

Textbooks	
1	Liu, C. L., and D. P. Mohapatra. Elements of Discrete Mathematics: A Computer-Oriented Approach. 3rd ed., Tata McGraw-Hill, 2008.
2	Lay, David C., Steven R. Lay, and Judi J. McDonald. Linear Algebra and Its Applications. 5th ed., Pearson, 2016.
3	Mendenhall, William, Robert J. Beaver, and Barbara M. Beaver. Introduction to Probability and Statistics. 15th ed., Cengage Learning, 2019.
4	Walpole, Ronald E., Raymond H. Myers, Sharon L. Myers, and Keying E. Ye. Probability and Statistics for Engineers and Scientists. 9th ed., Pearson, 2012.

References	
1	Stewart, James. Calculus. 8th ed., Cengage Learning, 2015.
2	Strang, Gilbert. Introduction to Linear Algebra. 5th ed., Wellesley-Cambridge Press, 2016.
3	Papoulis, Athanasios, and S. Unnikrishna Pillai. Probability and Statistics. 4th ed., Pearson, 2002.

Useful Links	
1	https://archive.nptel.ac.in/courses/111/104/111104144/
2	https://archive.nptel.ac.in/courses/111/106/111106135/
3	https://archive.nptel.ac.in/courses/111/105/111105090/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1									1			
CO2	2	2	1		1				1		1		1	1
CO3	2	3	1	2	2						2		3	2
CO4	3	2	1	3	3		2	1	1	1	2		2	3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2025-26

Course Information

Programme	B. Tech. (MDM - Artificial Intelligence and Machine Learning)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7MD325
Course Name	Machine Learning
Desired Requisites:	Essentials of AI, Mathematics for AI.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To introduce foundational principles of Machine Learning (ML).
2	To equip students with practical implementation skills using tools like scikit-learn, ensuring they can build and test ML models on real-world datasets.
3	To foster analytical thinking by training students to evaluate models using appropriate statistical and performance metrics.
4	To guide students through end-to-end project development, including data pre-processing, feature engineering, algorithm selection, model tuning, and final deployment.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain core concepts, techniques, and workflows in machine learning.	II	Understand
CO2	Implement supervised learning algorithms using Python-based libraries.	III	Apply
CO3	Compare ML algorithms based on clustering techniques.	IV	Analyse
CO4	Interpret model performance using accuracy metrics, confusion matrix, ROC-AUC, etc.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to Machine Learning:** Introduction to ML – Definitions, Applications, Types (Supervised, Unsupervised, Reinforcement), Steps in ML Pipeline – Problem Formulation to Model Evaluation, Data Pre-processing – Cleaning, Normalization, Feature Scaling, Feature Engineering – Selection and Extraction, Bias-Variance Trade-off, Overfitting, Underfitting, Cross-validation & Train-Test Split Strategies	6
II	**Supervised Learning Algorithms:** Linear Regression – Theory, Cost Function, Gradient Descent, Polynomial and Ridge Regression, Logistic Regression – Binary & Multiclass, Decision Trees – ID3, Gini Index, Entropy, Random Forest – Ensemble Learning, K-Nearest Neighbors – Distance Metrics, Support Vector Machines – Margins & Kernels, Naive Bayes Classifier.	8

III	**Unsupervised Learning Algorithms:** **Clustering – K-Means, Hierarchical Clustering** – Dendrograms, DBSCAN and Density-Based Clustering, Dimensionality Reduction: PCA, t-SNE & LDA Basics, Applications of Unsupervised Learning in Real World	6
IV	**Model Evaluation & Tuning:** Confusion Matrix, Accuracy, Precision, Recall, F1 Score, ROC Curve & AUC, Hyperparameter Tuning – Grid Search, Random Search, Model Selection – Validation Curves, Learning Curves, Handling Imbalanced Data – SMOTE, Class Weights	6
V	**Neural Networks:** Introduction to Neural Networks – Perceptron, Backpropagation & Activation Functions, Multilayer Perceptrons (MLP) & Optimization (SGD, Momentum Based, NAG, Adam), Explainability in ML – SHAP, LIME (Brief).	7
VI	**Applications, Tools & Case Studies:** Ethics in AI, Pipeline creation and deployment process, Tools: Tensorflow, Pytourch, ML for various disciplines – Credit Scoring, ML in Recommendation Systems. Brief on MLOps.	6

Textbooks	
1	Mitchell, Tom M. Machine Learning. 1st ed., McGraw-Hill, 1997.
2	Géron, Aurélien. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. 3rd ed., O'Reilly Media, 2023.
References	
1	Bishop, Christopher M. *Pattern Recognition and Machine Learning*. 1st ed., Springer, 2006.
2	Murphy, Kevin P. Machine Learning: A Probabilistic Perspective. 1st ed., MIT Press, 2012.
Useful Links	
1	scikit-learn: https://scikit-learn.org/stable/documentation.html
2	NPTEL https://onlinecourses.nptel.ac.in/noc23_cs18/preview
3	Andrew Ng – Machine Learning (Coursera) https://www.coursera.org/learn/machine-learning

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2				1									1
CO2				3		2					1			3
CO3	1	3	2								2		3	
CO4	3			1	1	2							2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2025-26

Course Information

Programme	B. Tech. (MDM - Artificial Intelligence and Machine Learning)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7MD375
Course Name	Artificial Intelligence & Machine Learning Lab
Desired Requisites:	General computer proficiency, Python language knowledge

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	Develop the ability to solve problems using state-space search techniques.
2	Equip students with practical skills in data preparation and pre-processing techniques.
3	Provide hands-on experience with core machine learning algorithms and their implementation.
4	Develop the ability to evaluate and interpret machine learning model performance.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Represent logical statements using propositional and predicate logic.	II	Understand
CO2	implement search strategies (BFS, DFS) and analyze their performance in state-space problems like the 8-puzzle.	III	Apply
CO3	Analyze model performance using cross-validation, performance metrics, and hyperparameter tuning.	IV	Analyze
CO4	Design an end-to-end ML pipeline integrating pre-processing, modeling, evaluation, and domain-specific application.	V	Create

List of Experiments / Lab Activities/Topics

List of Lab Activities: Perform any 10 experiments and study various AI/ML tools

Note: Assume suitable data.

1. Write a program to generate truth tables for given propositional logic formulas.
2. Implement resolution-based inference for propositional logic statements.
3. Implement search algorithms to solve the 8-puzzle problem or similar search problems.
4. Create a simple game (e.g., Tic-Tac-Toe) and implement the minimax strategy.
5. Load a dataset (e.g., Iris, Titanic) and perform basic exploratory data analysis.
6. Handle missing values, outliers, and perform feature scaling, encoding (Label, One-Hot).
7. Implement linear regression on a dataset (e.g., housing prices) and evaluate R^2 score and MSE.
8. Apply logistic regression on a binary dataset and plot decision boundaries.
9. Train and visualize decision trees and evaluate feature importance.
10. Use KNN on the Iris dataset and analyze accuracy with different K values.
11. Implement linear and non-linear SVM with different kernels (RBF, Polynomial).
12. Apply K-Means to a dataset, use the elbow method to choose K, and visualize clusters.
13. Apply PCA on a multivariate dataset and visualize the reduced dimensions.
14. Perform k-fold cross-validation and tune hyperparameters.

15. Build a simple feedforward neural network for dataset classification.	
Textbooks	
1	*Géron, Aurélien. Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow. 3rd ed., O'Reilly Media, 2023.*
References	
2	Pedregosa, Fabian, et al. *Scikit-learn: Machine Learning in Python*. Version 1.4.2, scikit-learn developers, 2024, https://scikit-learn.org/stable/documentation.html. Accessed 23 Apr. 2023
Useful Links	
1	Severance, Charles. Python for Everybody. University of Michigan, Coursera, https://www.coursera.org/specializations/python. Accessed 23 Apr. 2025.

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2													1
CO2				3		2					1			
CO3	1	3	2											
CO4	3				1								2	
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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Course Information	
Programme	B. Tech. (MDM - Artificial Intelligence and Machine Learning)
Class, Semester	Final Year B. Tech., Sem. A/B
Course Code	7MD405
Course Name	Advanced Artificial Intelligence.
Desired Requisites:	Essentials of AI, Machine Learning

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives

1	To provide knowledge of advanced AI models and architectures.
2	To analyze, design, and develop intelligent solutions using cutting-edge AI frameworks.
3	To critically evaluate and innovate in the field of generative AI, graph AI, and LLMs.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand fundamental architectures like LSTM, RNN, CNN, GNN	II	Understand
CO2	Apply encoder-decoder mechanisms for sequence modeling	III	Apply
CO3	Analyze advanced AI systems including LLMs and Generative AI models	IV	Analyse
CO4	Evaluate the efficiency and performance of advanced AI models	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Deep Learning** - Neural Networks: Introduction to Perceptron, Backpropagation, Loss functions. - CNN: Layers (Convolution, Pooling, Fully Connected), Feature extraction, Image classification tasks. - AlexNet/ResNet: Importance of deep networks, skip connections. - RNN: Handling sequential data, issues like vanishing gradients.	6
II	**Sequence Modeling and RNN** - LSTM/GRU: Solving long-term dependency problems; gates (input, forget, output). - Encoder-Decoder: Structure for sequence-to-sequence tasks; applications in translation, chatbots. - Examples: Google Translate, Automatic summarizers.	7
III	**NLP (Natural Language Processing) with Deep Learning** - NLP Basics: Text pre-processing, Tokenization, Lemmatization. - Word2Vec/GloVe: Creating dense vector representations of words. - Transformer Model: Attention mechanism, Positional encoding, Encoder-Decoder layers. - Masked Language Modeling (MLM): BERT model training by predicting masked words.	6

IV	**LLM (Large Language Models)** - LLMs: Very large Transformer-based models trained on massive datasets. - GPT Models: Causal Language Modeling, few-shot learning capabilities. - Fine-tuning: Adapting a pre-trained model to a specialized task. - Prompt Engineering: Crafting inputs to maximize model outputs.	6
V	**GNN (Graph Neural Networks)** - Graph Theory Basics: Nodes, Edges, Adjacency matrices. - GCN (Graph Convolutional Networks): Convolution over graphs, Node embeddings. - GAT (Graph Attention Networks): Attention mechanism on graph nodes. - GraphSAGE: Inductive learning over graphs. -Neo4j Hands-On	6
VI	**Generative AI** - Definition, Working Principles, Key Techniques - GANs: Generator and Discriminator networks; image generation tasks. - Diffusion Models: Denoising-based generative models (e.g., Stable Diffusion). - Multimodal AI: Combining text, image, audio data (e.g., DALL-E).	7

Textbooks	
1	Goodfellow, Ian, Yoshua Bengio, and Aaron Courville. Deep Learning. MIT Press, 2016.
2	Aggarwal, Charu C. Neural Networks and Deep Learning: A Textbook. Springer, 2018

References	
1	NPTEL Course- Deep Learning – IIT Madras *Instructor*: Prof. Mitesh M. Khapra
2	NPTEL Course- Deep Learning for Computer Vision – IIT Hyderabad *Instructor*: Prof. Vineeth N Balasubramanian

Useful Links	
1	https://archive.nptel.ac.in/noc/courses/noc18/SEM2/noc18-cs41/
2	https://nptel.ac.in/courses/106106224

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2													1
CO2				3		2					1			
CO3	1	3	2											
CO4	3				1								2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information

Programme	B. Tech. (MDM - Robotics & Automation)
Class, Semester	Third Year - B. Tech., Sem. V
Course Code	7MD306
Course Name	Robot Kinematics and Dynamics
Desired Requisites:	Fundamentals of robotics, mathematics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives

1	Understand robot characteristics with their control systems
2	Comprehend and interpret various aspects relating to robot kinematics and dynamics.
3	Understand the robot dynamics and trajectory planning
4	Analyse and demonstrate knowledge of the relationship between mechanical structures of industrial robots and their operational work-space characteristics

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand relationship between joint space and Cartesian space	II	Understanding
CO2	Apply mathematics for manipulator positioning and motion planning	III	Applying
CO3	Analyse robot mechanism using kinematics	IV	Analysing
CO4	Evaluate trajectory of robot to reach the destination with controlled environment	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction to Robot Motion** Overview of Robotics: Types, Applications, and Trends Key Components of Robotic Systems Configuration space and degrees of freedom of rigid bodies and robots. Configuration space topology and representation; configuration and velocity constraints; task space and workspace. Rigid-body motions, rotation matrices, angular velocities, and exponential coordinates of rotation.	7
II	**Fundamentals of Robotic Mechanics (Kinematics)** Forward Kinematics: Product of exponentials formula for forward kinematics in the space frame and the end-effector frame. Velocity kinematics using the space Jacobian and body Jacobian, statics of open chains, singularities, and manipulability. Inverse Kinematics: Analytical and numerical inverse kinematics.	7
III	**Robot Dynamics** Lagrangian formulation, centripetal and Coriolis forces, robot mass matrix, dynamics of a rigid body, and Newton-Euler inverse dynamics for an open-chain robot. Forward dynamics of an open chain, task-space dynamics, constrained dynamics, and practical effects due to gearing and friction. Point-to-point "straight-line" trajectories and polynomial trajectories passing through via points.	6

IV	**Motion Planning and Path Generation** C-space obstacles, graphs and trees, and A* graph search. Motion planning on a discretized C-space grid, randomized sampling-based planners, virtual potential fields, and nonlinear optimization. First- and second-order linear error dynamics, stability of a feedback control system, and motion control of robots when the output of the controller commands joint velocities, joint torque and force control.	7
V	**Autonomous Robots and Control Techniques** Controllability, motion planning, and feedback control of nonholonomic wheeled mobile robots; odometry for wheeled mobile robots; and mobile manipulation. Generating a reference trajectory in SE (3) for the end-effector of a mobile manipulator to achieve a pick-and-place task.	7
VI	**Control of Endeffector** Feedforward control of the end-effector of a mobile manipulator to drive the end-effector along a reference trajectory. Feedforward-plus-feedback control of the end-effector of a mobile manipulator to stabilize a reference trajectory for the end-effector.	6

Text Books	
1	D.Nagrath and Mittal, “Robotics and Control”, Tata McGraw-Hill, 2003
2	Spong and Vidhyasagar, “Robot Dynamics and Control”, John Wiley and sons, 2008
3	Dilip Kumar Pratihar, Fundamentals of Robotics, Narosa Publishing House, 2019
References	
1	Harry Asada and Slottine “Robot Analysis and Control”, Wiley Publications, 2014
2	S K Saha, “Introduction to Robotics”, 2nd edition, TMH, 2013
3	S. B. Niku, Introduction to Robotics – Analysis, Contro, Applications, 3rd edition, John Wiley & Sons Ltd., 2020
Useful Links	
1	https://ocw.mit.edu/courses/mechanical-engineering/2-12-introduction-to-robotics-fall-2005/lecture-notes/
2	https://www.ni.com/en-us/innovations/instrumentation.html
3	https://www.coursera.org/learn/modernrobotics-course2
4	https://www.youtube.com/watch?v=Tf_DsOcCgio

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	3					2				2			3	
CO2		2					3	1						
CO3			3		2	2		2	2		3			2
CO4	2			2										

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (MDM - Robotics & Automation)
Class, Semester	Third Year - B. Tech., Sem. VI
Course Code	7MD326
Course Name	Computer Vision in Robotics
Desired Requisites:	Python programming, Linear algebra and probability

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives

1	To explain the essential facts, concepts and principles in robotics and computer vision.
2	Simultaneous Localization and Mapping (SLAM) integrated by computer vision technologies that are the future industry trends achieved through Robotics and Artificial Intelligence.
2	To employ hardware (e.g. cameras, robots) and software (e.g. Matlab, robot simulator) tools to solve a practical problem of sensory-motor control.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Identify basic concepts, terminology, theories, models and methods in the field of computer vision.	II	Understanding
CO2	Assist the students to understand computer vision including the image processing to enhance detection and object recognition.	III	Applying
CO3	Ability to work in the whole processing chain: acquisition, analysis and visualisation, within different application areas.	IV	Analysing
CO4	To use computer vision to detect and track objects in real-time for tasks like object grasping, path planning, and object recognition.	V	Evaluating

Module	**Module Contents**	**Hours**
I	**Introduction to Computer Vision** Image Acquisition: Understanding different camera types, image capture techniques, and sensor technologies, LiDAR survey. Image Representation: Learning about image formats (e.g., RGB, grayscale), pixel representation, and how images are stored and processed. Image Processing: Techniques for enhancing, manipulating, and analyzing images, including filtering, edge detection, and transformations.	7
II	**Feature Extraction and Object Recognition** Feature Extraction: Identifying key features in images, such as edges, corners, and textures, using methods like SIFT, HOG, and Harris corner detection. Object Recognition: Techniques for classifying and identifying objects in images, including traditional methods (e.g., SVM) and modern deep learning approaches.	6
III	**Object Tracking and 3D Vision** Object Tracking: Algorithms for following the movement of objects over time, including Kalman filters, optical flow, and deep learning-based trackers. Techniques for reconstructing 3D environments and objects from 2D images, including stereo vision, structure from motion, and SLAM (Simultaneous Localization and Mapping).	7

IV	**Machine Learning for Computer Vision** Machine Learning Basics: Understanding different machine learning models, including supervised and unsupervised learning, regression, and classification. Deep Learning for Computer Vision: Learning about convolutional neural networks (CNNs), their architecture, and applications in object detection, image segmentation, and scene understanding.	6
V	**Robot Perception and Control** Robot Perception: Understanding how robots use computer vision to perceive their environment, including object recognition, localization, and navigation. Robot Control: Integrating computer vision data into robot control systems to enable tasks like grasping, manipulation, and autonomous navigation.	7
VI	**Robotics and Computer Vision Integration** Training robots to learn from experience using reinforcement learning and other machine learning techniques. Developing projects that involve building robotic systems that can perform tasks like object recognition, navigation, or manipulation using computer vision.	6

Text Books	
1	Computer Vision - A modern approach, by D. Forsyth and J. Ponce, Prentice Hall Robot Vision, by B. K. P. Horn, McGraw-Hill.
2	Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing, Analysis and Machine Vision, Cengage, Third Edition, 2013
3	Abdulmajeed Wael, Mansoor Revan, Visual Robot Slam of 2D & 3D Indoor Environment, LAP Lambert Academic Publishing, 2014.
References	
1	Richard Szeliksy "Computer Vision: Algorithms and Applications" (http://szeliski.org/Book/)
2	Peter Corke, Robotics, Vision and Control: Fundamental Algorithms, Springer Tracts in Advanced Robotics, Volume 118, Second Edition, 2016
3	Robin R. Murphy, Introduction to AI Robotics, MIT Press, 2000
4	Solomon and Breckon, Fundamentals of Digital Image Processing, Wiley-Blackwell, 2010
Useful Links	
1	www.vision-systems.com
2	https://www.baslerweb.com/en/vision-campus/markets-and-applications/robots-withvision-technology/
3	https://new.abb.com/products/robotics/application-equipment-and-accessories/visionsystems
4	www.invision-news.de

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2				3	2			3		1			
CO2		2						1						
CO3			1		1		2	2		2			3	
CO4	3		2	2										2
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2025-26

Course Information

Programme	B. Tech. (MDM - Robotics & Automation)
Class, Semester	Third Year - B. Tech., Sem. VI
Course Code	7MD376
Course Name	ROS Simulation Lab
Desired Requisites:	Mathematics, Python programming, Learning Ubuntu Linux for ROS

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide an introductory understanding on robotic operating system and gazebo simulation environment.
2	Set up and configure Gazebo simulations, including robot models and simulation environments
3	Implement and test navigation algorithms and path planning strategies within the simulation environment.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Understand the fundamental concepts of ROS nodes, topics, services, and parameters, and how they interact within the ROS ecosystem.	II	Understanding
CO2	Apply the principles of ROS for module development of robotic systems.	III	Applying
CO3	Apply the knowledge of robotic system and ROS for mobile robot control, navigation and environment mapping using ROS simulators.	IV	Analysing
CO4	To simulate sensors and actuators in Gazebo and interface them with ROS nodes.	V	Evaluating

List of Experiments / Lab Activities

1. "ROS architecture & philosophy, ROS master, nodes, and topics
   Console commands, Catkin workspace and build system, Launch-files, Gazebo simulator - Programming Tools"
2. "ROS package structure
   Integration and programming with Eclipse, ROS C++ client library (roscpp)
   ROS subscribers and publishers, ROS parameter server, RViz visualization"
3. "TF Transformation System, rqt User Interface
   Robot models (URDF), Simulation descriptions (SDF)"
4. "ROS services
   ROS actions (actionlib), ROS time, ROS bags
   Debugging strategies, Introduction to ROS2"
5. Simulating with ROS2: Gazebo simulator, robot models (URDF) and simulation environments (SDF)
6. Case study: Using ROS in complex real-world applications in Gazebo
7. Creating your own mobile robot and robot arm simulation
8. Turtlebot control application

Text Books	
1	Joseph, Lentin, and Jonathan Cacace. Mastering ROS for Robotics Programming: Design, build, and simulate complex robots using the Robot Operating System. Packt Publishing Ltd, 2018.
2	Programing Robots with ROS', M. Quigley, B. Gerkey, and W. D. Smart, Oreilly Publishers, 2015.
3	Lentin Joseph, "Robot Operating Systems (ROS) for Absolute Beginners, Apress, 2018
References	
1	Koubâa, Anis, ed. Robot Operating System (ROS). Vol. 1. Cham: Springer, 2017.
2	'ROS Robotics by example', Fairchild & Harman, PACKT Publishing, 2016
3	Patrick Gabriel, "ROS by Example: A do it yourself guide to Robot Operating System", Lulu, 2012.
Useful Links	
1	https://wiki.ros.org/ROS/Tutorials
2	https://www.theconstruct.ai/ros-for-beginners-how-to-learn-ros/
3	https://rsl.ethz.ch/education-students/lectures/ros.html

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	3						1				2			
CO2		2						1	3				3	
CO3					2			2		3				
CO4	2		2	1		2								2
The strength of mapping: 1:Low, 2:Medium, 3:High														

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

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AY 2026-27

Course Information

Programme	B. Tech. (MDM - Robotics & Automation)
Class, Semester	Final Year - B. Tech., Sem. A/B
Course Code	7MD406
Course Name	Control of Robotic Systems
Desired Requisites:	Engineering Mathematics III, Fundamentals of Electrical Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives

1	To impart knowledge for modeling physical systems.
2	To analyze physical systems using various time and frequency domain methods.
3	To enable students to determine the stability of linear systems using different methods.
4	To introduce the use of state space method for system analysis.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Calculate system transfer function and characteristics of different systems.	III	Applying
CO2	Analyze performance of physical systems using mathematical models.	IV	Analyzing
CO3	Check the stability of linear systems in time and frequency domain.	V	Evaluating
CO4	Design various compensators to attain desired system performance	VI	Creating

Module	**Module Contents**	**Hours**
I	**Analysis of System in Frequency Domain** History of control systems, Laplace transforms review, transfer function of Electrical systems, Mechanical systems, Rotational Systems, Electrical circuit analogs, Transfer function of DC motor	6
II	**Analysis of System in Time Domain** State space representation, Converting transfer function to state space: Phase Variable Form, State space to transfer function, State Transition Matrix, Solution of state equation, Controllability, Observability.	7
III	**Transient Response and Reduction of multiple subsystem** Time response, poles, zero and system response, Response of first, second and general second order system, system response with additional poles, additional zeros, Block diagram analysis and design of feedback systems, signal flow graph, mason's rule, signal flow graphs of state equation, similarity transformation.	7
IV	**Steady State Error** Steady state error for unity feedback systems, static error constants, and system type. Steady state error specifications, steady state error for system with disturbances, non-unity feedback systems. steady state error for systems in state space, PID Controllers.	4
V	**Stability Analysis: Routh Criterion and Root Locus** Routh criterion for stability and stability in state space, Sketching the root locus, transient response design via gain adjustment, Root locus for positive feedback	7

	system, pole sensitivity, lag, lead, lag-lead compensators in root locus domain.	
VI	**Stability Analysis: Bode Plot and Nyquist Plot, Compensators** Bode plot, Nyquist criterion, Determination of stability, gain margin, phase margin via the Nyquist diagram and bode plots Introduction to Compensators, lag, lead, lag-lead compensator in frequency domain.	8

Text Books	
1	Norman Nise, “Control System Engineering”, John Wiley, Seventh Edition, 2014.
2	I.J. Nagrath and M. Gopal, “Control System Engineering”, Anshan Publishers, Fifth edition,2008
References	
1	M Gopal, “Control System Principle & Design”, T.M.H., Fourth Edition, 2012.
2	K Ogata, “Modern Control Engineering”, P.H.I., Fourth Edition, 2002.
3	Dorf and Bishop, “Modern Control System”, Adison Wesley Longman, Eight Edition, 1998.
Useful Links	
1	https://nptel.ac.in/courses/108/106/108106098/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	1		2		3	2			2		2			
CO2		3						1					2	
CO3	3				2		3	2		2				3
CO4			3	1							1			

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2025-26						
Course Information						
Programme	B. Tech. (MDM – Geomatics Engineering)					
Class, Semester	Second Year B. Tech., Sem. IV					
Course Code	7MD224					
Course Name	Surveying and Mapping					
Desired Requisites:	Engineering graphics, basic geometry and geography					
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	2 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial	1 Hrs/week	30	20	50	100	
	-	**Credits: 3**				

Course Objectives	
1	To understand the importance of maps in engineering projects and the principles of map preparation.
2	To learn land surveying methods and instruments used in civil engineering.
3	To learn the concepts and applications of topographical mapping.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Identify and classify different types of maps and scales, and understand coordinate systems and map projections.	I	Understanding
CO2	Apply various land surveying techniques for engineering projects.	III	Applying
CO3	Utilize principles of aerial photogrammetry for terrain modelling.	III	Applying
CO4	Understand GPS functioning and its use in surveying and mapping.	I	Understanding

Module	Module Contents	Hours
I	**Principles of Land Surveying** Overview of survey levels and their classifications. Levelling methods: Differential levelling, reciprocal levelling, and precise levelling. Surveying instruments: Compass, Theodolite, Total Station, and Tachometer. Applications of surveying in infrastructure development.	4
II	**Advanced Surveying Techniques** Trigonometric levelling: Concepts and applications. Traversing: Methods, adjustments, and plotting. Triangulation and trilateration: Principles, computations, and applications.	4
III	**Coordinate systems** Cartesian and geographical map projections and their types: Conformal, equal-area, and equidistant. Map datum: Concepts of MSL (Mean Sea Level), Geoid, spheroid, and WGS-84. Importance of map datum in GIS and engineering applications. Systems and Map Projections	5
IV	**Introduction to Maps** Definition and significance of maps in engineering projects. Types of maps: Topographical maps, cadastral maps, thematic maps, engineering maps. Scales of maps: large scale, medium scale, small scale, and their applications. Plotting accuracy and precision in map-making. Map sheet numbering and standardization.	5
V	**Aerial Photogrammetry**	

	Types of aerial photographs: Vertical, oblique, and panoramic. Flying height, scale, and their importance in photogrammetry. Relief displacement and its effects on map accuracy. Introduction to Digital Elevation Models (DEM). Applications of DEM in slope analysis and topographical mapping. Introduction to stereoscopy and creation of 3D models.	4
VI	**Global Positioning Systems** Introduction to GPS: GPS signal structure, GPS modernization, types of GPS receivers, time systems, pseudo-range measurements, GPS measurements. GPS errors and Biases: GPS ephemeris errors, Selective availability, satellite receiver, and clock error, multipath error, ionospheric error, tropospheric errors Applications: GPS for utilities industry, forestry and natural resources, precision farming.	4

Text Books	
1	Bindra S. P., "A Course in Highway Engineering", Dhanpat Rai Publications, 5th Edition 2012.
2	Kang-tsung Chang, "Introduction to Geographic Information Systems", Tata McGrawHill, 4thEdition, 2007
3	Ian HeyWood, Sarah Cornelius and Steve Carver , "An Introduction to Geographical Information Systems" , Pearson Education, 2nd Edition, 2006
References	
1	Fundamentals of Global Positioning System Receivers: A Software Approach James Bao-Yen Tsui Copyright @ 2000 John Wiley & Sons, Inc.
2	B.C. Punmia, Ashok Kumar Jain, and Arun Kumar Jain, Surveying Vol. 1, 2 & 3.
Useful Links	
1	https://ocw.mit.edu/courses/12-540-principles-of-the-global-positioning-system-spring-2012/
2	https://nptel.ac.in/courses/106105219

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2		1		1	2	1	2		1	2		1	
CO2	1	2	3	1				1						2
CO3	1		2	2	1					1			1	
CO4	1				2						1		1	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 25%-30% weightage on modules 1 to 3 and 70% -75% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Tutorial
Tutorial 1: Principles of Land Surveying a. Overview of survey levels and classifications b. Levelling methods: Differential, reciprocal, and precise levelling **Tutorial 2: Levelling Methods** a. Differential levelling: Procedure and accuracy b. Reciprocal levelling: Elimination of errors **Tutorial 3: Levelling Methods Applications of Surveying in Infrastructure Development** a. Road alignment and construction b. Bridge and dam site selection **Tutorial 4: Advanced Surveying Techniques** a. Trigonometric levelling: Concepts and field applications b. Traversing: Methods, plotting, and adjustments **Tutorial 5: Systems and Map Projections** a. Introduction to map projection systems b. Importance of map datum in GIS and engineering **Tutorial 6: Introduction to Maps** a. Definition and significance of maps in engineering projects b. Types of maps: Topographical, cadastral, thematic, engineering maps **Tutorial 7: Aerial Photogrammetry** a. Types of aerial photographs: Vertical, oblique, panoramic b. Flying height, scale, and importance in photogrammetry **Tutorial 8: Global Positioning Systems (GPS)** a. GPS signal structure and modernization b. Types of GPS receivers and their applications **Tutorial 9: Global Positioning Systems (GPS)** a. GPS errors and biases: Ephemeris, selective availability, multipath, ionospheric, tropospheric b. Applications of GPS in utilities, forestry, and precision farming **Tutorial 10: Revision**

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2026-27						
Course Information						
Programme	B. Tech. (MDM – Geomatics Engineering)					
Class, Semester	Second Year B. Tech., Sem. V					
Course Code	7MD304					
Course Name	Digital Image Processing and Remote Sensing					
Desired Requisites:						
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial	-	30	20	50	100	
	-	**Credits: 3**				

Course Objectives	
1	To introduce the fundamentals of Digital Image Processing and Remote Sensing (RS)
2	To comprehend to concepts of image enhancement, segmentation, classification and various image processing algorithms
3	To explore various Remote Sensing satellites, their characteristics and data products.
4	To inculcate advantages, limitations and interdisciplinary applications of Image processing and Remote Sensing.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Explain fundamental concepts of Image Processing and Remote Sensing	I	Understanding
CO2	Apply various image processing algorithms to the Satellite images	III	Applying
CO3	Compare and Analyze the images acquired from different satellites and sensors.	III	Analyzing
CO4	Identify and validate appropriate remote sensing datasets and image processing techniques to develop effective solutions for diverse interdisciplinary challenges using image analysis methods and remote sensing tools	I	Evaluate

Module	Module Contents	Hours
I	**Digital Image Fundamentals** Introduction and applications, Fundamental Steps and Components of Image Processing System Digital Image Fundamentals: Image Acquisition, A simple image model, Sampling and Quantization, Imaging, Different types of digital images	6
II	**Image Transforms and Enhancement** Mathematical preliminaries, 2D Orthogonal and Unitary Transforms, Discrete Fourier Transform, Point Processing, Basic Gray Level Transformations, Convolution and Correlation, HistogramProcessing, Spatial domain Filtering	8
III	**Image Segmentation and Classification** Edge Detection- Canny, Sobel, Prewitt, Robert edge detector, Region-based Segmentation –region growing, region splitting and merging, Classification – Supervised and unsupervised classification.	6
IV	**Concepts and Foundation of Remote Sensing** Introduction, Remote Sensing System, Electromagnetic Energy, Electromagnetic	7

	Spectrum and its Characteristics, Energy Interaction in the Atmosphere and with the Earth‟s Surface, Resolution in Remote Sensing, Applications of Remote Sensing.	
V	**Sensors, Platforms and Satellite Data Products** Broad Classifications of Sensors and Platform, Earth Observation Satellite and Sensors, Data Reception, Transmission and Processing, Remote Sensing Data and Data Products	6
VI	**Satellite Image Interpretation and Processing** Interpretation Procedure and Elements, Interpretation strategies and keys, Digital Image processing and Image Analysis steps, Image Rectification and Restoration, Image Enhancement, Image Transformation, Image Classification and Analysis.	6

Text Books	
1	R. C. Gonzalez, R. E. Woods, Digital Image Processing, 4th Edition. 2018, PHI
2	S. Jayaraman, S. Esakkirajan, T. Veerkumar, Digital Image Processing, Tata McGraw Hill
3	Chandra, A.M. and Ghosh, S.K., “Remote Sensing and GIS”, Narosa Publishing House. 2008
4	Lo, C.P. and Young, A.K.W., “Concepts and Techniques of Geographical Information System”, Prentice Hall India. 2012
References	
1	Milan Sonka, Vaclav Hlavac, Boyle, Digital Image Processing and Computer Vision, Cengage Learning
2	A. K. Jain, Fundamentals of Digital Image Processing, PHI
3	Lillesand, T.M. and Kieffer, “Remote Sensing and Image Interpretation”, - 6th Edition, John Wiley and Sons. 2012
Useful Links	
1	https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-ce08

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2		1		1	2	1	2		1	2		1	
CO2	1	2	3	1				1						2
CO3	1		2	2	1					1			1	
CO4	1				2						1		1	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher’s assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*						
AY 2026-27						
Course Information						
Programme	B. Tech. (MDM – Geomatics Engineering)					
Class, Semester	Second Year B. Tech., Sem. VI					
Course Code	7MD324					
Course Name	Geographic Information System					
Desired Requisites:	NA					
Teaching Scheme		**Examination Scheme (Marks)**				
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**	
Tutorial	-	30	20	50	100	
	-	**Credits: 3**				

Course Objectives	
1	To introduce basic concepts in GIS.
2	To describe how geographical data is used, managed, and analyzed.
3	To gain an understanding of how to model and analyze spatial data.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Summarize the basic concepts in GIS	II	Understanding
CO2	Preparing and manage spatial information and data	III	Applying
CO3	Understand processes and methods of geospatial data acquisition and to design geospatial databases	III	Analyzing
CO4	Effectively communicate and present results in oral, written, and graphic (map) forms.	IV	Evaluate

Module	Module Contents	Hours
I	**Basics of GIS** Introduction to GIS and history and development, components and applications trends of GIS, GPS system, DGPS, digital mapping concepts, paper-based maps, computer automated cartography, advantages of digital maps.	6
II	**Data Types and Data Models** Modeling real world features, data structure and formats, spatial data models – raster and vector, data types, point, line, polygon- arc, nodes, vertices, and topology. spatial data, non-spatial data, data input, metadata, conversion of existing data, creating new data, data models, vector data model, raster data model, integration and comparison of vector and raster data models	7
III	**Database Management** Geo-database model, role of databases in GIS, attribute data in GIS, attribute data entry, manipulation of fields and attribute data, data exploration, database structures, files, standard data formats, compression techniques, DBMS software.	6
IV	**Spatial Data error handling** Types of digitizing errors, causes for digitizing errors, detecting and correcting errors, re-projection, transformation and generalization, edge matching and rubber sheeting, topology, topological editing and non-topological editing, editing using topological rules, conversion from other digital sources.	7
V	**Spatial Analysis**	7

	Set theory and map algebra, vector and raster-based GIS operations, overlay analysis, buffer analysis, proximity analysis, network analysis.	
VI	**GIS Project Planning and Implementation** Map elements and composition, preparation of qualitative and quantitative maps, understanding the requirements, phases of planning, specifications, and procedure for analysis projects and design projects, introduction to Web GIS.	6

Text Books	
1	Kang-Tsung Chang (2018), 'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi, 9th Edition.
2	Paul Longley (2015), Geographic Information systems and Science, John Wiley & Sons, 4th Edition.
3	C. P. Lo & Albert K. W. Yeung, (2016), Concepts and Techniques of Geographic Information Systems, Prentice Hall India Pvt. Ltd, 2nd Edition.
References	
1	Magwire, D.J. Goodchild, M.F. and Rhind, D.M., (2005), 'Geographical Information Systems: Principles and Applications', Longman Group, U.K.
2	John E. Harmon & Steven J. Anderson., (2003), The design and implementation of Geographic Information Systems, John Wiley & Sons.
Useful Links	
1	https://nptel.ac.in/courses/105107206 (accessed on 05.05.2025)
2	https://nptel.ac.in/courses/107105088 (accessed on 05.05.2025)

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2													2
CO2			2	2				2		2			2	
CO3		3	3		3	2		2					3	3
CO4			3		4		3		2	3	3			3

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli
(Government Aided Autonomous Institute)

AY 2026-27

Course Information

Programme	B. Tech. (MDM - FinTech)
Class, Semester	Third Year - B. Tech., Sem. VI
Course Code	7MD374
Course Name	Geographic Information System Laboratory
Desired Requisites:	-

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To provide exposure to basic tools and techniques in GIS software.
2	To develop technical skills and competence in GIS data acquisition, management and analysis.
3	To apply GIS tools and techniques in related applications.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Create raster and vector data (point, line, polygon, attribute).	III	Create
CO2	Create and manage Geo-database.	IV	Create
CO3	Write and execute queries on Geo-database and GIS data.	IV	Execute
CO4	Perform spatial (vector and raster) operations on GIS data.	V	Perform
CO5	Designing thematic GIS maps using software.	V	Designing

List of Experiments / Lab Activities

List of Lab Assignments:

1. Study of open source GSI software – QGIS-1.
2. Working with Bhuvan – Indian Geo platform of ISRO
3. Collecting GPS and spatial data and mapping in GIS software
4. Geo-database creation with Spatial data Integration (Digitization) – point, line, polygon and non-Spatial (attribute) Data Integration.
5. Editing of Spatial & Non-Spatial data in geo-database.
6. Querying GIS data.
7. Raster data calculations and operations-1.
8. Vector data calculations and operations-2.
9. Spatial Data Analysis.
10. Classification & Modeling of GIS data.
11. Generalizations of maps, map design, map production.
12. Mapping and editing of digital maps.
13. Web GIS and Mobile GIS Applications.

Text Books

1	Kang-Tsung Chang (2018), 'Introduction to Geographic Information Systems' Tata McGraw Hill, New Delhi, 9th Edition.
2	Hwang Sungsoon, Follett Cassie (2019), 'GIS : An Introduction to Mapping Technologies', McHaffie, Patrick; Boca Raton CRC Press

References

1	Jonathan Campbell, Michael Shin (2011), Essentials of Geographic Information Systems,

	Saylor Foundation
2	John Krygier, Denis Wood (2011), Making Maps, Second Edition: A Visual Guide to Map Design for GIS, The Guilford Press, 2nd Edition.
Useful Links	
1	"Gentle Introduction to GIS" guide, found at www.docs.qgis.org
2	QGIS User Manual, https://docs.qgis.org/3.10/en/docs/training_manual/foreword/intro.html
3	Bhuvan User Hand Book - Indian Geo Platform of ISRO – NRSC, https://bhuvan-app1.nrsc.gov.in/2dresources/documents/1_Bhuvan_User_Handbook.pdf

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	2				3		3		3				3	
CO2		3	3					3			3		3	2
CO3					3		3		3					3
CO4	3				3		3			3			3	3
CO5					3		3			3	3			4
The strength of mapping: 1:Low, 2:Medium, 3:High														

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Walchand College of Engineering, Sangli
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AY 2027-28

Course Information

Programme	B. Tech. (MDM – All Streams)
Class, Semester	Final Year - B. Tech., Sem. A/B
Course Code	7MD441 – EV, 7MD442 – Smart Cities, 7MD443 – FinTech, 7MD445 – AIML, 7MD446 – Robotics and Automation, 7MD444 – Geomatics Engineering
Course Name	Mini Project
Desired Requisites	Basic and advanced concepts and principles in respective MDM stream, graduate level courses. Latest developments in engineering fields.

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	-	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	-	30	30	40	100
Practical	2 hrs/week				
Interaction	-	**Credits: 1**			

Course Objectives

1	To help students to identify real life needs and discuss project requirements.
2	To give technical solutions through the latest design & development tools.
3	To learn to translate feasible business ideas into compelling business strategies and successful start-ups.
4	Ability to develop innovative and entrepreneurial mindset.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Will be able to understand the importance of team work and will be able to work in a team for achieving group goals / will be prepared to assume a leadership role in any team.	III	Applying
CO2	Will have ability to explain various concepts and tools used in their project	IV	Analyzing
CO3	Will be able to analyze and give solutions for a specific problem statement related to their project.	V	Evaluating
CO4	Will be able to prepare and present a detailed report based on project work spread over two semesters.	VI	Creating

List of Experiments / Lab Activities

1. Group of 2 to3 students per project
2. Completion of algorithm/computer program/ data analysis/ manufacturing / processing-assembly / testing / analysis / simulation work of the project.
3. Testing, result analysis with clear conclusions etc.
4. Demonstration of the working of the project set-up / model / software program as applicable.
5. Rectifications/ correction if required to be completed.
6. Students are encouraged to publish a technical paper in conference / reputed peer reviewed journals based on their mini project work.
7. Students are encouraged to file a patent or refine it for the startup idea

Project shall be assessed based on following points;

1. Novelty of the problem and Clarity
2. Innovativeness in solutions
3. Cost effectiveness and Societal impact

4. Full functioning of working model project set-up / model / software program as applicable.
5. Potential of patentability, publications and startup idea
6. Effective use of skill sets
7. Effective use of standard engineering norms
8. Contribution of an individuals as member or leader
9. Fluency in written and oral communication
10. Quality of project report

Text Books	
1	Suitable books based on the contents of the project selected.
References	
1	Suitable books based on the contents of the project selected and research papers from reputed national and international journals and conferences.
Useful Links	
1	As per the need of the project

CO-PO Mapping														
	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11		1	2
CO1	3							3			3		3	
CO2		3	3	3	3	2		3		3			2	1
CO3		3					3		3	3				1
CO4							1		1		2		2	1
The strength of mapping: 1:Low, 2:Medium, 3:High														

Assessment				
There are three components of lab assessment, LA1, LA2, and Lab ESE IMP: Lab ESE is a separate head of passing. Lab ESE is treated as End Semester Exam and is based on all experiments/lab activities.				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 6 Marks Submission at the end of Week 6	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 7 to Week 12 Marks Submission at the end of Week 12	30
Lab ESE	Lab Performance and documentation	Lab Course faculty	During Week 13 to Week 18 Marks Submission at the end of Week 18	40
Week 1 indicates the starting week of a semester. The actual schedule shall be as per the academic calendar. Lab activities/Lab performance shall include performing experiments, mini-projects, presentations, drawings, programming and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments.				

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	B. Tech. (Civil Engineering)
Class, Semester	Third-Year B. Tech., Sem. V
Course Code	7MDCV301
Course Name	Waste Management and Pollution Control
Desired Requisites:	Water Supply and Treatment Technology, Environmental Science

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 3**			

Course Objectives

1	To introduce concepts of wastewater engineering, solid waste processing, air and noise pollution control.
2	To provide pertinent knowledge for the design and operation of waste management facilities.
3	To prepare students for higher studies and research in the field of waste management and pollution control.
4	To make students aware of recent advances in waste management.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	**Explain** collection and characteristics of wastewater and solid waste; monitoring air quality and meteorological impact; treatment/processing/control technologies for prevention of pollution associated with wastewater, solid waste, air and noise.	Understand	II
CO2	**Apply** the waste management concepts	Apply	III
CO3	**Analyze** the problems on wastewater and solid waste associated with generation, characteristics, collection and treatment/processing; air and noise pollution.	Analyze	IV
CO4	**Design** sewerage and wastewater treatment system.	Design	VI

Module	**Module Contents**	**Hours**

I	**Wastewater and Collection** Wastewater: Sources, Flow rate and variations, Quantitative estimation, Characteristics Gravity sewer collection system: Nomenclature, Manhole, Pumping station Introduction to pneumatic (vacuum drainage) sewer system Design of sanitary and storm sewer, Computer application SEWERCAD	**6 L**
II	**Introduction to Wastewater treatment** Wastewater treatment: Philosophy, Unit operations and unit processes Primary treatment: Screening, Grit removal, Settling Biological/Secondary treatment: Fundamentals of aerobic and anaerobic treatment, Classification	**5 L**
III	**Aerobic Wastewater treatment** Aerobic suspended growth: Conventional Activated Sludge Process (ASP), Sequential batch reactor (SBR), Process design and operating parameters (ASP and SBR), Operational problems (ASP), Concepts of oxidation ditch and Waste stabilization pond Biological filtration	**10 L**
IV	**Decentralized treatment and Disposal** Decentralized treatment: Concept, Septic tank and soakage pit, Anaerobic baffled reactor (ABR), Anaerobic filter (AF), Constructed wetland (CW), Typical system Advances in wastewater treatment : Moving bed bioreactor (MBBR), Membrane bioreactor (MBR) Concept of package sewage treatment plant Disposal of wastewater: Methods, Effluent standards Stream pollution: Self-purification (Stream rejuvenation), DO sag curve, Streeter Phelp's equation for point source, Stream classification	**7 L**
V	**Solid waste** Sludge: Characteristics, thickening, dewatering, digestion, disposal Solid Waste: Characteristics, Generation, Collection and transportation Engineered systems for solid waste processing: Mechanical, Thermal, Biological Sanitary land fill: Location, Components, Design, Bio-mining	**6 L**

VI	**Air and Noise pollution** Air Pollution: Meteorological parameters, Ambient air quality monitoring, Indoor air pollution, Air quality standards Air pollution control: Approaches and equipment for particulate and gaseous pollutants Noise pollution: Permissible limits of noise pollution, measurement of noise, Control of noise pollution.	**6 L**

Text Books	
1	Nathanson, J. A., "Basic Environmental Technology", PHI Learning private limited, 5th Edition, 2009.
2	Modi, P. N., "Wastewater Engineering" Standard Book House, 6th Edition, 2018.
3	Peavy H, S, Rowe D, R, and Tchobanoglous G, "Environmental Engineering", McGraw-Hill Book Company, Indian Edition, 2017.

References	
1	Hammer M, J and Hammer M, J, "Water and Wastewater Technology", PHI learning private limited, 7th Edition, 2018.
2	"Manual on Sewerage and Sewage Treatment", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 2013.
3	"Manual on Municipal Solid Waste Management", CPHEEO, Ministry of Housing and Urban Affairs Development, Govt., of India, New Delhi, 2016.

Useful Links	
1	https://nptel.ac.in/course.html

CO-PO Mapping

	Programme Outcomes (PO)												**PSPO**	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3			1			2			1		1	3	3
CO2	3			1			2			1		1	3	3
CO3		3		1			2			1		1	3	3
CO4			3	1			2			1		1	3	3

The strength of mapping: - 1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE, and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO. ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Prepared by	DAC/BoS Secretary	Head/BoS Chairman

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26 onwards

Course Information

Programme	BTech (Civil Engineering)
Class, Semester	Third Year Sem VI
Course Code	7MDCV321
Course Name	Infrastructure Planning and Development
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	4 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
Practical	-				
Interaction	-	**Credits: 4**			

Course Objectives

1	To study the necessity of infrastructure & its management
2	To evaluate and managerial economics of infrastructure projects.
3	To analyse and design the efficient infrastructure projects.

Course Outcomes (CO)

CO	Description	Blooms Taxonomy	
		Descriptor	Level
CO1	Achieve Knowledge of Planning and development of problem-solving skills in management.	Understanding	2
CO2	Understand the principles of financial fundamentals.	Understanding	2
CO3	Evaluate the concepts of financial and Economics management.	Evaluating	4
CO4	Assess the risk involved in infrastructure projects.	Applying	3

Module	**Module Contents**	**Hours**
I	**Basics of Infrastructure** Understanding of Infrastructure, Types of Infrastructure, Role of Infrastructure, Infrastructure scenarios in India and problems of Infrastructure Development in India. An overview of Urban Infrastructure in India, Models of Urban Governance, Municipal Finances, Major municipal reforms, Framework for Urban Infrastructure Delivery, Quality of water supply and services, Models of Urban governance, Municipal governance, Urban renewal projects.	9
II	**Rural Infrastructure in India** Road development scenario in India, the state of rural infrastructure in India, Infrastructure and rural growth, Characteristics of rural India, Strategies to improve infrastructure in rural areas, Government initiatives for rural infrastructure improvement, Role of private sector in infrastructure development.	8
III	**Key Issues of provision of Infrastructure system** Leadership and strategy issues in the funding, financing, development and delivery of new infrastructure in the country Issues regarding the design and technology to be used, priority of location of infrastructure development, cost and level of risks that we have to tolerate.	9
IV	**Infrastructure Investment and Finance** Background behind investment and funding required for the financial planning of the infrastructure Various forms of funding available for infrastructure (public, private and combined), Cost- benefit analysis Stages of an infrastructure project Lifecycle.	9

V	**Privatization in Infrastructure Projects** Overview of history of privatization, The Benefits of Infrastructure Privatization, Problems with Infrastructure Privatization, Privatization of road Transportation Infrastructure in India	8
VI	**Risk and Risk management framework for infrastructure project implementation** Legal contractual Issues in Infrastructure Projects, Environmental issues in infrastructure development, Challenges in Construction and Maintenance of Infrastructure, case studies.	9

Text Books	
1	Goodman AS, Hastak M (2006). Infrastructure Planning Handbook: Planning, Engineering, and Economics. McGraw Hill/ ASCE Press
2	Proag, V. (2020). Infrastructure Planning and Management: An Integrated Approach. Germany: Springer International Publishing.
References	
1	Elmer, Vicki, and Leigland, Adam. Infrastructure Planning and Finance: A Smart and Sustainable Guide. United Kingdom, Taylor & Francis, 2013.
2	Routledge Handbook of Planning and Management of Global Strategic Infrastructure Projects. (2020). United Kingdom: CRC Press.
Useful Links	
1	https://www.youtube.com/watch?v=bxNSXutf3N4&list=PLFGUksPYY9Qp5rLjedeUIwcu13eAeETkh

CO-PO Mapping

	Programme Outcomes (PO)												PSPO	
COs	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2										3			
CO2	2										3			
CO3						1					3			
CO4				3							3			
CO5														
CO6														

The strength of mapping: - 1: Low, 2: Medium, 3: High

Assessment

The assessment is based on MSE, ISE, and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of a teacher's assessment. The mode of assessment can be field visits, assignments, etc., and is expected to map at least one higher-order PO.

ESE shall be on all modules with around 25-30% weightage on modules 1 to 3 and 70-75% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed, and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing).

Walchand College of Engineering, Sangli
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AY 2025-26

Course Information

Programme	B.Tech. (Mechanical Engineering)
Class, Semester	Third Year, SEM V-MDM
Course Code	7MDME301
Course Name	Manufacturing Systems
Desired Requisites:	Basic Workshop Practice, EME,

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To provide a foundational understanding of manufacturing systems and processes including conventional and non- conventional manufacturing techniques.
2	To introduce the use of computer-aided tools in design and manufacturing.
3	To familiarize students with modern manufacturing technologies such as CNC and additive manufacturing.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Understand the basic manufacturing processes.	I	Understanding
CO2	Classify the conventional and non- conventional manufacturing processes.	II	Classify
CO3	Explain the working principles, advantages, and limitations of metal forming, shaping processes.	II	Remembering
CO4	Apply the knowledge of modern manufacturing processes for various engineering applications.	III	Applying

Module	**Module Contents**	**Hours**
I	**Basics of Manufacturing Systems:** Definition of Manufacturing System, types- job shop manufacturing, batch manufacturing, mass manufacturing, continuous manufacturing and additive manufacturing, its applications.	6
II	**Metal Forming Processes:** a. Rolling – Introduction, Hot and cold Rolling, Classification of Rolling Mills, Defects in Rolling, b. Forging- Introduction, Hand Forging Operations, Forging Machines (board Hammer, Air and Steam, Hydraulic Hammer) Open and Closed Die Forging, Defects in Forging. c. Extrusion- Introduction, Types – Direct, Indirect, Tube, Impact and Hydraulic Extrusion, Defects in Extrusion	7

III	**Metal Shaping Processes:** a. Plastics Processing: Types and characteristics of plastics, Molding of thermoplastics – working principles and typical applications, injection molding, Plunger and screw machines, Compression molding. b. Sheet metal working: Sheet metal cutting operations, sheet metal noncutting operations.	7
IV	**Non-Conventional Machining Processes:** Need Classification, selection of process, Electro Discharge Machining, Electro Chemical Machining, Ultra Sonic Machining, Electron Beam Machining, Laser Beam Machining, Plasma Arc machining, Abrasive Jet Machining, Water Jet Machining, Abrasive water jet machining	7
V	**Background of Manufacturing Systems and Its Support Systems:** Computer applications in Design and manufacture, Introduction to Design Process / Materials, Computer aided manufacturing, Integration of CAD/CAM/CAE in Digital Manufacturing.	6
VI	**Modern Manufacturing:** CNC, CNC vs Manual machining, parts, CNC Programming Basics, G-codes and M-codes, Coordinate systems (absolute vs incremental), Applications of CNC. VMC, basic parts, applications. Additive Manufacturing (3D Printing), Types of 3D Printing Technologies, Workflow of 3D Printing, applications.	7

Text Books	
1	A Textbook of Production Technology (Manufacturing Processes), P.C. Sharma, S. Chand publications.
2	Production Technology by R.K. Jain, Khanna publications.
3	Fundamentals of Modern Manufacturing: Materials, Processes, and Systems by Mikell P. Groover, Wiley publications.
4	CAD/CAM: Principles and Applications by P.N. Rao, Tata McGraw Hill publications.

References	
1	Manufacturing Engineering and Technology by Serope Kalpakjian & Steven R. Schmid, Pearson Education
2	NC Technology and Programming by Krar, Gill & Smid, Delmar Cengage publications
3	Automation, Production Systems, and Computer-Integrated Manufacturing by Mikell P. Groover.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc22_me28
2	https://www.youtube.com/watch?v=2vFdwz4U1VQ
3	https://nptel.ac.in/courses/112/103/112103306

CO-PO Mapping for Mechanical Engineering Department															
	Programme Outcomes (PO)												**PSO**		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	
CO1	1				2							1			
CO2		2			2										
CO3	1	2													
CO4		3			2							2			

The strength of mapping is to be written as 1,2,3; Where, 1:Low, 2:Medium, 3:High

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli *(Government Aided Autonomous Institute)*					
AY 2025-26					
Course Information					
Programme	B. Tech. (Mechanical Engineering)				
Class, Semester	Third Year B. Tech., SEM-VI				
Course Code	7MDME321				
Course Name	Thermal Engineering				
Desired Requisites:	Basic Mathematics, Chemistry				
Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Students will get Knowledge of basic concepts of thermal engineering, fluid mechanics, heat transfer and its applications.
2	Student will be aware about advanced concepts in thermal engineering subject to analysis of thermal systems and its environmental implications and sustainability
3	Student will be acquire the confidence in analyse the motion of combusting and no combusting fluids whilst accounting for variable specific heats, non-ideal gas properties, chemical no equilibrium and compressibility

Course Outcomes (CO)

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	Explain the concepts of thermodynamics, fluid mechanics and heat transfer	II	Understanding
CO2	Apply the concepts of Thermodynamics and heat transfer in the heat management of robotics system, batteries, building and electronic components.	III	Applying
CO3	Analyse the combustion mechanisms of various fuels.	IV	Analysing
CO4	Evaluate the performance of various thermal systems	V	Evaluating

Module	Module Contents	Hours
I	**Introduction to Thermal Engineering** **Basic Concepts** Thermodynamics and Energy, Systems and Control Volumes, Properties of a System, State and Equilibrium, Processes and Cycles, Temperature and the Zeroth Law of Thermodynamics. **Energy** Forms of Energy, Energy Transfer by Heat and Work, The First Law of Thermodynamics, Energy Conversion Efficiencies, Energy and Environment **Practical Applications** Relevance of thermodynamics in energy systems, HVAC, cooling in electronics, and automation.	6
II	**Heat Transfer and Thermal Management Techniques** **Modes of Heat Transfer**: Conduction, convection, and radiation.	6

	Thermal Management in Electronics: Active/passive cooling methods for microelectronics. Heat Management in actuators, sensors, and motors. **Applications**: Thermal management for smart buildings (HVAC), power plants, battery pack.	

III	**Fluid Mechanics and Thermal Systems** Distinction between solids and fluids, ideal vs. real fluids. Density, viscosity, surface tension, compressibility, specific volume, and specific weight. Bernoulli's equation, Reynolds number, and flow regimes (laminar and turbulent). Computational Fluid Dynamics **Heat Transfer in Fluids**: Flow in pipes, ducts, and heat exchangers (shell-and-tube, plate heat exchangers). Thermal boundary layers and heat transfer enhancement techniques (e.g., microchannels, nanofluids).	6
IV	**Power Generation and Refrigeration Systems** **Thermal Power Generation**: Basics of thermal power plants (Rankine cycle), Gas turbines and Brayton cycle, Combined heat and power (CHP) systems **Renewable Energy Systems: Solar** thermal and photovoltaic systems, Wind power and geothermal systems, Bioenergy and waste-to-energy systems **Refrigeration System :** **Basic principles** of refrigeration: heat transfer, thermodynamic cycles (vapor-compression, absorption, and others), Refrigeration cycle analysis, Coefficient of Performance (COP)., Heat Pump, Air Conditioning	6
V	**Combustion and Fuel Technologies** **Combustion Fundamentals**: Combustion reactions and stoichiometry, Adiabatic flame temperature and combustion efficiency, Types of combustion (Complete vs. incomplete) **Fuels and Emissions**: Types of fuels: Solid, liquid, gas, biofuels, Characteristics of fuels (heating value, combustion temperature), Pollutants in combustion (NOx, CO, SOx, particulate matter), Emission control and technologies	6
VI	**Environmental Impact and Sustainability in Thermal Engineering** Greenhouse gas emissions and thermal engineering solutions, Low-GWP refrigerants and environmentally-friendly energy systems, Thermal pollution and its control, Sustainable thermal management in buildings and industries	6

Text Books	
1	An Introduction to Thermodynamics, Y.V.C. Rao, University Press (India) Private Limited, Revised Edition, 2004).
2	Thermodynamics: an Engineering Approach, Y.A.Cengal and M.A.Boles, McGraw Hill (Fifth edition).
3	Fundamentals of Classical Thermodynamics, G.VanWylen, R.Sonntag and C.Borgnakke , John Willey & Sons (Fourth edition).
References	
1	Cengel, "Thermodynamics", Tata McGraw Hill Co., New Delhi, 1980.
2	Howell and Dedcius, "Fundamentals of Engineering Thermodynamics", McGraw Hill Inc., U.S.A
3	Van Wylen& Sonntag, "Thermodynamics", John Wiley and Sons Inc., U.S.A
4	Jones and Hawkings, "Engineering Thermodynamics", John Wiley and Sons Inc., U.S.A, 2004.
5	Holman, "Thermodynamics", McGraw Hill Inc., New York, 2002.
6	Faires V.M. and Simmang, "Thermodynamics", Macmillan Publishing Co. Inc., U.S.A.
7	Rao Y.V.C., "Postulational and Statistical Thermodynamics", Allied Publishers Inc, 1994
Useful Links	
1	https://youtu.be/lvy8h-yWhRQ
2	https://youtu.be/JIDK5iyatBk

3	https://youtu.be/EYKeBg4DmHI

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

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Course Information	
Programme	B. Tech. (Mechanical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI
Course Code	7MDME371
Course Name	Mechanical Systems Lab
Desired Requisites:	

Teaching Scheme		Examination Scheme (Marks)			
Lecture	3 Hr/week	**LA1**	**LA2**	**Lab ESE**	**Total**
Tutorial	--	30	30	40	100
		Credits: 1			

Course Objectives

1	To analyze and verify the motion characteristics and kinematic parameters of various mechanisms, including Hooke's joint and gear trains.
2	To develop computational tools and techniques for velocity and acceleration analysis of common planar mechanisms like four-bar chains and slider-crank mechanisms.
3	To understand and determine advanced dynamic concepts such as Coriolis acceleration and moment of inertia using experimental and analytical methods.
4	To study and apply gear design principles, including involute profile generation and analysis of epicyclic gear trains and automobile gearboxes.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	Course Outcome Statement/s	Bloom's Taxonomy Level	Bloom's Taxonomy Description
CO1	**Analyze** the motion characteristics of Hooke's joint and various mechanisms using fundamental kinematic principles.	4	Analyze
CO2	**Develop** computer programs for velocity and acceleration analysis of four-bar chain and slider-crank mechanisms.	3	Develop
CO3	**Determine** Coriolis component of acceleration and moment of inertia using experimental methods.	5	Evaluate
CO4	**Construct** and **evaluate** gear profiles and gear trains, including epicyclic and automobile gearboxes.	5	Evaluate

List of Experiments

1. To verify angular displacement ratio of shaft connected by Hooke's joint
2. To find out the Coriolis component of acceleration.
3. To develop a computer program for velocity and acceleration analysis of four bar chain and single slider crank mechanism.
4. To generate involute gear tooth profile.
5. To solve problems on the epicyclic gear train by the tabular method.
6. To determine M.I. by Bi-filler suspension, Tri-filler suspension, or compound pendulum method.
7. To study different mechanisms and analyse them for links, joints, DoF etc
8. To analyses gear trains in the lathe machine, the drilling machine, milling machine.
9. To study automobile gearboxes

References	
1	Thomas Bevan, *"Theory of Machines",* CBS Publishers, New Delhi, 1st Edition, 2010.
2	J. F. Shigley,*"Mechanical Engineering Design",* , McGraw Hill, New York. 4th Edition, 2011

Useful Links	
1	
2	

Textbooks	
1	Ratan S.S, *"Theory of Machines"*, Tata McGraw Hill, New Delhi, 3rd Edition, 2011
2	V. B. Bhandari, "*Design of Machine Elements",* Tata McGraw Hill, 3rd Edition, 2011
3	Sadhu Singh,*"Theory of Machines",* Pearson Education, 2nd Edition, 2009

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1		3											
CO2		3		2								1		
CO3				3	2					1				
CO4														

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.

IMP: Lab ESE is a separate head of passing. LA1, LA2 together is treated as In-Semester Evaluation.

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 5 Marks Submission at the end of Week 5	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 6 to Week 9 Marks Submission at the end of Week 9	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 10 to Week 12 Marks Submission at the end of Week 12	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per

the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

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Course Information	
Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem. V (MDM Course)
Course Code	7MDEL301
Course Name	Power System Engineering
Desired Requisites:	NIL

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To understand electrical power generation.
2	To understand transmission and distribution system.
3	To understand protection system with different element.
4	To Explain smart grid technology and trends in power system.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe the electrical power generation by convention and non-convention sources.	II	Understanding
CO2	Explain different methods of transmission and distribution system with components used for power transmission.	II	Understanding
CO3	Describe protection system with different element used in power system for protection of power system.	II	Understanding
CO4	Illustrate smart grid technology and trends in power system for modernisation of power grid.	III	Applying

Module	**Module Contents**	**Hours**
I	**Non-Renewable Energy Sources** Indian electricity scenario of non-renewable energy sources, overview of Indian national grid, single line diagram of electrical power system, types of non-renewable energy sources, schematic diagram, working, advantages and disadvantages of thermal power plant, hydro power plant	7
II	**Renewable Energy Sources** Indian electricity scenario of renewable energy sources, need for renewable energy, advantages and disadvantages of renewable energy, types of renewable energy sources, schematic diagram, working, advantages and disadvantages of solar and wind power plant	7
III	**Overhead Transmission System** Types of transmission system (short, medium and long), types of transmission line conductor (ACSR, expanded ACSR and ACAR), line supports and types of insulators, **Substation:** outdoor substation, indoor substation	6
IV	**Distribution System and UG Cables** Distribution system, classification of distribution feeders, connection scheme and operation of distribution system. **Underground cables:** construction and classification of cables, methods of laying underground cables.	6

V	**Protection and Power System Elements** Different types of fault, relay and circuit breaker, MCB, rewireable and HRC fuse, fuse characteristics, application and selection of fuse. **Power system elements:** brief description of power system element such as generator, transformer, bus bar, isolator, CT, PT and LA.	7
VI	**Smart Grid and Trends in Power System** introduction to smart grid in Indian context, architecture of smart grid, advantages and disadvantages, key challenges for smart grid, smart grid technologies, standards and codes for grid integration of dg systems. **Trends in Power System:** introduction to wireless power transmission system.	6

Textbooks	
1	Principles of Power System, V. K. Mehta & Rohit Mehta, S. Chand Publication, 4th Edition.
2	Electrical Power Generation, Transmission and Distribution, S. N. Singh, PHI Publication, 2nd Edition
3	Power System Protection and Switchgear, Badri Ram, Tata McGraw, 9th Edition.

References	
1	Electrical Power System, C. L, Wadhwa, New Age Int. Publication, 6th Edition.
2	Generation of Electrical Energy, B. R. Gupta, S. Chand Publication, 5th Edition.
3	Switchgear Protection, J. B. Gupta, S. k. Kataria & Sons., 2nd Edition.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc25_ee67/preview

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2						1							
CO2	2													
CO3	2													
CO4	2													

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Dr. Swapnil D. Patil
Syllabus Checked By	Mr. M. S. Mahagaonkar

Walchand College of Engineering, Sangli

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AY 2025-26

Course Information	
Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI (MDM Course)
Course Code	7MDEL321
Course Name	Power Electronics and Drives
Desired Requisites:	Fundamentals of Electrical Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To provide basic knowledge of different power electronic devices, rectifiers, converters, inverters and choppers.
2	To impart skills to control different types of converters such as rectifiers, controlled converters, inverters and choppers.
3	To understand the fundamentals of electrical drives.
4	To strengthen control principles of various DC and AC motors using solid state converters.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Describe the basics of semiconductor switches, rectifier, controlled converter, inverter, choppers,	I	Remember
CO2	Explain the applications of rectifier, controlled converter, inverter, choppers,	II	Understand
CO3	Explain the various concepts used in electric drives.	II	Understand
CO4	Apply the control techniques for electric drives for speed control.	III	Apply

Module	**Module Contents**	**Hours**
I	**Power Semiconductor Switches and DC to DC Converters** Introduction to semiconductor switches such as Power diode, thyristor, MOSFET, IGBT and GTO. V-I characteristics, turn -on and turn- off and comparison between them and their applications. DC to DC converters, buck, boost and buck-boost converter, two quadrant and four quadrant chopper, (only circuit operation and output voltage control) applications of DC to DC converter	7
II	**AC to DC Converters (Uncontrolled and Controlled)** Single phase full wave diode bridge and single phase full wave full controlled AC to DC thyristor converter, three phase full wave diode bridge and three phase full wave full controlled and semi controlled thyristorised converter. (operation and output voltage control.)	6
III	**Single phase and three phase Inverters** Basic concepts of switch mode inverters, types: VSI and CSI, single phase half bridge and full bridge inverter, three phase six step inverter, 120 degree mode of conduction, 180 degree mode of conduction, three phase PWM Inverter, sinusoidal PWM technique, output voltage and frequency control	7

IV	**Fundamentals of Electrical Drives** Introduction to electric drives and classifications, advantages and applications of electric drives, components of drive systems, four-quadrant operation of drives, speed-torque characteristics of: DC shunt motor, separately excited DC motor, induction motor (squirrel cage and slip-ring)	6
V	**Control of DC Drives** Methods of speed control, starting and braking operation, single phase and three phases full controlled and half controlled converter fed DC drives, multi quadrant operation of separately excited DC shunt motor, dual converter fed DC drives, circulating and non – circulating mode of operation, converter fed DC series motor drive, chopper control of DC shunt and series motor drives, four quadrant operation of chopper fed DC shunt motor drive.	7
VI	**Control of AC Drives** Torque equation, Speed control methods for three phase cage induction motor, braking methods, stator voltage control induction motor drive, VSI fed induction motor drive, constant torque (constant E/F and constant V/F), constant HP operation, closed loop speed control block diagram,. Speed control of BLDC and PMSM	6

Textbooks	
1	P. S. Bhimra, "Power Electronics",3rd Edition, Khanna Publishers, 2002.
2	Dubey, G. K. Fundamentals of Electrical Drives. 2nd ed., Narosa Publishing House, 2002. ISBN-13: 978-8173194283.
References	
1	M. H. Rashid "Power Electronics, Circuits, Devices and Applications", Pearson Education Inc., 4th Edition, November 2017.
2	Subrahmanyam, Vedam. Electric Drives: Concepts and Applications. 1st ed., Tata McGraw-Hill Publishing Company, 2001. ISBN: 978-0074603703.
Useful Links	
1	https://nptel.ac.in/courses/108/104/108104140/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3													2
CO2	2			2										2
CO3	3													2
CO4		2												2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Syllabus Prepared By	Seema P Diwan
Syllabus Checked By	Dr. D S More

Walchand College of Engineering, Sangli

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Course Information

Programme	B. Tech. (Electrical Engineering)
Class, Semester	Third Year B. Tech., Sem. VI (MDM Course)
Course Code	7MDEL371
Course Name	Power Electronics and Drives Lab
Desired Requisites:	Basic Electrical and Electronics Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 1			

Course Objectives

1	This course intends to provide the practical knowledge of different power electronics devices.
2	It is aimed to impart skills of working of different power electronic converter through simulation and experimentation.
3	Make the students acquainted with simulation, analysis and design of power electronic converters.
4	To provide the practical knowledge of different power electronics drives

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	To Analyse the performance of single phase half wave and full wave converters	IV	Analysing
CO2	To Analyse the performance of three phase half wave and full wave converters	IV	Analysing
CO3	Construct different types of converters such as rectifier, inverter and Chopper with their control techniques using simulation.	IV	Analysing
CO4	Measure the performance of Electrical drives.	V	Applying

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Analyze the performance of DC motor FED from single phase full wave half control converter.
2. Analyze the performance of DC motor FED from single phase full wave full control converter.
3. Study the operation of two quadrant single phase converter fed 5 HP DC drive (Simulation).
4. Analyze the performance of three phase full wave half control converter.
5. Analyze the performance of three phase full wave full control converter.
6. Analyse the performance of chopper fed D. C. drive for closed – loop speed control (simulation).
7. Open loop speed control of three inductions motor supplied from three phase PWM inverter.
8. Simulation of PWM inverter FED induction motor drive.
9. Simulation of BLDC motor drive.
10. Simulation of PMSM drive.

Textbooks

1	M.H.Rashid "Power Electronics, Circuits, Devices and Applications", Pearson Education Inc., 4th Edition, November 2017.
2	P. S. Bhimra, "Power Electronics",3rd Edition, Khanna Publishers, 2002.

References

1	B.K. Bose, "Modern Power Electronics and A.C. Drives", Prentice Hall of India Pvt. Ltd. Publication, 2002.

2	Mohan, Undeland and Robins, "Power Electronics, Converter Applications and Design", John Wiley and sons (Asia) Pvt. Ltd., 3rd Edition, 2010.
3	G. K. Dubey and Others "Thyristorised Power Controller", New Edge International Publishers, 1st Edition Reprint, 2005.
Useful Links	
1	https://nptel.ac.in/courses/108/104/108104140/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3					2					
CO2					3									
CO3				3					2					
CO4				3										

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

Syllabus Prepared By	Seema P Diwan
Syllabus Checked By	Dr. D S More

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AY 2024-25

Course Information

Programme	Multidisciplinary Minor (Electronics Engineering)
Class, Semester	Second Year B. Tech., Sem.-II
Course Code	7MDEN221
Course Name	Electronic Devices and Circuits
Desired Requisites:	Basic Electrical and Electronics Engineering

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives

1	To **explain** the working of diode circuits and electronic circuits like small signal amplifiers, power amplifiers using BJT and MOSFETs. .
2	To **illustrate** the methods used for AC/DC analysis of transistorized and op-amp based circuits.
3	To **Explain** the working of power semiconductor devices and electrical power converter circuits.
4	To **explain** the working of oscillators, multivibrators, timing circuits and voltage regulators.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO1	**Explain** the working of diode circuits, transistorized and op-amp based circuits.	Understand
CO2	**Explain** the working of power semiconductor devices such as SCR, GTO, Power MOSFET and IGBT and power electronics circuits.	Understand
CO3	**Explain** the working of oscillators, multivibrators and applications of operational amplifier in analog computations.	Understand
CO4	**Solve** the examples on diode circuits, amplifiers, voltage regulators and op-amp based circuits considering ideal op-amp.	Applying

Module	**Module Contents**	**Hours**
I	**Diode Circuits:** Rectifier circuits, RC filter circuit, Zener diode voltage regulator, voltage multiplier circuits, diode logic circuits, photodiode and LED circuits.	**6**
II	**Transistorized Amplifiers:** Amplifier fundamentals, small signal amplifiers: common emitter amplifier, common collector amplifier; JFET/MOSFET common source/ common drain amplifier, frequency response of amplifiers.	**8**
III	**Power Amplifiers** Classification of power amplifiers: class-A, class-B, class-AB, class-C power amplifiers; transformer-coupled amplifiers, heat sink and its operation	**6**
IV	**Op-Amp Applications**: Differential amplifier, unity gain buffer (voltage follower), voltage comparator, zero crossing detector, effect of positive feedback, Schmitt trigger circuit, multivibrators, types of oscillator, RC oscillators, monolithic timers (IC555).	**7**
V	**Power Semiconductor Devices and Circuits:** SCR, TRIAC, DIAC, GTO, Power MOSFET and IGBT; controlled rectifiers, ac voltage controllers, inverter, chopper, UPS,	**6**
VI	**Regulated DC Power Supply:** Block diagram of regulated dc power supply, Zener diode voltage regulator, op-amp based voltage regulator, three terminal IC voltage regulator, switching regulators.	**6**

Textbooks	
1	R. Boylestad and L. Nashelsky, "*Electronic Devices and Circuit Theory*", 9th Edition, PHI, 2009.
2	D. A. Neamen, "*Microelectronics: Circuit Analysis and Design*", 4th Edition, McGraw Hill Education (India) Private Limited, New Delhi, 2021.
3	Ramakant Gaikwad, "Op-amp and Linear Integrated Circuits", 4th edition, Pearson, 2015.
4	M.H. Rashid, "*Power Electronics: Circuits, Devices & Applications*", Third Edition, PHI, New Delhi, 2008.
References	
1	Albert Malvino, David J. Bates, "Electronic Principles", 7th Edition, McGraw Hill Education, 2017.
2	Robert F. Coughlin and Frederick F. Driscoll, "Operational Amplifiers and Linear Integrated Circuits," Pearson Education, 2009.
3	M. D. Singh & K. B. Khanchandani, "*Power Electronics*", Second Edition, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2007.
4	
Useful Links	
1	https://nptel.ac.in/courses/108101091
2	https://nptel.ac.in/courses/108105158
3	https://www.tutorialspoint.com/semiconductor_devices/semiconductor_devices_operational_amplifiers.htm
4	https://nptel.ac.in/courses/108/105/108105066/#

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	3												2
CO2	2	3												2
CO3		3	3											2
CO4			3											2

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.
MSE shall be typically on modules 1 to 3.
ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.
ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.
For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering - MDM)
Class, Semester	Third Year B. Tech., Sem (V)
Course Code	7MDCS301
Course Name	Software Engineering and Database Essentials
Desired Requisites:	

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	Understand importance of engineering approach to software development and comprehend the knowledge of software processes & models practiced at IT industries
2	Be acquainted with the SDLC phases in detail and appreciate the importance of software quality by virtue of software testing methods.
3	To use conceptual designs to prepare database schemas.
4	To understand the relational model and the theoretical issues associated with relational database Design..
5	To learn SQL and Database Architectures.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	explain proficiency to undertake software projects based on software engineering practices	II	Understand
CO2	apply SQL to extract required information from the database. Compare, analyses various ways of writing the queries for a given problem and Differentiating database Architecture	III	Apply
CO3	summarizing the spirit of team-working in SDLC phases & project planning benefits	III	Apply
CO4	describe the conceptual designs of Database, identifies the need, analyse the problem and Design ER diagram as well as prepare the relational database schema.	IV	Analyze

Module	**Module Contents**	**Hours**
I	Introduction Software Engineering Basics, Software Crisis, Need of software engineering approach, Software Processes: project management process, software development process models, Configuration management process, process management process.	6
II	Software Quality & Project Planning, Notion of Software Quality: Quality objectives, Need for improvement, Software quality factors, Quality standards, Project Planning Basics: Project management plan, Cost estimation, Project scheduling, Staffing and personnel Planning, Risk management	7
III	Software Development Phases, Software Requirement Process, Design principles, Structured design methodology, Coding Standards, levels of Testing.	6

IV	Introduction and Database Modelling using ER Model, General introduction to database systems, its advantages and applications, Database System Architecture, Database users and Administrator, Data models, DBMS, DB languages, View of DB, Data Models, ER Model: Entity set, Entity types, attributes, Notations, Relationship sets, Relationship types, Keys- super key, candidate key, primary key, Extended Features: Generalization, Specialization, aggregation	6
V	Relational Model and SQL, Structure of Relational Database, Reduction of ER model into Relational schemas, Schema-instance distinction, Key, Relational algebra, Tuple and Domain relational calculus, Example queries, SQL: Introduction, DDL with constraints, Insert, Update, Delete, Set Operations, Aggregate functions, group by/having, Nested Queries, Views, Joins.	8
VI	Database Architectures, Centralized &Client-Server architectures, server system architecture, parallel databases, Distributed DB concepts, Homogeneous & Heterogeneous DBs, data fragmentation, replication, allocation techniques	6

Textbooks	
1	Pankaj Jalote, "An integrated approach to S/W engineering", Narosa Publishers, 2nd Edition
2	Abraham Silberschatz, Henry F. Korth and S. Sudarshan, Database System Concepts, Mc-Graw Hill, 4th Edition 2002 / 6th Edition 2011
3	Pankaj Jalote, "Software Project Management in practice", Pearson education

References	
1	Roger S. Pressman, "Software Engineering: Practitioner"s Approach". McGraw Hill
2	Raghu Ramakrishnan and Johannes Gehrke, Database Management Systems, 3rd Edition. 2002

Useful Links	
1	https://cryptobook.nakov.com
2	https://www.cs.umd.edu/~jkatz/crypto/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1													
CO2		2												
CO3			3											
CO4					2									

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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Course Information	
Programme	B.Tech. (Computer Science and Engineering)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7MDCS321
Course Name	Machine LEarning in Practice
Desired Requisites:	Basics of probability, statistics and calculus

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	3	30	20	50	100
		Credits: 3			

Course Objectives	
1	To introduce fundamentals and applications of Artificial Intelligence and Generative AI.
2	To train exploratory data analysis required for Machine Learning tasks.
3	To familiarize learning paradigms in Machine Learning and their applications.
4	To acquaint with use of algorithms for solving machine learning tasks.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	grasp basic concepts of AI, GenAI, their components, uses and applications.	II	Understanding
CO2	explain data pre-processing, learning paradigms and algorithms in Machine Learning.	II	Understanding
CO3	use GenAI tools and techniques in data pre-processing and Machine Learning to solve simple AI problems.	III	Applying
CO4	identify data pre-processing techniques, learning paradigms and techniques applicable for real-life scenarios.	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction** What is AI, what is data, AI terminologies, Machine Learning vs Data Science vs Deep Learning, Supervised, unsupervised and reinforcement learning paradigms, workflow of a Machine Learning project, tools used, bias in AI, attacks in AI systems, AI applications, state-of-the-art case study.	5
II	**Exploratory Data Analysis** Data summarization, Data cleaning: handling missing values, removing noise from data, handling categorical features, feature selection and reduction, Data standardization, Data visualizations, Introduction to python libraries required for EDA.	7
III	**Supervised Learning I** Introduction, Train, dev and test dataset, Linear regression, evaluation measures in regression, cross validation, ensemble learning – bagging, boosting and stacking.	7
IV	**Supervised Learning II** Logistic regression, Naïve Bayes, Decision tree, evaluation metrics, Bias-variance trade off, Regularization	8

V	**Unsupervised Learning** **Clustering:** Agglomerative clustering, K means, DBSCAN. **Outlier detection:** Univariate techniques, kNN, iForest.	8
VI	**GenAI and state-of-the-art application** Basics of GenAI, Introduction to LLM, Prompt engineering, tools in the market, an application case study.	5

Textbooks	
1	Stuart Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", Prentice Hall, 3rd Edition, 2009
2	Oliver Theobald, Machine Learning for Absolute Beginners
3	Han, Jiawei, Jian Pei, and Hanghang Tong. Data mining: concepts and techniques. Morgan kaufmann, 2022.
References	
1	Machine Learning in Action by Peter Harrington
Useful Links	
1	https://www.deeplearning.ai/courses/ai-for-everyone/
2	Machine Learning Specialization on deeplearning.ai: Link
3	https://www.deeplearning.ai/courses/generative-ai-for-everyone/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1							2	1			2	
CO2	2	3	1						2	1			2	1
CO3	2	3	1						2	1			2	1
CO4	1	3							2	1			2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2024-25

Course Information

Programme	B.Tech. (Computer Science Engineering - MDM)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7MDC S3371
Course Name	Machine Learning in Practice Lab
Desired Requisites:	Basics of python programming

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	2	30	30	40	100
		Credits: 1			

Course Objectives

1	To inculcate programming fundamentals required for Machine Learning projects.
2	To introduce tools for Machine Learning projects and python libraries.
3	To impart skills for selection of appropriate data pre-processing and Machine Learning techniques.
4	To infuse abilities to use state-of-the-art technologies to design and develop AI projects.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	grasp fundamentals of python libraries used for Machine Learning.	II	Understanding
CO2	implement data pre-processing and machine learning techniques on given dataset.	III	Applying
CO3	test accuracy of machine learning techniques on given dataset.	IV	Analysing
CO4	select appropriate data pre-processing techniques and machine learning techniques based on their performance.	V	Evaluating
CO5	design a complete solution for solving real-life scenarios.	VI	Creating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Revisiting python basics and introduction to libraries required for Machine Learning.
2. Know your data: Load dataset in python, summarize it, compute simple central tendencies, slicing and dicing using pandas.
3. Perform data pre-processing: Removing missing data and anomalies, standardization and normalization, feature reduction.
4. Perform data visualizations.
5. Implementation of linear regression and performance evaluation.
6. Implementation of logistic regression and performance evaluation.
7. Implementation of Naïve Bayes and performance evaluation.
8. Implementation of Decision tree and performance evaluation.
9. Implement cross validation and ensemble learning.
10. Implement univariate anomaly detection, iForest and analyse reported anomalies.
11. Implement k-means clustering and analyse results.
12. Implement Agglomerative clustering and analyse results.
13. Perform prompt engineering on latest GenAI tool for different types of data.

Textbooks

1	Bell J., "*Machine Learning Hands-On for Developers and Technical Professionals*", Wiley 2015
2	Müller, Andreas C., and Sarah Guido. Introduction to machine learning with Python: a guide for data scientists. " O'Reilly Media, Inc.", 2016.

References	
1	Ekin, Sabit. "Prompt engineering for ChatGPT: a quick guide to techniques, tips, and best practices." Authorea Preprints (2023).
2	Yashwanth Sai Palghat, Prompt Engineering: The Art of Asking
3	Tushar Kute, Python Programming, Prakrut Publication
Useful Links	
1	https://scikit-learn.org/
2	https://www.datacamp.com/tutorial/machine-learning-python

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1			1	1						1			1	1
CO2			2	2	3					1		2	2	
CO3			2	2	3					1		2	2	
CO4			2	3	2					1		2	2	
CO5			3	1						1			1	
The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO, and preferably to only one PO.														

Assessment				
There are three components of lab assessment, LA1, LA2 and Lab ESE. IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%				
Assessment	**Based on**	**Conducted by**	**Typical Schedule**	**Marks**
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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AY 2025-26

Course Information

Programme	B.Tech. (Computer Science and Engineering - MDM)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	7MDCS322
Course Name	MDM Elective-1 Internet of Things
Desired Requisites:	Basics of Networking and Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 03			

Course Objectives

1	To introduce the fundamental concepts, architecture, and societal relevance of the Internet of Things (IoT).
2	To explore communication protocols and interface standards essential for IoT systems.
3	To understand the roles of sensors, actuators, and cloud platforms in IoT application development.
4	To examine real-world IoT applications and analyse their effectiveness in various domains such as healthcare, industry, and smart cities.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the fundamental concepts, communication principles, and societal applications of IoT, including the role of cloud technologies.	II	Understand
CO2	Develop simple IoT applications by integrating sensors, actuators, and microcontrollers using appropriate communication protocols.	III	Apply
CO3	Analyse IoT system architectures and data flow mechanisms for device integration, data acquisition, and cloud-based storage.	IV	Analyse
CO4	Evaluate the effectiveness of IoT solutions in real-world scenarios such as smart cities, industrial automation, and healthcare, with respect to performance, scalability, and societal impact.	V	Evaluate

Module	**Module Contents**	**Hours**
I	**Introduction to IoT: -** Introduction to Internet of Things (IoT), Functional Characteristics, Recent Trends in the Adoption of IoT, Role of cloud in IoT, Societal Benefits of IoT: - Health Care, Machine to Machine (M2M).	
II	**Communication Principles: -** RFID, ZigBee, Bluetooth, Internet Communication- IP Addresses - MAC Addresses , IEEE 802 Family of Protocols , I/O interfaces Software Components.	
III	**Sensing and Actuation: -** Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, purpose of Sensors and Actuators in IoT.	

IV	**IoT Application Development: -** Frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices.	
V	**Cloud computation: -** Evolution of Cloud Computation, Commercial clouds and their features, open source IoT platforms, cloud dashboards, Interfacing and data logging with cloud: Blync, Thing speak, platforms.	
VI	**IoT Case Studies: -** IoT Case studies based on industrial Automation, Transportation, Smart cities, smart supply chain, Remote site monitoring .	

Textbooks	
1	Adrian Mcewen, Hakin Cassimally, "Designing The Internet of Things", First Edition, Wiley, 2014.
2	Keysight Technologies, "The Internet of Things: Enabling Technologies and Solutions for Design and Test", Application Note, 2016.
3	Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014, ISBN:978 0996025515.

References	
1	Raj Kamal , " Internet of Things: Architecture and Design", McGraw Hill.2nd edition June 2022
2	Pethuru Raj, Anupama C. Raman," The Internet of Things Enabling Technologies, Platforms, and Use Cases", Taylor and Francis group. February 2017
3	Peter Waher, "Mastering Internet of Things: Design and create your own IoT applications using Raspberry Pi 3", First Edition, Packt Publishing, 2018.

Useful Links	
1	https://onlinecourses.nptel.ac.in/noc19_cs65/preview
2	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	1				2	1			1			1	
CO2	1		2		2				1	1			2	
CO3		1	2	2	1	2							3	2
CO4		2	2	3	1	3	2	1	1	2			3	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2025-26

Course Information	
Programme	B.Tech. (Computer Science Engineering - MDM)
Class, Semester	Third Year B. Tech., Sem
Course Code	7MDC S3372
Course Name	MDM Elective-1 Internet of Things Lab
Desired Requisites:	Basics of Networking and Programming

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 01			

Course Objectives	
1	Understand the fundamental concepts of IoT systems, including sensors, actuators, microcontrollers, and communication protocols.
2	Apply microcontroller programming skills to interface various sensors and actuators for real-world IoT applications.
3	Analyse and interpret sensor data through local displays, web servers, and cloud platforms to monitor and control IoT devices.
4	Design and develop functional IoT prototypes using cloud integration, wireless communication, and automation technologies.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain the architecture of IoT systems and the roles of sensors, actuators, and communication protocols used in typical IoT applications.	II	Understand
CO2	Implement IoT applications by interfacing microcontrollers with sensors and actuators using appropriate programming techniques.	III	Apply
CO3	Analyse sensor data and network behaviour in IoT systems using local and remote data handling methods such as web servers and cloud platforms.	IV	Analyse
CO4	Evaluate and develop integrated IoT prototypes with cloud connectivity and automation features to solve real-world problems.	V	Evaluate

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Blinking LED using Arduino/NodeMCU
2. Reading Temperature and Humidity using DHT11 Sensor
3. Controlling LED using Web Interface (ESP8266/ESP32)
4. Controlling Servo Motor using IoT Interface
5. Creating a Wi-Fi Based Web Server using ESP8266/ESP32
6. Sending Sensor Data to ThingSpeak Cloud Platform
7. Displaying Sensor Data on OLED Display
8. Implementing MQTT Protocol using ESP and Public Broker
9. IoT-Based Home Automation System
10. Data Logging on SD Card using Arduino
11. Smart Parking System using IR Sensor
12. Voice-Controlled Device using Google Assistant and IFTTT
13. Smart Street Light System using LDR

Textbooks	
1	Vijay Madisetti, Arshdeep Bahga," Internet of Things A Hands-On- Approach",2014, ISBN:978 0996025515.
2	Jeeva Jose "Internet of Things", January 2018, ISBN:978-9386173591

References	
1	Dieter Uckelmann, Mark Harrison, Florian Michahelles, "Architecting the Internet of Things", April 2011, ISBN:978-3642191572
2	Adrian Mcewen , Hakim Cassimally, "Designing the Internet of Things", December 2013, ISBN: 978-1118430620

Useful Links	
1	https://nptel.ac.in/courses/106105166

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	1										1	
CO2	2	2	3		3								2	2
CO3	2	3	2	3	3								2	
CO4	1	2	3	3	3	2	2	2	2	2	2	2	2	

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks

LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

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AY 2024-25

Course Information	
Programme	B.Tech. (Computer Science and Engineering- MDM)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Data Analytics
Desired Requisites:	Nil

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
		Credits: 3			

Course Objectives	
1	To differentiate between different types of data.
2	To apply statistical techniques to explore data.
3	To develop different visualizations that effectively communicate data findings.
4	To apply simple machine learning techniques to predict relationship among data.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	understand the fundamental concepts and importance of data analytics in various domains.	II	Understanding
CO2	apply appropriate techniques to gain knowledge from data.	III	Applying
CO3	illustrate various statistical and machine learning approaches to discover relationship among data.	III	Applying
CO4	construct clear and insightful visualizations among data.	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction to Data Analytics** Data analytics importance and overview, data analytics benefits Terminologies in data analytics, Data categorization (constant and variable; discrete and continuous; Qualitative and Quantitative; structure, semi structured and unstructured, cross-sectional, time-series and panel), data measurement scale. Types of Analytics(Descriptive, predictive, prescriptive, diagnostic) Descriptive Analytics: Measures of Central Tendency, Measures of Variation, Measures of Shape and symmetry, Fundamentals of Python useful in data analytics.	**7**
II	**Probability Distributions** Conditional Probability and Bayes Theorem, Random variable and probability distribution. Probability Density Function (PDF)and Cumulative Distribution Function (CDF) of a Continuous Random variable. Various probability distribution (Binomial, Poisson, Uniform, Exponential, Normal)	**6**

III	**Inferential Statistics** Sampling and its various techniques, Estimation, Sampling distribution of mean and proportion, Normal distribution and z - statistic, Central limit theorem, Confidence Interval estimation for mean and proportion, sample size estimation, estimation of parameters. **Basic Analysis Techniques** One Sample test (Hypothesis testing, Z-test, t-Test) Two Sample test (Analysis of variance, Correlation analysis) Chi-Square test	**7**
IV	**Data Visualization** Graphical representation of data, Characteristics and charts for effective graphical displays, Dot plot, Jitter plot, Error bar plot, Box-and whisker plot, Histogram, Bar chart, Scatter plot, Line plot. Open source tools like PowerBI, Tableu etc.	**6**
V	**Machine Learning basics** Supervised and unsupervised machine learning, Regression: Simple and multiple linear regression, classification: Naïve bayes, Decision tree, ANN etc.	**7**
VI	**Data analytics: Case studies** How Google, LinkedIn, Amazon, Netflix uses analytics Data analytics in media and entertainment industry, education, government, weather forecasting.	**6**

Textbooks	
1	Business Analytics: The Science of Data - Driven Decision Making - The Science of Data - Driven Decision Making, U Dinesh Kumar, Wiley India.
2	Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. "John Wiley & Sons, Inc"
3	Data Science & Analytics, V.K. Jain, Khanna Book Publishing, New Delhi

Reference Books	
1	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O'Reilly Publisher Media.
2	Business Analytics: The Science of Data - Driven Decision Making - The Science of Data - Driven Decision Making, U Dinesh Kumar, Wiley India.

Useful Links	
1	Data Analytics using Python- https://onlinecourses.nptel.ac.in/noc21_cs45/preview
2	Introduction to Data Analytics, https://nptel.ac.in/courses/110/106/110106072/

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2											2	
CO2	3	2							1	1			2	
CO3	3	2							1	1			2	
CO4	2	3											2	

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO.

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

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AY 2024-25

Course Information

Programme	B.Tech. (Computer Science Engineering - MDM)
Class, Semester	Third Year B. Tech., Sem VI
Course Code	
Course Name	Data Analytics lab
Desired Requisites:	Basics of python programming

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/Week	**LA1**	**LA2**	**Lab ESE**	**Total**
Interaction	-	30	30	40	100
		Credits: 01			

Course Objectives

1	To understand the characteristics of data using descriptive statistics.
2	To use probability distributions and conditional probability to analyze data and understand underlying patterns.
3	To train students to apply inferential statistical and machine learning techniques to draw meaningful conclusions from data.
4	To develop students' ability to create and interpret various graphical representations of data to effectively communicate insights and findings.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Apply fundamental statistical and probabilistic methods to analyze and interpret data effectively.	III	Applying
CO2	Implement different inferential statistical and machine learning techniques to make data-driven decisions.	III	Applying
CO3	Identify various data insights with help of statistical tests and correlation analysis.	IV	Analyzing
CO4	Select appropriate data visualization techniques to understand data.	V	Evaluating

List of Experiments / Lab Activities/Topics

List of Lab Activities:

1. Programs based on usefulness of python libraries like NumPy, pandas, Scipy required for data analytics.
2. Perform descriptive analytics of the given data.
3. Generate Probability Density Function (PDF) and Cumulative Distribution Function (CDF) for given data.
4. Perform various distributions on the given dataset to gain an insight into the relation between various attributes.
5. Generate different confidence interval for population mean and standard deviation for given data.
6. Estimate various population parameters from sample statistics for the Indians Diabetes Dataset.
7. Perform one-sample tests on the selected dataset to generate data analysis outcomes.
8. Perform two-sample tests on the selected dataset to generate data analysis outcomes.
9. Generate various graphical visualizations for given data.
10. Implement simple/multiple linear regression.
11. Implement Naïve bayes classification.
12. Perform Analytics of data to get an insight in Educational sector with specific data analytics tool.

Textbooks

1	Business Analytics: The Science of Data - Driven Decision Making - The Science of Data - Driven Decision Making, U Dinesh Kumar, Wiley India.
2	Douglas C. Montgomery, George C. Runger (2002). Applied Statistics & Probability for Engineering. “John Wiley & Sons, Inc”
3	Data Science & Analytics, V.K. Jain, Khanna Book Publishing, New Delhi
4	Python for data science for dummies 2nd Edition, John Paul Mueller, Luca Massaron, and Wiley
References	
1	McKinney, W. (2012). Python for data analysis: Data wrangling with Pandas, NumPy, and Python. " O'Reilly Media, Inc.".
2	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O’Reilly Publisher Media.
Useful Links	
1	Data Analytics using Python- https://onlinecourses.nptel.ac.in/noc21_cs45/preview
2	Introduction to Data Analytics, https://nptel.ac.in/courses/110/106/110106072/

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1				3	3				1	1			2	
CO2				2	2				1	1			2	
CO3				3	2				1	1			2	
CO4				2	3				1	1			2	

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High
Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.
IMP: Lab ESE is a separate head of passing (min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40

Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.

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AY 2025-26

Course Information	
Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V (MDM Course)
Course Code	
Course Name	Database system and Web Technology
Desired Requisites:	Fundaments of Information Technology, Programming Basics

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**ISE**	**MSE**	**ESE**	**Total**
Tutorial	-	20	30	50	100
		Credits: 3			

Course Objectives	
1	To introduce basic concepts of database management systems
2	To impart conceptual designs for databases and working with SQL
3	To develop simple web form using web technologies

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Summarize the relational database system	II	Understanding
CO2	Determine the use of basics of HTML and CSS styles	II	Understanding
CO3	Execute databases using Query languages	III	Applying
CO4	Implement Web Forms and web pages using front end technologies	III	Applying
CO5	Construct a simple web application with database connectivity	IV	Analysing

Module	**Module Contents**	**Hours**
I	**Introduction of database system and relation model:** Database Systems, view of data, Database design, Data abstraction, Data Models, Architecture of Database Systems, Entity-Relationship Model Relational model: Structure of Relational Databases, database schema, keys,	6
II	**Integrity Constraints and Design:** Domain Constraints, Referential Integrity, Normal forms, Functional Dependencies Features of Good Relational Designs, Database Decomposition	6
III	**Structured Query Language (SQL):** Overview of the SQL Query Language, SQL Data Definition, Basic Structure of SQL Queries, Additional Basic Operations, Set Operations, Aggregate Functions	7

IV	**HTML and CSS Basics:** Creating simple HTML Page with Headings, Paragraphs, Lists, working with Hyperlinks, tables, DIVs, Introduction to CSS styles, Styling HTML elements: text, colour, background, borders, creating layouts using CSS positioning and floats	6
V	**Introduction to JavaScript and Document Object Model (DOM):** Basics of JavaScript Programming language, variables, Data Types, Operators, JavaScript's Functions and control structures DOM and its significance, Manipulating HTML Elements using JavaScript, Handling Events and User Interaction	7
VI	**Web Forms and Data validation:** HTML form Attributes, Form Elements, Input Types, Input Attributes, Creating HTML Forms for user input, Form Handling using JavaScript, server side scripting, Building a simple server side application	6
Textbooks		
1	Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, "*Database System Concepts*", McGraw-Hill Education, 6th Edition, 2010.	
2	Raghu Ramakrishnan, "*Database Management Systems*", McGraw-Hill Education, 3rd Edition, 2003	
3	Web Technology: Theory and Practice by M. Srinivasan, Pearson India, Released June 2012	
References		
1	C.J.Date, A.Kannan, S.Swamynathan, "*An Introduction to Database Systems*", Pearson Education, 8th Edition, 2006	
2	Web Technologies by Achyut Godbole and Atul Kahate, Tata MacGraw Hill Education Pvt. Ltd	
Useful Links		
1	http://www.nptelvideos.in/2012/11/database-management-system.html	

CO-PO Mapping

	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1												
CO2	2	2										1	3	
CO3	1	2			2				1					1
CO4	2		2		3					2			2	
CO5	3		3									2	2	1

The strength of mapping is to be written as 1: Low, 2: Medium, 3: High

Each CO of the course must map to at least one PO.

Assessment

The assessment is based on MSE, ISE and ESE.

MSE shall be typically on modules 1 to 3.

ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO.

ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6.

For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)

Walchand College of Engineering, Sangli

(Government Aided Autonomous Institute)

AY 2025-26

Course Information	
Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem V (MDM Course)
Course Code	
Course Name	Database Engineering and Web Technology Lab
Desired Requisites:	Basic knowledge of Computer and Designing

Teaching Scheme		**Examination Scheme (Marks)**			
Practical	2 Hrs/ Week	**LA1**	**LA2**	**Lab ESE**	**Total**
		30	30	40	100
		Credits: 1			

Course Objectives	
1	To discuss fundamentals DDL, DML, DQL, DCL Commands
2	To describe interacting with databases using query languages
3	To Demonstrate JavaScript for dynamic effects and prepare PHP scripts.
4	To implement XML documents and XML Schema

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Explain ER Model and Convert entity relationship diagrams into RDBMS	II	Understanding
CO2	Demonstrate proficiency of SQL syntax and use it to interact with database	III	Applying
CO3	Implement static and dynamic web pages.	III	Applying
CO4	Demonstrate the incorporation of CSS and JAVASCRIPT in HTML	IV	Analyzing

List of Experiments / Lab Activities/Topics

List of Lab Assignments: (Minimum 10)

Database Engineering Lab

1. Identify entity, its attributes to draw ER diagram for database schema design.
2. Create database tables and write SQL queries to retrieve information from the database using DDL and DML commands. Give Primary key and foreign key constraints.
3. Perform Data Control Language (DCL) and Transaction Control Language (TCL) command in SQL
4. Study of various types of integrity constraints (NOT NULL Constraint, DEFAULT Constraint, UNIQUE Constraint, PRIMARY Key, FOREIGN Key, CHECK Constraint).
5. Implementation of DML commands of SQL with suitable examples. Perform Insertion, Deletion, Modifying, Altering, Updating and Viewing records based on specific conditions.
6. Perform Aggregation and group by, having clause queries to retrieve summary information from the database.

Web Technology Lab

1. Implement a program to design static web page required for an online bookstore website.
   1. Home Page
   2. Login Page
   3. Catalogue Page : The catalogue page should contain the details of all the books available in the website in a table.
   4. Registration Page.
2. Create a HTML form for a student for course registration which should have following fields:
   1. Student Name (textbox)
   2. Age (textbox with numbers only)
   3. Date of Birth (Calendar)
   4. Select Course (Drop Down)
   5. Submit and Cancel (Button)
3. Program On CSS properties in HTML page:
   a) Develop and demonstrate the usage of inline, internal and external style sheets using CSS.
   b) Design and develop web pages by applying CSS text formatting properties, such as Text Alignment, Text Decoration, Text Transformation, Text Spacing, Text Shadow, Font family, Font style Font Size, etc. Also apply CSS colors and backgrounds properties, such as color, RGB, HEX, HSL values, background image, background color, etc.
   c) Design and develop web pages by using CSS Selectors.
4. Develop and demonstrate JavaScript with POP-UP boxes and functions for the following problems:
   a) Input: Click on Display Date button using onclick( ) function
      Output: Display date in the textbox
   b) Input: A number n obtained using prompt
      Output: Factorial of n number using alert
   c) Input: A number n obtained using prompt

Output: A multiplication table of numbers from 1 to 10 of n using alert

d) Input: A number n obtained using prompt and add another number using confirm

Output: Sum of the entire n numbers using alert.

5 a) Implement a script using JavaScript that shows use of JavaScript conditionals and loops for web pages.

5 b) Implement a script using JavaScript that shows use of JavaScript Functions, Arrays, and Objects for web pages.

Textbooks	
1	Abraham Silberschatz, Henry F. Korth, and S. Sudarshan, "Database System Concepts", McGraw-Hill Education, 7th Edition, 2019.
2	Raghu Ramakrishnan, "Database Management Systems", McGraw-Hill Education, 3rd Edition, 2003.
3	Kogent Learning Solution Inc.,"Web Technologies: HTML, JAVASCRIPT, PHP, JAVA, JSP, ASP.NET ,XML and Ajax, Black Book", Dreamtech Press ,1st Edition,2009.
4	Jhon Duckeet ,"HTML and CSS:Design and Building Websites ",Jhon Willey and Sons,Inc".1st Edition, 2011.

References	
1	Vinicius M. Grippa, Sergey Kuzmichev, "Learning MySQL: Get a Handle on Your Data", O'reilly, 2nd edition 2021
2	Hector Garcia-Molina, Jeffrey D. Ullman, " Database Systems: The Complete Book", Pearson, 2nd Edition, 2014
3	Steven M Schafer, "HTML, XHTML and CSS" Wiley India Education,5th Edition, 2010
4	Thomas A. Powell,,"The Complete Reference :HTML & CSS", McGraw Hill Education, 5th Edition,2017.

Useful Links	
1	https://nptel.ac.in/courses/106/105/106105175/
2	https://onlinecourses.swayam2.ac.in/nou25_cs09/preview

CO-PO Mapping

	Programme Outcomes (PO)												**PSO**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2			1								1	2
CO2		1	2											2
CO3	1	2			3								2	
CO4			3		2								1	2

The strength of mapping is to be written as 1,2,3; where, 1: Low, 2: Medium, 3: High

Each CO of the course must map to at least one PO, and preferably to only one PO.

Assessment

There are three components of lab assessment, LA1, LA2 and Lab ESE.

IMP: Lab ESE is a separate head of passing.(min 40 %), LA1+LA2 should be min 40%

Assessment	Based on	Conducted by	Typical Schedule	Marks
LA1	Lab activities, attendance, journal	Lab Course Faculty	During Week 1 to Week 8 Marks Submission at the end of Week 8	30
LA2	Lab activities, attendance, journal	Lab Course Faculty	During Week 9 to Week 16 Marks Submission at the end of Week 16	30
Lab ESE	Lab activities, journal/ performance	Lab Course Faculty and External Examiner as applicable	During Week 18 to Week 19 Marks Submission at the end of Week 19	40
Week 1 indicates starting week of a semester. Lab activities/Lab performance shall include performing experiments, mini-project, presentations, drawings, programming, and other suitable activities, as per the nature and requirement of the lab course. The experimental lab shall have typically 8-10 experiments and related activities if any.				

Walchand College of Engineering, Sangli
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AY 2025-26

Course Information

Programme	B.Tech. (Information Technology)
Class, Semester	Third Year B. Tech., Sem VI (MDM Course)
Course Code	
Course Name	Operating System and Computer Network
Desired Requisites:	Computer Architecture

Teaching Scheme		**Examination Scheme (Marks)**			
Lecture	3 Hrs/week	**MSE**	**ISE**	**ESE**	**Total**
Tutorial	-	30	20	50	100
	-	**Credits: 3**			

Course Objectives

1	To introduce concepts, functions and services of operating systems.
2	To inculcate the concepts of process communication, file and memory management techniques.
3	To acquire foundational knowledge of networks and the challenges involved in their implementation.
4	To explore wireless, mobile communication and other latest trends in the network.

Course Outcomes (CO) with Bloom's Taxonomy Level

At the end of the course, the students will be able to,

CO	**Course Outcome Statement/s**	**Bloom's Taxonomy Level**	**Bloom's Taxonomy Description**
CO1	Examine the functions and services provided by operating systems.	II	Understanding
CO2	Explore the concepts of file system and memory management and analyze the process, threads and scheduling techniques.	III	Applying
CO3	Study network architectures, the client/server model, and essential of layered protocols	IV	Analyzing
CO4	Discuss and understand network configuration and wireless and Mobile communications	IV	Analyzing

Module	**Module Contents**	**Hours**
I	**Introduction to Operating system:** Notion of operating systems, Computer system organization, Computer System architecture, Computer System Structure, Basics of Operating System Operations, Process Management, Memory Management, Storage Management, protection and security. **System Structure:** Operating system services, user operating system interface, system calls, types of system calls, system programs, operating system design and implementation.	6

II	**Process Management in Operating Systems:** Process Concept, Operation on process, Cooperating process, Threads, Inter-process Communication, **Process Scheduling:** Basic concept, Scheduling Criteria , Introduction to scheduling algorithms, Multiple processor scheduling, Real time scheduling.	7
III	**Memory and File System Management** Background, Memory Allocation (Fixed, Dynamic), Logical Versus Physical Address space, Paging and Segmentation, swapping, Virtual Memory, Demand Paging. File System Management:- File concept, access methods, directory and disk structure, file-system mounting, file sharing, protection.	7
IV	**Introduction to Network Concepts :** What Is the Internet, The Network Core ,Delay, Loss, and Throughput in Networks ,Layered Architecture, Protocol Layers and Their Service Models Principles of Network Applications , Web and HTTP ,Electronic Mail in the Internet ,DNS—The Internet's Directory Service ,Video Streaming and Content Distribution Networks , Introduction to Socket Programming	6
V	**Major layers of TCP/IP model:** Introduction and Transport-Layer Services ,Multiplexing and De multiplexing , Connectionless Transport: UDP ,Connection-Oriented Transport: TCP , Overview of Network Layer , Switching , Router , Internet Protocol (IP): IPv4, Addressing, IPv6, Basics of Routing Algorithms	7
VI	**Wireless , Mobile and other Technologies:** Wireless and mobile networks-WiFi: 802.11 Wireless LANs, Cellular Internet Access, Mobile IP ,Wireless Links and Network Characteristics Network management including SNMP. Network troubleshooting, Introduction to SDN and other latest trends in network	6

Text Books	
1	James. L. Peterson and A. Silberchatz ,"*Operating System Concepts*", Addison Westley Publication, 9th Edition,2018
3	James F. Kurose, Keith W. Ross, *"Computer Networking: A Top-Down Approach", 7*th Edition, Pearson Publication.
References	
1	William Stallings," *Operating Systems : Internals and Design Principles*",Peterson Publication,7th Edition,2013
2	Crowley Charles ," *Operating Systems : A Design-Oriented Approach*",Mc Graw Hill Publication,1st Edition,2017
3	Dr. Sunilkumar Manavi and M. Kakkasageri, "Wireless and mobile networks concepts and protocols", Wiley publication, 2nd edition, 2016
Useful Links	
1	https://onlinecourses.swayam2.ac.in/cec20_cs06/preview
2	https://onlinecourses.nptel.ac.in/noc22_cs19/preview

CO-PO Mapping														
	Programme Outcomes (PO)												PSO	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2		2		1							2		3
CO2	2	3	2		1					2			2	
CO3	3	2	2						1					2
CO4		2			2			1				1	2	
The strength of mapping is to be written as 1: Low, 2: Medium, 3: High Each CO of the course must map to at least one PO.														

Assessment
The assessment is based on MSE, ISE and ESE. MSE shall be typically on modules 1 to 3. ISE shall be taken throughout the semester in the form of teacher's assessment. Mode of assessment can be field visit, assignments etc. and is expected to map at least one higher order PO. ESE shall be on all modules with around 40% weightage on modules 1 to 3 and 60% weightage on modules 4 to 6. For passing a theory course, Min. 40% marks in (MSE+ISE+ESE) are needed and Min. 40% marks in ESE are needed. (ESE shall be a separate head of passing)