Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electrical Engineering

EE3301: Signals & Systems

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		MSE	20
Tutorials	01 Hrs/week		ISE	20
Total Credits	04		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Linear algebra and Calculus ,Differential and Integral Calculus

Course Outcomes (CO): Students will be able to

CO1	Compare CT and DT signals and analyse LTI systems in frequency domain.
CO2	Analyse and design the time domain and frequency domain behaviour of higher order systems
CO3	Analyse and characterize of LTI systems using Laplace and Z Transforms
CO4	Transform given set of state variables into another form by using different transform methods

	Course Contents	CO	Hours
Unit 1	**Continuous and Discrete Time Signals and Systems:** Continuous and Discrete Time Signals, Signal Energy and Power CT and DT Exponential and Sinusoidal Signals CT and DT Unit Impulse and Unit step signals CT and DT systems-Basic System properties Linear Time Invariant (LTI) Systems, Discrete time LTI System- Convolution Sum Continuous time LTI systems-Convolution Integration Causal LTI systems described by differential and difference equations Singularity Functions	**CO1**	**(08)**
Unit 2	**Fourier series representation and Fourier Transforms:** Fourier series representation of CT periodic signals Properties of CT Fourier series Fourier series representation of DT periodic signals Properties of DT Fourier series Fourier Transform for periodic signals Properties of CTFT.	**CO2**	**(07)**
Unit 3	**Time and Frequency Characterization of Signals and Systems:** The magnitude and phase representation of the frequency response of LTI systems Ideal filters and time and frequency domain aspects of non-ideal filters. First and second order CT systems	**CO2**	**(05)**
Unit 4	**Laplace and Z Transforms:** Analysis and characterization of LTI systems using Laplace Transforms Analysis and characterization of LTI systems using Z Transforms	**CO3**	**(07)**
Unit 5	**State Space Analysis:** State space equations, Solution of State Equations for Continuous Systems, Linear transformation of State Vector, Controllability and Observability, State space Analysis of Discrete system	**CO4**	**(06)**
Unit 6	**Sampling** Sampling theorem, Aliasing and reconstruction of signal from its samples **Transformations** Symmetrical components of unsymmetrical phasor Park's Transformation and its applications Clark's Transformation	**CO4**	**(07)**

Text Books

1.	A. V. Oppenheim, A. S. Willsky and S. H. Nawab, "Signals and systems", Prentice Hall India, 1997.

Reference Books

1.	B. P. Lathi, "Linear Systems and Signals", Oxford University Press, 2009.
2.	S. Haykin and B. V. Veen, "Signals and Systems", John Wiley and Sons, 2007.
3.	Ned Mohan, "Power Electronics-Converters ,Applications and Design"
4.	J. Grainger and W. D. Stevenson, "Power System Analysis", McGraw Hill Education
5.	HadiSaadat, "Power System Analysis" Tata McGraw Hill Edition

Useful Links

1.	https://nptel.ac.in/courses/108104100/ by Prof. Aditya K. Jagannatham. IIT Kanpur
2.	https://nptel.ac.in/courses/108105055/ by Prof. T.K.Basu, IIT Kharagpur

3.	https://nptel.ac.in/courses/117101055/ by Prof. V.M.Gadre. IIT Bombay

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	3	2	2	2	-	-	-	1	1	-	3	3	-
CO 2	3	3	2	2	3	-	-	-	1	1	-	3	3	-
CO 3	3	3	2	2	3	-	-	-	1	1	-	3	3	-
CO 4	3	3	2	3	3	-	-	-	1	1	-	3	3	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember			
Understand			
Apply	10	5	20
Analyse	5	10	20
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

First Year B. Tech. Electrical Engineering

EE3302- DC Machines and Transformer

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/Week		**MSE**	20
Tutorials	00 Hrs/Week		**ISE**	20
Total Credits	03		**ESE**	60
			Duration of ESE	02:30 Hrs

Course Outcomes (CO): Students will be able to

CO1	Apply engineering concepts in construction & working of DC machines
CO2	Formulate mathematical equations to model DC machines for obtaining various parameters under different loading conditions.
CO3	Apply engineering concepts in construction & working of Transformers.
CO4	Make selection of appropriate machine for different applications.

	Course Contents	CO	Hrs
Unit 1	Transformer- single phase: Transformer construction, Condition for Maximum Efficiency, Losses in Transformers, Transformer reactance's and equivalent circuits, Effect of load on power factor, Phasor diagrams, Testing of Transformer-Load test, Open Circuit and Short Circuit Tests, Sumpner's test, separation of losses polarity test, Parallel Operation, Scott connection.	CO1 CO2	**(07)**
Unit 2	Three phase transformer: Construction, working, types, connections, applications, testing, parallel operation, open delta, Special transformers: Autotransformer:- Autotransformer Working, Advantages of Autotransformer over Two winding Transformer, Audio frequency transformer, Grounding transformer, welding transforms, , Isolation Transformer and its applications, High Frequency Transformer.	CO1 CO2	(07)
Unit 3	D.C. Machines Construction, principle of operation, Emf equation, torque equation. Armature winding – Lap, wave, single layer, double layer. Armature reaction and commutation, method of improving commutation. Concept of General terms pertaining to Rotating Machines: Electrical and Mechanical degree, Pole pitch, Coil, Generated EMF in full pitched coil, Generated EMF in a short pitched coil	CO1 CO3	(06)
Unit 4	D.C. Generators. Types, Characteristics of D.C. Generators, Separately Excited DC Generator, Voltage Build-up in Self-Excited Generator, D.C. Shunt, D.C. Series and D.C. Compound Generator Characteristics and applications. Parallel operation of d.c. shunt, series and compound generators.	CO1 CO5	(07)
Unit 5	Dc motors: Working principle of Motor, Back E.M.F., Types, characteristics and applications of DC Motors, Equivalent Circuit of a D.C. Motor, Torque of DC Motor, losses and efficiency,Need of starter, three point and 4 point starter	CO1 CO5	(07)
Unit 6	Speed control of dc shunt/series motors, testing, Braking in dc motors: Dynamic braking, plugging, regenerative and numericals based on it.	CO1 CO4	(06)

Text Books

1.	Kothari D.P, Nagrath I.J., "Electric Machines", TMH Publications, 4th Edition
2.	Alexander S Langsdorf, "Theory of Alternating Current Machinery", 2nd edition, Tata McGraw-Hill, 2001
3.	Dr. Bimbhra P.S., "Electric Machinery", Khanna Publisher, Fifth Edition

Reference Books

1.	M.G. Say and E. O. Taylor, Alternating current machines, Pitman publication
2.	Irving L Koskow, Electric Machinery and transformer, 2nd Edition, Prentice Hall Indi

Useful Links

1.	nptel.ac.in/courses/108105017 by Dr. D.Kastha. IIT Kharagpur
2.	www.nptelvideos.in/2012/11/electrical-machines-i.html by D Kashta, IIT Khargpur

Mapping of COs and Pos

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO
CO 1	3	2	1	2	1	2	1	-	1	1	1	1	-
CO 2	3	2	2	1	2	2	1	-	1	1	1	1	-
CO 3	3	2	1	1	2	2	1	-	1	1	-	1	-
CO 4	3	2	1	1	3	2	1	-	1	1	1	1	-

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	8	20
Understand	5	4	10
Apply	5	4	10
Analyse	5	4	20
Evaluate	-	-	-
Create	-	-	-
Total	20	20	60

Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electrical Engineering

EE3303:Measurements and instrumentation

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Mathematics, Network Theory

Course Outcomes (CO): Students will be able to

CO1	Apply physical laws used in different measuring instruments.
CO2	Analyse the dynamic response and the calibration of instruments.
CO3	Recognise need of using advanced and contemporary instruments.
CO4	Understand proper sensor technologies for specific applications

	Course Contents	CO	Hours
Unit 1	Fundamentals of Measurement: Performance characteristics (static, dynamic), Concepts relating to Measurements: True value, Accuracy, Precision, Resolution, Drift, Hysteresis, Dead-band, Sensitivity, Errors in Measurements, Current and Voltage Measurements: Shunts, Potential Dividers, Instrument Transformers.	**CO1**	**(06)**
Unit 2	Measurements of R, L and C: Types of AC and DC bridges. Measurement of low, medium, and high resistance. Measurement of power and energy in single phase and poly-phase circuits. Calibration of energy meter.	**CO1**	**(07)**
Unit 3	Measurement using digital instruments: Digital meters: Ammeter, Voltmeter, and multimeter, wattmeter, and Energy meter. Basic circuitry of electronic counter, frequency measurement using electronic counter.	**CO2**	**(06)**
Unit 4	Sensors and Transducers for physical parameters: Sensors & transducers for common engineering measurements like temperature, pressure, torque, level, displacement, flow, Speed and Position Sensors. Opto-electronics-Shaft encoders, CD Sensors, Vision System etc.	**CO3**	**(07)**
Unit 5	Recent developments in Instrumentation and Measurements: Introduction to PLC, Wave Analysers and Harmonic Distortion, Power Analyzer, Fiber Optic Transducers, Micro sensors, Smart Sensors, Virtual Instrumentation. Hall effect transducers, Strain gauge.	**CO4**	**(07)**
Unit 6	Instrumentation & Sensor Technologies for Engineering Applications: Measurement and Instrumentation for Industrial Automation.	**CO4**	**(06)**

Text Books

1. Instrumentation: Measurement and Analysis, Nakra and Chaudhari, Tata McGraw Hill, New Delhi
2. Alan S. Morris, Reza Langari, “Measurement and Instrumentation: Theory and application”, Academic Press, 2012.
3. Ernest O.Doebelin, “Measurement Systems Application and Design, International Student Edition”, McGraw Hill Book Company, 1998.

Reference Books

1. “Electrical Measurement and Measuring Instruments”, Fifth edition, by E. W. Golding and Widdies, A. H. Wheeler and Co. Ltd.
2. “A Course in Electrical and Electronic measurements and Instrumentation” – by A. K. Sawhney, Dhanpat Rai and Sons.
3. Mikell P. Groover, “Automation, Production Systems, and Computer-integrated Manufacturing”, prentice Hall.

Useful Links			
1.	http://www.journals.elsevier.com/flow-measurement-and-instrumentation/		
2.	http://www.irsst.qc.ca/en/publications-and-tools/useful-links/category/c/19/n/measurement-and-instrumentation		
3.	https://nptel.ac.in/courses/108/105/108105063/ by Prof.S.Mukhopadhyay, Prof. S.Sen. IIT Kharagpur.		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	-	3	1	2	-	1	-	1	-	1	-	-	-
CO 2	-	3	1	1	-	-	1	-	1	-	1	-	1	-
CO 3	-	-	3	1	-	-	1	-	1	-	1	-	2	-
CO 4	-	1	2	1	2	-	1	-	1	-	1	-	2	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Engineering

EE3304: DC Machines and Transformer(Multi-disciplinary Minor - 01)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic of Electrical engineering

Course Outcomes (CO): Students will be able to

CO1	Acquire knowledge about constructional details of DC generator
CO2	Understand the concept of DC Motor
CO3	Acquire knowledge about constructional details of single-phase transformer
CO4	Understand the concept of different type transformers

	Course Contents	CO	Hours
Unit 1	**DC generator:** Constructional details of dc machines - armature winding- single layer winding, double layer winding- lap and wave principle of operation, EMF equation, excitation, armature reaction demagnetizing and cross magnetizing ampere turn, compensating windings, interpoles, commutation, voltage build up and load characteristics, parallel operation. Power flow diagram	**CO1**	**(07)**
Unit 2	**DC Motor:** Types**,** back emf, generation of torque, torque equation, performance characteristics, Starting of dc motors- starters 3-point and 4-point starters (principle only). Speed control of dc motors - field control, armature control. Braking of dc motors. Power flow diagram – losses and efficiency, applications	**CO2**	**(07)**
Unit 3	**Single phase Transformer**: working principle, types of Transformer, construction, EMF equation, Phasor diagrams, Voltage regulation of a Transformer, Losses in a transformer, Efficiency of a Transformer, Condition for maximum efficiency, All day efficiency, Application	**CO3**	**(06)**
Unit 4	**Three–phase Transformer**: Advantages of three phase Transformer, Principle of operation, Construction of three phase transformers, three–phase transformer connections, Rating of Transformers, Potential transformer, Current transformer, Autotransformer: Autotransformer Working, Advantages of Autotransformer over Two winding Transformer, application	**CO4**	**(06)**

Text Books

1. Kothari D.P, Nagrath I.J., “Electric Machines”, TMH Publications, 4th Edition
2. Dr. Bimbhra P.S., “Electric Machinery”, Khanna Publisher, Fifth Edition
3. B. L. Theraja, “Electrical Technology” Vol II,S.Chand Publications.

Reference Books

1. Deshpande M. V., “Electrical Machines”, Prentice Hall India, New Delhi
2. Irving L Koskow, “Electric Machinery and transformer”, 2nd Edition, Prentice Hall Indi

Useful Links

1. nptel.ac.in/courses/108105017 by Dr. D.Kastha. IIT Kharagpur
2. www.nptelvideos.in/2012/11/electrical-machines-i.html by D Kashta, IIT Khargpur

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CO 1	3	2	1	2	1	2	1	-	1	1	1	1	3	-
CO 2	3	2	2	1	2	2	1	-	1	1	1	1	3	-
CO 3	3	2	1	1	2	2	1	-	1	1	-	1	3	-
CO 4	3	2	1	1	3	2	1	-	1	1	1	1	3	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electrical Engineering

Open Elective-I – EE3315: Sustainable Energy Systems

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : semiconductor physics

Course Outcomes (CO): Students will be able to

CO1	Understand the Need, importance, and scope of non-conventional energy resources.
CO2	Demonstrate new type of renewable energy sources.
CO3	Develop and deploy renewable energy sources on much wider scale.
CO4	Implement improved-technologies for harnessing fossil fuels.

	Course Contents	CO	Hours
Unit 1	**Introduction to Sustainable Energy System:** Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources, Present Indian and international energy scenario of conventional and RE sources.	**CO1**	**(04)**
Unit 2	**Wind Energy:** Basic principle of wind energy conversion, efficiency of conversion, site selection. Electric power generation-basic components, horizontal axis and vertical axis wind turbines, wind speed & velocity, towers, Applications of wind energy.	**CO2**	**(06)**
Unit 3	**Solar PV and thermal systems:** Solar Radiation, Radiation Measurement, Solar Thermal Power Plant, Central Receiver Power Plants, Solar Ponds - Thermal Energy storage system with PCM- Solar Photovoltaic systems: Basic Principle of SPV conversion – Types of PV Systems- Types of Solar Cells, Photovoltaic cell concepts: Cell, module, array, PV Module I-V Characteristics, Efficiency & Quality of the Cell, series and parallel connections, maximum power point tracking, Applications.	**CO2, CO3**	**(08)**
Unit 4	**Biomass Energy:** Introduction, biomass categories, biofuels. Introduction to biomass conversion technologies. Biogas generation, basic biogas plants-fixed dome type, floating gasholder type, Deen-Bandhu biogas plant, Pragati design biogas plant. Utilization of biogas. Energy plantation. Alternative liquid fuels – ethanol and methanol. Ethanol production	**CO2**	**(07)**
Unit 5	**Geothermal Energy:** Geothermal fields, estimates of geothermal power. Basic geothermal steam power plant, binary fluid geothermal power plant and geothermal preheat hybrid power plant. Advantages and disadvantages of geothermal energy. Applications of geothermal energy. Geothermal energy in India.	**CO2, CO3**	**(07)**
Unit 6	**Other Energy Sources:** Tidal Energy: Energy from the tides, Barrage and Non Barrage Tidal power systems. Wave Energy: Energy from waves, wave power devices. Ocean Thermal Energy Conversion (OTEC) - Hydrogen Production and Storage- Fuel cell: Principle of working- various types - construction and applications. Energy Storage System- Hybrid Energy Systems.	**CO2, CO4**	**(07)**

Text Books

1.	B. H. Khan, “Non-Conventional Energy Resources”, , The McGraw Hill
2.	S. P. Sukhatme, “Solar Energy: Principles of Thermal Collection and Storage”, McGraw Hill, 1984.
3.	D.P.Kothari, K.C Singal, RakeshRanjan “Renewable Energy Sources and Emerging Technologies”, PHI Learning Pvt.Ltd, New Delhi, 2013.

Reference Books

1.	Chetan Singh Solanki, “Solar Photovoltaics: fundamentals, Technologies and Applications”, Prentice Hall of India.
2.	K. M. Mittal, “Non-Conventional Energy Systems”, A H WheelerPublishing Co Ltd

3.	G.D. Rai, “Non-conventional Energy sources”, Khanna Publishers.
4.	BansalKeemann, Meliss, “Renewable energy sources and conversion technology”, Tata McGraw Hill.
5.	Ali Keyhani, “Design of Smart Power Grid Renewable Energy Systems”, Wiley-IEEE Press.
6.	Remus Teodorescu, Marco Liserre, Pedro Rodriguez, “Grid Converters for Photovoltaic and Wind Power Systems”, John Wiley and Sons, Ltd.
Useful Links	
1.	https://nptel.ac.in/courses/103/107/103107157/ by Prof P.Mondal. IIT Roorki
2.	https://nptel.ac.in/courses/108/105/108105058/ by Prof. S.Banerjee. IIT Kharagpur
3.	https://nptel.ac.in/courses/108/108/108108078/ by Prof.L.Umanand. IISc Bengalore

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	-	3	-	2	-	3	1	-	-	-	2	-	-
CO 2	-	3	1	-	-	-	3	1	-	-	-	2	1	-
CO 3	-	-	3	-	-	-	3	1	-	-	-	2	2	-
CO 4	-	1	2	-	-	-	3	1	-	-	-	2	2	-

1: Slight (Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom’s Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Engineering

EE3325-OE I -(MOOC) Energy Systems Engineering

Teaching Scheme			Examination Scheme	
Lectures	-		ISE	-
Tutorials	-		ESE	100
Total Credits	02			

Course Outcomes (CO): Students will be able to

CO1	Understand the Need, importance, and scope of non-conventional energy resources.
CO2	Equip lead the transition to a sustainable, secure and resilient energy future.
CO3	Provide understanding of the science and engineering issues related to the design and development and installation of Solar PV systems, solar thermal technology and wind energy technology.
CO4	Upgrade the knowledge with the current thoughts and newer technology.

Course Contents

Students should complete the MOOC course certification in the domain of Energy Systems Engineering and submit a copy of the certificate to Head of Department prior to ESE.

Guidelines:

- Selection of the MOOC course should be with the prior permission of Head of Department
- Duration for completion of MOOC course certification is minimum 8 Weeks.
- Platform: NPTEL or SWYAM only
- Assessment Guideline:- The evaluation of the MOOC Course will be based on at actual score secured by the student in NPTEL or SWAYAM course certification and it will be converted to ESE score.
- If the student unable to submit the NPTEL or SWAYAM completion Certificate, in such cases evaluation will be based on assignment score (60% weightage) of registered NPTEL/SWAYAM and internal evaluation (40 % weightage).
- The rubrics for internal evaluation are given below.

Government College of Engineering, Karad

Department of Electrical Engineering

A. Y. 2024-25

Course Code : **Assessment Sheet** **Class**:

Course Title :-

Sr No.	Reg. No	Name of Student	Course Title	Knowledge of Course (08 Marks)	Communication Skill (08 Marks)	Presentation Skill (08 Marks)	Content (08 Marks)	Q & A (08 Marks)	Total Marks (out of 40)
1									
2									

Guide Name and Sign. **Head of the Department**

Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electrical Engineering

EE3306: Universal Human Values

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	-
Tutorials	00 Hrs/week		ISE	50
Total Credits	02		ESE	-

Prerequisite : First year Induction program

Course Outcomes (CO): Students will be able to

CO1	Understand and recall a holistic perspective on life and profession, grounded in Universal Human Values.
CO2	Apply holistic understanding to authentic situations, and implications for ethical conduct with Nature.
CO3	Analyse, evaluate connections between a holistic perspective, ethical conduct, & transformative impact on behaviour.
CO4	Evaluate the course's impact ,proficiency in applying Universal Human Values across diverse contexts.

	Course Contents	CO	Hours
Unit 1	**Introduction to Value Education:** Right understanding, relationship, and physical facility (holistic development and the role of education), understanding value education, self-exploration as the process for value education.	**CO1**	**(03)**
Unit 2	**Fundamental Human Aspirations:** Continuous happiness and prosperity – the basic human aspirations, happiness and prosperity – current scenario, method to fulfil the basic human aspirations.	**CO2**	**(03)**
Unit 3	**Harmony between Self and Body:** Understanding human being as the co-existence of the self and the body. Distinguishing between the needs of the self and the body, the body as an instrument of the self, understanding harmony in the self, harmony of the self with the body, programme to ensure self-regulation and health.	**CO2**	**(06)**
Unit 4	**Values in Human Interaction:** Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship.	**CO3**	**(04)**
Unit 5	**Society, Universal Order, and Nature:** Understanding Harmony in the Society, Vision for the Universal Human Order, Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels. (**Self Study**: The Holistic Perception of Harmony in Existence.)	**CO2, CO3**	**(06)**
Unit 6	**Ethical Conduct and Professional Transition:** Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, (**Self Study**: Strategies for Transition towards Value-based Life and Profession)	**CO4**	**(06)**

Text Books

1.	R. R. Gaur, R. Asthana, G. P. Bagaria, "The Textbook A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034- 47-1 (Unit: 1,2,3,4,5,6)
2	R. R. Gaur, R. Asthana, G. P. Bagaria, "The Teacher's Manual Teachers: Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2. (Unit: 1,2,3,4,5,6)

Reference Books

1.	D R Kiran , "Professional ethics and human values", McGraw Hill Education (India) Private Limited P-24, 2nd edition, 2014, Green Park Extension, New Delhi 110 016
2.	V. Jayakumar, "Professional ethics and Human values in Engineering"

3.	Rudolf Steiner, "Human Values in Education (The Foundations of Waldorf Education, 20)", Anthroposophic Press, Year: 2004, ISBN: 0880105445,9780880105446
4.	R.S. Naagarazan, "A Textbook on Professional Ethics and Human Values", New Age International Pvt Ltd Publishers, Year: 2007 ISBN: 8122419380,9788122419382,9788122423013
Useful Links	
1.	https://nptel.ac.in/courses/109104068 Exploring Human Values: Visions of Happiness and Perfect Society, IIT Kanpur, Prof. A.K. Sharma
2.	https://onlinecourses.nptel.ac.in/noc23_hs89/preview Moral Thinking: An Introduction To Values And Ethics, By Prof. Vineet Sahu IIT Kanpur
3.	https://uhv.org.in/course Universal Human Values

Mapping of COs and POs

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CO 1	-	1	-	1	1	2	2	2	1	2	-	2	-	-
CO 2	-	-	-	-	-	3	1	3	-	3	-	3	2	-
CO 3	1	-	2	1	2	3	1	2	-	3	1	2	1	-
CO 4	-	1	1	-	-	2	-	3	2	2	1	3	-	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	5	-
Understand	-	5	-
Apply	-	15	-
Analyse	-	10	-
Evaluate	-	15	-
Create	-	-	-
TOTAL	-	50	-

Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electrical Engineering

EE3307 : Economics for Engineer

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	-
Tutorials	00 Hrs/week		ISE	50
Total Credits	02		ESE	-

Prerequisite : Basic knowledge of mathematics and economics

Course Outcomes (CO): Students will be able to

CO1	Identify the need, usage and importance of an information system to an organization.
CO2	Understand the basic concepts of economics, micro and macro economics.
CO3	Analyse the different strategies beneficial for industrial economics.
CO4	Apply the personal economics methods in our day to day life to gain personal financial control.

	Course Contents	CO	Hours
Unit 1	**Basic of Information system and management:** Role of Information Systems in Organizations, The Information System Manager and his challenges, Concepts of Information Systems, Information Systems and Management Strategy Case Studies - Information Systems in the Indian Railways, Information Systems in an ecommerce Organization.	**CO1**	**(05)**
Unit 2	**Basic Concepts of Economics:** Definitions, Overview of Micro and Macro Economics, Explanation of theories of demand, supply and market equilibrium and Economics Basics – Cost, efficiency and scarcity, Opportunity Cost, (**Self-Study**: Use of IT in economics)	**CO2**	**(05)**
Unit 3	**Micro and Macro Economics:** Micro economics: Differences and Comparison, Theories of Utility and Consumers Choice,Competition and Market Structures, Macro Economics: Aggregate Demand and Supply, Economic Growth and Business Cycles, Therole of the Nation in economic activity	**CO2**	**(05)**
Unit 4	**Industrial Economics:** Behaviour of firms: Strategies with regard to entry, pricing, advertising, and R & D and innovation. The development of Firms and Market and Industrial Structure: Stochastic models of firm growth, and market structure.	**CO3**	**(05)**
Unit 5	**Cash Flow:** Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis, Understanding Financial Statements, Case Studies - cash flow analysis done in start-up companies.	**CO4**	**(04)**
Unit 6	**Personal Economics:** Compound Interest and Credit, Financial Markets, Human Capital and Insurance, Money Management/ Budgeting, Risk and Return, Saving and Investing, (**Self-Study**: Role of IT in financial market, IT economics and data mining in stock market).	**CO4**	**(04)**

Text Books

1.	Rahul De, "MIS: Management Information Systems in Business, Government and Society", Wiley India, ISBN:13: 978-81-265-2019-0. (Unit: 1)
2.	Panneer Selvam, R, "Engineering Economics", Prentice Hall of India Ltd, New Delhi, 2001.(Unit: 5)
3.	Hay, Donald A., Derek J. Morris, "Industrial Economics and Organization: Theory and Evidence", 2nd Edition(Oxford: Oxford University Press), 1991. (Unit: 4)
4.	Varian, Hal, " Intermediate Microeconomics: A Modern Approach", Norton, 5th Edition, 1999.(Unit: 3)
5.	Baumol, William J., "Economic Theory and Operations Analysis", Prentice Hall India Ltd.,4th Edition, 1985. (Unit:2)
6.	Rachel Siegel, Carol Yacht, "Personal finance", Publisher Saylor Foundation ISBN 13: 9780982361863, 2009.(Unit: 6)

Reference Books

1.	R.J. Gordon, "Macroeconomics", Little Brown& Co. Boston, 4th Edition,1987.
2.	Donald G. Newman, Jerome P. Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
Useful Links	
1.	https://nptel.ac.in/courses/112/107/112107209/ Dr. P. K. Jha IIT Roorkee
2.	https://nptel.ac.in/courses/109/104/109104073/ Dr. S. Sinha IIT Kanpur
3.	https://www.econlib.org/library/Topics/HighSchool/HighSchoolTopics.html#finance

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	3	-	-	-	1	2	1	2	1	2	1	1	-
CO 2	2		-	-	-	1	2	1	2	1	2	1	1	-
CO 3	1	3	-	-	-	1	2	1	2	1	2	1	1	-
CO 4	-	-	-	3	-	1	2	1	1	2	1	1	1	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	05	-
Understand	-	15	-
Apply	-	10	-
Analyse	-	20	-
Evaluate	-	-	-
Create	-	-	-
TOTAL	-	50	-

Government College of Engineering, Karad					
Second Year (Sem – III) B. Tech. Electrical Engineering					
EE3308: DC Machines and Transformer Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		ISE	50	
Total Credits	01		ESE	25	
Prerequisite : Basic Electrical Engineering					
Course Outcomes (CO): Students will be able to					
CO1	Apply appropriate experimental setup for performance evaluation of machines.				
CO2	Understand various tests on DC machines				
CO3	Understand various tests on Transformer				
CO4	Interpret obtained results to reach appropriate conclusion				

Course Contents		CO
Implementation of following concepts		
Experiment 1	O.C.C. on Separately Excited DC generator	**CO1,CO2,CO4**
Experiment 2	Load test on DC Shunt Motor	**CO1,CO2,CO4**
Experiment 3	Load test on DC Series Motor	**CO1,CO2,CO4**
Experiment 4	Speed Control of DC Shunt Motor (Armature and Field Control)	**CO1,CO2,CO4**
Experiment 5	Swinburne's Test	**CO1,CO2,CO4**
Experiment 6	Hopkinson's Test	**CO1,CO2,CO4**
Experiment 7	To Find equivalent circuit parameters from O.C and S.C Test on single phase Transformer	**CO1,CO3,CO4**
Experiment 8	Sumpner's Test on single phase transformer	**CO1,CO3,CO4**
Experiment 9	Load test on single phase transformer	**CO1,CO3,CO4**
Experiment 10	Scott connection	**CO1,CO3,CO4**
Experiment 11	Parallel operation of single-phase transformer	**CO1,CO3,CO4**
Experiment 12	To separate core losses of single-phase transformer at no-load.	**CO1,CO3,CO4**
List of Submission:		
	Minimum number of Experiments: 10	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	1				1	1	2	1	1	2		1	-
CO 2	1		1		1	1	1	1	1	2	1		2	-
CO 3	1		1	1	1	1			1	2	1		1	-
CO 4	1	2		2	1		1	1	1	1	1			-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad					
Second Year (Sem – III) B. Tech. Electrical Engineering					
EE 3309 :Measurements and Instrumentation Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		ISE	50	
Total Credits	01		ESE	25	
Prerequisite : Mathematics, Network Components					
Course Outcomes (CO): Students will be able to					
CO1	Learn about various measurement devices, their characteristics, their operation and their limitations.				
CO2	Design and validate DC and AC bridges.				
CO3	Understand the principles of operation and characteristics of instrumentation and integrated sensor systems.				
CO4	Apply proper method, sensors and transducers for specific applications and measurement.				

Course Contents		CO
Implementation of following concepts		
Experiment 1	Study of various analog measuring instruments and demonstration of working parts of various types of meter by opening the instrument and explanation of symbols and notations used on instruments.	**CO1**
Experiment 2	Measurement of Active and reactive power in three phase circuit using two wattmeter method (Balanced and Unbalanced Loads).	**CO2**
Experiment 3	Calibration of Single phase energy meter at different power factors.	**CO2**
Experiment 4	Measurement of Reactive Power by one wattmeter with all possible connections of current coil and pressure coil.	**CO3**
Experiment 5	Measurement of R, L & C using appropriate bridge as well as LCR meter	**CO3**
Experiment 6	Identification of a temperature sensor from the list, which has minimum response time. (Thermocouple, RTD and Thermistor).	**CO3**
Experiment 7	Implementation of Virtual instrumentation for energy, power, power factor measurement	**CO3**
Experiment 8	Study of DSO control panel and its specifications. Implement applications of DSO.	**CO3**
Experiment 9	Design and implementation of DAC using R-2R ladder network.	**CO4**
Experiment 10	Study of Bosch sensor applications.	**CO4**
	Minimum number of Experiments : 10	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	-	-	1	-	1	1	-	-	-	-	-	-	-
CO 2	1	2	-	1	-	1	1	-	-	-	-	-	1	-
CO 3	-	1	3	2	1	1	-	-	-	-	-	-	2	-
CO 4	-	1	2	3	-	1	1	-	-	-	-	-	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad					
Second Year (Sem – III) B. Tech. Electrical Engineering					
Open Elective – 01 EE3316: Sustainable Energy Systems Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		ISE	25	
Total Credits	01		ESE	25	
Prerequisite : Computer fundamentals					
Course Outcomes (CO): Students will be able to					
CO1	Understand the solar resource and utilization of solar thermal energy				
CO2	Improve the quality of Solar PV system installations, especially in the rooftop solar segment				
CO3	Understand how to estimate available solar energy for a given site and application				
CO4	Improve the understanding of the wind energy concepts and the application of general				

Course Contents		CO
Implementation of following concepts		
Experiment 1	To demonstrate the I-V and P-V characteristics of PV module with varying radiation and temperature level.	**CO1**
Experiment 2	To demonstrate the I-V characteristics of series and parallel combination of PV module.	**CO2**
Experiment 3	To show the effect of variation in tilt angle of PV module.	**CO2**
Experiment 4	To demonstrate the effect of shading on module output power.	**CO3**
Experiment 5	To demonstrate the working of diode as bypass diode and blocking diode.	**CO3**
Experiment 6	Workout power flow calculations of stand-alone PV system with DC load and battery.	**CO3**
Experiment 7	Workout power flow calculations of stand-alone PV system with AC load and battery.	**CO3**
Experiment 8	To draw the charging and discharging characteristics of battery.	**CO3**
Experiment 9	Evaluate the efficiency of charge controller.	**CO4**
Experiment 10	Find out the start up speed and cut-in speed of wind turbine experimentally.	**CO4**
Experiment 11	Evaluate the tip speed ratio at different wind speeds	**CO4**
Experiment 12	Draw the power curve of turbine with respect to rotational speed of rotor at fix wind speeds.	**CO4**
List of Submission:		
	Minimum number of Experiments : 10	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	-	-	1	-	1	1	-	-	-	-	-	-	-
CO 2	1	2	-	1	-	1	1	-	-	-	-	-	1	-
CO 3	-	1	3	2	1	1	-	-	-	-	-	-	2	-
CO 4	-	1	2	3	-	1	1	-	-	-	-	-	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Government College of Engineering, Karad

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Avg
Task I	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25

Second Year (Sem – III) B. Tech. Electrical Engineering

EE3326-OE I -(MOOC) Energy Systems Engineering Lab

Teaching Scheme			Examination Scheme	
Lectures	-		ISE	25
Tutorials	-		ESE	25
Total Credits	01			

Course Outcomes (CO): Students will be able to

CO1	Understand the Need, importance, and scope of non-conventional energy resources.
CO2	Equip lead the transition to a sustainable, secure and resilient energy future.
CO3	Provide understanding of the science and engineering issues related to the design and development and installation of Solar PV systems, solar thermal technology and wind energy technology.
CO4	Upgrade the knowledge with the current thoughts and newer technology.

Course Contents

Students should complete the MOOC course certification in the domain of Energy Systems Engineering and submit a copy of the certificate to Head of Department prior to ESE.

Guidelines:

- For Open Elective Lab course conducted in online mode (MOOC), assessment may be done in line with course undertaken in MOOC. Assessment method should be decided by concerned BoS.

General Instruction:

- Course coordinator will decide the suitable assessment method for internal evaluation of 25 marks and for ESE Evaluation of 25 marks based on presentation conducted by Panel of minimum two internal faculty members for the course completion.

Government College of Engineering, Karad				
Second Year (Sem – IV) B. Tech. Electrical Engineering				
EE3401: AC Machines				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basic of Electrical Engineering, DC Machines and Transformer

Course Outcomes (CO): Students will be able to

CO1	Understand the concept of AC machines and their industrial applications
CO2	Apply the concept of equivalent circuit of machines in different application
CO3	Analyse the numerical methods in ac machines
CO4	Evaluate the performance analyses of different AC machines

	Course Contents	CO	Hours
Unit 1	**Three phase Induction Motor** Construction & types of 3 ph. Induction motors, torque equation, starting torque, running torque, condition of maximum torque ,torque slip characteristics, Need of starters for 3 phase Induction motors, types of starters, Speed control methods from stator side (Stator voltage control ,Stator Frequency control, Pole changing) & rotor side (rotor resistance control), Applications of 3 ph. Induction motors.	**CO1**	**(08)**
Unit 2	**Equivalent circuit analysis of three phase induction motor** Losses & efficiency of 3 phase induction motor, power flow diagram with numerical treatment, No load & blocked rotor test, equivalent circuit of 3 phase induction motor, Phasor diagram of 3 phase induction motor, performance of 3 phase induction motor using circle diagram, Cogging & crawling of 3 phase induction motor.	**CO3**	**(07)**
Unit 3	**Single Phase Induction Motor** Construction, Working and types of single phase induction motors (Split phase, capacitor start/run, shaded pole motors), Double field revolving theory, Characteristics & Applications.	**CO1**	**(05)**
Unit 4	**Alternator** Construction, principle of operation of three phase alternator, emf equation, parameters of armature winding, armature reaction, concept of synchronous reactance and synchronous impedance. Equivalent circuit of 3 phase alternator, alternator on load (resistive, inductive &capacitive)	**CO1**	**(07)**
Unit 5	**Equivalent circuit analysis of Alternator** OC test & SC test on 3 Phase alternator, short circuit ratio, voltage regulation methods (emf, mmf, zero power factor and direct loading method) with numerical treatment, Losses and efficiency, power flow diagram, need of parallel operation, conditions for parallel operation, synchronizing procedures, hunting and oscillations in alternators.	**CO2, CO4**	**(06)**
Unit 6	**Synchronous motor** Synchronous motor, starting methods, Phasor Diagram, Effect of excitation on power factor and armature current, V and inverted V Curves, Operation of Synchronous motor as Synchronous Condenser, Applications of three phase synchronous motor. Permanent Magnet Machines, Principle, operation and applications of Brushless motors	**CO4**	**(07)**

Text Books	
1.	"Electrical Machines", S. K. Bhattacharya, 3rd edition, Tata Mc-Graw-Hill publication.
2.	"Electrical Machines", I. J. Nagrath, D. P. Kothari, 4th edition, Tata McGraw Hill publication
Reference Books	
1.	"Electric Machinery", A. E. Fitzgerald, Mc-Graw Hill publications
2.	"Theory of AC machines", A. S. Langsdorf, Mc-Graw Hill publications.
3.	"Design of Brushless Permanent Magnet motors,"J. R. Hendershot and T. J. E. Miller, Magna Physics Publishing and Clarendon press. 1994edition.
4.	"Brushless Permanent Magnet Motor Design", Duane C. Hanselman, McGraw- Hill Inc.
Useful Links	
1.	www.nptel.iitm.ac.in (Video Courses on Electrical Machines by Prof. S K Bhattacharya, IIT Kharagapur)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	2	1	2	1	-	1	1	1	1	3	-
CO 2	3	2	2	1	2	2	1	-	1	1	1	1	3	-
CO 3	3	2	1	1	2	2	1	-	1	1	-	1	3	-
CO 4	3	2	1	1	3	2	1	-	1	1	1	1	3	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember			
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	5	5	10
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electrical engineering

EE3402: Analog and Digital Electronics

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03 PCC		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic Electronics engineering, AC & DC circuits, Numbering system, Logic Gates and flip flops, Diode and BJT

Course Outcomes (CO): Students will be able to

CO1	Design logical, sequential, and combinational digital circuit using K-Map.
CO2	Demonstrate different digital memories and programmable logic families.
CO3	Apply and analyze applications of OPAMP in open and closed loop condition.
CO4	Design uncontrolled rectifier with given specifications

	Course Contents	CO	Hours
Unit 1	**Operational Amplifier Applications:** Open loop and close loop configuration of Op-Amp. Applications of Op- Amp- zero crossing detectors, Comparator, Schmitt trigger, V-I and I-V converters, Instrumentation amplifier, peak detector, Waveform generation using Op-amp - sine, square, saw tooth and triangular generator,	**CO1**	**(07)**
Unit 2	**Other Analog circuits:** Active filters-Its configuration with frequency response, Analysis of first order low pass and high pass filters using OPAMP, IC 555 –construction, working and modes of operation- a stable and monostable multi vibrators, Sequence generator, voltage regulators using IC78xx, 79xx, LM 317	**CO1**	**(07)**
Unit 3	**Diode rectifier:** Single phase half wave rectifier with R, RL loads. Single phase full wave rectifier-Center tap and bridge rectifier supplying R and RL load and performance parameters. Three phase full wave bridge rectifier with R load**.**	**CO2**	**(06)**
Unit 4	**Design of combinational circuit:** Booleans algebra, De-Morgan theory etc, Karnaugh map: structure for two, three and four Variables, SOP and POS form reduction of Boolean expressions by K-map. Design of combinational circuits using Boolean expression and K-map, encoder, decoder, half, and full adder.	**CO2**	**(07)**
Unit 5	**Design of sequential circuit:** Introduction to sequential circuit. Design of synchronous (K-map) and asynchronous counters. Up down counters, N modulo counters, Shift registers, ring, and twisted ring counters	**CO2, CO3**	**(07)**
Unit 6	**Digital memories and logic families:** A) Digital memories: SRAM, DRAM, ROM, EPROM B) Digital logic families: PAL, PLA, CPLD, FPGA	**CO4**	**(06)**

Text Books

1.	[T1] Floyd and Jain, “Digital Fundamentals”, Pearson Education.
2.	[T2] R. P. Jain, “Digital Electronics”, Tata McGraw Hill, New Delhi.
3.	[T3] Gaikwad R., “Operational Amplifier”, PHI New Delhi.
4.	[T4] Floyd, “Electronics Devices”, Pearson Education.
5.	[T5] Mottershed, “Electronics Devices & Circuits”, PHI New Delhi
6.	[T6] Fundamental of digital circuits, 4th Edition, by A Anand Kumar, PHI learning private limited publication

Reference Books

1.	[R1] Tokheim, “Digital Electronics-Principles and Application”, 6th edition, Tata McGraw Hill, New Delhi
2.	[R2] A Jaico and Charles H. Roth, “Fundamentals of Logic Design” Jr. Forth Edition.
3.	[R3] K. R. Botkar, “Integrated Circuits”, Khanna Publication, New Delhi.

4.	[R4] James, “Operational Amplifier and Linear Integrated Circuits Theory and Application.”
5.	[R5] P John Paul, “Electronics Devices and circuits”, New Age international Publications.
6.	[R6] P. S. Bimbhra, “Power Electronics”, Khanna Publications.
Useful Links	
1.	NPTEL course on Digital Electronics Circuit, IIT, Kharagpur. https://nptel.ac.in/courses/108105132/
2.	NPTEL course on Integrated circuit, MOSFET, OPAMP and their applications IISC Bangalore. https://nptel.ac.in/courses/108/108/108108111/
3.	NPTEL course on power electronics by IIT Kharagpur. https://nptel.ac.in/courses/108/105/108105066/

UNIT No	Textbook	Reference book
1	T4, T5	R3, R4, R6
2	T4, T5	R3, R4, R6
3	T6	R6, L3
4	T1, T2, T6	R1, R6
5	T1, T2, T4, T6	R2, L1
6	T6	L1

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	-	3	-	2	1	-	-	2	-	1	-	-	-
CO 2	-	3	1	-	-	1	-	-	2	-	1	-	1	-
CO 3	-	-	3	-	-	-	2	-	1	-	1	-	2	-
CO 4	-	1	2	-	-	-	2	-	1	-	1	-	2	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom’s Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Engineering

EE3403: Power Electronics

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		MSE	20
Tutorials	01 Hrs/week		ISE	20
Total Credits	04		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basic Electronics Engineering

Course Outcomes (CO): Students will be able to

CO1	Apply the basic knowledge of Power Electronics for practical implementation
CO2	Analyze switching circuits & gate drive circuits for control of power switches.
CO3	Analyze functioning and design process of various Power Electronics converters.
CO4	Understand various PWM techniques for inverter.

	Course Contents	CO	Hours
Unit 1	**Introduction to Power Electronics:** Applications of Power Electronics in various sectors, Power Electronics Structure (how it differs from low power analog electronics) Power Electronics Switches: Basic construction, characteristics, and commercial ratings, integrated power modules (IPM), study of modules / power switches available in commercial market.	**CO1**	**(04)**
Unit 2	**Analysis of switching circuits:** Gate Drive Circuits: Requirements of gate drive, Gate drive circuits for various power switches (transistor, MOSFET, IGBT etc), study of gate drivers available in commercial market.	**CO2**	**(04)**
Unit 3	**AC-DC Converters:** Uncontrolled Rectifiers: 1-ph, 3-ph, rectifiers, control techniques, analysis with R-L-E load, numerical, applications in practice Controlled Rectifiers: 1-ph, 3-ph, rectifiers, control techniques, analysis with R-L-E load, numerical, applications in practice Dual Converters, applications of various converters in practice Effect of source impedance on performance of converters	**CO3**	**(12)**
Unit 4	**DC-DC Converters:** Non-isolated DC-DC Converters: Buck, Boost, Buck-Boost, Cuk converters and analysis, Introduction to modified DC-DC converters Isolated DC-DC Converters, Applications of DC-DC converters in practice Introduction: Modified DC-DC converters	**CO3**	**(05)**
Unit 5	**AC-AC Converters:** 1-ph, 3-ph converters, control techniques, applications, introduction to matrix converters	**CO3**	**(03)**
Unit 6	**DC-AC Converters:** Classifications of inverters, 1-ph, 3-ph VSI and CSI, Control (modulation) techniques of VSI (e.g., SPWM, SVPWM, Simple Harmonic Elimination etc.) Introduction to Multilevel inverters (MLI) and control techniques (SPWM)	**CO4**	**(12)**

Text Books

1.	"Power Electronics: Circuits Devices and Applications", M. H. Rashid, 3rd Edition, Pearson/Prentice Hall Publications
2.	"Power Electronics Converters, Applications and Design", Ned Mohan, 3rd edition, Jonh Wiley and Sons.

Reference Books

1.	"Power Electronics: Principles and Applications", Joseph Vithayathil, McGraw Hill Publication, 2010
2.	"Power Electronics", Cyril W. Lander, 3rd Edition McGraw Hill publication
3.	"Pulse Width Modulation for Power Converters": Principles and Practice, D. G. Holmes, Thomas A. Lipo, IEEE press, Wiley interscience, Jonh Wiley and Sons Inc. Pub.

Useful Links

1.	https://nptel.ac.in/courses/108/101/108101038/ (Prof. B. G. Fernandes)
2.	https://nptel.ac.in/courses/108/101/108101126/ (Prof. L. Umanand)

3.	https://nptel.ac.in/courses/108/102/108102145/ (Prof. G. Bhuvaneshwari)
4.	https://nptel.ac.in/courses/108/107/108107128/ (Prof. Avik Bhattacharya)

Mapping of COs and POs

PO → CO ↓	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	1	3	2	1	-	-	1	-	-	-	2	3
CO 2	3	2	3	3	-	-	2	-	-	-	-	3	2
CO 3	3	3	3	3	3	2	1	2	-	1	-	3	2
CO 4	3	1	3	2	2	-	-	-	-	-	-	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Engineering

EE3404: AC Machines(Multi-disciplinary Minor - 02)

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basic of Electrical engineering

Course Outcomes (CO): Students will be able to

CO1	Utilize the concept of AC machines and their industrial applications
CO2	Analyse the equivalent circuit of machines in different application
CO3	Acquire knowledge about constructional details of single-phase Induction motor
CO4	Evaluate the performance analyses of different AC machines

	Course Contents	CO	Hours
Unit 1	**Three phase Induction Motor** Construction & types of 3 ph. Induction motors, torque equation, starting torque, running torque, condition of maximum torque ,torque slip characteristics, Need of starters for 3 phase Induction motors, types of starters, Speed control methods from stator side (Stator voltage control ,Stator Frequency control, Pole changing) & rotor side (rotor resistance control), Applications of 3 ph. Induction motors.	**CO1**	**(07)**
Unit 2	**Equivalent circuit analysis of three phase induction motor** Losses & efficiency of 3 phase induction motor, power flow diagram with numerical treatment, No load & blocked rotor test, equivalent circuit of 3 phase induction motor, Phasor diagram of 3 phase induction motor, performance of 3 phase induction motor using circle diagram, Cogging & crawling of 3 phase induction motor.	**CO2**	**(06)**
Unit 3	**Single Phase Induction Motor** Construction, Working and types of single phase induction motors (Split phase, capacitor start/run, shaded pole motors), Double field revolving theory, Characteristics & Applications.	**CO3**	**(07)**
Unit 4	**Synchronous motor** Synchronous motor, starting methods, Phasor Diagram, Effect of excitation on power factor and armature current, V and inverted V Curves, Operation of Synchronous motor as Synchronous Condenser, Applications of three phase synchronous motor. Permanent Magnet Machines, Principle, operation and applications of Brushless motors	**CO4**	**(06)**

Text Books

1.	"Electrical Machines", S. K. Bhattacharya, 3rd edition, Tata Mc-Graw-Hill publication.
2.	"Electrical Machines", I. J. Nagrath, D. P. Kothari, 4th edition, Tata McGraw Hill publication

Reference Books

1.	"Electric Machinery", A. E. Fitzgerald, Mc-Graw Hill publications
2.	"Theory of AC machines", A. S. Langsdorf, Mc-Graw Hill publications.
3	"Design of Brushless Permanent Magnet motors,"J. R. Hendershot and T. J. E. Miller, Magna Physics Publishing and Clarendon press. 1994edition.

Useful Links

1.	www.nptel.iitm.ac.in (Video Courses on Electrical Machines by Prof. S K Bhattacharya, IIT Kharagapur)

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	2	1	2	1	2	1	-	1	1	1	1	3	-
CO 2	3	2	2	1	2	2	1	-	1	1	1	1	3	-
CO 3	3	2	1	1	2	2	1	-	1	1	-	1	3	-
CO 4	3	2	1	1	3	2	1	-	1	1	1	1	3	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Engineering

Open Elective – 02: EE3417: Robotics and Automation

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Linear Algebra, Basic Electronics, Problem Solving

Course Outcomes (CO): Students will be able to

CO1	Identify and classify various types of industrial robots.
CO2	Illustrate the power transmission system for robot drive.
CO3	Decide gripper and sensor for specific applications.
CO4	Develop programming principles and languages for a robot control system.

	Course Contents	CO	Hours
Unit 1	**Introduction to Robot and automation: Automation:** Types of automation, Robotics in automation, Definition of robot, history of Robotics, law of robotics, Components and Terminology of Robotics., Wrist Mechanism, Degrees of freedom, of a robot, Classification of Robots, Specifications of robot, Application of Robotics.	**CO1**	**(05)**
Unit 2	**Robot Drive and Power transmission Systems:** Introduction of drive system, structure of drive system, Necessity of drive system, Characteristics of Actuating Systems, design consideration of drive system, Hydraulic and Pneumatic Systems, Electrical Actuation System, Advantages and limitations of drive system. Power transmission Systems (Gear, Belt, Chains etc.)	**CO2**	**(04)**
Unit 3	**Robotic sensor system:** Need of sensor, Sensor Performance Characteristics, Position sensors Velocity sensors, Accelerometers, Touch sensor, Slip sensors, Wrist Sensors, Vision sensors, Force sensor, Torque sensor, Tactile sensor,	**CO3**	**(04)**
Unit 4	**Control system of robot and End effectors:** Basic control systems concepts and models, Types of Controllers, feedback components, Adaptive control system, Design Considerations of End Effectors, Basic types of End Effectors, Gripper classification,	**CO3**	**(04)**
Unit 5	**Kinematics of Robot Manipulator:** Co-ordinate and vector transformation using matrices, Rotation matrix, Inverse Transformations, Problems, Composite Rotation matrix, Homogenous Transformations, Robotic Manipulator Joint Coordinate System, Euler Angle & Euler Transformations, Roll Pitch-Yaw (RPY) Transformation,	**CO4**	**(04)**
Unit 6	**Robot Programming:** Introduction to robot programming, Programming Types (Flex Pendant, Lead through programming), Interlock commands- Operating mode of robot, Jogging-Types, Motion commands, end effectors and sensors commands. VAL Programming, programming-basic commands, motion control, hand control, program control, pick and place applications, palletizing applications using VAL.	**CO4**	**(05)**

Text Books

1. M.P. Groover, M. Weiss, R.N. Nagel, N.G. Odrey, "Industrial Robotics", Tata McGraw Hills Publication, Second Edition, 2017.
2. Richard D Klafter, Thomas A Chmielewski, Michael Negin, —"Robotics Engineering: An Integrated Approach", PHI Learning, New Delhi, 2009.

Reference Books

1. Thomas R. Kurfess, "Robotics and Automation Handbook", CRC Press, 1st edition, 2005.
2. Ashitava Ghoshal, "Robotics-Fundamental Concepts and Analysis ", Oxford University Press, Sixth impression, 2010.
3. Robert J. Schilling, —"Fundamentals of Robotics Analysis and Controll", PHI Learning, 2011.

Useful Links			
1.	https://nptel.ac.in/courses/112/105/112105249/- I.I.T, Kharagpur.		
2.	https://see.stanford.edu/Course/CS223A - Stanford University, Stanford, California.		
3.	http://nptel.ac.in/courses/112101099 - I.I.T, Bombay		

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	-	3	-	2	-	2	-	-	-	2	-	-	-
CO 2	-	3	1	-	-	-	-	-	1	-	2	-	1	-
CO 3	-	-	3	-	-	-	2	2	-	-	2	-	2	-
CO 4	-	1	2	-	-	-	-	-	1	-	2	-	2	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Engineering

EE3427-OE II -(MOOC) Power System Engineering

Teaching Scheme			Examination Scheme	
Lectures	-		ISE	-
Tutorials	-		ESE	100
Total Credits	02			

Course Outcomes (CO): Students will be able to

CO1	Relate and classify various types of electricity generating units.
CO2	Discover the ideas about power transmission system.
CO3	Conclude about different parameters in transmission and distribution system.
CO4	Appraise modern power system protection system.

Course Contents

Students should complete the MOOC course certification in the domain of Power System Engineering and submit a copy of the certificate to Head of Department prior to ESE.

Guidelines:

- Selection of the MOOC course should be with the prior permission of Head of Department
- Duration for completion of MOOC course certification is minimum 8 Weeks.
- Platform: NPTEL or SWYAM only
- Assessment Guideline:- The evaluation of the MOOC Course will be based on at actual score secured by the student in NPTEL or SWAYAM course certification and it will be converted to ESE score.
- If the student unable to submit the NPTEL or SWAYAM completion Certificate, in such cases evaluation will be based on assignment score (60% weightage) of registered NPTEL/SWAYAM and internal evaluation (40 % weightage).
- The rubrics for internal evaluation are given below.

Government College of Engineering, Karad

Department of Electrical Engineering

A. Y. 2024-25

Course Code : **Assessment Sheet** **Class**:

Course Title :-

Sr No.	Reg. No	Name of Student	Course Title	Knowledge of Course (08 Marks)	Communication Skill (08 Marks)	Presentation Skill (08 Marks)	Content (08 Marks)	Q & A (08 Marks)	Total Marks (out of 40)
1									
2									

Guide Name and Sign. **Head of the Department**

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Technology

EE3406 : Strategic Management

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	-
Tutorials	00 Hrs/week		ISE	25
Total Credits	02		ESE	-

Prerequisite :

Course Outcomes (CO): Students will be able to

CO1	Understand the Strategic Management Process.
CO2	Apply Strategic Analysis Tools for Competitive Advantage.
CO3	Analyze External Environmental Factors Impacting Firms.
CO4	Design and Implement Business-Level Strategies.

	Course Contents	CO	Hours
Unit 1	**The Tools of Strategic Analysis:** Strategy and the Strategic Management Process, What Is Competitive Advantage, The Strategic Management Process, Measuring Competitive Advantage, Emergent Versus Intended Strategies**.**	**CO1**	**(04)**
Unit 2	**Evaluating a Firm's External Environment:** Understanding a Firm's General Environment, The Structure-Conduct-Performance Model of Firm, Performance, A Model of Environmental Threats. Industry Structure and Environmental Opportunities, The 7-S Framework, Corporate Governance, Code and Laws for Corporate Governance.	**CO2**	**(04)**
Unit 3	**Evaluating a Firm's Internal Capabilities :** The Resource-Based View of the Firm, The VRIO Framework, Applying the VRIO Framework, Imitation and Competitive Dynamics in an Industry, Implications of the Resource-Based View.	**CO2**	**(05)**
Unit 4	**Cost Leadership:** Business-Level Strategy, Cost Leadership, The Value of Cost Leadership, Cost Leadership and Sustained Competitive Advantage, Organizing to Implement Cost Leadership.	**CO3**	**(04)**
Unit 5	**Product Differentiation:** Product Differentiation, The Value of Product Differentiation, product differentiation and Sustained Competitive Advantage, Organizing to Implement Product Differentiation.	**CO3**	**(05)**
Unit 6	**Vertical integration & Corporate diversification:** Corporate Strategy, Vertical Integration, Vertical Integration and Sustained Competitive Advantage, Organizing to Implement Vertical Integration, Corporate Diversification, Organizational Structure and Implementing Corporate, Diversification, (**Self Study**: Management Controls and Implementing Corporate).	**CO4**	**(06)**

Text Books

1.	Jay B. Barney and William S. Hesterly, "Strategic Management and Competitive Advantage Concepts", 5th edition, Pearson Education Limited 2015 (Unit : 1,2,3,4,5,6)
2	Mason Carpenter Gerry Sanders, "Strategic Management Concepts and Cases", 2nd Edition Pearson Education Limited 2014

Reference Books

1.	Frank Rothaer, "Strategic Management Concepts", McGraw-Hill Irwin, 2014.
2.	Michael A. Hitt, R. Duane Ireland, Robert E. Hoskisson, "Strategic Management Concepts and Cases", 7th edition, South Western College Pub, 2006
3.	Michael A. Hitt, R. Duane Ireland, Robert E. Hoskisson, "Strategic Management Concepts Competitiveness and Globalization", South Western College Pub, 2010

Useful Links

1.	https://onlinecourses.nptel.ac.in/noc22_mg88/preview Prof. Sanjib Chowdhury, IIT Kharagpur
2.	https://archive.nptel.ac.in/courses/110/108/110108047/ Prof. R. Shrinivasan, IISc, Banglore

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	1	2	-	2	-	3	-	2	1	1	1	1	3	-
CO 2	-	1	3	1	1	3	1	3	-	3	2	2	-	1
CO 3	-	-	3	2	2	3	1	2	-	3	1	2	1	2
CO 4	-	2	2	3	-	2	-	3	2	2	1	1	-	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	5	-
Understand	-	5	-
Apply	-	5	-
Analyse	-	5	-
Evaluate	-	5	-
Create	-	-	-
TOTAL	-	25	-

Government College of Engineering, Karad

Second Year (Sem – IV) B. Tech. Electrical Technology

EE3407 : Professional Ethics

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	-
Tutorials	00 Hrs/week		ISE	25
Total Credits	02		ESE	-

Prerequisite :

Course Outcomes (CO): Students will be able to

CO1	Apply analytical techniques to enhance Self-awareness of personality types.
CO2	Utilize ethical decision-making principles to negative complex dilemmas.
CO3	Implement professional work ethics to achieve excellence in practice.
CO4	Analyse positive interpersonal skills through effective collaboration strategies.

	Course Contents	CO	Hours
Unit 1	**Developing self-knowledge:** Know Yourself, Profiles and Types, personality, Applying Your Knowledge of Personality, Applying Your Knowledge of Learning Styles, Introverts and Extroverts	**CO1**	**(03)**
Unit 2	**Recognize your values and ethics:** Observe yourself, ethics Should and Should Nots, Personal Code of Ethics, The Importance of Being on Time, The Art and Importance of Follow. Personal, financial and private responsibility, Professional Values – Integrity, Credibility & Responsibility, Loyalty, Commitment, Passion, Valuing Time	**CO2, CO1**	**(05)**
Unit 3	**Achieving professional excellence:** Establishing a Work Ethic, Unselfish Excellence, Professional Etiquette, Professional Attitude, Professional Privacy, Professional Honesty, Role of Professional – Interpersonal Role, Informational Role, Decisional Role, Role of engineers in industry, Society Nation and the World.	**CO3**	**(05)**
Unit 4	**Approach situations with an enthusiastic and genuinely:** Ways to Be Aggressively Nice in the Office, Improve Interpersonal Skills in the Office, Be Aggressively Nice in Business Dealings, Your Role with Your Team. (**Self Study**: The Benefits of Mentoring)	**CO4**	**(04)**
Unit 5	**Improve your time-management, and goal setting, skills:** The Tyranny of the Urgent, Setting Personal Goals, short term goals, long term goals, Schedule the Plan, Avoid Procrastination, Memory Skills	**CO1**	**(05)**
Unit 6	**Maintain balance to succeed in the workplace** Unreasonable Expectations, The Power of Working Hard, Roll with the Punches, Admit Your Mistakes, Sense of Humor.	**CO2**	**(05)**

Text Books

1.	David Strelecky, Ferguson, "Professional Ethics and Etiquette", 2nd Edition, An imprint of Facts On File, Inc (Unit: 1,2,3,4,5,6)
2	R. Subramanian, "Professional Ethics", Oxford University Press, 2015.
3	Caroline Whitbeck, "Ethics in Engineering Practice & Research", 2nd Edition, Cambridge University Press 2015.
4.	Professional Ethics and Human Values by By Premvir Kapoor Khanna Publishing House.

Reference Books

1.	Charles E Harris Jr., Michael S Pritchard, Michael J Rabins "Engineering Ethics, Concepts Cases", 4th edition, Cengage learning, 2015.
2.	Charles B. Fleddermann, "Engineering Ethics", Pearson Prentice Hall, New Jersey, 2004.
3.	John R Boatright, "Ethics and the Conduct of Business", Pearson Education, New Delhi, 2003
4.	Edmund G Seebauer and Robert L Barry, "Fundamentals of Ethics for Scientists and Engineers", Oxford University Press, Oxford, 2001.
5	Laura P. Hartman and Joe Desjardins, "Business Ethics: Decision Making for Personal Integrity and Social Responsibility", Mc Graw Hill education, India Pvt. Ltd., New Delhi, 2013.
6	Erode, "World Community Service Centre Value Education", Vethathiri publications, 2011

Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc22_mg54/preview Prof. Susmita Mukhopadhyay, IIT Kharagpur
2.	https://archive.nptel.ac.in/courses/109/106/109106117/ Prof. Shrikumar Mellickappli, IIT Madras

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	1	-	1	1	1	1	3	3	-	1	1	1	2
CO 2	1	-	1	2	2	2	2	2	-	2	2	2	1	2
CO 3	-	2	-	1	1	1	1	3	3	1	1	3	1	2
CO 4	-	-	1	2	2	2	2	3	1	3	2	2	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	5	-
Understand	-	5	-
Apply	-	5	-
Analyse	-	5	-
Evaluate	-	5	-
Create	-	-	-
TOTAL	-	25	-

Government College of Engineering, Karad					
Second Year (Sem – IV) B. Tech. Electrical Engineering					
EE3408 : AC Machines Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		ISE	50	
Total Credits	01		ESE	25	
Prerequisite : Machines Fundamental					
Course Outcomes (CO): Students will be able to					
CO1	Make appropriate connections for testing of AC machines				
CO2	Deduce conclusions about the performance using obtained readings				
CO3	Calculate regulation and efficiency of single and three phase machines				
CO4	To select appropriate AC machines for the application				

Course Contents		**CO**
Implementation of following concepts		
Experiment 1	Determination of efficiency & speed regulation of 3 phase induction motor by direct loading method	**CO1**
Experiment 2	Determination of circle diagram parameters of 3 Phase induction motor by conducting No Load &Blocked Rotor Tests.	**CO2**
Experiment 3	Study of starters for 3 Phase induction motors.	**CO4**
Experiment 4	Speed control methods of 3 Ph.IM. (Stator Side).	**CO4**
Experiment 5	Speed control methods of 3 Ph.IM. (Rotor Side).	**CO4**
Experiment 6	Determination of efficiency & speed regulation of 1-phIM.	**CO3**
Experiment 7	Determination of Voltage regulation of an alternator by EMF method.	**CO3**
Experiment 8	Determination of Voltage regulation of an alternator by MMF method	**CO3**
Experiment 9	Determination of Voltage regulation of an alternator by ZPF method.	**CO3**
Experiment 10	Determination of Xd and Xqof an Alternator by Slip test	**CO2**
Experiment 11	Determination of efficiency of synchronous motor by direct loading method	**CO3**
Experiment 12	Determination of efficiency and regulation of Alternator by direct loading method	**CO3**
List of Submission:		
	Minimum number of Experiments : 10	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	-	-	1	-	1	1	-	-	-	-	-	-	-
CO 2	1	2	-	1	-	1	1	-	-	-	-	-	1	-
CO 3	-	1	3	2	1	1	-	-	-	-	-	-	2	-
CO 4	-	1	2	3	-	1	1	-	-	-	-	-	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad				
Second Year (Sem – IV) B. Tech. Electrical engineering				
EE3409: Analog & Digital Electronics Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		CA	25
Total Credits	01		ESE	25
Prerequisite : Basic Electronics engineering, AC & DC circuits, Numbering system, Logic Gates and flip flops, Diode and BJT				
Course Outcomes (CO): Students will be able to				
CO1	Design logical, sequential, and combinational digital circuit using K-Map.			
CO2	Demonstrate different digital memories and programmable logic families.			
CO3	Apply and analyze applications of OPAMP in open and closed loop condition.			
CO4	Design uncontrolled rectifier with given specifications			

Course Contents		**CO**
Perform any eight (three experiment should be on bread board/trainer kit) experiment from following list:		
Experiment 1	Design of logical circuit for display of decimal number on seven segment display. **(Hardware)**	**CO1**
Experiment 2	Deign 3:8 decoder for binary to octal decoding**.(Hardware)**	**CO2**
Experiment 3	Design three bit full adder using any open source software. **(Software)**	**CO2**
Experiment 4	Design logical circuit to convert binary to EXCESS 3/Gray number system. (**Hardware)**	**CO3**
Experiment 5	Design digital clock or stop watch using decade counter.(IC74192)(**Hardware)**	**CO3**
Experiment 6	Find phase angle difference between same frequency signal using ZCD and AND gate. **(Hardware)**	**CO3**
Experiment 7	Design of comparator and schmitt trigger**. (Hardware)**	**CO3**
Experiment 8	Study of Instrumentation amplifier using three Op-amp, CMRR measurement **(Hardware)**	**CO3**
Experiment 9	A. Design sine, and triangular wave generator. (**Hardware)** B. Design astable multivibrator using IC-555. **(Hardware)**	**CO4**
Experiment 10	Design first order high pass and low pass filter using OPAMP in any open source software. (For this provide one statement to each of four students to perform with desired cut-off frequency. Each group will demonstrate their result and prepare documentation) (**Software)**	**CO4**
Experiment 11	Design of monostable mutivibrator using IC555 and digital circuit to count number of pulses. (**Hardware)**	**CO4**
Experiment 12	Design of single phase bridge rectifier with output voltage and specified ripple.(this practical should be design by each students, perform in simulation and demonstrate with hardware in laboratory with design documents) (**Software and Hardware)**	**CO4**
List of Submission:		
	Minimum number of Experiments : 10	

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	-	-	1	-	1	1	2	1	1	1	2	-	-
CO 2	1	2	-	1	-	1	1	2	1	1	1	2	1	-
CO 3	-	1	3	2	1	1	-	2	1	1	1	2	2	-
CO 4	-	1	2	3	-	1	1	-	1	1	1	2	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad					
Second Year (Sem – IV) B. Tech. Electrical Engineering					
EE3410: Power Electronics Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		ISE	25	
Total Credits	01		ESE	25	
Prerequisite : MATLAB fundamentals					
Course Outcomes (CO): Students will be able to					
CO1	Plot VI characteristics of various power electronics switches.				
CO2	Simulate converter circuits. and analyze its performance				
CO3	Demonstrate inverter circuit using MATLAB.				
CO4	Analyze the voltage waveform for PWM inverter using various modulation techniques.				

Course Contents		**CO**
Implementation of following concepts		
Experiment 1	Study & verification of SCR characteristics.	**CO1**
Experiment 2	Study & verification of MOSFET and IGBT characteristics.	**CO1**
Experiment 3	MATLAB simulation and verification of performance parameters of 1-ph diode rectifiers	**CO2**
Experiment 4	MATLAB simulation and verification of performance parameters of 3-ph diode rectifiers.	**CO2**
Experiment 5	MATLAB simulation of 1-ph controlled rectifier.	**CO2**
Experiment 6	MATLAB simulation and performance parameters verification of 3-ph controlled rectifiers.	**CO2**
Experiment 7	MATLAB simulation and verification of performance parameters of non-isolated DC-DC converters.	**CO2**
Experiment 8	MATLAB simulation and verification of performance parameters of isolated DC-DC converters.	**CO2**
Experiment 9	MATLAB simulation of inverter.	**CO3**
Experiment 10	MATLAB simulation for various PWM techniques.	**CO4**
List of Submission:		
	Minimum number of Experiments: 08	

Mapping of COs and POs

PO → CO ↓	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO
CO 1	3	-	-	1	-	-	1	-	2	-	1	1	-
CO 2	-	2	3	3	3	-	1	-	2	2	1	1	3
CO 3	-	2	3	3	3	-	1	-	2	2	1	1	3
CO 4	3	2	2	3	3	1	1	-	2	2	1	2	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Avg
Task I	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad				
Second Year (Sem – IV) B. Tech. Information Technology				
EE3411: Environmental Science				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	--
Tutorials	00 Hrs/week		ISE	--
Total Credits	Audit Course		ESE	--

Prerequisite : Universal Human Values

Course Outcomes (CO): Students will be able to

CO1	Understand environmental principals which in turn help in sustainable development.
CO2	Develop technologies on the basis of ecological principles.
CO3	Evaluate environmental impacts of human activities on ecosystems and on the environment.
CO4	Apply interdisciplinary knowledge in environmental science.

	Course Contents	CO	Hours
Unit 1	**Introduction:** Definition and Concept of Environment, Types of Environment, Multidisciplinary Nature of Environmental Studies, Scope of Environmental Studies, Components of Environment, Importance, Need for Public Awareness, Institutions and People, Raising Environmental Awareness in India. Case study of Ganga rejuvenation plan(Namami Gange)	**CO1**	**(03)**
Unit 2	**Natural Resources:** Classification of Resources: Living and Non-Living resources, water resources: use and over utilization of surface and ground water, Mineral resources: use and exploitation, environmental effects of extracting and using mineral resources, Land resources: Forest resources, Energy resources: growing energy needs. (**Self Study:** renewable and non-renewable energy sources, use of alternate energy source, case studies)	**CO3**	**(05)**
Unit 3	**Biodiversity and Biotic Resources:** Introduction, Definition, genetic, species and ecosystem diversity. Value of biodiversity; consumptive use, productive use, social, ethical, aesthetic and optional values. India as a mega diversity nation, Hot spots of biodiversity. Threats to biodiversity: habitat loss, man-wildlife conflicts; conservation of biodiversity: In-Situ and Ex-situ conservation. National Biodiversity act. Field visit to a biodiversity park/nature park. **Ecosystems:** Definition, Scope, and Importance of ecosystem. Classification, structure, and function of an ecosystem, Food chains and ecological pyramids. Flow of energy, ecosystem value, services, Field visit to a biodiversity park/nature park.	**CO4** **CO2**	**(05)**
Unit 4	**Environmental Pollution and Control Technologies:** Environmental Pollution: Classification of pollution, Air Pollution: Primary and secondary pollutants, Automobile and Industrial pollution, Water pollution: Sources and types of pollution, drinking water quality standards. Soil Pollution: Sources and types, Impacts of modern agriculture, Noise Pollution: Sources and Health hazards, standards, Solid waste: Municipal Solid Waste management, composition and characteristics of e-Waste and its management,Waste Management (Self Study:- Pollution case studies:- Bhopal Gas Tragedy,)	**CO4** **CO2**	**(05)**
Unit 5	**Global Environmental Issues and Global Efforts**: Climate change and impacts on human environment. Ozone depletion and Ozone depleting substances (ODS). Deforestation and desertification. International conventions / Protocols: Earth summit, Kyoto protocol, and Montréal Protocol. (Self Study:- Chernobyl nuclear accident case)	**CO1**	**(03)**
Unit 6	**Environmental Policy, Legislation & EIA:** Introduction to Environmental Protection act, Air Act1981, Water Act, Forest Act,	**CO4** **CO3**	**(05)**

	Wild life Act, biomedical waste management and handling rules, hazardous waste management and handling rules. Nature of Environmental Policies, Stockholm Conference (1972), Rio Conference (UNCED, 1992) EIA: EIA structure, methods of baseline data acquisition.. Towards Sustainable Future: Concept of Sustainablity and sustainable Development. Environmental Ethics, Concept of Green Building,		

General Instruction:

Course coordinator will decide the suitable assessment method for internal evaluation of 50 marks and award Pass or Fail grade for the course completion.

Text Books

1.	Erach Bharucha, "Textbook of Environmental Studies for Undergraduate Courses", University Grants Commission. (Unit: 1,2,3,4,5)
2.	R. Rajagopalan, "Environmental Studies", Oxford University Press. (Unit: 1,2,3,4)
3.	Dr. M. Anji Reddy, "Text book of Environmental Science and Technology", 2007, BS Publications. (Unit: 1,2,3,4,5,6)
4.	Dr. P. D. Raut, "Text book of Environmental studies", Department of Environmental Science, Shivaji University, Kolhapur. (Unit: 1,2,3,4,5,6)
5.	Fundamentals of Environmental Studies by Mahua Basu & S. Xavier - Cambridge University Press.

Reference Books

1.	Richard T. Wright, "Environmental Science: towards a sustainable future", PHL Learning Private Ltd. New Delhi, 2008
2.	Gilbert M. Masters and Wendell P. Ela, "Environmental Engineering and science", PHI Learning Pvt. Ltd., 2008
3.	Daniel B. Botkin & Edward A. Keller, " Environmental Science", Wiley INDIA edition.

Useful Links

1.	https://www.unishivaji.ac.in/uploads/syllabus/2022/syllabus/common/Environmentat%20English%20Book%201-3-2022%20Final%20Corrected%20copy_compressed.pdf

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	-	-	-	-	-	-	3	2	-	-	-	-	-	1
CO 2	-	-	3	-	-	2	3	2	3	-	-	-	-	1
CO 3	-	-	-	-	-	-	-	3	-	-	-	-	-	1
CO 4	-	-	-	-	-	2	3	2	3	-	-	3	-	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Government College of Engineering, Karad

Second Year (Sem – III) B. Tech. Electrical Engineering

EE3412: Community Engagement Project

Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		ISE	50
Total Credits	01		ESE	--

Prerequisite : Students must be willing to learn and understand

- The role of community engagement in national development.
- The responsibility of Indian citizens towards community development.

Course Outcomes (CO): Students will be able to

CO1	Undertake community problem identification, formulation and solution.
CO2	Design engineering solutions to complex problems.
CO3	Implement a project that focuses on community issues.
CO4	Communicate with the community and demonstrate the knowledge.

Course Contents

Implementation of following concepts

The course outlines the benefits of community engagement through research and innovation. Students will be able to understand the various problems of any community and the possible ways to address the same. The specific objectives of the course could depend on the problem definition for the project but the overall Performance must be measured on the following criteria.

1. Literature survey and Problem statement- Students should be able to define the problem statement with Clearly specified inputs and outputs. A brief survey of the available literature and an initial draft of possible directions should be adequate.

2. Modelling or Theoretical results- An appropriate model should be chosen for the problem. They should be

Able to reason the pros and cons of various models and choose a suitable one. It is important that they be in a position to defend their choices. The model should also involve the criteria by which they will quantify and test its performance.

3. Engineering or Mathematical tools- Numerous available methods could be put to use in implementing and testing the described model. They should demonstrate the ability to learn and put various methods to use.

4. Demonstration and Presentation- A model designed and implemented should be convincingly presented to showcase its positive and negative aspects. A demonstration to this end where applicable or a presentation in case of theoretical contributions should clearly describe the work.

Maximum two students may carry out the project together.
Project should be based on community problem.
Evaluation will be done based on presentations, written report and developed system.

Text Book	"Principles of Community Engagement", 2nd Edition, NIH Publication No. 11-7782, Printed June 2011.
Link	https://onlinecourses.swayam2.ac.in/ugc23_ge04/preview

Multi-disciplinary Minor (Institute Level-Industrial)

Electrical Vehicle

(Electrical Engineering- Institute Level-Industrial)

Government College of Engineering, Karad				
Second Year (Sem – III) MDM- Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)				
IMI3311: Foundation of EV and Hybrid Vehicle				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite: Basics of Electrical and Electronics.

Course Outcomes (CO): Students will be able to

CO1	Explain the fundamental concepts, principals and configuration of electric and hybrid electric vehicles.
CO2	Identify the various electrical and electronics components for advanced EV.
CO3	Discuss hybridization of automobile.
CO4	Illustrate the electric drive-trains characteristics.

	Course Contents	CO	Hours
Unit 1	**Introduction to EV:** • Current demand in EV industry and opportunities of skilled EV engineers, • History and evolution of electric vehicles, • Components of an electric vehicle.	**CO1**	**(04)**
Unit 2	**Electrical Engineering for EV:** • EV classification and their electrification levels • Battery technology, • Motor and controller systems, • EV numerical calculation • EV charging infrastructure.	**CO1**	**(04)**
Unit 3	**Advanced Electric Vehicles:** • Electrical Requirement, • Power Distribution Specifications, • Electronic Component System, • EV Standard Specifications • Selection of Electrical and Electronic Components.	**CO2**	**(05)**
Unit 4	**Hybridization of the Automobile**: • Challenges and Key Technology of HEVs. • Basics of Hybrid Electric Vehicle (HEV) • Basics of Plug-in Hybrid Electric Vehicles(PHEV) • Basics of Fuel Cell Vehicles (FCVs). • Vehicle to Grid technology	**CO3**	**(05)**
Unit 5	**Hybrid Electric Vehicles :** • HEVs Fundamentals, • Vehicle performance, • Configuration of HEV (Series, Parallel, Series-parallel &Complex), • Power Flow control, Examples • Operation of HEVs	**CO3**	**(04)**
Unit 6	**Hybrid Electric Drive-trains**: • Basic concept of hybrid traction, • introduction to various hybrid drive-train topologies,	**CO4**	**(04)**

	• power flow control in hybrid drive-train topologies, • fuel efficiency analysis. **Electric Drive-trains:** • Basic concept of electric traction, • introduction to various electric drive-train topologies, • power flow control in electric drive-train topologies, • Fuel efficiency analysis.		

Text Books	
1.	Electric And Hybrid Electric Vehicles Braking Systems & NVH considerations, Author Jurgen R.K., Publisher - Sae International
Reference Books	
1.	Iqbal Hussein, "Electric and Hybrid Vehicles: Design Fundamentals", CRC Press, 2nd Edition, 2003.
2.	Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004
3.	James Larminie, John Lowry, "Electric Vehicle Technology", Wiley publications, 1st Edition, 2003.
4.	B D McNicol, D A J Rand, "Power Sources for Electric Vehicles", Elsevier publications, 1st Edition, 1998
5.	Seth Leitman, "Build Your Own Electric Vehicle" MC Graw Hill, 1st Edition, 2013
Useful Links	
1.	https://archive.nptel.ac.in/courses/108/102/108102121/ Prof. Amit Jain IIT Delhi.
2.	https://nptel.ac.in/courses/108/103/108103009/ Prof. S. Majhi, Dr. Praveen Kumar IIT Guwahati.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	-	1	-	-	2	3	-	-	-	-	3	-	-
CO 2	2	-	1	-	-	2	3	-	-	-	-	3	-	-
CO 3	2	-	1	-	-	2	3	-	-	-	-	3	-	-
CO 4	2	2	1	-	-	2	3	-	-	-	-	3	-	-

1: Slight (Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	5
Understand	5	5	20
Apply	5	5	15
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) MDM- Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)

IMI3412: EV Battery Technology and Powertrain Development

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Electrostatics and Basic Circuit Laws

Course Outcomes (CO): Students will be able to

CO1	Analyze the performance of the batteries.
CO2	Discuss and Analyze different energy storage technologies used for hybrid electric vehicles.
CO3	Implement proper drive configuration to electric and hybrid vehicle.
CO4	Visualize the working of an EV powertrain.

	Course Contents	CO	Hours
Unit 1	**Batteries:** Overview of Batteries, Battery Parameters, Lead acid batteries, Lithium ion batteries, Metal air batteries, Battery Charging, Thermal runway battery management system (BMS), Functionality, SOC/SOH estimation.	**CO1**	**(04)**
Unit 2	**Energy Storage Systems for EV:** Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Different batteries for EV, Battery Characterization Comparison of Different Energy Storage Technologies for HEVs, Battery Charging Control	**CO2**	**(04)**
Unit 3	**Energy Storage and its analysis:** Battery based energy storage and its analysis, Solar Photovoltaic based energy storage system, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices	**CO2**	**(04)**
Unit 4	**Battery Pack Design and Modeling** Battery pack Design, Properties of Batteries, Battery Pack Assembly and Test, Thermal Analysis on Battery Pack, Battery Pack Modeling, The basics of charging technology Types of charging architecture existing globally, CAN communication	**CO1**	**(04)**
Unit 5	**Electric Propulsion unit**: Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, Drive system efficiency	**CO3**	**(04)**
Unit 6	**Electric Vehicle Powertrain:** Introduction to EV Powertrain, Special electric traction motors, Various types of regulations and standards set in the CMVR (Central Motor Vehicles Rules - 1989) for selecting and manufacturing various components of an electric vehicle. The rules and regulations need to follow while designing a retrofit powertrain model. Architecture and Components of EV Powertrain, Basics of Carbon footprint of companies and understand how companies utilize carbon credits to reduce their carbon footprint issues	**CO4**	**(06)**

Text Books

1. Handbook on Battery Energy Storage System, Asian Development Bank,2018.
2. Handbook of Automotive Powertrain and Chassis Design, 1998.

Reference Books

1. Iqbal Hussein, “Electric and Hybrid Vehicles: Design Fundamentals”, CRC Press, 2nd Edition, 2003.
2. Mehrdad Ehsani, Yimi Gao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press, 2004
3. James Larminie, John Lowry, “Electric Vehicle Technology”, Wiley publications, 1st Edition, 2003.
4. B D McNicol, D A J Rand, “Power Sources for Electric Vehicles”, Elsevier publications, 1st Edition, 1998
5. Seth Leitman, “Build Your Own Electric Vehicle” MC Graw Hill, 1st Edition, 2013

Useful Links

1.	https://nptel.ac.in/courses/108106170 Prof. Ashok Jhunjhunwala , IIT Madras.
2.	https://onlinecourses.swayam2.ac.in/ntr24_ed16/preview Dr G.A.Rathy, Dr R. Suja, NITTTR, Chennai.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	2	-	-	2	3	2	-	-	-	2	-	-
CO 2	2	-	-	-	-	2	3	-	-	-	-	2	-	-
CO 3	2	2	2	-	-	2	3	-	-	-	-	2	-	-
CO 4	2	-	2	-	-	2	3	2	-	-	-	2	-	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	5
Understand	5	5	20
Apply	5	5	15
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Third Year (Sem – V) MDM- Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)

IMI3513: EV Power Electronics and Embedded System

Teaching Scheme			Examination Scheme	
Lectures	03 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of Electronics

Course Outcomes (CO): Students will be able to

CO1	Select proper machine drive for HEVs application.
CO2	Compare different power converters topologies in HEVs
CO3	Develop the basic fundamentals of embedded system , C++ and Linux programming.
CO4	Discuss the sensor characteristics, communication protocol and configuration of the embedded systems

	Course Contents	CO	Hours
Unit 1	**Electric Machines and Drives in HEVs :** Introduction, BLDC motors, Induction Motor Drives, Permanent Magnet Motor Drives, Switched Reluctance Motors, Doubly Salient Permanent Magnet Machines, Design and Sizing of Traction Motors, Thermal Analysis and Modelling of Traction Motors. **(only functional treatment to be given)** .	**CO1**	**(04)**
Unit 2	**Power Electronics in HEVs:** Power electronics including switching, AC-DC, DC-AC conversion, Electronic devices and circuits used for control and distribution of electric power, Thermal Management of HEV Power Electronics, Generator and Basics of controlling System in Hybrid Vehicle.	**CO1**	**(05)**
Unit 3	**Power Converter:** Introduction, various power electronics converter topologies and its comparisons, Control of convertor operations in EV and HV, EV Charging and Battery System ,Emerging power electronic devices ,PE in renewable energy system, PE in industrial system	**CO2**	**(04)**
Unit 4	**Introduction to Embedded System:** Microcontrollers and microprocessors in EVs, Basics of Embedded System, Embedded C/C++ programming, Idea about Linux, Linux in Embedded System.	**CO3**	**(04)**
Unit 5	**Sensor Characteristics and communication Protocols:** Sensor Principal Characteristics, Sensor-Actuator Integration System. Basic introduction to communication protocols CAN bus, LIN, FlexRay.	**CO3**	**(04)**
Unit 6	**Configuration of Embedded System:** Building of Linux-Embedded System, Application in Embedded Devices, Real-Time Operating Systems (RTOS)**,** RTOS concepts and usage in EVs, Scheduling and task management	**CO4**	**(05)**

Handbooks

1. Nicolas Navet, Francois Simonot-Lion, “Automotive Embeded Systems Handbook”, CRC Press Taylor & Francic group, 2009.
2. Ersan Kabalci, “Power Electronics and Drives Used In Automotive Applications”2014.

Reference Books

1. Joseph Vithayathil “Power Electronics: Principles and Applications”, McGraw Hill Publication, 2010
2. Cyril W. Lander “Power Electronics”, 3rd Edition McGraw Hill publication.
3. Frank Vahid and Tony Givargis, “Embedded system design: A unified hardware/Software introduction”, Third edition, John Wiley & sons, 2010
4. L. Ashok Kumar, S. Albert Alexander, “Power Converters for Electric Vehicles”, CRC Press, Taylor & Francis Group, 2021
5. Automotive Industry Standards, India, 2015-2016

Useful Links

1. https://nptel.ac.in/courses/108/101/108101038/ Prof. B. G. Fernandes

2.	https://nptel.ac.in/courses/108/102/108102145/ Prof. G. Bhuvaneshwari
3.	https://d1.amobbs.com/bbs_upload782111/files_38/ourdev_629261ASTZIF.pdf

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	1	1	-	-	1	-	-	-	-	-	2	-	-
CO 2	2	1	2	-	-	1	-	-	-	-	-	2	-	-
CO 3	2	2	2	-	3	1	-	-	-	-	2	2	-	-
CO 4	2	2	2	-	3	1	-	-	-	-	2	2	-	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	10
Apply	5	5	20
Analyse	5	5	25
Evaluate	5	5	5
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad				
Third Year (Sem –V) MDM- Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)				
IMI3514: Electric Vehicle Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		**ISE**	50
Total Credits	1		**ESE**	--
			TOTAL: 50	

Prerequisite : Basics of Electronics

Course Outcomes (CO): Students will be able to

CO1	Perform experiments by interfacing sensor with microcontroller
CO2	Illustrate the MATLAB programming for EV systems
CO3	Develop and execute the Simulink model for different EV units
CO4	Design the power supply EV unit on PCB

Course Contents		CO
Experiment 1	Introduction to booting process of raspberry pi	**CO1**
Experiment 2	Perform experiment to control the speed of dc motor	**CO1**
Experiment 3	Interface IR/ PIR sensor with microcontroller	**CO1**
Experiment 4	Interface ultrasonic sensor with microcontroller and find distance	**CO1**
Experiment 5	Developing SIMULINK Models for Vehicle Units	**CO3**
Experiment 6	Programming EV Systems in MATLAB	**CO2**
Experiment 7	Application of Data Analysis Techniques in EV Electrical system	**CO2**
Experiment 8	Design a power supply unit and create a PCB design for same.	**CO4**
Experiment 9	Modelling and simulation of EV powertrain components in MATLAB	**CO3**
Experiment 10	Analysis of EV powertrain components in ANSYS	**CO3**
Experiment 11	Battery Management System modelling	**CO3**
Experiment 12	Modelling of Li-ion battery pack using MATLAB and ANSYS	**CO3**

List of Submission:

Minimum number of Experiments: 10

Mapping of COs and POs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	1	2	3	1	3	-	1	-	2	-	2	2	-	2
CO2	1	2	3	2	3	-	1	-	2	-	2	2	1	-
CO3	1	2	3	3	3	-	1	-	2	-	2	2	2	-
CO4	1	2	3	3	3	-	1	-	2	-	2	2	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Avg
Task I	15	15	15	15	15	15	15	15	15
Task II	5	5	5	5	5	5	5	5	5
Task III	5	5	5	5	5	5	5	5	5
ISE	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad				
Third Year (Sem – VI) MDM- Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)				
IMI3615: EV Charging Infrastructure, Vehicle Testing and Homologation				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of Power Electronics Converters.

Course Outcomes (CO): Students will be able to

CO1	Discuss the electric vehicle market, opportunities and challenges
CO2	Illustrate different EV development methods and unit economics
CO3	Describe the EV charging technologies, standards and protocols.
CO4	Execute site selection and planning infrastructure design

	Course Contents	CO	Hours
Unit 1	**Fundamentals of EV Management:** Introduction to EV Market, EV Design Procedure and ICE Model, EV Management, EV Homologation and Testing.	**CO1**	**(04)**
Unit 2	**Charger Manufacturing:** FAME India and Manufacturing Guidelines, EV Certification Process, EV Charging, Electric Vehicle and Retrofitting, EV Categories and Proposed Chargers.	**CO1**	**(05)**
Unit 3	**Product Development Plan:** Segment Selection, Product Design Plan, Product Validation Plan, Vehicle Dynamics Selection, Product Design Validation, Product Selection Plan.	**CO2**	**(04)**
Unit 4	**Development Methods:** Product Development Methods, Product Development Plans, Unit Economics, Design feasibility, Design for Manufacturing.	**CO2**	**(05)**
Unit 5	**EV Charging Technology:** Overview, Charging Standards.	**CO3**	**(04)**
Unit 6	**Charging Infrastructure and Site Selection:** EV Charging Infrastructure Design, Site Selection and Planning, Safety and Regularities.	**CO4**	**(04)**

Handbook

1.	Amitabh Kant, Randheer Singh and Sanjeev Kumar Kassi, "Handbook of Electric Vehicle Charging Infrastructure Implementation" version 1, 2021.
2.	"EV Charging Station Technician Technical Handbook", USAID Gov,2023.

Reference Books

1.	Husain Iqbal, "Electric And Hybrid Vehicles Design Fundamentals" CRC Press, 2nd edition, 2010
2.	Ehsani M.,Gao Yimin , Emadia A., "Modern Electric, Hybrid Electric and Fuel Cell Vehicles , Fundamentals Theory and Design" Crc Press Newyork.

Useful Links

1.	https://onlinecourses.nptel.ac.in/noc20_ee99/preview Prof. Ashok Jhunjhunwala IIT Madras.
2.	https://nptel.ac.in/courses/108/103/108103009/
3.	https://onlinecourses.swayam2.ac.in/ntr24_ed54/preview
4.	https://www.niti.gov.in/sites/default/files/2023-02/EV_Handbook_Final_14Oct.pdf
5.	https://sarepenergy.net/wp-content/uploads/2023/07/EV-Technican-Handbook-SAREP.pdf

Mapping of COs and POs

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CO 1	1	-	-	-	-	-	2	-	-	-	3	2	-	2
CO 2	1	-	1	-	-	-	2	-	-	-	3	2	1	-
CO 3	1	2	2	-	-	2	3	-	-	-	-	2	2	-
CO 4	1	2	2	2	-	3	3	2	-	-	2	2	2	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Final Year (Sem – VII) MDM- Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)

IMI3716: EV Vehicle Design, Analysis and Control

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Semiconductor Devices Knowledge

Course Outcomes (CO): Students will be able to

CO1	Apply the power electronics technique to diagnostics fault
CO2	Explore the knowledge about analog and digital electronics
CO3	Develop the EV architecture with the help of design and simulation parameters.
CO4	Design and modelling the different EV units.

	Course Contents	CO	Hours
Unit 1	**Analog Electronics:** Sensors for EV Applications (Temperature, Pressure, Current, Voltage) Signal Conditioning Circuits (Amplifiers, Filters) Interface Circuits (Analog-to-Digital Converters)	**CO2**	**(04)**
Unit 2	**Power Electronics:** Pulse Width Modulation (PWM) Techniques Current and Voltage Regulation Over current and Overvoltage Protection Fault Detection and Diagnostics.	**CO1**	**(04)**
Unit 3	**Digital Electronics:** Analog-to-Digital Conversion (ADC) Sensor Types and Characteristics (Temperature, Pressure, Acceleration, etc.) Signal Conditioning Circuits Filtering and Noise Reduction Techniques	**CO2**	**(04)**
Unit 4	**Automotive Components:** Power Semiconductors, Trends in Power semiconductors, Bidirectional Converters, Inverters, Interleaving mode in power converters, Passive Components	**CO3**	**(04)**
Unit 5	**EV Architecture:** Motor development and induction motor characteristics, Simulink model to calculate vehicle configuration, Multilevel inverter design and simulation, DC –DC converter, Motor controllers	**CO3**	**(05)**
Unit 6	**Modelling and Simulation of Electric Vehicles:** Modeling and sizing of the traction systems, Modeling and sizing of the storage systems, Modeling of EV battery and BMS, Interaction between the different blocks of the electrical Architecture	**CO4**	**(06)**

Handbooks

1.	K. T. Chau ,"Electric Vehicle Machines and Drives: Design, Analysis and Application", Wiley-IEEE Press, ISBN: 978-1-118-75252-4, August 2015.
2.	Per Enge ,Nick Enge, Stephen Zoepf, "Electric Vehicle Engineering", 1st Edition, McGraw Hill publication 2021
3.	Nicolas Navet, Francois Simonot-Lion, "Automotive Embeded Systems Handbook", CRC Press Taylor&Francic group, 2009.

Reference Books

1.	M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons Inc.
2.	Michael Shur, Introduction to Electronic Devices, John Wiley & Sons Inc., 2000.
3.	R. T. Howe and C. G. Sodini, Microelectronics: An Integrated Approach, PrenticeHall Inc. 1997.
4.	Jacob Millman, and C.C. Halkias, "Electronic devices and circuits", TMH Publications
5.	Ben G. Streetman, Solid State Electronic Devices, PHI, 5th Ed, 2001

Useful Links

1.	http://web.iitd.ac.in/~shouri/eel201/lectures.php
2.	http://www.daenotes.com/electronics/digital-electronics
3.	https://onlinecourses.nptel.ac.in/noc24_ee30/preview Prof. Amit Jain IIT Delhi.
4.	https://onlinecourses.nptel.ac.in/noc22_ee53/preview Prof. Amit Jain IIT Delhi

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	-	-	-	-	-	1	-	-	-	-	2	-	-
CO 2	2	-	-	-	-	-	1	-	-	-	-	2	-	-
CO 3	2	1	2	1	1	-	1	-	-	-	-	2	-	-
CO 4	2	1	2	1	1	-	1	-	-	-	-	2	-	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	-	10
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	10
Create	-	5	-
TOTAL	20	20	60

Government College of Engineering, Karad

Final Year (Sem – VIII) MDM- Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)

IMI3817: EV PCB Design & Data Analytics

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of Analog and Digital Electronics

Course Outcomes (CO): Students will be able to

CO1	Discuss the basics of PCB Design and its components.
CO2	Organize and execute hierarchical schematics of EV
CO3	Explore ideas about data visualization.
CO4	Analyze data for electric and autonomous vehicles.

	Course Contents	CO	Hours
Unit 1	**Basics of PCB Design:** Overview, Basic Ideas, Different Technologies, Understanding Schematic Capture.	**CO1**	**(04)**
Unit 2	**Component Working:** Symbol and Nets, Creating Hierarchical Schematic, Multi Sheet Design, Generating Netlist and Bill of Material.	**CO2**	**(05)**
Unit 3	**Design Applications :** Design for Analog and Digital Circuits, Design for Power Electronics, Design for Microwave circuits.	**CO1**	**(04)**
Unit 4	**Data Analytics:** Introduction, Data Collection, Preprocessing, Data Collection Techniques in Electric Vehicle.	**CO4**	**(04)**
Unit 5	**Data Visualization:** Introduction to Data Visualization Technique, Data Exploration, Data Exploration for EV.	**CO3**	**(04)**
Unit 6	**Overview and Application of Data Analysis:** Overview of Data Analysis Techniques, Regression Analysis, Clustering, Application in EV Electrical System, Data Analysis Platform for EV System.	**CO4**	**(05)**

Handbook

1. "P-CAD PCB User's Guide", p-cad PCB layout system from Altum,2006.

Reference Books

1. "IPC-PCB Design Desk Reference 2022 Edition", IPC design,2022.

2. Sai Kiran "PCB Designing E- Learning Book", Digimind 2009.

Useful Links

1. https://resources.pcb.cadence.com/ebooks-white-papers

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	2	2	3	2	2	-	1	-	-	-	-	2	-	-
CO 2	1	2	2	-	-	-	1	-	-	-	-	2	-	-
CO 3	1	1	1	2	-	-	1	-	-	-	-	2	-	-
CO 4	1	1	1	2	-	-	1	-	-	-	-	2	-	-

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	-	-	10

Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	10
Create	5	5	-
TOTAL	20	20	60

Multi-disciplinary Minor (Institute Level-Industrial)

Image Processing (ETC- Institute Level-Industrial)

Government College of Engineering, Karad				
Second Year (Sem – III) MDM- Image Processing (ETC- Institute Level-Industrial)				
IMI3321: Fundamentals of Image				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	--		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Mathematics basics

Course Outcomes (CO): Students will be able to

CO1	Understand the image fundamentals
CO2	Study the Image perception
CO3	Explain different operations applied to Medical Images
CO4	Apply various image transformation procedures used in health care

	Course Contents	CO	Hours
Unit 1	**Fundamentals of Image :** Fundamentals of Image and Pictures, Analog image and Digital Image, Elements of Visual perception, Image sampling and quantization,	**CO1**	**(04)**
Unit 2	**Different Types of Image:** Image Perception, Greyscale Images, RGB Images, Indexed Colour Images, Medical Images.	**CO1, CO2**	**(04)**
Unit 3	**Representation of Image:** Camera Models , Imaging Geometry, Basics Of Image Display, Data Types And Conversions	**CO1, CO2**	**(04)**
Unit 4	**Image Operations:** Neighborhood Pixel Relationships, Basic Image Operations - Arithmetic, Geometric And Morphological	**CO3**	**(04)**
Unit 5	**Transformation:** Image Transform: 2d Dft- Discrete Cosine, Sine , Haar Transform, Walsh Transform.	**CO4**	**(05)**
Unit 6	Case study 1. Medical Image Display using MATLAB /Python Case Study 2. Representation of Grey and RGB images using MATLAB /Python Case study 3. Different Operations on Images.	**CO4**	**(05)**

Text Books

1.	Rafael C. Gonzales, Richard E. Woods, "Digital Image Processing", Third Edition, Pearson Education, 2010.
2.	Anil Jain K. "Fundamentals of Digital Image Processing", PHI Learning Pvt. Ltd., 2011 An Introduction to Digital Image Processing with Matlab, Alasdair McAndrew

References

1.	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, "Digital Image Processing Using MATLAB", Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2.	Willliam K Pratt, "Digital Image Processing", John Willey, 2002.
3.	Malay K. Pakhira, "Digital Image Processing and Pattern Recognition", First Edition, PHI Learning Pvt. Ltd., 2011.

Useful Links

1.	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
2.	https://www.coursera.org/specializations/image-processing

3.	https://www.coursera.org/learn/introduction-image-processing

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2	1	-	1	1	2	1	-	-	1	2	1	1	-
CO 2	2	2	1	2	1	1	1	-	-	-	-	1	-	1	-
CO 3	3	2	3	3	3	2	-	-	-	1	-	-	1	2	2
CO 4	3	2	3	3	3	2	-	-	-	1	1	1	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) MDM- Image Processing (ETC- Institute Level-Industrial)

IMI3422: Basics of Image Processing for Healthcare

Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	--		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Digital Signal Processing basics

Course Outcomes (CO): Students will be able to

CO1	Study digital image fundamentals.
CO2	Explain image enhancement and restoration, compression, segmentation techniques

	Course Contents	**CO**	**Hours**
Unit 1	**Fundamentals of Image Processing:** Digital Image Representation – Fundamental Steps In Image Processing, Components Of An Image Processing System.	**CO1**	**(03)**
Unit 2	**Image Enhancement In The Spatial Domain:** Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics Of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	**CO1, CO2**	**(04)**
Unit 3	**Image Enhancement In The Frequency Domain:** Introduction To The Fourier Transform And The Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.	**CO2**	**(04)**
Unit 4	**Image Restoration:** A Model Of The Image Degradation/Restoration Process, Linear, Position Invariant Degradations, Inverse Filtering, Minimum Mean Square Error (Wiener) Filtering, Constrained Least Squares Filtering. Wavelets And Multi Resolution Processing: Multi Resolution Expansions, Wavelet Transforms In One Dimension, The Fast Wavelet Transform, Wavelet Transforms In Two Dimensions	**CO2**	**(06)**
Unit 5	**Image Compression and segmentation:** Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards, Detection Of Discontinuities, Edge Linking And Boundary Detection, Thresholding, Region-Based Segmentation	**CO2**	**(05)**
Unit 6	**Object Representation And Description:** Various Schemes For Representation, Boundary Descriptors, And Regional Descriptors	**CO2**	**(04)**

Text Books

1.	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.

References

1.	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.
2.	Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.

Useful Links

1.	https://onlinecourses.nptel.ac.in/noc19_ee55/preview
2.	https://www.coursera.org/learn/introduction-computer-vision-watson-opencv

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1	1	2	1	-	-	-	-	-	-	2	3	2	1
CO 2	2	2	1	1	1	-	-	-	-	-	-	1	3	2	-

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Third Year (Sem – V) MDM- Image Processing (ETC- Institute Level-Industrial)

IMI3523: Particle Size Analysis using Image Processing

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	03		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of Image Processing

Course Outcomes (CO): Students will be able to

CO1	Understanding of particle size analysis techniques and their applications in health care
CO2	Apply Methods of particle size Measurements by microscopic technique
CO3	Develop interpretation of particle size distribution data and analyzing particle morphology.

	Course Contents	**CO**	**Hours**
Unit 1	Principles of Particle Size Analysis	**CO1**	**(05)**
Unit 2	Techniques in Particle Size Measurement	**CO1, CO2**	**(07)**
Unit 3	Interpretation of Particle Size Distribution Data	**CO3**	**(07)**
Unit 4	Particle Morphology Analysis	**CO3, CO4**	**(07)**
Unit 5	Particle Size Analysis in health care medical system and Biomedical Samples	**CO3**	**(07)**
Unit 6	Introduction of MATLAB operations used for image processing, Image sampling and quantization, Study of DICOM standards. Histogram Processing and Basic Thresholding functions, Image Enhancement-Spatial filtering,	**CO1, CO2**	**(07)**

Text Books

1.	G.R. Sinha, Bhagwaticharan patel, Medical Image Processing: Concepts and Applications, PHI Learning private limited.2014
2.	KayvanNajarian and Robert Splinter, "Biomedical Signal and Image Processing", Second Edition, CRC Press, 2005.
3.	E. R. Davies, “Computer & Machine Vision”, Fourth Edition, Academic Press, 2012

References

1.	Geoff Dougherty, Medical Image Processing: Techniques and Applications, Springer Science & Business Media, 25-Jul-2011
2.	Isaac N. Bankman, Handbook of Medical Image Processing and Analysis, Science Direct,2nd Edition , 2009
3.	Deserno T M, “Biomedical Image Processing”, Springer, 2011.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	1	3	3	2	1	-	-	-	-	-	1	2	2	1
CO 2	-	3	3	2	2	1	-	-	-	-	-	1	1	2	1
CO 3	-	3	3	2	2	1	-	-	-	-	-	2	2	3	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad				
Third Year (Sem – V) MDM- Image Processing (ETC- Institute Level-Industrial)				
IMI3524: Particle Size Analysis using Image Processing Lab				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	-
Tutorials	-		ISE	50
Total Credits	01		ESE	-

Course Contents	
Prerequisite : Basics of Image Processing	
Course Outcomes (CO): Students will be able to	
CO1	Identify and describe the different tools and instruments used in particle characterization and formulation analysis.
CO2	Prepare and organize the laboratory environment, ensuring all equipment is correctly set up for experiments.
CO3	Execute particle characterization and morphological analysis procedures independently, demonstrating proficiency and accuracy.
	Course Contents
Experiment 1	Principles of Particle Characterization in Formulations
Experiment 2	Techniques in Reverse Engineering of Formulations
Experiment 3	Classification Analysis of Formulated Products, Morphological Characterization of Formulations
Experiment 4	Microscopic Analysis of Formulated Products, Advanced Topics in Formulation Characterization

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	-	-	3	3	-	1	-	2	2	-	2	-	2	2
CO 2	1	3	3	2	2	1	3	1	2	-	2	2	1	2	2
CO 3	1	3	3	2	2	1	-	2	2	-	2	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Avg
Task I	15	15	15	15	15
Task II	5	5	5	5	5
Task III	5	5	5	5	5
ISE	25	25	25	25	25

Government College of Engineering, Karad				
Third Year (Sem – VI) MDM- Image Processing (ETC- Institute Level-Industrial)				
IMI3625: Particle Characterization in Healthcare				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of Image processing

Course Outcomes (CO): Students will be able to

CO1	Understand of particle characterization techniques used in the health care sector.
CO2	Analyse the morphology, structure, and properties of particles.
CO3	Apply particle characterization techniques in health care medical research, formulation development, and quality control.

	Course Contents	CO	Hours
Unit 1	Fundamentals of Particle Characterization	**CO1**	**(04)**
Unit 2	Techniques in Particle Morphology Analysis	**CO2**	**(04)**
Unit 3	Analysis of API Particles	**CO1, CO2**	**(04)**
Unit 4	Microscopy Techniques for Characterization	**CO3**	**(04)**
Unit 5	Impurities Analysis and Detection	**CO3,**	**(05)**
Unit 6	Advanced Topics in Particle Characterization for health care applications.	**CO3**	**(05)**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	-	2	3	3	3	-	-	-	-	1	-	1	-	2	1
CO 2	-	3	3	2	2	1	-	-	-	-	1	1	1	2	1
CO 3	-	3	3	2	2	1	-	-	-	-	-	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad				
Final Year (Sem – VII) MDM- Image Processing (ETC- Institute Level-Industrial)				
IMI3726: Particle Characterization in Formulation and Reverse Engineering				
Teaching Scheme			**Examination Scheme**	
Practical	2 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min
Prerequisite : Basics of image processing				
Course Outcomes (CO): Students will be able to				
CO1	Explain the advanced knowledge and skills in particle characterization techniques applicable to health care image analysis.			
CO2	Illustrate the reverse engineering methods for analysing complex formulations and identifying key components			
CO3	Explain the techniques for microscopy image analytics for formulation characterization.			
CO4	Apply the particle characterization techniques in formulation development, optimization, and quality control.			

	Course Contents	**CO**	**Hours**
Unit 1	Principles of Particle Characterization in Formulations	**CO1**	**(04)**
Unit 2	Techniques in Reverse Engineering of Formulations	**CO2**	**(04)**
Unit 3	Classification Analysis of Formulated Products	**CO2**	**(04)**
Unit 4	Morphological Characterization of Formulations	**CO3**	**(05)**
Unit 5	Microscopic Analysis of Formulated Products	**CO3**	**(05)**
Unit 6	Advanced Topics in Formulation Characterization	**CO4**	**(04)**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	3	3	3	3	-	-	-	-	1	-	2	-	2	2
CO 2	-	3	3	2	2	1	-	-	-	-	-	2	1	2	2
CO 3	-	3	3	2	2	1	-	-	1	-	-	2	1	2	2
CO 4	-	3	3	3	3	2	-	1	-	-	1	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	5	5	05
Apply	5	5	20
Analyse	5	5	20
Evaluate	5	5	15
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad				
Final Year (Sem – VIII) MDM- Image Processing (ETC- Institute Level-Industrial)				
IMI3827: Project/Internship				
Teaching Scheme			**Examination Scheme**	
Practical	04 Hrs/week		ISE	-
Tutorials	-		ESE	100
Total Credits	02			
Prerequisite -				
Course Outcomes (CO): Students will be able to				
CO1	Carry out comprehensive reverse engineering of a formulation, utilizing multiple analytical techniques to deduce the composition and structure.			
CO2	Modify standard procedures to troubleshoot and optimize techniques for specific formulations, demonstrating flexibility and problem-solving skills.			
CO3	Design and implement novel analytical protocols to characterize new formulations, showcasing innovation and advanced technical skills.			
	Course Contents			**CO**
	Project /Internship based on the completion of previous courses.			**CO1,CO2,CO3**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	3	3	3	3	-	3	-	2	-	2	2	-	2	2
CO 2	-	3	3	2	2	1	2	3	-	2	2	2	1	2	2
CO 3	-	3	3	2	2	1	2	-	1	-	2	2	1	2	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	-	10
Understand	-	10
Apply	-	20
Analyse	-	20
Evaluate	-	20
Create	-	20
Total	-	100

Multi-disciplinary Minor (Institute Level-Industrial)

Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)

Government College of Engineering, Karad

Second Year (Sem – III) MDM- Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)

IMI3331: Foundation of EV and Hybrid Vehicle

Teaching Scheme			**Examination Scheme**		
Lectures	02 Hrs/week		MSE		20
Tutorials	-		ISE		20
Total Credits	02		ESE		60
			Duration of ESE		02 Hrs 30 Min

Prerequisite : Basics of mechanical, Basics of electrical

Course Outcomes: Student will be able to

CO1	Explain the fundamentals of EV technology
CO2	Identify and discuss different components and their operation need in a Hybrid vehicle
CO3	Demonstrate different battery technologies and charging stations
CO4	Calculate motors and motor controller sizing need in an EV

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to EV:** Explaining EV technology and summarize Automotive revolution, explore Electrical Requirement of a vehicle.	**CO1**	**(04)**
Unit 2	**EV layout and components:** Exploring different types of EV layouts and basic components of Electric Vehicle	**CO1**	**(04)**
Unit 3	**Introduction to Hybrid electric vehicle:** Defining Hybrid Vehicle working principles and architecture, Introduction, Battery chemistry ,Efficiency ,Definition and parameters for Hybrid Systems	**CO2**	**(04)**
Unit 4	**Layout and component of hybrid electric vehicle :** Electric Motors ,Generators , and Power electronics for Hybrid systems, control systems, Hybrid electric vehicle operation	**CO2**	**(04)**
Unit 5	**Identify and demonstrate Battery Technology and charging station infrastructure:** Defining Battery Technology, recognize different types of batteries and components of Battery, describing EV charging Infrastructure	**CO3**	**(05)**

Unit 6	**Advanced EV:** Listing of Electrical Requirement needed in EV, state Power distribution specifications, describe Electronic control system, Listing of EV standards and classifications. Summarize criteria for selection of electrical and electronic components for EV. brief outline of Motors need in EV	**CO4**	**(05)**

Reference Books

1.	Julian Happian-Smith; Transport Research Laboratory (TRL) Introduction to Modern Vehicle Design, Publisher: Elsevier-edition 2001
2.	Heinz Heisler; Advanced Vehicle Technology, Publisher: Butterworth-Heinemann Ltd; 2nd edition- July 2002
3.	Seth Leitman, Bob Brant, Leitman Seth; Build Your Own Electric Vehicle: Publisher: McGraw-Hill - 3rd edition-feb 2013

Reference links

1.	https://www.carbodydesign.com/
2.	https://www.team-bhp.com/
3.	https://autoprotoway.com/automotive-design-process/
4.	https://www.carbodydesign.com/

Mapping of COs and POs:

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	-	-	3	-	2	-	-	2	-	3
CO 2	3	1	-	-	3	-	3	-	-	2	-	2
CO 3	3	2	2	3	3	-	3	-	2	2	-	3
CO 4	2	3	3	3	3	1	3	1	2	2	-	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	4	4	10
Understand	4	4	10
Apply	4	4	10
Analyse	4	4	10

Evaluate	4	4	20
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) MDM- Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)

IMI3432:Automotive Mechanics for EV

Teaching Scheme			**Examination Scheme**		
Lectures	02 Hrs/week		MSE		20
Tutorials	-		ISE		20
Total Credits	02		ESE		60
			Duration of ESE		02 Hrs 30 Min

Prerequisite: Basics of mechanical, Basics of electrical, fundamentals of EV.

Course Outcomes: Student will be able to

CO1	Describe vehicle dynamics and elements involved in Automobile engineering
CO2	Demonstrate different automotive sketching techniques and various creative softwares
CO3	Design various systems of EV using advance modeling techniques and softwares
CO4	Analyze advance EV system using different data analysis software

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to vehicle dynamics:** Fundamentals of vehicle dynamics, different mechanisms and dynamics involved in wheels, fundamentals of Hybrid vehicle dynamics.	**CO1**	**(04)**
Unit 2	**Aerodynamics and power train system:** Basics of aerodynamics, principles of aerodynamics, fluid mechanics and airflow dynamics, Suspension and Braking system, Vehicle stability control and vehicle safety,	**CO1**	**(04)**
Unit 3	**Sketching of automotive EV design:** Introduction to Automotive sketching software, Overview of vehicle design process and Automotive sketching, Basic sketching techniques.	**CO2**	**(04)**
Unit 4	**Software for EV drafting and designing** Basic sketching techniques and tools in the software, sketching car exteriors, interiors and details. creating different views and angles of vehicle	**CO3**	**(05)**
Unit 5	**Advance EV modeling techniques using Solidworks :** Basic vehicle design principles, design and modeling of chassis and frame, suspension systems, design and modeling of braking and steering systems, automotive sketching softwares, advance body design modeling.	**CO4**	**(05)**

Unit 6	**Advance EV analysis using different data analysis software:** Analyse the EV designed in modeling software using advance data analysis software, setting up modeling environment.	**CO4**	**(04)**

Reference Books

1.	Julian Happian-Smith, "Introduction to Modern Vehicle Design", Transport Research Laboratory (TRL) ,Elsevier- edition, 2001
2.	Heinz Heisler; "Advanced Vehicle Technology", Butterworth-Heinemann Ltd; 2nd edition, July 2002.
3.	Seth Leitman, Bob Brant, Leitman Seth; Build Your Own Electric Vehicle: Publisher: McGraw-Hill, 3rd edition, 2013.

Reference links

1.	https://www.carbodydesign.com/
2.	https://www.team-bhp.com/
3.	https://autoprotoway.com/automotive-design-process/
4.	https://www.carbodydesign.com/

Mapping of COs and POs:

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	1	-	2	-	-	2	-	3
CO 2	2	-	2	-	2	-	1	-	-	1	-	2
CO 3	3	3	3	3	3	1	3	1	2	2	-	3
CO 4	3	3	3	3	3	1	3	1	2	1	-	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	4	4	10
Apply	4	4	10
Analyse	4	4	20

Evaluate	4	4	10
Create	4	4	10
TOTAL	20	20	60

Government College of Engineering, Karad

Third Year (Sem – V) MDM- Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)

IMI3533:EV Design, Development, Analysis and Control

Teaching Scheme			**Examination Scheme**		
Lectures	03 Hrs/week		MSE		20
Tutorials	00 Hrs/week		ISE		20
Total Credits	03		ESE		60
			Duration of ESE		02 Hrs 30 Min

Prerequisite : Basics of mechanical, Basics of electrical, fundamentals of EV

Course Outcomes: Student will be able to

CO1	Demonstrate various tools and techniques of modeling and simulation of EV
CO2	Design and model components of EV
CO3	Analyze EV powertrain components
CO4	Examine and simulate thermal management in EV powertrain

	Course Contents	**CO**	**Hours**
Unit 1	**Essential for designing and simulation using MATLAB:** Overview and environment, Basic variables, syntax , commands ,commands ,M-files and types, Operators decision making and loops, vector ,matrix and arrays, colon notation and numbers, string and functions	**CO1**	**(05)**
Unit 2	**Fundamentals of EV system using MATLAB:** DC motor characteristics, induction to motor characteristics, Simulink model to calculate vehicle configuration, Solar PV based charger, DC-DC converter, motor controller design,	**CO1**	**(05)**
Unit 3	**Design and modeling of EV system using MATLAB:** Designing DC motor and induction motor, multilevel inverter designing,	**CO2**	**(04)**
Unit 4	**Modeling of EV power train in Solid works:** Introduction to EV Power train, Modeling architecture of EV Powertrain, Modeling of EV powertrain components. Battery pack modeling in solidworks	**CO2**	**(04)**
Unit 5	**Analysis of EV power train components:** Modeling and simulation of EV powertrain components in ANSYS,	**CO3**	**(04)**
Unit 6	**Simulation of Thermal management system for EV:**	**CO4**	**(04)**

	Battery management system modeling, simulation li-ion battery pack using MATLAB		

Reference Books	
1.	Julian Happian-Smith, "Introduction to Modern Vehicle Design", Transport Research Laboratory (TRL) ,Elsevier- edition, 2001
2.	Heinz Heisler; "Advanced Vehicle Technology", Butterworth-Heinemann Ltd; 2nd edition, July 2002.
3.	Seth Leitman, Bob Brant, Leitman Seth, "Build Your Own Electric Vehicle", McGraw-Hill, 3rd edition, 2013.
Reference links	
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Mapping of COs and POs:

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	2	1	2	2	1	2	1	1	1	1	2
CO 2	3	2	3	3	2	1	2	1	1	1	1	2
CO 3	2	3	3	3	3	1	3	2	2	2	2	3
CO 4	3	3	3	3	3	1	3	1	2	2	2	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	4	4	10
Apply	4	4	10
Analyse	4	4	20

Evaluate	4	4	10
Create	4	4	10
TOTAL	20	20	60

Government College of Engineering, Karad				
Third Year (Sem –V) MDM- Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)				
IMI3534: 3D Modelling and simulation Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	2 Hrs/week		ISE	50
Total Credits	**1**		ESE	--
Prerequisite : Basics of mechanical, Basics of electrical, fundamentals of EV				
Course Outcomes (CO): Students will be able to				

CO1	Demonstrate various softwares needed for 3D modelling
CO2	Design 3D model of EV components
CO3	Analysis 3D data with different simulation softwares
CO4	Thermal analysis of battery components

Course Contents		**CO**
Experiment 1	Introduction to Solidworks	**CO1**
Experiment 2	3D modelling of EV components	**CO1**
Experiment 3	Drafting of EV components in solidworks	**CO2**
Experiment 4	Visualization techniques for 3D data	**CO2**
Experiment 5	Basic sketching techniques need for EV components	**CO3**
Experiment 6	Introduction to ANSYS AND ABAQUS	**CO2**
Experiment 7	Introduction to 2D meshing,3D meshing	**CO2**
Experiment 8	Mesh modelling of 3D data	**CO2**
Experiment 9	Modelling and simulation of EV powertrain components in MATLAB	**CO1**
Experiment 10	3D modelling of EV powertrain components in ANSYS	**CO3**
Experiment 11	simulation of EV powertrain components in ANSYS	**CO3**
Experiment 12	Thermal simulation of EV Battery system in ANSYS	**CO4**
List of Submission:		
Minimum number of Experiments: 08		

Mapping of COs and POs:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2
CO1	2	2	1	2	2	1	2	1	2	1	1	2	2	2
CO2	3	2	1	3	2	2	2	1	1	1	1	2	3	2
CO3	2	3	3	3	3	1	3	2	2	2	2	3	2	3
CO4	3	3	3	3	3	1	3	1	2	2	2	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15
Task II	5	5	5	5	5	5	5	5	5	5	5	5	5
Task III	5	5	5	5	5	5	5	5	5	5	5	5	5
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad

Third Year (Sem – VI) MDM- Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)

IMI3635: EV Product Development, Homologation and Hydrogen FCEV

Teaching Scheme			**Examination Scheme**		
Lectures	02 Hrs/week		MSE		20
Tutorials			ISE		20
Total Credits	02		ESE		60
			Duration of ESE		02 Hrs 30 Min

Prerequisite : Basics understanding of EV

Course Outcomes: Students will be able to

CO1	Explain fundamentals of EV business management
CO2	Classify different EV testing parameters
CO3	State different product development methods
CO4	Describe Hydrogen vehicle and Fuelcell in Hybrid vehicles

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to Business management:** Introduction to EV market and opportunities, EV market categories, regulations and standards, product development plan segment selection, product design plan, product specification-competitor analysis, development methods	**CO1**	**(04)**
Unit 2	**Business plan and product launch:** Process of making business plans, different marketing methods, product launch ideation and executions	**CO1**	**(04)**
Unit 3	**EV testing and Homologation:** FAME India and manufacturing guidelines,, EV certification process, standards for EV charging and retrofitting, EV motor parameter guidelines, batter selection criteria.	**CO2**	**(04)**
Unit 4	**Product development methods:** Design feasibility, Selection of off the shelf parts, product design validation, design for manufacturing, Vehicle dynamics selection, product planning, segment selection, product design plan, product specification, product development methods, working prototyping methods.	**CO3**	**(05)**
Unit 5	**Introduction to Hydrogen vehicle:** Introduction to future mobility, Why hydrogen based technology, essentials of hydrogen, Hydrocarbons terms in fuels, energy, flammability and safety, use of hydrocarbons in IC engine.	**CO4**	**(04)**

Unit 6	**Fuel cell in Hybrid electric vehicle:** Hydrogen fuel cells techniques and systems. fuel cell engine safety and maintenance, Fuel vehicle Acts, codes, Regulations and Guidelines, maintenance and fueling Facility requirements, Fuel cells in Hybrid electric vehicle and pure electric vehicle, Auxiliary power generation using Hydrogen.	**CO4**	**(05)**

Reference Books

1.	Julian Happian-Smith, "Introduction to Modern Vehicle Design", Transport Research Laboratory (TRL) ,Elsevier-edition, 2001
2.	Heinz Heisler; "Advanced Vehicle Technology", Butterworth-Heinemann Ltd; 2nd edition, July 2002.
3.	Seth Leitman, Bob Brant, Leitman Seth, "Build Your Own Electric Vehicle", McGraw-Hill, 3rd edition, 2013.

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CO 1	1	-	-	-	-	2	3	2	1	2	1	2
CO 2	2	-	-	-	-	3	2	3	2	3	2	2
CO 3	1	-	-	-	-	1	3	3	3	3	3	3
CO 4	2	-	-	-	-	3	3	3	3	3	3	2

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	20
Understand	5	5	20

Apply	10	10	20
Analyse	-	-	-
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Forth Year (Sem – VII) MDM- Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)

IMI3736:EV FEA ANALYSIS

Teaching Scheme			**Examination Scheme**		
Lectures	02 Hrs/week		MSE		20
Tutorials			ISE		20
Total Credits	02		ESE		60
			Duration of ESE		02 Hrs 30 Min

Prerequisite : Basic understanding of EV and 3D modelling

Course Outcomes: Students will be able to

CO1	Design and analyze structure of Electric vehicle
CO2	Demonstrate FEA analysis of EV
CO3	Analyse EV model
CO4	Execute model testing for thermal analysis of radiator and external cooling mechanism

	Course Contents	**CO**	**Hours**
Unit 1	**EV design and structural analysis:** Theory of FEA/CAE, Procedure of implementing FEA /CAE analysis, Introduction to hyper mesh, creating and modifying geometry, Geometry cleanup and defeature,	**CO1**	**(04)**
Unit 2	**Mesh model development using Hyper mesh:** Introduction to 2D meshing,3D meshing ,element Quality, Mesh Edit, Introduction to plastic mesh, Introduction 1D meshing ,Modal analysis	**CO2**	**(04)**
Unit 3	**FEA analysis for EV engineering with Abaqus:** Introduction to Abaqus software, fundamentals of FEA stress ,About Abaqus Software features, Create material and Create assembly, Create steps ,loads , boundary conditions ,Generate mesh ,Result visualization,1 D Analysis, Linear static analysis and linear buckling analysis.	**CO2**	**(05)**
Unit 4	**Analyze EV dynamic and simulation:** Basics of Finite-Element Analysis (FEA) along with ANSYS Tool and Software Interface, Essential Mechanical and Electrical Properties of Materials, Various Case Studies on ANSYS Mechanical	**CO2**	**(05)**
Unit 5	**CFD analysis for EV:** Basics of Computational Fluid Dynamics, Simulation of Battery Thermal Management in Electric Vehicle, Vibration and Fatigue Analysis of Battery Pack,	**CO3**	**(04)**

Unit 6	**Thermal analysis of EV:** Thermal Analysis of Liquid-Cooled Radiator, CFD Study of External Cooling Mechanism for Battery Pack.	**CO4**	**(04)**

Reference Books

1.	Julian Happian-Smith, "Introduction to Modern Vehicle Design", Transport Research Laboratory (TRL) ,Elsevier-edition, 2001
2.	Heinz Heisler; "Advanced Vehicle Technology", Butterworth-Heinemann Ltd; 2nd edition, July 2002.
3.	Seth Leitman, Bob Brant, Leitman Seth, "Build Your Own Electric Vehicle", McGraw-Hill, 3rd edition, 2013.

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3.	https://autoprotoway.com/automotive-design-process/
4.	https://www.carbodydesign.com/

Mapping of COs and POs:

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	2	3	2	1	2	2	2	2	-	1
CO 2	2	2	3	2	3	1	3	1	2	1	-	2
CO 3	3	3	2	3	2	1	2	2	1	2	-	2
CO 4	3	3	3	3	3	1	3	1	2	12	-	3

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	-	-
Understand	4	4	10
Apply	4	4	10
Analyse	4	4	20
Evaluate	4	4	20
Create	-	-	-

TOTAL	20	20	60

Government College of Engineering, Karad

Forth Year (Sem – VIII) MDM- Electrical Vehicle (Mechanical Engineering- Institute Level-Industrial)

IMI3837:CYBER SECURITY AND DATA ANALYSIS

Teaching Scheme			**Examination Scheme**		
Lectures	02 Hrs/week		MSE		20
Tutorials			ISE		20
Total Credits	02		ESE		60
			Duration of ESE		02 Hrs 30 Min

Prerequisite : Basics understanding of EV

Course Outcomes: Students will be able to

CO1	Describe Data analysis techniques and methods
CO2	Demonstrate of software involved in data analysis
CO3	Classify different techniques of cyber security implementation
CO4	Explain different vehicle parking and driving methods

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to Data analysis:** Introduction to Data analytics and application in automotive industry, data analysis pipeline.	**CO1**	**(05)**
Unit 2	**Data analysis tools and techniques:** EV data collection and analysis, data preprocessing, static analysis and of EV data.	**CO1**	**(05)**
Unit 3	**Software involved in data analysis:** Overview of different software used for data analysis.	**CO2**	**(04)**
Unit 4	**Cyber security for EV systems:** Automotive megatrends, automotive electrical and electronics, automotive software technology, mobile apps for connected vehicles.	**CO3**	**(04)**
Unit 5	**Vehicle parking and charging Methods:** Vehicle sharing connected parking and automated parking systems.	**CO3**	**(04)**
Unit 6	**Autonomous vehicle systems:** ADAS and autonomous driving, different vehicle autonomous classifications.	**CO4**	**(04)**

Reference Books			
1.	Julian Happian-Smith, “Introduction to Modern Vehicle Design”, Transport Research Laboratory (TRL) ,Elsevier- edition, 2001		
2.	Heinz Heisler; “Advanced Vehicle Technology”, Butterworth-Heinemann Ltd; 2nd edition, July 2002.		
3.	Seth Leitman, Bob Brant, Leitman Seth, “Build Your Own Electric Vehicle”, McGraw-Hill, 3rd edition, 2013.		
Reference links			
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4.	https://www.carbodydesign.com/		

Mapping of COs and POs:

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	-	-	-	-	2	3	2	-	1	-	1
CO 2	2	-	-	-	2	2	2	3	-	2	-	2
CO 3	2	-	-	-	-	3	3	2	-	3	-	3
CO 4	2	-	-	-	-	2	3	3	-	3	-	3

Assessment Pattern (with revised Bloom’s Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	25
Understand	10	10	25
Apply	5	5	10
Analyse	-	-	-
Evaluate	-	-	-

Create	-	-	-
TOTAL	20	20	60

Institute Level- Industrial orientated Open Elective

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE)

AIDSML

Government College of Engineering, Karad

Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIDSML

IOE3311: Open Elective I Foundations of AI, Data Science, and Data Engineering

Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	03		Duration of ESE	As applicable

Prerequisite : Mathematics, Programming for problem solving

Course Outcomes: Students will be able to

CO1	Understand foundational concepts of AI and Data Science.
CO2	Apply programming skills in Python for data manipulation.
CO3	Demonstrate proficiency in mathematical foundations for AI and ML applications.
CO4	Utilize various techniques for data wrangling, cleaning, visualization, inferential statistics, regression analysis, and SQL database management.

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to AI & Data Science:** Overview of AI and Data Science, The data science workflow, AI applications across various industries, Ethical considerations in AI and data science	**CO1**	**(05)**
Unit 2	**Programming Fundamentals for AI & Data Science** Python for data manipulation, Libraries: NumPy and Pandas for data science, Data visualization with Matplotlib, Introduction to Scikit-learn for AI, Introduction to TensorFlow and PyTorch	**CO2**	**(07)**
Unit 3	**Mathematical Foundations for AI & ML:** Linear algebra basics: vectors, matrices, and operations, Calculus essentials: derivatives and integrals, Probability and statistics for data science.	**CO3**	**(07)**
Unit 4	**Data Wrangling & Cleaning:** Techniques for handling missing values, Addressing outliers and inconsistencies in data Data transformation and normalization.	**CO4**	**(06)**
Unit 5	**Data Visualization and Inferential Statistics:** Data exploration and visualization techniques, Understanding data distributions, Inferential statistics: hypothesis testing, confidence intervals, and statistical tests for comparisons.	**CO4**	**(08)**
Unit 6	**Regression Analysis and SQL Database Management:** Linear regression concepts, Time series analysis, Model building, evaluation, and interpretation, SQL for database management, Data analysis with SQL, ETL processes (Extract, Transform, Load).	**CO4**	**(07)**

Text Books

1.	Wes McKinney, "Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython" O'Reilly Media, 2017.
2.	Gareth James, Daniela Witten, Trevor Hastie, and Robert Tibshirani - "Introduction to Statistical Learning: with Applications in R" Springer 2017.
3	Sanjeev J. Wagh , Manisha S. Bhende, Anuradha D. Thakare "Fundamentals of Data Science, Tayler & Fransic CRC press 2021.
4	Alan Beaulieu - "Learning SQL: Generate, Manipulate, and Retrieve Data" - O'Reilly Media 2009.

Reference Books

1.	Joel Grus - "Data Science from Scratch: First Principles with Python" - O'Reilly Media 2015.
2.	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media 2019.

Useful Links

1.	https://onlinecourses.nptel.ac.in/noc21_cs69/preview

2.	https://onlinecourses.nptel.ac.in/noc22_cs32/preview
3.	https://nptel.ac.in/courses/106106226/

*Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	3	-	-	-	2	2	-	1
CO 2	2	2	2	2	3	-	-	-	2	1	-	2
CO 3	3	3	3	3	3	1	2	-	2	1	-	3
CO 4	3	3	3	3	3	2	1	2	2	3	1	3

: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	5	5
Understand	5	5
Apply	15	15
Analyse	10	10
Evaluate	15	15
Create	-	-
TOTAL	50	50

Government College of Engineering, Karad				
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIDSML				
IOE3312: Open Elective -01 Lab - "Foundations of AI, Data Science, and Data Engineering Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25
Prerequisite : Mathematics, Programming for problem solving				
Course Outcomes (CO): Students will be able to				
CO1	Understand the fundamental principles of data science, AI applications, and Python scripting.			
CO2	Apply Python programming skills to perform data manipulation, analysis, and visualization			
CO3	Demonstrate proficiency in linear algebraic computations and implement basic machine learning models.			
CO4	Utilize advanced data handling techniques and SQL database management.			

Course Contents		**CO**
Implementation of following concepts		
Experiment 1	**Data Science Workflow:** Implement a basic data science workflow using a sample dataset.	**CO1**
Experiment 2	**AI Applications**: Case study analysis of AI applications in healthcare, finance, and retail.	**CO1**
Experiment 3	**Python Basics**: Write Python scripts for basic data operations (CRUD - Create, Read, Update, Delete).	**CO2**
Experiment 4	**NumPy:** Perform array operations and linear algebraic computations using NumPy.	**CO2**
Experiment 5	**Pandas:** Data manipulation and analysis using Pandas (e.g., merging, grouping, and aggregating data).	**CO2**
Experiment 6	**Matplotlib**: Create various types of plots (line, bar, scatter) using Matplotlib.	**CO2**
Experiment 7	**Scikit-learn Basics**: Implement simple machine learning models like linear regression and k-means clustering.	**CO3**
Experiment 8	**Linear Algebra**: Implement matrix operations, eigenvalues, and eigenvectors using Python.	**CO3**
Experiment 9	**Handling Missing Values**: Techniques to handle missing data (e.g., imputation, deletion).	**CO4**
Experiment 10	**Exploratory Data Analysis (EDA):** Perform EDA on a dataset to summarize its main characteristics.	**CO4**
Experiment 11	**Visualization:** Create histograms, box plots, and pair plots to visualize data distributions.	**CO4**
Experiment 12	**SQL Basics:** Write SQL queries to create, read, update, and delete data in a database.	**CO4**
List of Submission:		
	Minimum number of Experiments : 10	

*Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	3	3	3	3	1	-	-	-	-	-	2

CO 2	2	2	2	2	3	2	-	-	2	2	2	2
CO 3	3	3	3	3	3	-	1	2	1	2	3	2
CO 4	2	3	2	3	3	2	2	2	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	5	5	5	5	5	5	5	5	5	5	5	5	5
Task II	10	10	10	10	10	10	10	10	10	10	10	10	10
Task III	10	10	10	10	10	10	10	10	10	10	10	10	10
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad

Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- AIDSML

IOE3413: Open Elective II Advanced AI Integration

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : Foundations of AI, Data Science, and Data Engineering

Course Outcomes (CO): Students will be able to

CO1	Implement supervised and unsupervised algorithms using Scikit-learn.
CO2	Enhance model performance through feature engineering and model selection.
CO3	Develop and apply CNNs and RNNs for deep learning and NLP tasks.
CO4	Utilize advanced data mining techniques and big data platforms for analytics.

	Course Contents	CO	Hours
Unit 1	**Introduction to Machine Learning:** Supervised Learning: Definition, examples, and common algorithms (e.g., linear regression, decision trees, SVM).. Unsupervised Learning: Definition, examples, and common algorithms (e.g., k-means clustering, hierarchical clustering, PCA). Common Algorithms: Overview and implementation basics of various machine learning algorithms.	**CO1**	**(04)**
Unit 2	**Machine Learning with Python:** Introduction to Scikit-learn library., Implementing Supervised Learning Algorithms: Implementation of algorithms like linear regression, logistic regression, decision trees, and SVM using Scikit-learn., Implementing Unsupervised Learning Algorithms: Implementation of algorithms like k-means clustering, hierarchical clustering using Scikit-learn.	**CO1**	**(05)**
Unit 3	**Feature Engineering & Model Selection:** Feature Extraction: Techniques for extracting features from raw data., Feature Transformation: Techniques for transforming features to improve model performance., Model Selection: Strategies for selecting the best model, cross-validation, and hyperparameter tuning.	**CO2**	**(05)**
Unit 4	**Deep Learning Fundamentals:** Basics of neural networks, activation functions, and architectures., Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs): Structure, applications, and implementation basics	**CO3**	**(04)**
Unit 5	**Natural Language Processing (NLP) and Computer Vision:** Text processing, sentiment analysis, and building chatbots., Computer Vision Fundamentals: Image processing techniques, object detection, and recognition.	**CO3**	**(04)**
Unit 6	**Big Data Fundamentals and Advanced Data Mining Techniques:** Introduction to big data, its importance, and challenges., Overview of frameworks like Hadoop., Introduction to platforms like AWS, Azure for big data analytics., Advanced Data Mining Techniques: Association rule learning, clustering, time series analysis, and forecasting.	**CO4**	**(04)**

Text Books

1.	Ethem Alpaydin - "Introduction to Machine Learning" - MIT Press (2020)
2.	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media (2019)
3.	Richard Szeliski - "Computer Vision: Algorithms and Applications" - Springer (2010)
4	Nathan Marz and James Warren - "Big Data: Principles and Best Practices of Scalable Realtime Data Systems" - Manning Publications (2015)

Reference Books

1.	Jiawei Han, Micheline Kamber, and Jian Pei - "Data Mining: Concepts and Techniques" - Morgan Kaufmann (2011)
2.	Alice Zheng and Amanda Casari - "Feature Engineering for Machine Learning: Principles and Techniques for

	Data Scientists" - O'Reilly Media (2018)
3.	S. J. Wagh , Manisha S. Bhende, Anuradha D. Thakare “Fundamentals of Data Science, Tayler & Fransic CRC press 2021
Useful Links	
1.	https://nptel.ac.in/courses/106102220/
2.	https://nptel.ac.in/courses/106106145/
3.	https://nptel.ac.in/courses/106106212/
4.	https://nptel.ac.in/courses/106105152/

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

Mapping Table:

PO→ CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	3	3	2	-	-	-	1	-	3
CO 2	2	3	2	3	3	1	-	-	-	2	-	2
CO 3	2	2	3	2	3	2	1	-	2	-	1	3
CO 4	2	3	3	3	3	1	1	1	2	3	1	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern

Knowledge Level	ISE	ESE
Remember	5	5
Understand	5	5
Apply	15	15
Analyse	15	15
Evaluate	10	10
Create	-	-
TOTAL	50	50

Government College of Engineering, Karad

Third Year (Sem – V) OE- Institute Level- Industrial orientated Open Elective- AIDSML

IOE3514: Open Elective III AI Applications and Emerging Technologies

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : Advanced AI Integration

Course Outcomes (CO): Students will be able to

CO1	Implement reinforcement learning algorithms and apply them in autonomous systems.
CO2	Utilize GANs for generating creative content and explore advanced techniques like conditional GANs.
CO3	Ensure AI models are interpretable and address ethical issues, including bias and fairness.
CO4	Deploy AI on edge devices and integrate with IoT for applications in smart cities, industry, and healthcare.

	Course Contents	CO	Hours
Unit 1	**Reinforcement Learning and Autonomous Systems:** Introduction to reinforcement learning principles, Applications of reinforcement learning in autonomous systems, Deep dive into algorithms such as Q-learning and deep Q-networks, Case studies on robotics, gaming, and control systems.	**CO1**	**(04)**
Unit 2	**Generative Adversarial Networks (GANs) and Creative AI:** Understanding the concept of GANs and their architecture, Applications of GANs in generating realistic images, videos, and creative content, Exploring conditional GANs and style transfer techniques, Case studies in art, design, and content creation.	**CO2**	**(04)**
Unit 3	**Explainable AI (XAI) and Ethical AI:** Techniques for making AI models interpretable and transparent, Addressing bias, fairness, and accountability in AI systems, Ethical considerations in AI development and deployment, Responsible AI practices and guidelines.	**CO3**	**(04)**
Unit 4	**Edge AI and Internet of Things (IoT) Integration:** Deploying AI algorithms on edge devices for real-time processing, Integration of AI with IoT ecosystems for smart applications, Use cases in smart cities, industrial IoT, and healthcare monitoring, Challenges and opportunities in edge AI and IoT convergence.	**CO4**	**(05)**
Unit 5	**Quantum Machine Learning and Quantum Computing:** Fundamentals of quantum computing and quantum machine learning, Quantum algorithms for optimization and pattern recognition tasks, Potential applications of quantum computing in AI and data science, Implications of quantum computing for future AI advancements.	**CO1**	**(05)**
Unit 6	**AI for Healthcare and Biomedical Applications:** Role of AI in medical imaging analysis and diagnosis, AI-driven drug discovery and personalized medicine, Patient care management using AI-based solutions, Ethical considerations and regulatory challenges in AI-driven healthcare.	**CO4**	**(04)**

Text Books

1.	Maxim Lapan - "Deep Reinforcement Learning Hands-On" - Packt Publishing (2018)
2.	David Foster - "Generative Deep Learning: Teaching Machines to Paint, Write, Compose, and Play" - O'Reilly Media (2019)
3.	Perry Lea ¸IoT and Edge Computing for Architects - Second Edition Paperback – Import, 6 March 2020

Reference Books

1.	Peter Wittek - "Quantum Machine Learning: What Quantum Computing Means to Data Mining" - Academic Press (2016)
2.	S. Kevin Zhou, Hayit Greenspan, Dinggang Shen - "Deep Learning for Medical Image Analysis" - Academic Press (2017)
3.	Pete Warden and Daniel Situnayake - "TinyML: Machine Learning with TensorFlow Lite on Arduino and Ultra-Low-Power Microcontrollers" - O'Reilly Media (2020)

Useful Links

1.	https://nptel.ac.in/courses/106106139/
2.	https://nptel.ac.in/courses/106105215/
2.	https://nptel.ac.in/courses/106106143/

3.	https://nptel.ac.in/courses/106105158/
4.	https://nptel.ac.in/courses/106106213/

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	3	3	3	3	-	-	2	2	1	3
CO 2	2	3	1	2	3	-	-	-	3	-	3	2
CO 3	2	2	2	3	3	3	1	3	3	3	3	3
CO 4	2	2	3	3	3	-	-	1	2	3	3	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember		
Understand	5	5
Apply	15	15
Analyse	15	15
Evaluate	15	15
Create	-	-
TOTAL	50	50

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE)

Industry oriented Open Elective : AIOT

Government College of Engineering, Karad				
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIOT				
IOE3321: Open Elective I IoT Hardware and Sensors				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	03		Duration of ESE	As applicable

Prerequisite : Mathematics, Programming for problem solving/Computer fundamentals

Course Outcomes (CO): Students will be able to

CO1	Understand the foundational principles and hardware of IoT
CO2	Apply IoT circuit and programming software:
CO3	Develop AI models and integrate with IoT:
CO4	Analyze and implement AIoT applications:

	Course Contents	CO	Hours
Unit 1	**Introduction to IoT Hardware:** Overview of IoT development kits (e.g., Raspberry Pi, Arduino, ESP32) Understanding the components and capabilities of IoT hardware platforms Types of sensors (temperature, humidity, motion, light, etc.) Exploring actuators (motors, servos, relays) and their applications in IoT.	**CO1**	**(05)**
Unit 2	**IoT Circuit and Programming Software:** IoT Circuit Designing Software: Software with drag & drop features to build a circuit, Block Designer Software for IoT Programming, Introduction to IoT hardware components and connectivity, Simulation of IoT circuits in a virtual environment, Hands-on practice with IoT development boards and sensors	**CO2**	**(07)**
Unit 3	**AI and Python Programming Software:** Block Designer Software for AI Programming, Python Direct Software for Python Programming, Introduction to AI concepts and machine learning basics, Developing AI models using block-based programming, Implementing Python scripts for data analysis and AI applications, Integrating AI models with IoT devices for smart solutions.	**CO3**	**(06)**
Unit 4	**Introduction to Artificial Intelligence and Internet of Things (AIoT)** Overview of Artificial Intelligence (AI) and its applications across various industries. Introduction to the Internet of Things (IoT) and its significance in the modern interconnected world. Understanding the concept of Artificial Intelligence of Things (AIoT) and its potential to revolutionize technology integration.	**CO4**	**(09)**
Unit 5	**Connecting Mobile Devices to IoT Gateways** Exploring the role of IoT gateways in bridging the gap between mobile devices and IoT networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobile-to-IoT connections.	**CO1**	**(06)**
Unit 6	**Sensor Technologies and Academic Concepts** Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.	**CO4**	**(07)**

Text Books

1. Matt Richardson and Shawn Wallace - "Getting Started with Raspberry Pi" - O'Reilly Media - 2016
2. Eric Matthes - "Python Crash Course" - No Starch Press - 2019
3. Arshdeep Bahga and Vijay Madisetti - "Internet of Things: A Hands-On Approach" - VPT - 2014

Reference Books

1. Michael Margolis - "Arduino Cookbook" - O'Reilly Media - 2011

2.	Patrick F. Dunn - "Fundamentals of Sensors for Engineering and Science" - CRC Press - 2010
3.	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media – 2019

Useful Links	
1.	https://nptel.ac.in/courses/106105195
2.	https://www.coursera.org/learn/iot
3.	https://www.tinkercad.com/things?type=circuits&sort=staff&view_mode=small

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	3	3	-	-	2	-	-	1
CO 2	2	2	2	2	3	1	-	-	3	-	3	2
CO 3	2	1	3	2	3	3	1	1	3	2	3	3
CO 4	2	2	3	3	3	2	1	-	2	1	3	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember		
Understand	10	10
Apply	15	15
Analyse	15	15
Evaluate	10	10
Create		
TOTAL	50	50

Government College of Engineering, Karad					
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIOT					
IOE3322: Open Elective -01 Lab - IoT Hardware and Sensors Lab					
Laboratory Scheme:			**Examination Scheme:**		
Practical	02 Hrs/week		ISE	25	
Total Credits	01		ESE	25	
Prerequisite : Mathematics, Programming for problem solving					
Course Outcomes (CO): Students will be able to					
CO1	Understand IoT hardware fundamentals and development kits.				
CO2	Apply IoT circuit design and programming using software tools.				
CO3	Demonstrate proficiency in sensor technologies for IoT applications.				
CO4	Integrate AI concepts and Python programming with IoT devices for smart solutions.				
Course Contents					**CO**
Implementation of following concepts					
Experiment 1	Setting up Raspberry Pi for IoT applications				**CO1**
Experiment 2	Configuring Arduino for sensor data collection				**CO1**
Experiment 3	Using ESP32 for wireless communication in IoT				**CO1**
Experiment 4	Designing IoT circuits using drag & drop software				**CO2**
Experiment 5	Programming IoT devices with block-based software				**CO2**
Experiment 6	Measuring temperature and humidity with DHT11 sensor				**CO3**
Experiment 7	Detecting motion with PIR sensor				**CO3**
Experiment 8	Controlling LEDs with relay modules				**CO3**
Experiment 9	Developing AI models with block designer software				**CO4**
Experiment 10	Implementing Python scripts for data analysis				**CO4**
Experiment 11	Integrating AI models with IoT devices for smart applications				**CO4**
Experiment 12	Mini Project on the basis of learning				**CO4**
List of Submission:					
	Minimum number of Experiments : 10				

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	1	3	3	2	-	1	1	1	1
CO 2	2	3	1	2	3	-	3	-	2	2	2	2
CO 3	2	1	3	2	3	3	3	1	3	2	3	3
CO 4	2	2	2	3	3	1	2	1	3	3	3	3

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05	05	05

ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad

Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- AIOT

IOE3423: Open Elective II Fundamentals of AIoT

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : IoT Hardware & Sensors, Programming for problem solving

Course Outcomes (CO): Students will be able to

CO1	Understand the concepts of AIoT and their significance in modern industries.
CO2	Apply techniques to connect mobile devices to IoT gateways, bridging the gap between different networks.
CO3	Analyze sensor technologies in IoT and their academic foundations to showcase practical understanding.
CO4	Develop and Evaluate AIoT applications to address real-world challenges.

	Course Contents	CO	Hours
Unit 1	**Introduction to Artificial Intelligence and Internet of Things (AIoT)** Overview of Artificial Intelligence (AI) and its applications across various industries. Introduction to the Internet of Things (IoT) and its significance in the modern interconnected world. Understanding the concept of Artificial Intelligence of Things (AIoT) and its potential to revolutionize technology integration.	**CO1, CO2**	**(04)**
Unit 2	**Connecting Mobile Devices to IoT Gateways** Exploring the role of IoT gateways in bridging the gap between mobile devices and IoT networks. Techniques for establishing seamless connections between mobile devices and IoT gateways. Hands-on exercises demonstrating the setup and configuration of mobile-to-IoT connections.	**CO1, CO2**	**(05)**
Unit 3	**Sensor Technologies and Academic Concepts** Comprehensive overview of sensor technologies commonly employed in IoT applications. In-depth exploration of various types of sensors and their academic underpinnings. Practical demonstrations and experiments showcasing the functionality and applications of sensors in IoT systems.	**CO3**	**(04)**
Unit 4	**AIoT Application Development** Introduction to tools and platforms essential for building AIoT applications. Practical Aspects of AIoT applications, including: Smart Traffic Signal System for Color Blind Individuals Plant Health Analysis Smart Door Access Control System.	**CO4**	**(04)**
Unit 5	**Unit 5: Weather Forecasting with AIoT** Design and implementation of a weather forecasting system leveraging AIoT technologies. Integration of real-time weather data from sensors with AI algorithms for accurate predictions. Hands-on exercises for building, testing, and refining weather forecasting systems.	**CO4**	**(04)**
Unit 6	**Unit 6: Smart Solutions Development** Development and deployment of smart solutions utilizing AIoT principles. Case studies and real-world examples of successful smart solutions in various domains. Project-based learning allowing students to conceptualize, design, and implement their own AIoT solutions**.**	**CO4**	**(05)**

Text Books

1.	Michael Negnevitsky, "Artificial Intelligence: A Guide to Intelligent Systems", Pearson Education, 2021
2.	Rajkumar Buyya, Amir Vahid Dastjerdi, "Internet of Things: Principles and Paradigms", Morgan Kaufmann, 2016
3.	Michael J. McGrath, "Sensor Technologies: Healthcare, Wellness and Environmental Applications", Apress, 2013

Reference Books

1.	Chandra Singh, Sairam, Niranjan N Chiplunkar, Rathishchandra R Gatti Create citation, "Self-Powered Aiot Systems" :Apple Academic Press 2024
2.	Kashif Naseer Qureshi, Thomas Newe Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems, CRC Press 2024

Useful Links

1.	https://www.linkedin.com/learning/ai-in-connected-products-aiot
2.	https://www.coursera.org/learn/iot

3.	https://www.tinkercad.com/things?type=circuits&sort=staff&view_mode=small

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO→ CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	1	2	1	2	2	-	-	-	-	-	2
CO 2	2	2	1	2	3	2	-	-	-	1	-	2
CO 3	3	2	3	3	3	2	2	1	1	1	1	3
CO 4	2	3	2	3	3	2	1	-	1	2	1	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	5	5
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	15	15
Create	-	-
TOTAL	50	50

Government College of Engineering, Karad

Third Year (Sem – V) OE- Institute Level- Industrial orientated Open Elective- AIOT

IOE3524: Open Elective III Cloud Services for IoT

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : Fundamentals of AIoT

Course Outcomes (CO): Students will be able to

CO1	Understand cloud computing's benefits for IoT and grasp various cloud service models.
CO2	Apply cloud storage solutions for IoT data storage and retrieval.
CO3	Implement cloud compute services to deploy, manage IoT applications & its security concerns.
CO4	Integrate AI/ML capabilities into IoT projects using cloud services and ensure cloud security and compliance for IoT data.

	Course Contents	CO	Hours
Unit 1	**Introduction to Cloud Computing** Overview of cloud computing and its benefits for IoT, Understanding different cloud service models (IaaS, PaaS, SaaS)	**CO1**	**(03)**
Unit 2	**Cloud Storage Solutions** Introduction to cloud storage services (Amazon S3, Google Cloud Storage) exercises on storing and retrieving data from cloud storage platforms.	**CO2**	**(04)**
Unit 3	**Cloud Compute Services:** Overview of cloud computes services (Amazon EC2, Google Compute Engine) Deploying IoT applications on cloud compute instances.	**CO2**	**(05)**
Unit 4	**AI/ML Services in the Cloud:** Introduction to AI/ML services provided by cloud platforms (Amazon SageMaker, Google AI Platform, Azure AI), Integrating AI/ML capabilities into IoT applications using cloud services.	**CO4**	**(04)**
Unit 5	**Cloud Security and Compliance:** Security best practices for cloud-based IoT solutions. Compliance requirements and regulations for IoT data stored in the cloud.	**CO3**	**(05)**
Unit 6	**Project Work and Case Studies:** Developing and deploying IoT applications leveraging cloud services Analyzing case studies of successful IoT projects using cloud platforms	**CO3, CO4**	**(05)**

Text Books

1. Buyya R, Vecchiola C, Selvi S T "Mastering Cloud Computing" , McGraw Hill Education (India), 2013
2. Praveen Kukreti Google Cloud Platform All-In-One Guide: Get Familiar with a Portfolio of Cloud-based Services in GCP,2023
3. Pawan Varma "Cloud Native Development with Azure: A practical guide to build cloud-native apps on Azure cloud platform, 2024

Reference Books

1. Cloud Computing Bible, Barrie Sosinsky ,Wiley Publishing Inc. 2011
2. Cloud Computing from Beginning to End by Ray J Rafaels
3. Cloud Computing: Concepts, Technology & Architecture by Zaigham Mahmood, Ricardo Puttini, Thomas Erl

Useful Links

1. https://www.udemy.com/course/exploring-aws-iot/
2. https://www.coursera.org/specializations/mlops-machine-learning-duke
3. https://learn.microsoft.com/en-us/training/paths/microsoft-azure-architect-design-prerequisites/

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	1	3	-	-	-	-	-	-	1
CO 2	2	2	3	2	3	1	-	-	-	-	-	2
CO 3	3	3	2	3	3	2	1	1	1	-	2	1
CO 4	2	2	2	3	3	1	1	1	1	1	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	5	5
Understand	10	10
Apply	15	15
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE)

Industry orientated Open ElectivE : ARVR

Government College of Engineering, Karad				
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- ARVR				
IOE3331: Open Elective I AR/VR Application Development				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	03		Duration of ESE	As applicable

Prerequisite : Mathematics, Programming for problem solving/Computer fundamentals

Course Outcomes (CO): Students will be able to

CO1	Recall fundamentals and real-time 3D content creation basics & scripting.
CO2	Understand software interface and tools for scene creation and optimization.
CO3	Apply 3D modeling, animation, and physics in 3d design tool.
CO4	Analyze and optimize audio, visual effects using hardware and performance in software.

	Course Contents	CO	Hours
Unit 1	**Introduction to Real-time 3D Content & Unity Game Engine:** Understanding 3D content creation: The concept of real-time rendering, comparison with offline rendering, and the importance of optimization, Exploring different game engines features and capabilities, Unity components and its features.	**CO1**	**(05)**
Unit 2	**Fundamentals of Unity Game Engine:** Exploring Unity's interface and tools: Scene view, Game view, Hierarchy, Project, and Inspector windows, various tools Transform, Creating and organising scenes and objects in Unity from scratch, importing 3D models, textures, audio files, and other resources into Unity, and optimizing them for use in the project.	**CO2**	**(07)**
Unit 3	**3D Modelling, Animation, and Physics:** Basics of 3D modelling concepts, tools, and techniques. Animating objects and characters: Understanding key frame animation, skeletal animation, and animation blending. Creating animations. Introduction to Unity's physics engine and components like Rigid body, Collider, and Physics materials. Implementing basic physics interactions.	**CO3**	**(07)**
Unit 4	**User Interface Design & Application Scripting:** Principles of UI/UX design, creating UI elements using Unity's UI system (Canvas, Image, Text, Button, etc.), Basics of C# programming language, syntax, variables, data types, control structures, functions, and classes. Writing scripts for various applications, UI interactions, and coding to reinforce learning.	**CO1**	**(08)**
Unit 5	**Audio, Visual Effects, and Optimization:** Adding and managing audio assets, implementing sound effects, background music, and spatial audio. Incorporating visual effects for enhanced immersion (VFX Graph) creating particle effects, shaders, post-processing effects, and other visual enhancements. Techniques for optimizing performance in Unity projects, LOD (Level of Detail), batching, occlusion culling, and more.	**CO4**	**(06)**
Unit 6	**Augmented Reality & Virtual Reality Development:** Understanding AR and VR: hardware, setting up AR sessions. Detecting and tracking surfaces, placing virtual objects in the real world, and interactions. Developing a VR experience for the Meta Quest platform, configuring Unity for Oculus development, implementing VR interactions (grabbing, teleportation), optimizing the VR experience for performance.	**CO4**	**(07)**

Text Books

1.	Mastering Unity 2D Game Development - Second Edition, Ashley Godbold, Simon Jackson, Packt Publishing, October 2016, ISBN: 9781786463456
2.	Zeynep Tacgin, “Virtual and Augmented Reality: An Educational Handbook”, Cambridge Scholars Publisher, 2020
3	Joe Hocking, Unity in Action: Multiplatform Game Development in C# with Unity, Manning Publications, 2018

4	Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009
Reference Books	
1.	Steven M. LaValle, "Virtual Reality", Cambridge University Press, 2016
2.	John Vince, "Virtual Reality Systems", Pearson Education Asia, 2007.
3.	Joe Hocking Unity in Action: Multiplatform Game Development in C# with Unity 5
Useful Links	
1.	https://stanford.edu/class/ee267/syllabus.html Prof. Ivan Sutherland, Standford University
2.	https://nptel.ac.in/courses/106/106/106106138/ Prof. Steve Lavalle,IIT Madras.
3.	https://nptel.ac.in/courses/121/106/121106013/ Prof. Dr. M. Manivannan,IIT Madras.

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	1	-	1	-	-	-	-	-	-	1
CO 2	2	3	2	2	2	-	-	-	-	-	-	1
CO 3	3	3	3	2	3	1	-	-	1	-	1	2
CO 4	2	2	3	3	3	1	1	-	2	1	-	3

: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	10	10
Understand	10	10
Apply	10	10
Analyse	10	10
Evaluate	10	10
Create	-	-
TOTAL	50	50

Government College of Engineering, Karad				
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- ARVR				
IOE3332: Open Elective -01 Lab - AR/VR Application Development Lab				
Laboratory Scheme:			**Examination Scheme:**	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25

Prerequisite : Mathematics, Programming for problem solving

Course Outcomes (CO): Students will be able to

CO1	Apply real-time 3D scene creation with basic physics interactions.
CO2	Design user interfaces utilizing UI system for game or application prototypes.
CO3	Develop and test C# scripts to control game behaviour and player interactions.
CO4	Integrate audio-visual effects and optimize performance.

Course Contents		**CO**
Implementation of following concepts		
Experiment 1	Create a real-time 3D scene in Unity incorporating basic physics interactions.	**CO1**
Experiment 2	Design and implement a user interface for a game or application prototype using Unity's UI system.	**CO2**
Experiment 3	Write and test scripts in C# to control game behavior, such as player movement and object interactions.	**CO3**
Experiment 4	Integrate audio effects and visual enhancements into a Unity project to enhance immersion. e. Optimize a Unity project for performance on different platforms, focusing on techniques like LOD, batching, and occlusion culling.	**CO4**
Experiment 5	Experiment with augmented reality using Unity's AR Foundation package to develop basic AR interactions.	**CO1**
Experiment 6	Develop a VR experience for the Meta Quest platform, implementing VR interactions like grabbing and teleportation.	**CO1**
Experiment 7	Develop a simple web-based mini-game using Unity WebGL, incorporating basic gameplay mechanics and visual effects.	**CO1**
Experiment 8	Create an AR sample app for Android devices using Unity and AR Foundation.	**CO2**
Experiment 9	Implement AR features such as plane detection, object placement, and basic interactions like tapping to spawn virtual objects.	**CO3**
Experiment 10	Develop a VR sample app for the Meta Quest platform using Unity and Oculus integration.	**CO4**
Experiment 11	Design immersive VR environments and implement VR interactions using Oculus controllers.	**CO4**
Experiment 12	Optimize the VR experience for smooth performance on the Meta Quest headset, considering factors like frame rate and rendering quality	**CO4**

List of Submission:

Minimum number of Experiments : 10

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	2	2	3	1	1	2	-	-	1	2
CO 2	2	1	3	2	3	2	2	1	2	2	2	2
CO 3	3	2	3	2	3	-	1	2	1	2	3	2
CO 4	2	3	2	3	3	2	2	-	2	2	1	2

1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	5	5	5	5	5	5	5	5	5	5	5	5	5
Task II	10	10	10	10	10	10	10	10	10	10	10	10	10
Task III	10	10	10	10	10	10	10	10	10	10	10	10	10
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad

Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- ARVR

IOE3433: Open Elective II Fundamentals of Real-time Rendering

Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : AR/VR Application Development

Course Outcomes (CO): Students will be able to

CO1	Understand virtual production techniques' historical evolution and applications.
CO2	Apply green screen technology effectively for virtual production setups.
CO3	Utilize Game Engine proficiently in virtual production.
CO4	Implement real-time rendering techniques for high-quality visuals in virtual environment

	Course Contents	**CO**	**Hours**
Unit 1	**Introduction to Virtual Production:** Historical overview and evolution of virtual production techniques. Applications and benefits of virtual production in film, television, and other media industries..	**CO1**	**(03)**
Unit 2	**Fundamentals of Green Studio:** Exploring Green Screen Studios, exploring green screen technology and its significance in virtual production. Setup and operation of green screen studios and Lighting techniques.	**CO2**	**(04)**
Unit 3	**Unity for Virtual Production:** Overview of Unity Game Engine and its role in virtual production. Importing assets and setting up virtual environments in Unity for production purposes.	**CO3**	**(04)**
Unit 4	**Real-time Rendering & Visualisation:** Real-time Rendering and Visualization, basics and its importance in virtual production, Techniques for achieving realistic visuals in real-time environments. Utilizing Unity's rendering capabilities for high-quality visual output.	**CO4**	**(05)**
Unit 5	**Virtual Design:** Virtual Set Design principles and layout., Designing immersive virtual environments for different production needs., Incorporating props, set dressing, and lighting to enhance realism and aesthetics..	**CO1, CO4**	**(05)**
Unit 6	**Virtual Camera system and Scene composition:** Virtual Camera Systems and their role in virtual production, Types of virtual cameras and their functionalities. Operating virtual cameras within Unity for scene composition and framing.	**CO2, CO3**	**(05)**

Text Books

1.	Tomas Akenine-Möller, Eric Haines, and Naty Hoffman, Real-Time Rendering, Fourth Edition, A K Peters/CRC Press, 2018
2.	Noah Kadner, The Virtual Production Field Guide, Epic Games, 2020
3.	Jeremy Hanke and Michele Yamazaki, Green Screen Made Easy: Keying and Compositing Techniques for Indie Filmmakers, Michael Wiese Productions, 2017
4	Jeff Foster, The Green Screen Handbook: Real-World Production Techniques, Sybex, 2014

Reference Books

1.	Joe Hocking, Unity in Action: Multiplatform Game Development in C# with Unity, Manning Publications, 2018
2.	Blain Brown, Cinematography: Theory and Practice: Image Making for Cinematographers and Directors, Routledge, 2016
3.	Laura Frank, Real-Time Video Content for Virtual Production & Live EntertainmentA Learning Roadmap for an Evolving Practice, Routledge, 2023

Useful Links

1.	https://www.udemy.com/course/unitycourse/
2.	https://archive.nptel.ac.in/courses/121/106/121106013/
3.	https://unity.com/resources
4.	https://www.classcentral.com/classroom/youtube-learn-unity-multiplayer-free-complete-course-netcode-for-game-objects-unity-tutorial-2023-135735

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	1	1	2	2	-	-	-	-	-	2
CO 2	2	2	2	2	3	2	-	-	-	1	-	2
CO 3	3	2	3	2	3	2	2	2	1	1	1	3
CO 4	2	3	2	3	3	2	1	-	-	2	1	3

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern

Knowledge Level	ISE	ESE
Remember	5	5
Understand	10	10
Apply	10	10
Analyse	15	15
Evaluate	10	10
Create	-	-
TOTAL	50	50

Government College of Engineering, Karad

Third Year (Sem – V) OE- Institute Level- Industrial orientated Open Elective- ARVR

IOE3534: Open Elective III Game Development with Unreal Engine

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02		Duration of ESE	As applicable

Prerequisite : Fundamentals of Real-time Rendering

Course Outcomes (CO): Students will be able to

CO1	Understand the basics of game development Engine, including interface navigation and asset management.
CO2	Apply advanced gameplay mechanics, such as controls, movement, animation, and interactivity.
CO3	Analyze and implement visual effects, audio assets, and concepts in game development engine.
CO4	Evaluate and optimize game performance, preparing projects for distribution across platforms in Unreal Engine

	Course Contents	CO	Hours
Unit 1	**Introduction to Unreal Engine:** Introduction to Unreal Engine: Overview of Unreal Engine and its interface, Installation and setup, Basics of game assets and importing.	**CO1**	**(04)**
Unit 2	**Fundamentals of Game development:** Game Development Fundamentals, Level design and environment creation, Introduction to Blueprint visual scripting, Implementing basic gameplay mechanics.	**CO2**	**(04)**
Unit 3	**Gameplay and Blending:** Advanced Gameplay Mechanics, Player controls and character movement, Animation blending and state machines, Adding interactive elements and game mechanics.	**CO2**	**(04)**
Unit 4	**Virtual effects:** Audio, and Multiplayer, incorporating visual effects and particle systems, integrating audio assets for sound effects and music, Introduction to networking and multiplayer concepts.	**CO3**	**(04)**
Unit 5	**Optimization and performance enhancement:** Techniques for optimizing game performance, profiling tools and performance monitoring, Best practices for improving frame rate and reducing memory usage..	**CO4**	**(05)**
Unit 6	**Packaging and Distribution:** Packaging and Distribution, Preparing the game for distribution, Building and packaging for different platforms, Showcase and presentation of completed projects.	**CO4**	**(05)**

Text Books

1.	Joanna Lee, "Learning Unreal Engine Game Development" - Packt Publishing, 2016.
2.	Tracy Fullerton, "Game Design Workshop: A Playcentric Approach to Creating Innovative Games", A K Peters/CRC Press, 2014.
3.	Scott Rogers, "Level Up! The Guide to Great Video Game Design" Wiley, 2014.

Reference Books

1.	Joshua Glazer, "Multiplayer Game Programming: Architecting Networked Games" - Addison-Wesley Professional, 2015.
2.	Jesse Schell, "The Art of Game Design: A Book of Lenses", CRC Press, 2008.
3.	Jason Gregory, "Game Engine Architecture" CRC Press, 2018.

Useful Links

1.	https://www.udemy.com/course/unrealcourse/
	https://archive.nptel.ac.in/courses/121/106/121106013/
2.	https://www.udemy.com/course/unreal-engine-5-the-complete-beginners-course/
3.	https://www.coursera.org/specializations/cplusplusunrealgamedevelopment

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	2	1	2	1	3	-	-	-	-	-	-	1
CO 2	2	2	3	2	3	1	-	-	-	-	-	2
CO 3	3	3	3	3	3	2	1	2	1	-	-	1
CO 4	2	2	2	2	2	1	1	2	1	1	1	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember		
Understand	10	10
Apply	10	10
Analyse	15	15
Evaluate	15	15
Create	-	-
TOTAL	50	50

OPEN ELECTIVE OTHER THAN PARTICULAR PROGRAM (OE)

ERP-SAP

Government College of Engineering, Karad				
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- ERP-SAP				
IOE3341: Open Elective- I- ABAP Programming for SAP HANA				
Teaching Scheme			**Examination Scheme**	
Lectures	03 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	03			
			Duration of ESE	As applicable

Prerequisite : Database Management System

Course Outcomes (CO): Students will be able to

CO1	Understand SAP HANA concepts, key technologies, and use of SAP HANA Studio and ADT
CO2	Identify and address ABAP code performance issues and understand SAP HANA's technical requirements and deployment options
CO3	Utilize Enhanced Open SQL, Core Data Services (CDS), and develop with SAP HANA Native SQL and ABAP Managed Database Procedures
CO4	Integrate SAP HANA models into ABAP, transport objects, and optimize reports with Full Text Search and ALV IDA.

	Course Contents	CO	Hours
Unit 1	**Introduction:** SAP HANA Basics and Technical Concepts, SAP HANA Studio, ABAP and SAP HANA Introducing the ABAP Development Tools (ADT), Taking ABAP to SAP HANA, SAP HANA as Secondary Database– Access via Open SQL.	**CO 1**	**(08)**
Unit 2	Code Checks to Prepare ABAP Code for SAP HANA, Tools to Analyse Potential Performance Issues, Guided Performance Analysis. SQL Performance Rules for SAP HANA, Database Independent Code-to-Data,Classical Open SQL and Its Limitations.	**CO 2**	**(07)**
Unit 3	Enhanced Open SQL, The Basics of Core Data Services in ABAP, Associations in Core Data Services, Outlook: More Interesting Features of CDS.SAP HANA specific Code-to-Data, The Syntax of SAP HANA Native SQL, ABAP Managed Database Procedures, ABAP Managed Database Procedures.	**CO 3**	**(07)**
Unit 4	Use of SAP HANA Information Models in ABAP, Advanced Topics, Transporting SAP HANA Objects with ABAP Transport Requests. Using SAP HANA Full Text Search, ABAP List Viewer with Integrated Database Access (ALV IDA), Case Study: Optimize a Report on Flight Customer Revenue Case Study: Optimize a Report on Flight Customer Revenue	**CO 4**	**(07)**
Unit 5	Describing SAP HANA, Understanding the Need for a Modern Digital Platform, Describing How SAP HANA Powers a Digital Platform, Key Technologies of SAP HANA, Deploying SAP HANA, Identifying the Key Roles in an SAP HANA Implementation.	**CO 1**	**(07)**
Unit 6	Technical Requirements of SAP HANA, Technical Deployment Options High Availability and Disaster tolerance, SAP HANA Lifecycle Management Tools	**CO 2**	**(04)**

Text Books

1.	Hermann Gahm, Thorsten Schneider, Christiaan Swanepoel, Eric Westenberger, "ABAP Programming for SAP HANA", SAP Press, ISBN-13: 978-1493213049, 3rd Edition
2.	Hermann Gahm, Thorsten Schneider, Eric Westenberger, Thomas Jung , "SAP HANA for ABAP Developers", SAP Press, ISBN-13: 978-1592298789, 2nd Edition
3.	Paul Hardy , "ABAP to the Future: Advanced, Modern ABAP 7.5x Programming Techniques", Espresso Tutorials, ISBN-13: 978-1946390073, 1st Edition

Reference Books

1.	Rehan Zaidi , “SAP ABAP Advanced Cookbook”, Packt Publishing, ISBN-13: 978-1782176440 1st Edition
Useful Links	
1.	https://www.linkedin.com/learning/topics/sap
2.	https://community.sap.com/t5/enterprise-resource-planning/ct-p/erp
3.	https://open.sap.com/

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	1	-	-	-	1	2	-	1
CO 2	3	2	-	3	3	-	-	-	3	3	-	1
CO 3	3	3	3	3	3	1	-	1	2	3	-	1
CO 4	3	3	3	3	3	1	-	1	3	3	2	1

Assessment Pattern (with revised Bloom’s Taxonomy)

Knowledge Level	ISE	ESE
Remember	8	8
Understand	8	8
Apply	8	8
Analyse	8	8
Evaluate	8	8
Create	10	10
TOTAL	50	50

Government College of Engineering, Karad					
Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- ERP-SAP					
IOE3342 : OE I Lab- ABAP programming in Eclipse LAB					
Laboratory Scheme:			**Examination Scheme:**		
Practical	2 Hrs/week		**ISE**	25	
Total Credits	**1**		**ESE**	25	

Prerequisite : Database Management System

Course Outcomes (CO): Students will be able to

CO1	Explain the role and functionality of Eclipse in SAP development, including installation and navigation
CO2	Develop ABAP projects by creating, editing, and debugging repository objects using Eclipse
CO3	Assess ABAP code performance and quality using static testing tools, ABAP Unit Tests, and the ABAP Profiler within Eclipse
CO4	Design and implement advanced SAP applications, including Web Dynpro components and ABAP Dictionary Objects, utilizing Eclipse's development environment

Course Contents		**CO**
Experiment 1	Introduction to Eclipse, Understanding How SAP Uses Eclipse, Installing Eclipse	**CO 1**
Experiment 2	Defining an ABAP Project, Organizing Work with the Eclipse Workbench, The ABAP Development Cycle in Eclipse.	**CO 2**
Experiment 3	Creating Repository Objects, Editing a Repository Object, Debugging ABAP in Eclipse.	**CO 2**
Experiment 4	Function Groups and Function Modules.	**CO 2**
Experiment 5	ABAP Dictionary Objects in Eclipse, Working With Data Element, Working With Structures, Modelling Views with ABAP Core Data Services	**CO 4**
Experiment 6	ABAP Objects and Eclipse, Creating a Global Class, Refactoring	**CO 4**
Experiment 7	Web Dynpro Development, Creating Web Dynpro Components	**CO 4**
Experiment 8	Navigating in Eclipse, Searching in Eclipse	**CO 1**
Experiment 9	Managing Version Control, Identifying Sources of Help and Information	**CO 1**
Experiment 10	Testing and Analysis, Performing Static Testing with the Syntax Check, Performing Static Testing with the ABAP Test Cockpit.	**CO 3**
Experiment 11	Performing ABAP Unit Tests, Analysing Performance with the ABAP Profiler.	**CO 3**
Experiment 12	Eclipse: An Extensible Toolkit, Lesson: Extending Eclipse Functionality with Other SAP Tools.	**CO 1**

List of Submission:

1.	Minimum number of Experiments : 10

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	-	2	-	-	-	2	2	-	1
CO2	3	1	3	2	2	-	-	-	2	2	-	1
CO3	3	3	3	3	2	-	-	1	3	3	-	1

CO4	3	2	3	3	3	1	1	1	3	3	1	1

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern:

Skill Level (as per CAS Sheet)	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	Exp 10	Exp 11	Exp 12	Avg
Task I	15	15	15	15	15	15	15	15	15	15	15	15	15
Task II	05	05	05	05	05	05	05	05	05	05	05	05	05
Task III	05	05	05	05	05	05	05	05	05	05	05	05	05
ISE	25	25	25	25	25	25	25	25	25	25	25	25	25

Government College of Engineering, Karad				
Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- ERP-SAP				
IOE3443: OE II- SAP HANA				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02			
			Duration of ESE	As applicable

Prerequisite : Basics of ABAP programming

Course Outcomes (CO): Students will be able to

CO1	Describe the fundamentals of analytical processing, data management, and advanced analytics in SAP HANA
CO2	Develop calculation views, custom SQL data warehouses, and applications on SAP HANA
CO3	Evaluate the performance and integration of SAP Business Intelligence tools and SAP Business Warehouse with SAP HANA
CO4	Design and implement data tiring strategies, SAP Data Warehouse Cloud solutions, and enterprise suite applications on SAP HANA

	Course Contents	**CO**	**Hours**
Unit 1	Analytical Processing with SAP HANA, Developing Calculation Views with SAP HANA, Advanced Analytics with SAP HANA.	**CO 1, CO 2**	**(04)**
Unit 2	Connecting SAP Business Intelligence Tools to SAP HANA, Data Management with SAP HANA, Data Tiering with SAP HANA, Describing Data Acquisition Tools.	**CO 1, CO 3, CO 4**	**(05)**
Unit 3	Powering Data Warehouses with SAP HANA, Running SAP Business Warehouse on SAP HANA.	**CO3,**	**(05)**
Unit 4	Developing Custom SQL Data Warehouses with SAP HANA, SAP Data Warehouse Cloud.	**CO 2, CO 4**	**(04)**
Unit 5	Running SAP Enterprise Suites on SAP HANA, Running SAP Enterprise Suites on SAP HANA.	**CO 4**	**(04)**
Unit 6	Developing Applications on SAP HANA, Developing ABAP applications for SAP HANA, Developing Native SAP HANA Applications.	**CO 2, CO 4**	**(04)**

Text Books

1.	Hermann Gahm, Thorsten Schneider, Christiaan Swanepoel, Eric Westenberger, "ABAP Programming for SAP HANA", SAP Press, ISBN-13: 978-1493213049, 3rd Edition
2.	Hermann Gahm, Thorsten Schneider, Eric Westenberger, Thomas Jung , "SAP HANA for ABAP Developers", SAP Press, ISBN-13: 978-1592298789, 2nd Edition
3.	Paul Hardy , "ABAP to the Future: Advanced, Modern ABAP 7.5x Programming Techniques", Espresso Tutorials, ISBN-13: 978-1946390073, 1st Edition

Reference Books

1.	Rehan Zaidi , "SAP ABAP Advanced Cookbook", Packt Publishing, 1st edition, ISBN-13: 978-1782176440.

Useful Links

1.	https://www.linkedin.com/learning/topics/sap
2.	https://community.sap.com/t5/enterprise-resource-planning/ct-p/erp
3.	https://open.sap.com/

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	1	-	-	-	1	2	-	-
CO 2	3	3	3	3	3	1	-	1	2	2	1	1

CO 3	3	3	3	3	3	1	-	1	3	2	2	1
CO 4	3	3	3	3	3	1	-	-	1	3	2	1

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	8	8
Understand	8	8
Apply	8	8
Analyse	8	8
Evaluate	8	8
Create	10	10
TOTAL	**50**	**50**

Government College of Engineering, Karad				
Third Year (Sem – V) OE- Institute Level- Industrial orientated Open Elective- ERP-SAP				
IOE3544: OE III- SAP PROJECT				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		ISE	50
Tutorials	00 Hrs/week		ESE	50
Total Credits	02			
			Duration of ESE	As applicable

Prerequisite : Knowledge of SAP HANA

Course Outcomes (CO): Students will be able to

CO1	Perform detail literature survey on the research topic of work.
CO2	Carry out detailed mathematical modelling or experimental validation.
CO3	Draw inferences from the findings and present conclusion.
CO4	Develop presentation and technical report writing skills.

	Course Contents	**CO**
	The student shall choose any of the topics of interest for Project work using SAP. Project group shall consists of minimum THREE and maximum FIVE students. The group is required to do literature survey, formulate the problem, propose and execute methodology required for project.. • Students will prepare a technical report in prescribed format based on their work. • The assessment of the project will be done at the end of the semester by a committee consisting of three faculty members from the department along with Project Guide. • The students will present their project work before the committee. The presentation of the project shall be of 45 min followed by viva voce. • The project guide will award the marks to the individual student depending on the group average awarded by the committee. Each Project Guide shall be allotted maximum TWO groups for guidance. Each group will submit the copies of the completed project report.	**CO 1, CO 2, CO 3, CO 4**
	Submission: Project report in standard format.	

***Note: End Sem Exam (ESE) will be conducted either theory or oral or presentation mode.**

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	-	1	1	1	3	2	2	1	3	2	3	3
CO 2	2	3	3	3	3	3	3	1	3	2	3	3
CO 3	3	3	2	3	3	3	3	3	3	1	3	3
CO 4	1	-	1	-	3	1	1	1	3	3	3	3

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	ISE	ESE
Remember	9	9
Understand	9	9
Apply	9	9
Analyse	9	9
Evaluate	9	9
Create	5	5
TOTAL	50	50

Multi-disciplinary Minor (Other Discipline) – Law

Government College of Engineering, Karad				
Second Year (Sem – III) MDM-(Other Discipline) – Law				
IMO3311: Constitutional Law				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/Week		**MSE**	20
Tutorials	00 Hrs/Week		**ISE**	20
Total Credits	02		**ESE**	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of legal concepts and civics

Course Outcomes : Students will be able to

CO1	Know about the contribution of constituent assembly and role of Dr. B. R. Ambedkar in shaping the constitution of India.
CO2	Know about the structure of the constitution.
CO3	Know the significance of fundamental rights and duties in order to sensitize towards the constitutional goals which every citizen shall cherish and preserve.
CO4	Know the composition of parliament, judiciary and emergency provisions.

	Course Contents	CO	Hrs
Unit 1	**Making of constitution and features** Making of Indian Constitution ,Nature of constitution, Salient Features of the Indian Constitution .Preamble	**CO1**	**(04)**
Unit 2	**Fundamental rights** Right to Equality (Art 14-18), Freedoms and Social Control Units (Art 19-22), Right against Exploitation (Art 22-23), Right to Religion and Minority Rights (Art 25-30), Constitutional and Legal Remedies (Art 32).	**CO2**	**(05)**
Unit 3	**Directive principles, fundamental duties and social justice (art 35-51a)** Underlying object and significance of Directive Principles, Classification of Directives, Fundamental Right and Directive principles-Interrelationship, Fundamental Duties.	**CO3**	**(04)**
Unit 4	**Parliament** Composition, Election, qualifications, disqualifications and tenure of members, Functions of Parliament, Council of Minister and Prime Minister, Officers of the parliament, Speaker, Chairperson, powers and functions.	**CO3**	**(04)**
Unit 5	**Emergency provisions** National emergency- imposition and implications, Failure of constitutional emergency in the state- grounds, Financial emergency – grounds and implications, Misuse of state emergency -safeguards by judicial pronouncements	**CO4**	**(04)**
Unit 6	**Judiciary under constitution** Independence of Judiciary, High Court-Composition, Appointment, jurisdiction etc., Supreme Court- composition, Appointment procedure, jurisdiction etc., Doctrine of Judicial Review, judicial Activism- Nature and scope.	**CO, CO4**	**(05)**

Text Books

1.	Dr. Pandey J.N. : "Constitutional Law of India". Central Law Agency, 2007.
2.	D.D. Basu : "Shorter Constitution of India" : Prentice Hall of India, Delhi,1996.
3.	M.P.Jain "Indian Constitutional Law", Wadhwa.

Reference Books

1.	H.M. Seervai: "Constitution of India" Vol. 1-3 , Tripathi, Bombay, 1992.

2.	D.D. Basu : “Shorter Constitution of India” Prentice Hall of India, Delhi,1996.
3.	Constituent Assembly Debates Vol. 1 to 12 (1989)
4.	M.P.Singh (ed) V.N. Shukla : “Constitutional Law of India” Oxford, 2000.
5.	P.M.Bakshi, “Constitution of India”, Universal.
6.	The Framing of India's Constitution in Six Volumes (B.Shiva Rao)
Useful Links	
1.	https://www.constitutionofindia.net/constitution-assembly-debates/
2.	https://constitutionnet.org/
3.	https://www.india.gov.in/my-government/constitution-india

Mapping of COs and POs

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	-	-	-	-	-	3	-	2	-	-	1	2	-	-
CO 2	-	-	-	-	-	3	-	2	-	-	1	2	-	-
CO 3	-	-	-	-	-	3	-	2	-	-	1	2	-	-
CO 4	-	-	-	-	-	3	-	2	-	-	1	2	-	-

Assessment Pattern: (with revised Bloom’s Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	15
Understand	5	5	15
Apply	5	5	10
Analyse	5	5	10
Evaluate	-	-	10
Create	-	-	-
Total	20	20	60

Government College of Engineering, Karad				
Second Year (Sem – IV) MDM-(Other Discipline) – Law				
IMO3412: Human Rights and International Laws				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/Week		**MSE**	20
Tutorials	00 Hrs/Week		**ISE**	20
Total Credits	02		**ESE**	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Basics of legal concepts and civics

Course Outcomes : Students will be able to

CO1	Understand the development and sources of international laws.
CO2	Know the role of international agencies like UN in creation and maintenance of international law in order to maintain the peace and safety.
CO3	Know the concept and development of human rights.
CO4	Know the rights of vulnerable sections of the society and mechanism to protect the rights.

	Course Contents	CO	Hrs
Unit 1	**The concept, nature, and history of international law** Definitions and Nature of International Law, Historical Development of International Law , Basis of International Law, Relationship between International Law and Municipal Law.	**CO1**	**(04)**
Unit 2	**Sources of international law** Customs and Usages, Treaties – In general, Judicial Decisions, Other Sources – Writings of Jurists, Equity, Resolutions of General Assembly, etc.	**CO2**	**(04)**
Unit 3	**Role of united nations in international law** Historical background, Organs of United Nations, Preamble and Purposes of United Nations, The Principles of United Nations.	**CO2**	**(04)**
Unit 4	**Concept and development of human rights** Meaning, Definition, Importance and Scope of Human Rights, Kinds of Human Rights, Human Rights in India –Constitutional provisions, Role of NHRC, SHRC in India.	**CO3**	**(04)**
Unit 5	**International bill of rights** Universal declaration of human rights, 1948, the international covenant on civil and political rights, 1966, the international covenant on economic, social and cultural rights, 1966, role and importance of regional organisations.	**CO4**	**(05)**
Unit 6	**Human rights and vulnerable groups** Women and human rights, children and human rights, aged persons and human rights, disabled persons and human rights.	**CO, CO4**	**(05)**

Text Books

1.	H. O. Agarwal: "International Law and Human Rights" Central Law Agency, Allahabad
2.	S. K. Kapoor, "Public International Law", Central Law Agency, Allahabad.
3.	M. P. Tondon,"Public International Law"2024.

Reference Books

1.	Dr. S. K. Kapoor.,"International Law" 2021.
2.	S. K. Varma, "Public International Law" Prentice-Hall Pub., New Delhi, 1998.
3.	J. G. Starke, "Introduction to International Law",: Aditya Books, 10th edition, 1989.
4.	J. B. Brierly "The Law of Nations" Oxford Publications, London.
5.	Ian Brownlie " Principles of Public International Law" Oxford Publications, London.
6.	N. K. Jaykumar, "International Law & Human Rights" Lexis Nexis.

Useful Links

1.	https://www.un.org/en/global-issues/human-rights
2.	https://www.ohchr.org/en/what-are-human-rights
3.	https://nhrc.nic.in/

Mapping of COs and POs

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	-	-	-	-	-	3	-	2	-	-	1	2	-	-
CO 2	-	-	-	-	-	3	-	2	-	-	1	2	-	-
CO 3	-	-	-	-	-	3	-	2	-	-	1	2	-	-
CO 4	-	-	-	-	-	3	-	2	-	-	1	2	-	-

Assessment Pattern: (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	15
Understand	5	5	15
Apply	5	5	10
Analyse	5	5	10
Evaluate	-	-	10
Create	-	-	-
Total	20	20	60

Multi-disciplinary Minor (Other Discipline) – Management & Finance

Government College of Engineering, Karad				
Second Year (Sem – III) MDM-(Other Discipline) – Management & Finance				
IMO3321: Microeconomics				
Teaching Scheme			**Examination Scheme**	
Lectures	02 Hrs/week		MSE	20
Tutorials	00 Hrs/week		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Prerequisite : Mathematics, Computer Fundamentals

Course Outcomes (CO): Students will be able to

CO1	Apply the principles of microeconomics in real time scenarios.
CO2	Use supply and demand diagrams to analyze the impact of overall changes in supply and demand on price and quantity.
CO3	Identify the impact of changes in price and income on a consumer's decision via shifting income and substitution effects.
CO4	Analyze the behavior of firms in a perfectly competitive market in the short-run and the long-run

	Course Contents	CO	Hours
Unit 1	**Basic of microeconomics:** Economy And Its Basic Problems, Introduction, Objectives, Basic Economic Problem, Problems of Choice and Scarcity, Basic Economic Decisions, How the Market Mechanism Solves the Basic Problems, The Scope of Economics, Distinction Between Micro and Macro Economics, Methods of Analysis, Approaches To Economic Analysis: Micro And Macro Analysis.	**CO1**	**(05)**
Unit 2	**Consumer behaviour:** Introduction, Objectives, Cardinal and Ordinal Utility, Cardinal Utility Theory, Law of Diminishing Marginal Utility, Consumer Equilibrium and The Law of Equi-Marginal Utility, Derivation of Demand Curve (Cardinal Utility Approach), Drawbacks of Cardinal Approach, Ordinal Utility Theory, The Diminishing Marginal Rate of Substitution	**CO1**	**(04)**
Unit 3	**Demand analysis:** Demand, Introduction, Objectives, The Law of Demand, Demand Curve and Demand Schedule, Derivation of Individual Demand Curve (Utility Analysis), Reasons and Exceptions to The Law of Demand, Determinants of Market Demand, Elasticity of Demand, Introduction, Objectives, Definition of Elasticity of Demand, The Uses of Elasticity, Types of Elasticity of Demand	**CO2**	**(04)**
Unit 4	**Production and cost:** Factors of Production, Introduction, Objectives, Production: Basic Concepts, Short Run and Long Run, Production Possibilities of An Economy, Production Function, Introduction, Objectives, Laws of Production, The Law of Returns to Variable Proportions, Cost Function, Introduction, Objectives, Cost Concepts, Cost in Short and Long Run and their Importance, Cost Functions and Cost Curves: Meaning, Types of Cost Functions.	**CO2**	**(04)**
Unit 5	**Different market structures:** Market Structure, Introduction, Objectives, Characteristics of Market Structure, Perfect Competition and Imperfect Competition, Features of Perfect Competition, Market Pricing, Pricing Under Different Market Structures, Equilibrium and Supply Curve of The Firm, Price and Output Determination Under Perfect Competition, Price and Output Determination In The Long Run, Long-Run, Monopoly, Duopoly And Oligopoly	**CO3**	**(05)**
Unit 6	**Personal economics:** Compound interest and credit, financial markets, human capital and insurance, money management/ budgeting, risk and return, saving and investing, (**self-study:** role of it in financial market, it economics and data mining in stock market).	**CO4**	**(04)**

Text Books

1.	D. N. Dwivedi, "Microeconomics", Pearson Publication, New Delhi, 2011. (Unit 1,2,3,4,5)
2.	Rachel Siegel, Carol Yacht, "Personal finance", Publisher Saylor Foundation ISBN 13: 9780982361863, 2009.

	(Unit 6)
Reference Books	
1.	Varian, Hal, "Intermediate Microeconomics: A Modern Approach", Norton, 5th Edition, 1999.
2.	Sen, Anindya, "Microeconomics: Theory and Applications", Oxford University Press, New Delhi,1999
3.	Misra S.K. and V.K. Puri, "Advanced Microeconomic Theory", Himalay Publishing House, New Delhi, 2001
Useful Links	
1.	https://nptel.ac.in/courses/112/107/112107209/ Dr. P. K. Jha IIT Roorkee
2.	https://nptel.ac.in/courses/109/104/109104073/ Dr. S. Sinha IIT Kanpur
3.	https://www.econlib.org/library/Topics/HighSchool/HighSchoolTopics.html

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	2	2
CO 2	-	3	-	-	-	-	-	-	-	-	-	-	2	2
CO 3	-	-	3	-	-	-	-	-	-	-	-	-	2	2
CO 4	-	-	-	3	-	-	-	-	-	-	-	-	2	2

1: Slight(Low) 2: Moderate(Medium) 3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	10
Understand	5	5	20
Apply	5	5	10
Analyse	5	5	20
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad

Second Year (Sem – IV) MDM-(Other Discipline) – Management & Finance

IMO3422: Corporate Social Responsibilities

Teaching Scheme			Examination Scheme	
Lectures	02 Hrs/week		MSE	20
Tutorials	-		ISE	20
Total Credits	02		ESE	60
			Duration of ESE	02 Hrs 30 Min

Course Outcomes (CO): Students will be able to

CO1	Define and Explain CSR Concept.
CO2	Understand the Historical Evolution and Models of CSR.
CO3	Explore CSR in Relation to Governance and Environmental Responsibility
CO4	Assess Major Drivers, Codes, and Initiatives in CSR

	Course Contents	COs	Hours
Unit 1	**Introduction to CSR:** Meaning & Definition of CSR, History & evolution of CSR. Concept of Charity, Corporate philanthropy, Corporate Citizenship, CSR-an overlapping concept. Concept of sustainability & Stakeholder Management. CSR through triple bottom line and Sustainable Business; relation between CSR and Corporate governance; environmental aspect of CSR; Chronological evolution of CSR in India; models of CSR in India, Carroll's model; drivers of CSR; major codes on CSR; Initiatives in India.	**CO1**	**(05)**
Unit 2	**International framework for corporate social Responsibility:** Millennium Development goals, Sustainable development goals, Relationship between CSR and MDGs. United Nations (UN) Global Compact 2011. UN guiding principles on business and human rights. OECD CSR policy tool, ILO tri-partite declaration of principles on multinational enterprises and social policy.	**CO2**	**(05)**
Unit 3	**CSR-Legislation In India & the world**.: Section 135 of Companies Act 2013.Scope for CSR Activities under Schedule VII, Appointment of Independent Directors on the Board, and Computation of Net Profit's Implementing Process in India.	**CO3**	**(04)**
Unit 4	**The Drivers of CSR in India**: Market based pressure and incentives civil society pressure, the regulatory environment in India Counter trends. Performance in major business and programs. Voluntarism Judicial activism.	**CO4**	**(04)**
Unit 5	**Identifying key stakeholders of CSR & their roles:** Role of Public Sector in Corporate, government programs that encourage voluntary responsible action of corporations. Role of Nonprofit &Local Self Governance in implementing CSR; Contemporary issues in CSR & MDGs. Global Compact Self Assessment Tool, National Voluntary Guidelines by Govt. of India. Understanding roles and responsibilities of corporate foundations.	**CO3**	**(04)**
Unit 6	**Review current trends and opportunities in CSR:** CSR as a Strategic Business tool for Sustainable development. Review of successful corporate initiatives & challenges of CSR. Case Studies of Major CSR Initiatives.	**CO4**	**(04)**

Text Books

1. Mark S. Schwartz, "Corporate Social Responsibility": An ethical approach, Broadview press limited, 2011.
2. Wayne Visser and Nick Tolhurst, "The world guide to CSR,A Greenleaf publishing",2010
3. Sanjay K Agarwal,"Corporate social responsibility in India", Sage response,2008

Reference Books

1. C. V. Baxi and Ajit Prasad, "Corporate social responsibility": concepts and cases- The Indian experience,2006.
2. Sharma, J.P., "Corporate Governance and Social Responsibility of Business", Ane Books Pvt. Ltd, NewDelhi,2015

Useful Links	
1.	https://onlinecourses.nptel.ac.in/noc21_mg54/preview

Mapping of COs and POs

PO → CO ↓	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 6	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2
CO 1	3	-	-	-	-	-	-	-	-	-	-	-	2	2
CO 2	-	3	-	-	-	-	-	-	-	-	-	-	2	2
CO 3	-	2	3	-	-	-	-	-	-	-	-	-	2	2
CO 4	-	2	-	3	-	-	-	-	-	-	-	-	2	2

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