

**Government College of Engineering, Karad**

**Second Year (Sem –III) B. Tech. Civil Engineering**

**CE3301: Applied Mathematics III**

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

**Course Outcomes(CO):** Students will be able to

**CO1** Analyze data with different statistical tools, fit suitable curves and interpret the result.

**CO2** Apply proper distributions to engineering data and derive values of theoretical frequencies.

**CO3** Solve civil engineering problems involving higher order differential equations.

**CO4** Apply partial differential equation techniques to civil engineering problems.

Course Contents		COs	Hours
<b>Unit 1</b>	<b>Basic Statistics:</b> Measures of Dispersion: Moments: Moment about mean, moment about any value, skewness and Kurtosis, Correlation: Coefficient of Correlation, Lines of Regression.	<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>Curve fitting:</b> Method of least squares, fitting of straight lines, second degree parabolas and more general curves.	<b>CO1</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Probability Distributions:</b> Random variable, Discrete probability distribution, Continuous probability distribution, Binomial distribution, Normal distribution.	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Linear Differential Equations with Constant Coefficients:</b> Linear differential equations with constant coefficients, Methods to find C.F. and P.I. Method to find Particular Integral by shortcut method.	<b>CO3</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Applications of LDE with constant coefficients:</b> Method of variation of parameters, Applications to deflection of beam, whirling of shafts.	<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Partial Differential Equations:</b> Method of separation of variable, Solution of Wave equation, Solution of One dimensional heat equation.	<b>CO4</b>	<b>(04)</b>

**TextBooks**

1. N.P. Bali and Manish Goyal, "A text book of Engineering Mathematics", Laxmi Publications, Reprint, 2010, 2016
2. H.K.DASS, "Advance Engineering Mathematics", S. Chand publications. Fifteenth revised edition 2006.
3. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, 43<sup>rd</sup> Edition, 2000.
4. Debashis Datta "Textbook of Engineering Mathematics" 'New Age International Publication revised second edition.

**Reference Books**

1. G. B. Thomas and R. L. Finney, "Calculus and Analytic geometry", 9<sup>th</sup> Edition, Pearson, Reprint, 2002.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 9<sup>th</sup> Edition, John Wiley & Sons, 2006.
3. Veerarajan T., "Engineering Mathematics for first year", Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B. V., "Higher Engineering Mathematics", Tata McGraw Hill New Delhi, 11<sup>th</sup> Reprint, 2010.
5. S. C. Gupta "Fundamentals of Statistics", Himalaya Publishing House, sixth revised edition 2008.

**Useful Links**

1. <https://www.iitm.ac.in/>

## Mapping of COs and POs

PO →CO ↓	PO1	PO2	PO3	PO4	PO5	PO6	PO6	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1	1	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	1	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	2	-	-	-	-	-	-	-	-	-	-	-
CO4	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	2	3	5
Understand	3	2	5
Apply	5	5	20
Analyse	5	5	10
Evaluate	5	5	20
Create	-	-	-
TOTAL	20	20	60

**Government College of Engineering, Karad**

**Second Year (Sem-III) B. Tech. Civil Engineering**

**CE 3302 :Surveying**

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

**Prerequisite :** Basics of Civil Engineering

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	Measure distances, angles and bearings with various surveying methods and instruments.
<b>CO2</b>	Solve surveying problems using plane table and know applications of levelling & contouring
<b>CO3</b>	Demonstrate use of tacheometry, photogrammetry, GPS in surveying
<b>CO4</b>	Understand various advanced Surveying techniques used for various purposes

Course Contents		CO	Hours
<b>Unit1</b>	<b>Introduction and Principles of surveying</b> , Classification based on methods and instruments, Chain and compass Traversing, chaining, errors in chaining, ranging, offsetting, plotting chain survey data, instruments for measuring right angles, use of prismatic compass, bearing of lines, Local attraction, traversing with chain and compass, plotting and adjusting a traverse, Magnetic Declination etc.	<b>CO1</b>	<b>(06)</b>
<b>Unit2</b>	<b>Theodolite Traversing</b> Uses of Theodolite: Measurement of Horizontal angles, horizontal angles by repetition and by reiteration (errors eliminated) ,vertical angles, magnetic bearings, prolonging a line, setting out angles. Theodolite Traversing: Computation of Consecutive and independent coordinates, adjustment of closed traverse, by transit rule and Bowditch's rule, Gales Traverse table, Open Traverse – Its uses, measurement of deflection angles using transit Theodolite, open traverse survey, checks in open traverse.	<b>CO1</b>	<b>(07)</b>
<b>Unit3</b>	<b>Plane Table Survey</b> Equipment required for plane table Survey, uses, advantages, disadvantages and errors in plane table surveying; Methods of plane table Survey Radiation, intersection, traversing and resection; Two point and Three point problems and their solutions by different methods, Strength of fix, Lehman's Rules <b>Tacheometry:</b> Principle of stadia, fixed hair method with vertical staff to determine horizontal distances and elevations of the points. Use of Tacheometry in Surveying,	<b>CO2, CO3</b>	<b>(07)</b>
<b>Unit4</b>	<b>Leveling and contouring</b> Definitions, technical terms, different types of levels, Temporary and permanent adjustments of dumpy and auto level, Different methods of leveling, reduction of levels, Difficulties in leveling work, corrections and precautions to be taken in leveling work <b>Contour</b> – definitions, contour interval, equivalent, uses and characteristics of contour lines, direct and indirect methods of contouring Running a level line, L section, cross section, methods of interpolation	<b>CO2</b>	<b>(07)</b>
<b>Unit5</b>	<b>Photogrammetry:</b> Objects, applications to various fields, aerial camera, comparison of map & vertical photograph, scale of vertical photograph, Geographic Information System (GIS): definition and meaning, data modes for GIS, components of GIS and applications to Civil Engineering, etc. <b>Area calculation:</b> Area of a irregular figure by Trapezoidal rule, average ordinate rule, Simpson's 1/3 rule, various coordinate methods, Planimeter: types of planimeter including digital planimeter, area of zero circle, use of planimeter	<b>CO3</b>	<b>(06)</b>
<b>Unit6</b>	<b>Advance Surveying Techniques:</b> Global Positioning System(GPS): Applications to Civil Engineering, concept of Global Positioning Systems [GPS] and differential GPS, DGPS, Lidar surveying, Electromagnetic waves and their properties, Electromagnetic Distance Meters (E.D.M.), measurement principle of EDM instruments, Total Station and its uses, fundamental parameters of Total Station, Remote Sensing: basic principles, electromagnetic spectrum, classification of remote sensing systems, etc.	<b>CO4</b>	<b>(07)</b>

**Text Books**

<b>1.</b>	T.P Kanetkar and S.V. Kulkarni "Surveying and Levelling Vol. I and II", Pune Vidhyarthi Griha Prakashan.
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	(Edition 2008)
2.	Dr. B.C. Punmia , “Surveying Vol., I, II and III”, Laxmi Publishers, New Delhi. (Edition 2005)
3.	S. K. Duggal, “Surveying Vol. I and II”, New Delhi, India: Tata McGraw Hill, 2007.
<b>ReferenceBooks</b>	
1.	R. Agor, “Surveying and Levelling”, New Delhi, India: Khanna Publishers, 2000
2.	N. N. Basak, “Surveying and Levelling”, New Delhi, India: Tata McGraw Hill, 2014.
3.	K. R. Arora, “Surveying Vol. I, II and III”, New Delhi, India: Standard Book House, 2001
<b>UsefulLinks</b>	
1.	<a href="http://www.nptel.iitk.ac.in/BharatLohani">http://www.nptel.iitk.ac.in/BharatLohani</a>
2.	<a href="http://www.ocw.mit.edu">www.ocw.mit.edu</a>
3.	<a href="http://www.nptel.iitr.ac.in/S.K.Ghosh">http://www.nptel.iitr.ac.in/S.K.Ghosh</a>

### 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	2	1	0	0	2	0	0	0	3	1	0	1	1	1
CO 2	2	1	2	1	2	0	0	0	2	1	0	1	1	1
CO 3	2	2	2	1	3	1	1	0	3	2	0	0	1	2
CO 4	1	1	0	2	3	2	1	1	2	1	0	1	1	2

### Assessment Pattern(with revised Bloom’s Taxonomy)

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

**Government College of Engineering, Karad**

**Second Year (Sem – III) B. Tech. Civil Engineering**

**CE3303: Geoscience**

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 knowledge of types of soil and rocks

**Course Outcomes (CO):** Students will be able to

**CO1** Determine site characterization and geologic data using standards in engineering practice.

**CO2** Demonstrate fundamentals of the engineering properties of Earth materials and fluids.

**CO3** Determine rock mass characterization and the mechanics of planar rockslides and topples.

Course Contents		CO	Hours
<b>Unit 1</b>	<p><b>Introduction:</b>                      Importance of geological studies in various civil engineering projects. Internal structure of the earth and use of seismic waves in understanding the interior of the earth, Concept of continental drift and Plate tectonics.                      Weathering and Erosion, Brief study of geological action of river, wind, glacier, groundwater and the related landforms created by them                      Earthquake -Earthquake waves, Earthquake zones of India, elastic rebound theory.                      Preventive measures for structures constructed in earthquake prone areas.</p>	<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<p><b>Mineralogy and Petrology:</b>                      Rock forming minerals, Megascopic identification of primary and secondary minerals                      Igneous Petrology -Mode of formation, Texture and structure, Classifications, study of common occurring igneous rocks Concordant and Discordant modes of occurrence of Igneous rocks.                      Sedimentary Petrology -Mode of formation, Textures, structure, classification and study of commonly occurring sedimentary rocks.                      Metamorphic Petrology -Mode of formation, agents and types of metamorphism, structures and textures of metamorphic rocks, classification and study of commonly occurring metamorphic rocks, concrete petrology.</p>	<b>CO1</b>	<b>(05)</b>
<b>Unit 3</b>	<p><b>Structural Geology:</b>                      Structural elements of rocks, dip strike, outcrop patterns unconformities, outliers and inliers, Study of joints, Faults and folds, importance of structural elements in engineering operations.</p>	<b>CO2</b>	<b>(03)</b>
<b>Unit 4</b>	<p><b>Preliminary Geological Investigation:</b>                      Preliminary Geological Investigation and their importance to achieve safety and economy of the projects supporting dams and tunnel projects.                      Core Drilling -Geological logging, Inclined Drill holes. Electrical Resistivity method, Seismic method and their applications.                      favourable and unfavourable conditions for locating dam sites. Precautions over the unfavourable geological structures like faults, dykes, joints, unfavourable dips on dam sites and giving treatments, structural and erosional Valleys. Case Histories Geological conditions suitable and unsuitable for reservoir site. Conditions likely to cause leakage through reservoir rims.                      Case studies safe and unsafe geological and structure conditions, Difficulties during tunnelling and methods to overcome the difficulties.</p>	<b>CO2, CO3</b>	<b>(05)</b>
<b>Unit 5</b>	<p><b>Groundwater:</b>                      Sources, zones, water table, unconfined and Perched water tables, Factors controlling water bearing capacity of rocks, Pervious and Impervious rocks, Cone of depression and its use in Civil engineering. Geological work of groundwater, Artesian well.</p>	<b>CO3</b>	<b>(04)</b>

<b>Unit 6</b>	<b>Landslides:</b> Types, causes and preventive measures for landslides, Stability of Slopes, Landslides in Deccan region(Western Ghats) and Himalaya. Case Studies. Requirements of good building stones and its geological factors, controlling properties, consideration of common rocks as building stones. Rock Mass Classification and Rating (RMR) and Rock Quality Designation (RQD)	<b>CO3</b>	<b>(04)</b>
<b>Text Books</b>			
1.	Parbin Singh, "Text Book of Engineering and General Geology", New Delhi, India: S.K. Kataria and Sons.		
2.	N. ChennaKesavulu, "Text Book of Engineering Geology", 2nd ed., New Delhi, India: Macmillan Publishers India, 2009		
<b>Reference Books</b>			
1.	D. K. Rodd, "Groundwater Hydrology", New York, NY, USA: John Wiley and Sons		
2.	M. P. Billings, "Structural Geology", New Delhi, India: Prentice Hall of India Pvt. Ltd.		
3.	G. W. Tyrell, "Principals of Petrology", B.I. Publications.		
4.	J. C. Harvey, "Geology for Geotechnical Engineers", Cambridge, UK: Cambridge University Press, 1982		
<b>Useful Links</b>			
1.	<a href="https://youtu.be/fiMemypKqEI?si=smSFafZCBcU-TsOP">https://youtu.be/fiMemypKqEI?si=smSFafZCBcU-TsOP</a> Prof. Santanu Misra IIT Kanpur.		
2.	<a href="https://youtu.be/aTVDiRtRook?si=cKICjiEcuyGMeOO7">https://youtu.be/aTVDiRtRook?si=cKICjiEcuyGMeOO7</a> Prof. Debasis Roy, IIT Kharagpur.		
3.	<a href="https://youtu.be/exT3RrDBMig?si=DcSFXxDUyZVQiNt4">https://youtu.be/exT3RrDBMig?si=DcSFXxDUyZVQiNt4</a> Prof. Pitambar Pati, IIT Roorkee.		

### 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	0	1	0	0	0	0	0	0	0	1	1	1
CO 2	2	2	1	1	0	0	0	0	0	0	0	0	2	0
CO 3	2	2	2	2	-	-	-	-	-	-	-	-	2	-

### Assessment Pattern (with revised Bloom's Taxonomy)

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

**Government College of Engineering, Karad**

**Second Year (Sem – III) B. Tech. Civil Engineering**

**CE3304: Mechanics of Materials**

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 :** engineering mechanics

**Course Outcomes (CO):** Students will be able to

**CO1** Remember and understand laws and principles related to material behaviour under loading.

**CO2** Apply knowledge to solve problems in structural analyse and material testing.

**CO3** Evaluate and compare between different materials and verify with standards.

**CO4** Predict behaviour of materials and make necessary inferences.

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Fundamentals of Material Properties and Stress Analysis:</b> Engineering properties of different materials, St. Venant’s principle, simple stress and strain, Hooke’s law, elastic behaviour of the body under external actions, composite sections under axial loading, temperature stresses, elastic constants, normal stresses and strains in three dimensions.	<b>CO1, CO2, CO3</b>	<b>(07)</b>
<b>Unit 2</b>	<b>Analysis of Statically Determinate Structures:</b> Analysis of statically determinate beams, shear force and bending moment diagrams, Introduction of virtual work approach for computation of shear force and bending moment.	<b>CO1, CO2</b>	<b>(06)</b>
<b>Unit 3</b>	<b>Torsion:</b> Analysis of circular shafts subjected to torsion; power transmitted. Analysis of thin-walled cylinders.	<b>CO2</b>	<b>(07)</b>
<b>Unit 4</b>	<b>Theory of Bending and Beam Stresses:</b> Theory of Simple Bending, Bending Stresses in beams, Pure Bending, Application of flexure Formula, Composite Beam or Flitched Beam.	<b>CO2, CO3</b>	<b>(06)</b>
<b>Unit 5</b>	<b>Shear Stress in Beams:</b> Shear stress distribution in beams, Maximum Shear Stress, Average Shear Stress, Shear Stress Distribution Diagrams for various beam cross sections.	<b>CO2</b>	<b>(07)</b>
<b>Unit 6</b>	<b>Principal Stresses and Theories of Failure:</b> Principal stress and strain in two dimensions, Introduction to graphical method. Principal stress in beams and thin cylinders. Combined bending, torsion and axial thrust. Theories of failure.	<b>CO2, CO4</b>	<b>(07)</b>

**Text Books**

1. S. B. Junnarkar and Advi, "Mechanics of Structure (Vol. I and II)", Charotar Publications
2. S. S. Bhavikatti, "Strength of Materials", New Age Publications.
3. R. K. Rajput, "Strength of Materials", S. Chand Publications
4. Suchita Hirde, "Strength of Materials", EP Publications
5. S. Ramamrutham, "Strength of Materials", Dhanapat Rai Publications.
6. R. K. Bansal, "Strength of Materials", Laxmi Publications.

**Reference Books**

1. Gere and Timoshenko, "Mechanics of Materials", CBS Publishers.
2. F. Beer and R. Johnston, "Mechanics of Materials", Mc-Graw Hill, Higher Education
3. Timothy A. Philpot, "Mechanics of Materials, SI version", Wiley.

**Useful Links**

1. <http://www.nptel.iitm.ac.in>
2. [www.ocw.mit.edu](http://www.ocw.mit.edu)

### 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	1	1			1	1		1	1	1	3	3
CO 2	2	3	1	1	1			1			2	2	3	3
CO 3	1	2	2	2	2					1	1	2	3	3
CO 4	1	1	2	1		1	1	2	2	3		3	3	3

### Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	-	3	5
Understand	3	3	5
Apply	3	4	5
Analyse	8	6	30
Evaluate	6	4	15
Create	-	-	-
TOTAL	20	20	60

**Government College of Engineering, Karad****Second Year (Sem – III) B. Tech. Civil Engineering****CE-3305: MDM 01- Basic Civil Engineering**

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 :** Knowledge of identifying basic building components.

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	Understand role of Civil Engineer & applications of various branches of Civil Engineering.
<b>CO2</b>	Know various building components for construction.
<b>CO3</b>	Identify concepts of surveying & levelling and understand their applicability.
<b>CO4</b>	Understand types of infrastructure.

	Course Contents	CO	Hours
<b>Unit 1</b>	<b>Introduction to Civil Engineering:-</b> Role of Civil Engineer in various construction activities, Branches of Civil Engineering, Principles of planning, Selection of site for residential building, Important building bye-Laws, Typical plan of residential building with introduction to line plan.	CO1	(05)
<b>Unit 2</b>	<b>Building Components :</b> Sub-structure: Types of soil and rocks as foundation strata, Concept of bearing capacity, Types of foundations i.e. shallow & deep foundations, Plinth, Super-structure: Elements of super-structures: walls, floor, roof, doors & windows, lintel, staircase, etc.	CO2	(04)
<b>Unit 3</b>	<b>Types of structures:</b> Introduction to types of loads, Difference between load bearing and framed structures.	CO2	(04)
<b>Unit 4</b>	<b>Surveying:</b> Principles of surveying, Classification of surveys, Nominal scale and representative fraction. Ranging, offset, cross staff survey, compass survey & its types. <b>Levelling:</b> Introduction, Basic terminology, Types of Level, Levelling Staff.	CO3	(05)
<b>Unit 5</b>	<b>Introduction to Remote sensing and GIS:-</b> Geographical Information System (GIS), Global Positioning System (GPS) and its applications in Civil Engineering	CO3	(04)
<b>Unit 6</b>	<b>Introduction to Infrastructure:</b> Role of Infrastructure in Economic development, Types of Infrastructure.	CO4	(04)

**Text Books**

<b>1.</b>	S. P. Arora and S. P. Bindra, "A Text-Book of Building Construction", Dhanpat Rai Publication, ISBN 978-8189928803
<b>2.</b>	S. K. Duggal, "Building Materials", New Age Publishers, ISBN: 978-9387788398

**Reference Books**

<b>1.</b>	S. K. Sharma, "Civil Engineering Construction Materials", Khanna Book Publishing Co. Ltd., ISBN: 9789382609841.
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**Useful Links**

<b>1.</b>	<a href="https://youtube.com/playlist?list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT">https://youtube.com/playlist?list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT</a>
<b>2.</b>	<a href="https://youtube.com/playlist?list=PL8BA090E69BF01BC2">https://youtube.com/playlist?list=PL8BA090E69BF01BC2</a>
<b>3.</b>	<a href="https://youtube.com/playlist?list=PLk7ptZcI9vmhBh7evUtxAbHe3Ojs_099H">https://youtube.com/playlist?list=PLk7ptZcI9vmhBh7evUtxAbHe3Ojs_099H</a>

## 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	1	2	1	2
CO 2	-	-	-	-	2	3	3	3	2	2	2	2	1	1
CO 3	3	-	-	2	3	3	2	3	2	2	3	2	2	2

## Assessment Pattern (with revised Bloom's Taxonomy)

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

<b>Government College of Engineering, Karad</b>					
<b>Second Year (Sem – III) B. Tech. Civil Engineering</b>					
<b>CE3316: (OE- I) Environmental Chemistry</b>					
<b>Teaching Scheme</b>			<b>Examination Scheme</b>		
Lectures	03 Hrs/week		MSE	20	
Tutorials	00 Hrs/week		ISE	20	
Total Credits	03		ESE	60	
			<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>	
<b>Prerequisite :</b> chemistry					
<b>Course Outcomes (CO):</b> Students will be able to					
<b>CO1</b>	Interpret concepts of quantitative, physical, colloidal and bio-chemistry required in Environmental Engineering.				
<b>CO2</b>	Demonstrate working principles of different instruments related to Environmental Engineering.				
<b>CO3</b>	Analyse effect of toxic and trace contaminants on environment.				
<b>CO4</b>	Identify anthrosphere and atmospheric chemistry				
	<b>Course Contents</b>			<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Introduction:</b> Significance of Chemistry in Environmental Engineering, Basic concepts from general chemistry: Properties of chemical compounds- atomic structure, molecular weight, equivalent weight, normality, molarity, standard solutions, Introduction to Stoichiometric reactions, oxidation-reduction phenomena, basics of mass balance.			<b>CO1</b>	<b>(06)</b>
<b>Unit 2</b>	<b>Environmental significance of pollutant parameters:</b> Temperature, pH, Hardness, Iron, Manganese, Fluoride, Nitrogen, Phosphorous, Carbon, Sulphate, DO, BOD, COD, TOC. <b>Basic Concepts from Colloidal Chemistry:</b> Size, methods of formation, general properties, environmental significance, colloidal dispersion in liquids, colloidal dispersion in air			<b>CO1</b>	<b>(07)</b>
<b>Unit 3</b>	<b>Atmosphere and Atmospheric Chemistry:</b> Introduction, Importance of the Atmosphere, Physical Characteristics of the Atmosphere, Energy Transfer in the Atmosphere, Atmospheric Mass Transfer, Meteorology, and Weather, Inversions and Air Pollution, Global Climate and Microclimate, Chemical and Photochemical Reactions in the Atmosphere, Acid–Base Reactions in the Atmosphere, Reactions of Atmospheric Oxygen, Reactions of Atmospheric Nitrogen.			<b>CO4</b>	<b>(07)</b>
<b>Unit 4</b>	<b>Chemistry and the Anthrosphere:</b> Matter and Cycles of Matter, Carbon Cycle, Nitrogen Cycle, Oxygen Cycle, Phosphorus Cycle, Sulfur Cycle, Anthrosphere and Environmental Chemistry, Technology and the Anthrosphere, Components of the Anthrosphere That Influence the Environment, Effects of the Anthrosphere on Earth.			<b>CO4</b>	<b>(07)</b>
<b>Unit 5</b>	<b>Fundamental of analytical chemistry:</b> General Aspects of Environmental Chemical Analysis, Classical Methods, Spectrophotometric Methods, Electrochemical Methods of Analysis, Chromatography, Mass Spectrometry, Analysis of Water Samples, Automated Water Analyses, Emerging Contaminants in Water Analysis.			<b>CO2</b>	<b>(06)</b>
<b>Unit 6</b>	<b>Toxic effects of organic compound</b> such as phenols, pesticides, surfactants, tannin, lignin and hydrocarbon. Heavy metals and trace contaminants- significance and health effects, Characteristics of hazardous material. <b>Environmental Characteristics of organic compounds:</b> saturation concentration, solubility, hydrolysis, photolysis.			<b>CO3</b>	<b>(07)</b>
<b>Text Books</b>					
<b>1.</b>	Stanley E. Manahan, “Environmental Chemistry”, Taylor and Francis group, 9 <sup>th</sup> edition, 2010.				
<b>2.</b>	Sawyer. C.N. and Mc Carty. P.L., “Chemistry for Environmental Engineers”, Tata McGraw-Hill Publishing Company Limited, 4th Edition, 1994.				
<b>3.</b>	Dr. S. S. Dara and Dr. S. S. Umare, “A Text Book of Engineering Chemistry”, S. Chand and Company Ltd., New Delhi, 2017.				
<b>Reference Books</b>					

1.	Metcalf and Eddy “Wastewater Engineering Treatment and Reuse”, Tata McGraw Hill Publication, 6th Reprint. 2003.
2.	Conn. E.E. and Stumpf, P.K., “Outlines of Biochemistry”, Wiley Eastern Limited, 5th Edition, 1997.
3.	IS (3025) “Methods of sampling and test (physical and chemical) for water and wastewater”
<b>Useful links</b>	
1.	<a href="http://onlinecourses.nptel.ac.in/noc24_ce71/preview">http://onlinecourses.nptel.ac.in/noc24_ce71/preview</a> prof. Bhanu Prasad Vellanki, IIT Roorki

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

### Assessment Pattern (with revised Bloom’s Taxonomy)

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

**Government College of Engineering, Karad**

**Second Year (Sem – III) B. Tech. Civil Engineering**

**CE3326: OE- I – (MOOC) Environmental Chemistry**

Teaching Scheme		Examination Scheme	
Lectures	-	MSE	-
Tutorials	-	ISE	-
Total Credits	03	ESE	100

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	interpret concepts of quantitative, physical, colloidal and bio-chemistry required in Environmental Engineering.
<b>CO2</b>	Recognise working principles of different instruments related to Environmental Engineering.
<b>CO3</b>	analyse effect of toxic and trace contaminants on environment.

**Course Contents**

Students should complete the MOOC course certification in the domain of Environmental Chemistry 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 8Weeks.
- 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 Civil 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									

**Faculty Name and Sign.**

**Head of the Department**

**Government College of Engineering, Karad**

**Second Year (Sem – III) B. Tech. Civil Engineering**

**CE3307: 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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Introduction to Value Education:</b> Right understanding, relationship, and physical facility (holistic development and the role of education), understanding value education, self-exploration as the process for value education.	<b>CO1</b>	<b>(03)</b>
<b>Unit 2</b>	<b>Fundamental Human Aspirations:</b> Continuous happiness and prosperity – the basic human aspirations, happiness and prosperity – current scenario, method to fulfil the basic human aspirations.	<b>CO2</b>	<b>(03)</b>
<b>Unit 3</b>	<b>Harmony between Self and Body:</b> 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.	<b>CO2</b>	<b>(06)</b>
<b>Unit 4</b>	<b>Values in Human Interaction:</b> 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.	<b>CO3</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Society, Universal Order, and Nature:</b> 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.( <b>Self Study:</b> The Holistic Perception of Harmony in Existence.)	<b>CO2, CO3</b>	<b>(06)</b>
<b>Unit 6</b>	<b>Ethical Conduct and Professional Transition:</b> 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, ( <b>Self Study:</b> Strategies for Transition towards Value-based Life and Profession)	<b>CO4</b>	<b>(06)</b>

**Text Books**

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

**Reference Books**

<b>1.</b>	D R Kiran , “Professional ethics and human values”,McGraw Hill Education (India) Private Limited P-24, 2 <sup>nd</sup> edition, 2014, Green Park Extension, New Delhi 110 016
<b>2.</b>	V. Jayakumar, “Professional ethics and Human values in Engineering”
<b>3.</b>	Rudolf Steiner, “Human Values in Education (The Foundations of Waldorf Education, 20)”, Anthroposophic Press, Year: 2004, ISBN: 0880105445,9780880105446
<b>4.</b>	R.S. Naagarazan, “A Textbook on Professional Ethics and Human Values”, New Age International Pvt Ltd

	Publishers, Year: 2007 ISBN: 8122419380,9788122419382,9788122423013
<b>Useful Links</b>	
1.	<a href="https://nptel.ac.in/courses/109104068">https://nptel.ac.in/courses/109104068</a> Exploring Human Values: Visions of Happiness and Perfect Society, IIT Kanpur, Prof. A.K. Sharma
2.	<a href="https://onlinecourses.nptel.ac.in/noc23_hs89/preview">https://onlinecourses.nptel.ac.in/noc23_hs89/preview</a> Moral Thinking: An Introduction To Values And Ethics, By Prof. Vineet Sahu IIT Kanpur
3.	<a href="https://uhv.org.in/course">https://uhv.org.in/course</a> Universal Human Values

### 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	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. Civil Engineering**

**CE3308 : 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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Basic of Information system and management:</b> 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	<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>Basic Concepts of Economics:</b> 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)	<b>CO2</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Micro and Macro Economics:</b> Microeconomics: differences and comparison, theories of utility and consumer choice, competition and market structure. Macroeconomics: aggregate demand and supply, economic growth and business cycles, the role of the nation in economic activity	<b>CO2</b>	<b>(05)</b>
<b>Unit 4</b>	<b>Industrial Economics:</b> 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.	<b>CO3</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Cash Flow:</b> Accounting for Depreciation and Income Taxes, Project Cash-Flow Analysis, Understanding Financial Statements, Case Studies-cash flow analysis done in start-up companies	<b>CO4</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Personal Economics:</b> 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	<b>CO4</b>	<b>(04)</b>

**Text Books**

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

**Reference Books**

<b>1.</b>	R.J. Gordon, “Macroeconomics”, Little Brown & Co. Boston, 4th Edition, 1987.
<b>2.</b>	Donald G. Newman, Jerome P. Lavelle, “Engineering Economics and analysis” Engg. Press, Texas, 201

**Useful Links**

1.	<a href="https://nptel.ac.in/courses/112/107/112107209/">https://nptel.ac.in/courses/112/107/112107209/</a> Dr.P. K.Jha IITRoorkee
2.	<a href="https://nptel.ac.in/courses/109/104/109104073/">https://nptel.ac.in/courses/109/104/109104073/</a> Dr.S.SinhaITKanpur
3.	<a href="https://www.econlib.org/library/Topics/HighSchool/HighSchoolTopics.html#finance">https://www.econlib.org/library/Topics/HighSchool/HighSchoolTopics.html#finance</a>

### 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	2
CO 2	2		-	-	-	1	2	1	2	1	2	1	1	2
CO 3	1	3	-	-	-	1	2	1	2	1	2	1	1	2
CO 4	-	-	-	3	-	1	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	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. Civil Engineering**  
**CE3309: Surveying Lab**

<b>Laboratory Scheme:</b>			<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week		<b>ISE</b>	<b>25</b>
<b>Total Credits</b>	<b>1</b>		<b>ESE</b>	<b>-</b>
<b>Prerequisite :</b> Basics of Civil Engineering, Civil Workshop				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Carry out preliminary surveying in the field of Civil Engineering.			
<b>CO2</b>	Perform leveling practices and understand methods of leveling			
<b>CO3</b>	Measure horizontal, vertical angles and magnetic bearing using theodolite			
<b>CO4</b>	Relate the knowledge on Surveying to the new frontiers of science			
<b>Course Contents</b>				<b>CO</b>
<b>Experiment 1</b>	Field Exercises (inside the campus) : a. Measurement of a line using a chain taking offsets on both sides b. Traversing using compass.			<b>CO1</b>
<b>Experiment 2</b>	To Study two methods of Plane Table Survey(Radiation & Intersection)			<b>CO1</b>
<b>Experiment 3</b>	To Determine Linear distance, elevation and constants of Tachometer by Fixed Hair Method of Tacheometry			<b>CO1</b>
<b>Experiment 4</b>	Determination of R. L. (Differential leveling) by using Auto Level			<b>CO2</b>
<b>Experiment 5</b>	Study of Reciprocal Leveling & Fly leveling using Auto level			<b>CO2</b>
<b>Experiment 6</b>	Measurement of Horizontal angles, vertical angles and magnetic bearing using Theodolite			<b>CO3</b>
<b>Experiment 7</b>	Study and use of Total Station			<b>CO4</b>
<b>Experiment 8</b>	Introduction to Surveying using GPS			<b>CO4</b>
<b>Project 1</b>	Project-I -Theodolite traverse Survey project of a closed traverse with at least four stations, computation of area of the traverse.			<b>CO3</b>
<b>Project 2</b>	Road Surveying (Alignment, Earthwork calculations etc.) OR Block and Radial Contouring (Interpolation calculations, Drawings etc.)			<b>CO2</b>
<b>List of Submission:</b>				
<b>1.</b>	Total number of Experiments			
<b>2.</b>	Project reports			

**Mapping of COs and POs**

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	1	1	-	2	-	-	-	3	1	-	1	1	1
CO2	2	1	2	2	2	-	-	-	2	1	-	1	2	1
CO3	2	2	2	1	3	1	-	-	3	2	-	-	2	1
CO4	1	1	1	2	3	2	1	1	2	1	-	1	1	2

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)



<b>Government College of Engineering, Karad</b>				
<b>Second Year (Sem – III) B. Tech. Civil Engineering</b>				
<b>CE3310: Mechanics of Material Lab</b>				
<b>Laboratory Scheme:</b>			<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week		<b>ISE</b>	<b>25</b>
<b>Total Credits</b>	<b>1</b>		<b>ESE</b>	<b>-</b>
<b>Prerequisite :</b> engineering mechanics				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Understand operations of different machine/equipment for conducting different test.			
<b>CO2</b>	Demonstrate the testing on the different materials to find its physical, mechanical properties as per the IS code.			
<b>CO3</b>	Conclude behaviour of the material from experimental data and represent in the standard format.			
<b>Course Contents</b>				<b>CO</b>
<b>Experiment 1</b>	Study of Universal Testing Machine.			<b>CO1</b>
<b>Experiment 2</b>	Water absorption and compression test on burnt clay bricks.			<b>CO2,CO3</b>
<b>Experiment 3</b>	Compression test on timber.			<b>CO2</b>
<b>Experiment 4</b>	Tensile test on Mild steel bar and TMT steel bar.			<b>CO3</b>
<b>Experiment 5</b>	Bending test on Mild steel bar and Timber Beam.			<b>CO2, CO3</b>
<b>Experiment 6</b>	Direct shear test on Mild steel bar.			<b>CO2, CO3</b>
<b>Experiment 7</b>	Hardness test on different metals such as Iron, Copper, Bronze and Aluminium.			<b>CO2, CO3</b>
<b>Experiment 8</b>	Torsion test on Mild steel bar.			<b>CO2, CO3</b>
<b>Experiment 9</b>	Flexure test on flooring tiles.			<b>CO2, CO3</b>
<b>Experiment 10</b>	Izod Impact test on metal specimens.			<b>CO2, CO3</b>
<b>Experiment 11</b>	Compression test on paving blocks.			<b>CO2, CO3</b>
<b>Experiment 12</b>	Efflorescence of brick			<b>CO2, CO3</b>
<b>List of Submission:</b>				
	Minimum number of Experiments : 10			

### Mapping of COs and POs

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

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)



<b>Government College of Engineering, Karad</b>				
<b>Second Year (Sem – III) B. Tech. Civil Engineering</b>				
<b>CE3321 : (OE- I Lab) Environmental Chemistry Lab</b>				
<b>Laboratory Scheme:</b>			<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week		<b>ISE</b>	<b>25</b>
<b>Total Credits</b>	<b>1</b>		<b>ESE</b>	<b>25</b>
<b>Prerequisite :</b> chemistry				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Explain the principles and significance of water quality parameters such as ph, alkalinity, acidity, turbidity, and conductivity			
<b>CO2</b>	Perform standard laboratory procedures to determine key water quality indicators including total solids, suspended solids, dissolved solids, and hardness			
<b>CO3</b>	Analyze water samples by accurately measuring chloride content and interpreting the results to assess water quality			
<b>CO4</b>	Prepare buffer and stock solutions, demonstrating proficiency in solution preparation techniques critical for water analysis			
<b>Course Contents</b>				<b>CO</b>
<b>Experiment 1</b>	Determination of pH of given water sample by pH meter .			<b>CO1</b>
<b>Experiment 2</b>	Determination of alkalinity of given water sample.			<b>CO1</b>
<b>Experiment 3</b>	Determination of acidity of given water sample.			<b>CO1</b>
<b>Experiment 4</b>	Determination of turbidity of given water sample.			<b>CO1</b>
<b>Experiment 5</b>	Determination of conductivity of given water sample.			<b>CO1</b>
<b>Experiment 6</b>	Determination of total solids, suspended solids and dissolved solids of given water sample.			<b>CO2</b>
<b>Experiment 7</b>	Determination of hardness of given water sample.			<b>CO2</b>
<b>Experiment 8</b>	Determination of chloride content of given water sample.			<b>CO3</b>
<b>Experiment 9</b>	Demonstration of preparation of buffer solution.			<b>CO4</b>
<b>Experiment 10</b>	Demonstration of preparation of stock solutions			<b>CO4</b>
<b>List of Submission:</b>				
<b>1.</b>	Minimum number of Experiments : 08			

### Mapping of COs and POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	-	1	-	-	1	2	3	1	-	2	-	1	2	2
CO2	3	2	-	-	-	2	2	-	1	-	-	1	-	-
CO3	3	2	-	-	-	2	2	-	1	-	-	1	-	-
CO4	3	2	-	-	-	2	2	-	1	-	-	1	-	-

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)



**Government College of Engineering, Karad**

**Second Year (Sem – III) B. Tech. Civil Engineering**

**CE3331 : OE- I Lab – (MOOC) Environmental Chemistry Lab**

<b>Laboratory Scheme:</b>		<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week	<b>ISE</b>	<b>25</b>
<b>Total Credits</b>	<b>1</b>	<b>ESE</b>	<b>25</b>

**Prerequisite :** chemistry

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	quantify the pollutant concentration in water
<b>CO2</b>	Carry out water quality analysis
<b>CO3</b>	Explain the principles and significance of water quality parameters such as ph, alkalinity, acidity, turbidity, and conductivity

**Course Contents**

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

**Guidelines:**

- For Open Elective Lab conducted in online mode (MOOC), assessment may be done in line with course undertaken in MOOC.

**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. Civil Engineering****CE3401: Geotechnical Engineering**

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 Civil Engineering and Mechanics**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	Identify type of soils and its various properties
<b>CO2</b>	Determine permeability, compaction and consolidation
<b>CO3</b>	Compute stress distribution, shear strength and earth pressure
<b>CO4</b>	Apply knowledge of geo-environmental and geosynthetics

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Properties of Soil::</b> Introduction to Soil Mechanics, formation of soil & soil structure, three phase soil system, weight volume relationships, detail index properties of soil - methods of determination and its significance, particle size and shape, classification of soils, soil consistency, field identification of soils	<b>CO1</b>	<b>(07)</b>
<b>Unit 2</b>	<b>Permeability and Seepage:</b> Darcy's law, Factors affecting permeability, Determination of permeability by constant head and falling head method as per IS - 2720, field test as per IS – 5529 (part I) - pumping in test and pumping out test. Permeability of layered soils, Seepage forces, General flow equation (Laplace equation). Flow net construction and applications, Concept of effective neutral & total stress in soil mass. Quick sand condition. Uplift pressure, exit gradient, failure due to piping.	<b>CO2</b>	<b>(07)</b>
<b>Unit 3</b>	<b>Compaction and Consolidation:</b> Factors affecting compaction, Dry density and moisture content relationship, Zero air voids line, Effect of compaction on soil structure, Standard Proctor test and Modified Proctor test as per IS – 2720. Field compaction equipment and methods, Field control of compaction, Spring analogy, Terzaghi's theory of one-dimensional consolidation, Determination of coefficient of consolidation-square root of time fitting method and logarithm of time fitting method, Rate of settlement, normally consolidated and over consolidated soils, Determination of pre consolidation pressure.	<b>CO2</b>	<b>(07)</b>
<b>Unit 4</b>	<b>Stress Distribution in Soil &amp; Earth pressure:</b> Boussinesq theory- point load, line load, strip load, pressure distribution diagram on a horizontal and vertical plane, pressure bulb, Westergaard's theory, equivalent point load method, Newmark chart, contact pressure, approximate stress distribution method, earth pressure at rest, active and passive condition. Rankines and Coulomb's theory of earth pressure.	<b>CO3</b>	<b>(06)</b>
<b>Unit 5</b>	<b>Shear Strength:</b> Coulomb's theory and failure envelope, Principle stress, stress analysis (Total stress approach and effective stress approach), representation of stresses on Mohr's circle for cohesive, cohesionless, saturated and partly saturated soil, Application of shear stress parameters in the field Unconsolidated undrained, consolidated undrained and consolidated drained, type of test -box shear test, Triaxial compression test with pore pressure and volume change measurement, unconfined compression test, vane shear test.	<b>CO3</b>	<b>(07)</b>
<b>Unit 6</b>	<b>Introduction to Geo-Environmental Engineering and Geo-synthetics:</b> Scope, Soil-water-contaminant interaction, Waste containment system, Methods of landfill and design of landfills, Advance soil characterization, Limitations of landfills and importance of decentralized solid waste management systems, Introduction to Geosynthetic	<b>CO4</b>	<b>(06)</b>

	techniques and Geotextile.		
<b>Text Books</b>			
1.	A. Singh, "Text Book of Soil Mechanics in Theory and Practice", Bombay, India: Asian Publishing House, 2008.		
2.	V. N. S. Murthy, "Soil Mechanics and Foundation Engineering", New Delhi, India: U. B. S. Publishers and Distributors, 2011		
3.	P. Purushottam Raj, "Geotechnical Engineering", New Delhi, India: Tata McGraw Hill Company Ltd., 2012		
<b>Reference Books</b>			
1.	B. C. Punmia, "Soil Mechanics and Foundations", New Delhi, India: Laxmi Publications (P) Ltd., 2015.		
2.	K. Terzaghi and R. B. Peck, "Soil Mechanics", New York, NY, USA: John Wiley and Sons, 1994.		
3.	K. R. Arora, "Soil Mechanics and Foundation Engineering", Delhi, India: Standard Publishers Distributors, 2011		
4.	B. J. Kasamalkar, "Geotechnical Engineering", Pune, India: Pune Vidyarthi Griha Prakashan, 2010		
<b>Useful Links</b>			
1.	<a href="http://nptel.iitm.ac.in">http://nptel.iitm.ac.in</a> by Prof. B. V. S. Viswanadham and Prof. G. Venkatachalam		

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

### Assessment Pattern (with revised Bloom's Taxonomy)

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

**Government College of Engineering, Karad**

**Second Year (Sem – IV) B. Tech. Civil Engineering**

**CE3402: Concrete Technology**

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

**Prerequisite :** Basics of Civil Engineering

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	Recall and record material composition, properties and IS recommendations.
<b>CO2</b>	Apply knowledge to carry out test on fresh, hardened and ingredients of concrete to interpret results.
<b>CO3</b>	Choose, compare and apply different materials and admixtures as per site conditions.
<b>CO4</b>	Design concrete mix using different standard codes.

Course Contents		CO	Hours
<b>Unit 1</b>	<p><b>Ingredients of Concrete</b></p> <p>a) Cement: Physical properties of cement such as fineness, consistency test, Initial and final setting time, soundness, compressive strength, specific gravity. Hydration of cement, chemical compounds of cement. Grades of cement, Types of cement-Ordinary Portland, Portland pozzolana, Rapid Hardening Portland Cement, Quick setting cement, Sulphur resisting cement, Super sulphated cement, Expansive cement, Rediset cement, High strength cement, High Alumina, Low heat, White, Coloured, Oil well, Hydrophobic cement.</p> <p>b) Aggregates: Physical properties such as sieve analysis and fineness modulus, specific gravity and water absorption, silt content, Bulking of sand, Bulk density, moisture content, Flakiness index, Elongation index. Mechanical properties such as Crushing, Impact and Abrasion value, Alkali –Aggregate reaction, grading of Aggregate, Artificial and recycled aggregate.</p> <p>c) Water: Specifications of water as per IS 456 –2000.</p>	<b>CO1</b>	<b>(09)</b>
<b>Unit 2</b>	<p><b>Fresh Concrete:</b> Batching, Mixing, Transportation, placing of concrete including pumping and compaction techniques for good quality concrete, Workability of concrete and methods of measuring workability, Factors affecting workability, Segregation and bleeding, Curing of concrete, Different methods of curing, Temperature effects on fresh concrete.</p> <p><b>Admixtures:</b> Types of admixtures, Plasticizers and super plasticizers and their effects on workability, Air entraining agents, Retarders, their effects on proportion of concrete, Pozzolanic admixtures, Fly ash, fly ash on fresh concrete, Silica fume, Metalaolim, Ground Granulated Blast Furnace Slag.</p>	<b>CO2, CO3</b>	<b>(08)</b>
<b>Unit 3</b>	<p><b>Hardened Concrete:</b> Strength of concrete, w/c ratio, Gel-space ratio, Effect of maximum size of aggregate, Factors affecting strength of concrete, Characteristic strength - compressive, tensile and flexure strength, Relation between compressive &amp; tensile strength. Modulus of elasticity, Relation between modulus of elasticity &amp; strength, Creep and shrinkage of concrete. Test on hardened concrete – compressive strength test, flexural strength test, split tensile test, comparison of cube test and cylinder test.</p> <p><b>Non Destructive Testing:</b> Schmidt’s rebound hammer –Mechanical &amp; digital, Ultrasonic pulse velocity method, techniques of measuring &amp; factors affecting the measurement of pulse velocity, Corrosion meter, Cover meter and core cutter.</p>	<b>CO2, CO3</b>	<b>(08)</b>
<b>Unit 4</b>	<p><b>Concrete Mix Design:</b> Nominal Mix Concrete, Objectives of mix design, Factors governing mix design, Methods of expressing proportions, statistically quality control. Mix design , ACI 211.1-91 method, IS code method as per 10262 &amp; 456, Mix design of fly ash concrete by using IS 10262 –</p>	<b>CO4</b>	<b>(05)</b>

	2019.		
<b>Unit 5</b>	<b>Special Concrete:</b> Light weight concrete, no-fines concrete, high density concrete, fiber reinforced concrete, self-compacting concrete, high strength concrete, high performance concrete, manufacturing of ready mix concrete, cold weather concreting, hot weather concreting, pavement quality concrete, ultra high strength concrete.	<b>CO3</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Durability Concrete:</b> Strength and durability relationship, effect of w/c on durability, different exposure condition as per IS 456 minimum and maximum cement content, effect of permeability, sulphate attack, methods of controlling sulphate attack. Durability of concrete in sea water	<b>CO3</b>	<b>(05)</b>
<b>Text Books</b>			
1.	M. S. Shetty, "Concrete Technology", New Delhi, India: S. Chand & Company Ltd		
2.	M. L. Gambhir, "Concrete Technology", New Delhi, India: Tata McGraw-Hill Publishing Company Ltd.		
3.	K. T. Krishnaswamy, "Concrete Technology", New Delhi, India: Dhanpat Rai Publication		
<b>Reference Books</b>			
1.	A. M. Neville, "Concrete Technology", New Delhi, India: Pearson Education		
2.	Orchard Asia, "Concrete Technology", New Delhi, India: Orchard Asia Publication		
3.	V. N. Vazirani, "Concrete Technology", New Delhi, India: Khanna Publication		
4.	IS: 456, 2000, Indian Standard Plain and Reinforced Concrete		
5.	IS: 10262, 2019, Recommended guidelines for Concrete Mix Design		
6.	ACI 211.1-91		
<b>Useful Links</b>			
1.	<a href="https://jntuh239529920.files.wordpress.com/2018/08/concrete-technology.pdf">https://jntuh239529920.files.wordpress.com/2018/08/concrete-technology.pdf</a>		
2.	<a href="https://archive.nptel.ac.in/courses/105/102/105102012/NPTEL">https://archive.nptel.ac.in/courses/105/102/105102012/NPTEL</a>		
3.	<a href="https://www.scribd.com/doc/123298248/Concrete-technology-Lecture-notes-Ordinary-Diploma-in-Civil-Engineering">https://www.scribd.com/doc/123298248/Concrete-technology-Lecture-notes-Ordinary-Diploma-in-Civil-Engineering</a>		

### 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
<a href="#">CO1</a>	2	1	1		1								3	3
<a href="#">CO2</a>	3	1	2	3	3					1		1	3	3
<a href="#">CO3</a>	2	2	3	1	1	1					1	2	3	3
<a href="#">CO4</a>	3	2	3	3	1	1				1		1	3	3

### Assessment Pattern (with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
<a href="#">Remember</a>	5	4	20
<a href="#">Understand</a>	5	4	-
<a href="#">Apply</a>	5	4	10
<a href="#">Analyse</a>	-	4	20
<a href="#">Evaluate</a>	5	4	10
<a href="#">Create</a>	-	-	-
<b>TOTAL</b>	<b>20</b>	<b>20</b>	<b>60</b>

**Government College of Engineering, Karad**

**Second Year (Sem –IV) B. Tech. Civil Engineering**

**CE3403: Fluid Mechanics**

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 Knowledge of 11<sup>th</sup> and 12<sup>th</sup> standards Maharashtra State Board.

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	Understand the basic laws, principles and phenomena in the area of fluid mechanics
<b>CO2</b>	Compute values of forces and deformations in the areas of fluids properties, statics, kinematics and dynamics of fluids
<b>CO3</b>	Analyze and design engineering applications involving fluid
<b>CO4</b>	Select suitable method/techniques to solve examples of fluid mechanics

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Basic Concepts:</b> Fluid Properties: Viscosity, Newton law of viscosity, Vapour Pressure Cavitation, Surface Tension, Capillarity, Compressibility. <b>Fluid Statics:</b> Fluid Pressure: Pascal’s law, Pressure variation with temperature, density and altitude. Pressure measurement devices, Hydrostatic pressure and force. Buoyancy, Metacentre, Stability of Submerged and floating bodies.	CO1 CO2	(07)
<b>Unit 2</b>	<b>Fluid Kinematics:</b> Classification of fluid flow: Continuity equations in Cartesian coordinates, Path line, Streak line, Stream line, and Stream tube, Stream function, Velocity potential function and their relationship, Flow net.	CO1 CO2	(07)
<b>Unit 3</b>	<b>Fluid Dynamics:</b> Surface and body forces, Euler’s Equations of motion, Bernoulli’s equation, Energy Principle, Venturimeter, Orifice-meter and Pitot tube, Momentum principle, Vortex Flow-Free and Forced.	CO1 CO2	(07)
<b>Unit 4</b>	<b>Flow through pipes:</b> Loss of head through pipes, Darcy-Wiesbatch equation, Major and Minor losses, Total energy equation, Hydraulic gradient line, Pipes in series, Equivalent pipes, Pipes in parallel, Siphon, Power transmission through pipes, Water hammer.	CO3	(07)
<b>Unit 5</b>	<b>A. Laminar flow:</b> Reynolds’s Experiment, Laminar flow through: circular pipes and parallel plates, Hagen–Poiseuille equation. <b>B. Turbulent flow:</b> Velocity distribution and Shear stresses in turbulent flow, Prandtl mixing length theory, Hydro-dynamically smooth and rough boundary, Nikuradse's Experiment, Moody's Chart.	CO1 CO3 CO4	(06)
<b>Unit 6</b>	<b>Boundary Layer Theory and Flow around Submerged Bodies:</b> Assumption and concept of boundary layer theory. Boundary layer thickness, Laminar and Turbulent boundary layers on a flat plate; Laminar sub-layer, Smooth and Rough boundaries, Separation and it’s control, Stokes law, Concept of Drag and Lift.	CO1 CO4	(06)

**Text Books**

1.	K. Subramanya, “Theory and Applications of Fluid Mechanics”, Tata McGraw-Hill
2.	Modi, P. N., and S. M. Seth, “Fluid Mechanics - Hydraulic & Hydraulic Machines”, Delhi: Standard Book House, 2010
3.	R. L. Daugherty, J. B. Franzini, and E. J. Finnemore, "Fluid Mechanics with Engineering Applications", International Student Edition, McGraw-Hill
4.	S. Nagrathnam, "Fluid Mechanics", Delhi: Khanna Publishers, 2012

5.	H. Rouse, "Elementary Fluid Mechanics", Tokyo: Toppan Co. Ltd., 2010
6.	Garde-Mirajgaonkar, "Fluid Mechanics", Roorkee: Nemchand & Bros., 2004
7.	I. H. Shames, "Fluid Mechanics", Auckland: McGraw-Hill International Book Co., 2009
8.	S. Ramamrutham, "Fluid Mechanics", New Delhi: Dhanpat Rai & Sons, 2009
9.	Dr. R. K. Bansal, "Fluid Mechanics and Hydraulic Machines", New Delhi: Laxmi Publications, 2013
<b>Reference Books</b>	
1.	C. S. P. Ojha, R. Berndtsson, and P. N. Chadramouli, " <i>Fluid Mechanics and Machinery</i> ", Oxford University Press, 2010
2.	Streeter, V. L., and E. B. Wylie, " <i>Fluid Mechanics</i> ", Auckland: McGraw-Hill International Book Co., 2000
3.	John F. Douglas et al., " <i>Fluid Mechanics</i> ", Delhi: Pearson Education Co., International Edition, 2002
4.	Fox, R. W., A. T. McDonald, and P. J. Pritchard, " <i>Fluid Mechanics (SI Version)</i> ", New Delhi, India: Wiley India Pvt. Ltd., 2015
5.	Munson, B. R., T. H. Okiishi, W. W. Huebsch, and A. J. Rothmayer, " <i>Fluid Mechanics (SI Version)</i> ", New Delhi, India: Wiley India Pvt. Ltd., 2015
<b>Useful Links</b>	
1.	<a href="https://onlinecourses.nptel.ac.in/noc24_ce20/preview">https://onlinecourses.nptel.ac.in/noc24_ce20/preview</a> Hydraulic Engineering by Prof. Mohammad Saud Afzal IIT Kharagpur
2.	<a href="https://archive.nptel.ac.in/courses/105/103/105103192/">https://archive.nptel.ac.in/courses/105/103/105103192/</a> Fluid Mechanics by Dr. Subhashisa Dutta IIT Guwahati
3.	<a href="https://archive.nptel.ac.in/courses/105/101/105101082/">https://archive.nptel.ac.in/courses/105/101/105101082/</a> Fluid Mechanics by Dr. T.I. Eldho IIT Mumbai

### 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	0	2	2	0	0	0	0	0	0	0	1	1
CO 2	3	2	3	3	3	3	1	1	1	2	0	0	1	1
CO 3	3	2	2	2	3	2	0	0	1	2	1	1	1	1
CO 4	3	3	3	2	1	3	3	0	0	2	1	1	1	1

### Assessment Pattern (with revised Bloom's Taxonomy)

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

**Government College of Engineering, Karad**

**Second Year (Sem – IV) B. Tech. Civil Engineering**

**CE-3404: MDM 02-Building Materials**

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 :** Knowledge of identifying building materials.

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	Understand the properties of construction materials.
<b>CO2</b>	Understand the specific use of construction materials.
<b>CO3</b>	Apply the knowledge for selection of materials on field.

	Course Contents	CO	Hours
<b>Unit 1</b>	<b>Stones:-</b> History of stones as a construction material, Quarrying of stones (method only), Properties and uses of principle building stone, Requirement of good building stones, Types of building stones.	<b>CO1, CO2, CO3</b>	<b>(05)</b>
<b>Unit 2</b>	<b>Bricks:-</b> History of bricks as a construction material, Composition of clay bricks, Manufacturing of bricks, Types of bricks, Classification of burnt clay bricks, Flyash bricks, Field tests for good brick, Aerated cement concrete bricks.	<b>CO1, CO2, CO3</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Timber:-</b> Structure of a timber tree, Properties of good timber, Defects of timber, Decay of timber, Seasoning of timber, Preservation of timber.	<b>CO1, CO2, CO3</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Cement and Mortar:-</b> Functions of mortar, Properties of an ideal mortar, <b>Cement:-</b> Functions of cement ingredients, Composition of Portland cement, Types of cements.	<b>CO1, CO2, CO3</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Aggregates and Tiles:-</b> Properties of fine aggregates and coarse aggregates, Sand, artificial sand, Uses of sand. <b>Tiles:-</b> Properties of tiles, Use of tiles, Pavement blocks and their uses, Types of tiles.	<b>CO1, CO2, CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Miscellaneous Materials:-</b> Glass and its properties, Types of glass and uses, <b>Plastics:-</b> Properties of plastics and its uses, Use of aluminium in construction, Paints and its types.	<b>CO1, CO2, CO3</b>	<b>(05)</b>

Text Books	
1.	S. P. Arora and S. P. Bindra, "A Text-Book of Building Construction", Dhanpat Rai Publication, ISBN 978-8189928803
2.	S. K. Duggal, "Building Materials", New Age Publishers, ISBN: 978-9387788398

Reference Books	
1.	S. K. Sharma, "Civil Engineering Construction Materials", Khanna Book Publishing Co. Ltd., ISBN: 9789382609841.

Useful Links	
1.	<a href="https://youtube.com/playlist?list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT">https://youtube.com/playlist?list=PLyqSpQzTE6M_RfjEQMK7_L-UvxAMhplUT</a>
2.	<a href="https://youtube.com/playlist?list=PL8BA090E69BF01BC2">https://youtube.com/playlist?list=PL8BA090E69BF01BC2</a>
3.	<a href="https://youtube.com/playlist?list=PLk7ptZcI9vmhBh7evUtxAbHe3Ojs_099H">https://youtube.com/playlist?list=PLk7ptZcI9vmhBh7evUtxAbHe3Ojs_099H</a>

### 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	1	2	1	2
CO 2	-	-	-	-	2	3	3	3	2	2	2	2	1	1
CO 3	3	-	-	2	3	3	2	3	2	2	3	2	2	2

### Assessment Pattern (with revised Bloom's Taxonomy)

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

<b>Government College of Engineering, Karad</b>			
<b>Second Year (Sem –IV) B. Tech Civil Engineering</b>			
<b>CE 3415 : (OE- II) Project Management</b>			
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Lectures	02Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	02	ESE	60
		<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>
<b>Prerequisite :</b> Basic Civil Engineering			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Describe fundamentals of projects.		
<b>CO2</b>	Recognize the roles of project team including project manager.		
<b>CO3</b>	State the finance of project.		
<b>CO4</b>	Practice the Project monitoring.		
	<b>Course Contents</b>		<b>CO</b>
<b>Unit 1</b>	<b>Introduction to Management:</b> Concepts and definitions of projects, Objectives of Management, Life cycle of projects, Project formulation, Necessity of Project management.		<b>CO1</b>
<b>Unit 2</b>	<b>Project Controlling:</b> Project stakeholders, Site mobilization, planning for achieving time, cost, quality, safety requirements of projects, Work break down structure		<b>CO1</b>
<b>Unit 3</b>	<b>Project Organisation:</b> Roles and responsibilities of project manager, Project team, Project planning, Project selection methods, Multidisciplinary teams		<b>CO2,</b>
<b>Unit 4</b>	<b>Departments in Project:</b> Execution Department, Billing Dept., Planning Dept. Tendering Dept. Quality Control Dept.		<b>(04)</b>
<b>Unit 5</b>	<b>Project Finance:</b> Direct and Indirect cost ,Capital budgeting, Cost estimating, Budget uncertainty,		<b>CO3</b>
<b>Unit 6</b>	<b>Project Monitoring :</b> Data collection and reporting, Earned value concept, Project control and project management information systems, Monitoring and Control of construction project		<b>(04)</b>
			<b>(05)</b>
<b>Text Books</b>			
<b>1.</b>	Meredith Jack R. et.al. Project Management, Wiley India Edition, 2016		
<b>2.</b>	Grey Clifford et al, “Project Management”, 2010 Edition, Tata McGraw Hill Inc., New Delhi.		
<b>Reference Books</b>			
<b>1.</b>	Meredith Jack et al., “Project Management”, 2017 Wiley.		
<b>2.</b>	Mantel Samual et al , Project Management, Wiley India		
<b>3.</b>	Choudhury S., “Project Management”, Tata McGraw Hill Publishing Company Ltd. 2014		
<b>Useful Links</b>			
<b>1.</b>	<a href="https://nptel.ac.in/courses/110/104/110104073">https://nptel.ac.in/courses/110/104/110104073</a> Prof. Raghunandan Sengupta, IIT Kanpur		
<b>2.</b>	<a href="https://nptel.ac.in/courses/110/107/110107081">https://nptel.ac.in/courses/110/107/110107081</a> Prof. Mukesh Kumar Barua., IIT Roorkee		

**Government College of Engineering, Karad**

**Second Year (Sem – IV) B. Tech. Civil Engineering**

**CE3425: OE- II – (MOOC) Project Management**

Teaching Scheme		Examination Scheme	
Lectures	-	MSE	-
Tutorials	-	ISE	-
Total Credits	03	ESE	100

**Course Outcomes (CO):** Students will be able to

<b>CO1</b>	Describe fundamentals of projects.
<b>CO2</b>	Recognize the roles of project team including project manager.
<b>CO3</b>	State the finance of project.
<b>CO4</b>	Practice the Project monitoring.

**Course Contents**

Students should complete the MOOC course certification in the domain of Project Management 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 8Weeks.
- 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 Civil 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									

Faculty Name and Sign.

Head of the Department

### 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	2	0	1	1	1	1	2
CO 2	-	-	2	-	2	1	2	-	3	3	-	2	1	-
CO 3	2	3	-	-	-	-	1	2	-	2	3	-	-	2
CO 4	3	-	-	3	2	1	-	3	3	-	3	3	2	-

### Assessment Pattern(with revised Bloom's Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	5	09
Understand	5	5	18
Apply	5	5	18
Analyse	5	5	15
Evaluate	-	-	-
Create	-	-	-
TOTAL	20	20	60

**Government College of Engineering, Karad****Second Year (Sem – IV) B. Tech. Civil Engineering****CE3406 : 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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>The Tools of Strategic Analysis:</b> Strategy and the Strategic Management Process, What Is Competitive Advantage, The Strategic Management Process, Measuring Competitive Advantage, Emergent Versus Intended Strategies.	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Evaluating a Firm's External Environment:</b> Understanding a Firm's General Environment, The Structure-Conduct-Performance Model of Firm, Performance, A Model of Environmental Threats. Industry Structure and Environmental Opportunities.	<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Evaluating a Firm's Internal Capabilities:</b> 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.	<b>CO2</b>	<b>(05)</b>
<b>Unit 4</b>	<b>Cost Leadership:</b> Business-Level Strategy, Cost Leadership, The Value of Cost Leadership, Cost Leadership and Sustained Competitive Advantage , Organizing to Implement Cost Leadership.	<b>CO3</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Product Differentiation:</b> Product Differentiation, The Value of Product Differentiation, product differentiation and Sustained Competitive Advantage, Organizing to Implement Product Differentiation.	<b>CO3</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Vertical integration &amp; Corporate diversification:</b> Corporate Strategy, Vertical Integration, Vertical Integration and Sustained Competitive Advantage, Organizing to Implement Vertical Integration, Corporate Diversification, Organizational Structure and Implementing Corporate, Diversification, ( <b>Self Study:</b> Management Controls and Implementing Corporate).	<b>CO4</b>	<b>(06)</b>

**Text Books**

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

**Reference Books**

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

**Useful Links**

<b>1.</b>	<a href="https://onlinecourses.nptel.ac.in/noc22_mg88/preview">https://onlinecourses.nptel.ac.in/noc22_mg88/preview</a> Prof. Sanjib Chowdhury, IIT Kharagpur
<b>2.</b>	<a href="https://archive.nptel.ac.in/courses/110/108/110108047/">https://archive.nptel.ac.in/courses/110/108/110108047/</a> Prof. R. Shrinivasan, IISc, Bangalore

## 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	-

<b>Government College of Engineering, Karad</b>				
<b>Second Year (Sem – IV) B. Tech. Civil Engineering</b>				
<b>CE3407 : Professional Ethics</b>				
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		
Lectures	02 Hrs/week	MSE	-	
Tutorials	00 Hrs/week	ISE	25	
Total Credits	02	ESE	-	
<b>Prerequisite :</b>				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Apply analytical techniques to enhance Self-awareness of personality types.			
<b>CO2</b>	Utilize ethical decision-making principles to negative complex dilemmas.			
<b>CO3</b>	Implement professional work ethics to achieve excellence in practice.			
<b>CO4</b>	Analyse positive interpersonal skills through effective collaboration strategies.			
<b>Course Contents</b>			<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Developing self-knowledge:</b> Know Yourself, Profiles and Types, personality, Applying Your Knowledge of Personality, Applying Your Knowledge of Learning Styles, Introverts and Extroverts		<b>CO1</b>	<b>(03)</b>
<b>Unit 2</b>	<b>Recognize your values and ethics:</b> 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 resopocibility.		<b>CO2</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Achieving professional excellence:</b> Establishing a Work Ethic, Unselfish Excellence, Professional Etiquette, Professional Attitude, Professional Privacy, Professional Honesty		<b>CO3</b>	<b>(05)</b>
<b>Unit 4</b>	<b>Approach situations with an enthusiastic and genuinely:</b> 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. ( <b>Self Study:</b> The Benefits of Mentoring)		<b>CO4</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Improve your time-management, and goal setting, skills:</b> The Tyranny of the Urgent, Setting Personal Goals, short term goals, long term goals, Schedule the Plan, Avoid Procrastination, Memory Skills		<b>CO1</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Maintain balance to succeed in the workplace</b> Unreasonable Expectations, The Power of Working Hard, Roll with the Punches, Admit Your Mistakes, Sense of Humor.		<b>CO2</b>	<b>(05)</b>
<b>Text Books</b>				
<b>1.</b>	David Strelecky, Ferguson, “Professional Ethics and Etiquette”, 2 <sup>nd</sup> Edition, An imprint of Facts On File, Inc (Unit: 1,2,3,4,5,6)			
<b>2</b>	R. Subramanian, “Professional Ethics”, Oxford University Press, 2015.			
<b>3</b>	Caroline Whitbeck, “Ethics in Engineering Practice & Research”, 2 <sup>nd</sup> Edition, Cambridge University Press 2015.			
<b>Reference Books</b>				
<b>1.</b>	Charles E Harris Jr., Michael S Pritchard, Michael J Rabins “Engineering Ethics, Concepts Cases”, 4 <sup>th</sup> edition, Cengage learning, 2015.			
<b>2.</b>	Charles B. Fleddermann, “Engineering Ethics”, Pearson Prentice Hall, New Jersey, 2004.			
<b>3.</b>	John R Boatright, “Ethics and the Conduct of Business”, Pearson Education, New Delhi, 2003			
<b>4.</b>	Edmund G Seebauer and Robert L Barry, “Fundamentals of Ethics for Scientists and Engineers”, Oxford University Press, Oxford, 2001.			
<b>5</b>	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.			
<b>6</b>	Erode, “World Community Service Centre Value Education”, Vethathiri publications, 2011			
<b>Useful Links</b>				
<b>1.</b>	<a href="https://onlinecourses.nptel.ac.in/noc22_mg54/previewProf.SusmitaMukhopadhyay,IITKharagpur">https://onlinecourses.nptel.ac.in/noc22_mg54/previewProf.SusmitaMukhopadhyay,IITKharagpur</a>			
<b>2.</b>	<a href="https://archive.nptel.ac.in/courses/109/106/109106117/Prof.ShrikumarMellickapli,IITMadras">https://archive.nptel.ac.in/courses/109/106/109106117/Prof.ShrikumarMellickapli,IITMadras</a>			

## 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	-



<b>Government College of Engineering, Karad</b>				
<b>Second Year (Sem – IV) B. Tech. Civil Engineering</b>				
<b>CE3409: Concrete Technology lab</b>				
<b>Laboratory Scheme:</b>			<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week		<b>ISE</b>	<b>25</b>
<b>Total Credits</b>	<b>1</b>		<b>ESE</b>	<b>25</b>
<b>Prerequisite :</b> Concrete Technology				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Demonstrate tests on ingredients of concrete and interpret results.			
<b>CO2</b>	Experiment with fresh concrete and admixture			
<b>CO3</b>	Analyse destructive and NDT on hardened concrete.			
<b>CO4</b>	Design concrete mix as per the various guidelines.			
<b>Course Contents</b>				<b>CO</b>
<b>Experiment 1</b>	<b>Testing of cement:</b> Consistency, fineness, setting time, Specific Gravity, Soundness and strength.			<b>CO1</b>
<b>Experiment 2</b>	<b>Testing of fine aggregate:</b> Specific Gravity, sieve analysis and zoning, bulking of fine aggregate, bulk density, silt content.			<b>CO1</b>
<b>Experiment 3</b>	<b>Testing of coarse aggregate:</b> Specific Gravity, sieve analysis, bulk density, flakiness index, elongation index, water absorption & moisture content,			<b>CO1</b>
<b>Experiment 4</b>	<b>Concrete Mix design</b> by ACI 211.1-91 method, IS code method as per 10262-2009 & 456-2000			<b>CO4</b>
<b>Experiment 5</b>	<b>Tests on Fresh Concrete:</b> Workability tests –Slump cone test, compaction factor test, Vee-bee consistometer test.			<b>CO2</b>
<b>Experiment 6</b>	<b>Tests on Hardened Concrete:</b> compressive strength, flexural strength, split tensile strength.			<b>CO3</b>
<b>Experiment 7</b>	<b>Effects of Admixture:</b> Accelerator, Retarder, Plasticizer & Super Plasticizer.			<b>CO2</b>
<b>Experiment 8</b>	<b>Non-destructive Testing:</b> Rebound Hammer test, Ultrasonic Pulse Velocity test, Cover meter.			<b>CO3</b>
<b>Experiment 9</b>	Examining concrete permeability through testing			<b>CO2</b>
<b>List of Submission:</b>				
<b>1.</b>	Minimum number of Experiments : 08			

### Mapping of COs and POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	3	1	2	2			2		1		2	3	3
CO2	2	3	1	2	2			2		1		2	3	3
CO3	2	3	1	3	3			1		1		2	3	3
CO4	2	3	2	1				1		1		2	3	3

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)



**Government College of Engineering, Karad**

**Second Year (Sem – IV) B. Tech. Civil Engineering**

**CE3410 : Community Engagement Project**

<b>Laboratory Scheme:</b>		<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week	<b>ISE</b>	<b>25</b>
<b>Total Credits</b>	<b>1</b>	<b>ESE</b>	<b>25</b>
<b>Prerequisite :</b> chemistry			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Identify the community/social problem.		
<b>CO2</b>	Design engineering solutions to solve societal problems.		
<b>CO3</b>	Evaluate and analyze impact of a project that focuses on community issues.		
<b>CO4</b>	Communicate and demonstrate the project.		
<b>Course Contents</b>			
The course outlines the benefits of community engagement through research and innovation. Students will understand the various problems of 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. 2. Modeling 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. The model should also involve the criteria by which they will quantify and test its performance. 3. Implementation tools- Numerous available methods could be put to use in implementing and testing the described model. 4. Demonstration and Presentation- A demonstration to this end where applicable or a presentation in case of theoretical contributions should clearly describe the work. General instructions: <ul style="list-style-type: none"><li>• <b>Each group comprised of 2 - 4 students.</b></li><li>• <b>Project should be based on community problem.</b></li><li>• <b>Evaluation will be based on presentations, written report and developed system.</b></li></ul> <input type="checkbox"/> Note:-One supervisor from the department shall be assigned five project groups.			

<b>Government College of Engineering, Karad</b>			
<b>Second Year (Sem – IV) B. Tech. Civil Engineering</b>			
<b>CE3411:Environmental Science</b>			
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Lectures	02 Hrs/week	MSE	--
Tutorials	00 Hrs/week	ISE	--
Total Credits	Audit Course	ESE	--
<b>Prerequisite :</b> Universal Human Values			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Understand environmental principals which in turn help in sustainable development.		
<b>CO2</b>	Develop technologies on the basis of ecological principles.		
<b>CO3</b>	Evaluate environmental impacts of human activities on ecosystems and on the environment.		
<b>CO4</b>	Apply interdisciplinary knowledge in environmental science.		
<b>Course Contents</b>			<b>CO</b>
<b>Hours</b>			<b>Hours</b>
<b>Unit 1</b>	<b>Introduction:</b> 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)	<b>CO1</b>	<b>(03)</b>
<b>Unit 2</b>	<b>Natural Resources:</b> 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. ( <b>Self Study:</b> renewable and non-renewable energy sources, use of alternate energy source, case studies)	<b>CO3</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Biodiversity and Biotic Resources:</b> 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. <b>Ecosystems:</b> 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.	<b>CO4</b> <b>CO2</b>	<b>(05)</b>
<b>Unit 4</b>	<b>Environmental Pollution and Control Technologies:</b> 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.)	<b>CO4</b> <b>CO2</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Global Environmental Issues and Global Efforts:</b> 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)	<b>CO1</b>	<b>(03)</b>
<b>Unit 6</b>	<b>Environmental Policy, Legislation &amp; EIA:</b> Introduction to Environmental Protection act, Air Act1981, Water Act, Forest Act, 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	<b>CO4</b> <b>CO3</b>	<b>(05)</b>

	Future: Concept of Sustainability and sustainable Development. Environmental Ethics, Concept of Green Building,		
<b>General Instruction:</b>			
Course coordinator will decide the suitable assessment method for internal evaluation of 50 marks and award Pass or Fail grade for the course completion.			
<b>Text Books</b>			
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.		
<b>Reference Books</b>			
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.		
<b>Useful Links</b>			
1.	<a href="https://www.unishivaji.ac.in/uploads/syllabus/2022/syllabus/common/Environmentat%20English%20Book%201-3-2022%20Final%20Corrected%20copy_compressed.pdf">https://www.unishivaji.ac.in/uploads/syllabus/2022/syllabus/common/Environmentat%20English%20Book%201-3-2022%20Final%20Corrected%20copy_compressed.pdf</a>		

### 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)

<b>Government College of Engineering, Karad</b>				
<b>Second Year (Sem – IV) B. Tech. Civil Engineering</b>				
<b>CE3412: Fluid Mechanics Lab</b>				
<b>Laboratory Scheme:</b>			<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week		<b>ISE</b>	25
<b>Total Credits</b>	1		<b>ESE</b>	25
<b>Prerequisite :</b>				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Demonstrate measurement of fluid pressure in pipe flow and in open channel flow			
<b>CO2</b>	Demonstrate an ability to measure discharge and losses in pipe flow			
<b>CO3</b>	Demonstrate an ability to verify stability of floating body and Bernoulli's Theorem			
<b>CO4</b>	Demonstrate an ability to determine flow parameters in open channel flow			
<b>Course Contents</b>				<b>CO</b>
<b>Experiment 1</b>	Measurement of Discharge- 1.Direct Method and 2.Indirect Method			<b>CO2</b>
<b>Experiment 2</b>	Determination of metacentric height of Floating Body			<b>CO3</b>
<b>Experiment 3</b>	Verification of Bernoulli's Theorem			<b>CO3</b>
<b>Experiment 4</b>	Determination of coefficient of discharge of Venturimeter			<b>CO1</b>
<b>Experiment 5</b>	Determination of coefficient of discharge of orifice meter/ orifice			<b>CO1</b>
<b>Experiment 6</b>	Measurement of discharge using mouthpiece			<b>CO2</b>
<b>Experiment 7</b>	Study of factors affecting coefficient of friction for pipe flow (at least for two different materials and two different diameters)			<b>CO2</b>
<b>Experiment 8</b>	Determination of loss of head due to i) Sudden expansion, ii) contraction iii) elbow iv)bend v) Globe Valve etc. (At least Two minor losses)			<b>CO2</b>
<b>Experiment 9</b>	Determination of Chezy's and Manning's constants			<b>CO4</b>
<b>Experiment 10</b>	Calibration of notches and Weirs			<b>CO4</b>
<b>Experiment 11</b>	Study of Impact of jet			<b>CO1</b>
<b>Experiment 12</b>	Visualization of Laminar and Turbulent flow using Reynold's Apparatus and determination its sample value			<b>CO2</b>
<b>List of Submission:</b>				
<b>1.</b>	Minimum number of Experiments : 08			

### Mapping of COs and POs

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO1	2	2	-	2	2	-	1	-	-	-	-	-	1	1
CO2	2	2	-	2	2	-	1	-	-	-	-	-	1	1
CO3	2	1	-	2	2	-	1	-	-	-	-	-	1	1
CO4	-	1	-	2	2	-	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	
Task II	05	05	05	05	05	05	05	05	05	05	
Task III	05	05	05	05	05	05	05	05	05	05	
ISE	25	25	25	25	25	25	25	25	25	25	

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## 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	
<b>Prerequisite:</b> Basics of Electrical and Electronics.				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Explain the fundamental concepts, principals and configuration of electric and hybrid electric vehicles.			
<b>CO2</b>	Identify the various electrical and electronics components for advanced EV.			
<b>CO3</b>	Discuss hybridization of automobile.			
<b>CO4</b>	Illustrate the electric drive-trains characteristics.			
Course Contents			CO	Hours
<b>Unit 1</b>	<b>Introduction to EV:</b> <ul style="list-style-type: none"> <li>Current demand in EV industry and opportunities of skilled EV engineers,</li> <li>History and evolution of electric vehicles,</li> <li>Components of an electric vehicle.</li> </ul>		<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Electrical Engineering for EV:</b> <ul style="list-style-type: none"> <li>EV classification and their electrification levels</li> <li>Battery technology,</li> <li>Motor and controller systems,</li> <li>EV numerical calculation</li> <li>EV charging infrastructure.</li> </ul>		<b>CO1</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Advanced Electric Vehicles:</b> <ul style="list-style-type: none"> <li>Electrical Requirement,</li> <li>Power Distribution Specifications,</li> <li>Electronic Component System,</li> <li>EV Standard Specifications</li> <li>Selection of Electrical and Electronic Components.</li> </ul>		<b>CO2</b>	<b>(05)</b>
<b>Unit 4</b>	<b>Hybridization of the Automobile:</b> <ul style="list-style-type: none"> <li>Challenges and Key Technology of HEVs.</li> <li>Basics of Hybrid Electric Vehicle (HEV)</li> <li>Basics of Plug-in Hybrid Electric Vehicles(PHEV)</li> <li>Basics of Fuel Cell Vehicles (FCVs).</li> <li>Vehicle to Grid technology</li> </ul>		<b>CO3</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Hybrid Electric Vehicles :</b> <ul style="list-style-type: none"> <li>HEVs Fundamentals,</li> <li>Vehicle performance,</li> <li>Configuration of HEV (Series, Parallel, Series-parallel &amp;Complex),</li> <li>Power Flow control, Examples</li> <li>Operation of HEVs</li> </ul>		<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Hybrid Electric Drive-trains:</b> <ul style="list-style-type: none"> <li>Basic concept of hybrid traction,</li> <li>introduction to various hybrid drive-train topologies,</li> <li>power flow control in hybrid drive-train topologies,</li> <li>fuel efficiency analysis.</li> </ul> <b>Electric Drive-trains:</b> <ul style="list-style-type: none"> <li>Basic concept of electric traction,</li> <li>introduction to various electric drive-train topologies,</li> </ul>		<b>CO4</b>	<b>(04)</b>

	<ul style="list-style-type: none"> <li>power flow control in electric drive-train topologies,</li> <li>Fuel efficiency analysis.</li> </ul>		
<b>Text Books</b>			
1.	Electric And Hybrid Electric Vehicles Braking Systems & NVH considerations, Author Jurgen R.K., Publisher - Sae International		
<b>Reference Books</b>			
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		
<b>Useful Links</b>			
1.	<a href="https://archive.nptel.ac.in/courses/108/102/108102121/">https://archive.nptel.ac.in/courses/108/102/108102121/</a> Prof. Amit Jain IIT Delhi.		
2.	<a href="https://nptel.ac.in/courses/108/103/108103009/">https://nptel.ac.in/courses/108/103/108103009/</a> 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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Batteries:</b> Overview of Batteries ,Battery Parameters, Lead acid batteries ,Lithium ion batteries, Metal air batteries, Battery Charging, Thermal runaway battery management system (BMS), Functionality, SOC/SOH estimation.	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Energy Storage Systems for EV:</b> 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	<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Energy Storage and its analysis:</b> 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	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Battery Pack Design and Modeling</b> 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	<b>CO1</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Electric Propulsion unit:</b> 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	<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Electric Vehicle Powertrain:</b> 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	<b>CO4</b>	<b>(06)</b>

**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.	<a href="https://nptel.ac.in/courses/108106170">https://nptel.ac.in/courses/108106170</a> Prof. Ashok Jhunjhunwala , IIT Madras.
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2. [https://onlinecourses.swayam2.ac.in/ntr24\\_ed16/preview](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

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

**Course Contents**

	CO	Hours
<b>Unit 1</b> <b>Electric Machines and Drives in HEVs :</b> 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. <b>(only functional treatment to be given) .</b>	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b> <b>Power Electronics in HEVs:</b> 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.	<b>CO1</b>	<b>(05)</b>
<b>Unit 3</b> <b>Power Converter:</b> 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	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b> <b>Introduction to Embedded System:</b> Microcontrollers and microprocessors in EVs, Basics of Embedded System, Embedded C/C++ programming, Idea about Linux, Linux in Embedded System.	<b>CO3</b>	<b>(04)</b>
<b>Unit 5</b> <b>Sensor Characteristics and communication Protocols:</b> Sensor Principal Characteristics, Sensor-Actuator Integration System. Basic introduction to communication protocols CAN bus, LIN, FlexRay.	<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b> <b>Configuration of Embedded System:</b> Building of Linux-Embedded System, Application in Embedded Devices, Real-Time Operating Systems (RTOS), RTOS concepts and usage in EVs, Scheduling and task management	<b>CO4</b>	<b>(05)</b>

**Handbooks**

1.	Nicolas Navet, Francois Simonot-Lion, “Automotive Embedded Systems Handbook”, CRC Press Taylor&Francis 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.	<a href="https://nptel.ac.in/courses/108/101/108101038/Prof. B. G. Fernandes">https://nptel.ac.in/courses/108/101/108101038/Prof. B. G. Fernandes</a>
2.	<a href="https://nptel.ac.in/courses/108/102/108102145/">https://nptel.ac.in/courses/108/102/108102145/</a> Prof. G. Bhuvaneshwari
3.	<a href="https://d1.amobbs.com/bbs_upload782111/files_38/ourdev_629261ASTZIF.pdf">https://d1.amobbs.com/bbs_upload782111/files_38/ourdev_629261ASTZIF.pdf</a>

### Mapping of COs and POs

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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 – 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

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

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

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

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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

<b>Government College of Engineering, Karad</b>			
<b>Final Year (Sem – VII) MDM-Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)</b>			
<b>IMI3716: EV Vehicle Design, Analysis and Control</b>			
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Lectures	02 Hrs/week	MSE	20
Tutorials	00 Hrs/week	ISE	20
Total Credits	02	ESE	60
		<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>
<b>Prerequisite :</b> Semiconductor Devices Knowledge			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Apply the power electronics technique to diagnostics fault		
<b>CO2</b>	Explore the knowledge about analog and digital electronics		
<b>CO3</b>	Develop the EV architecture with the help of design and simulation parameters.		
<b>CO4</b>	Design and modelling the different EV units.		
	<b>Course Contents</b>		<b>CO</b>
			<b>Hours</b>
<b>Unit 1</b>	<b>Analog Electronics:</b> Sensors for EV Applications (Temperature, Pressure, Current, Voltage) Signal Conditioning Circuits (Amplifiers, Filters) Interface Circuits (Analog-to-Digital Converters)		<b>CO2</b>
			<b>(04)</b>
<b>Unit 2</b>	<b>Power Electronics:</b> Pulse Width Modulation (PWM) Techniques Current and Voltage Regulation Over current and Overvoltage Protection Fault Detection and Diagnostics.		<b>CO1</b>
			<b>(04)</b>
<b>Unit 3</b>	<b>Digital Electronics:</b> Analog-to-Digital Conversion (ADC) Sensor Types and Characteristics (Temperature, Pressure, Acceleration, etc.) Signal Conditioning Circuits Filtering and Noise Reduction Techniques		<b>CO2</b>
			<b>(04)</b>
<b>Unit 4</b>	<b>Automotive Components:</b> Power Semiconductors, Trends in Power semiconductors, Bidirectional Converters, Inverters, Interleaving mode in power converters, Passive Components		<b>CO3</b>
			<b>(04)</b>
<b>Unit 5</b>	<b>EV Architecture:</b> Motor development and induction motor characteristics, Simulink model to calculate vehicle configuration, Multilevel inverter design and simulation, DC –DC converter, Motor controllers		<b>CO3</b>
			<b>(05)</b>
<b>Unit 6</b>	<b>Modelling and Simulation of Electric Vehicles:</b> 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		<b>CO4</b>
			<b>(06)</b>
<b>Handbooks</b>			
<b>1.</b>	K. T. Chau ,”Electric Vehicle Machines and Drives: Design, Analysis and Application”,Wiley-IEEE Press, ISBN: 978-1-118-75252-4, August 2015.		
<b>2.</b>	Per Enge ,Nick Enge, Stephen Zoepf, “Electric Vehicle Engineering”, 1st Edition, McGraw Hill publication 2021		
<b>3.</b>	Nicolas Navet, Francois Simonot-Lion, “Automotive Embedded Systems Handbook”, CRC Press Taylor&Francis group, 2009.		
<b>Reference Books</b>			
<b>1.</b>	M. S. Tyagi, Introduction to Semiconductor Materials and Devices, John Wiley & Sons Inc.		
<b>2.</b>	Michael Shur, Introduction to Electronic Devices, John Wiley & Sons Inc., 2000.		
<b>3.</b>	R. T. Howe and C. G. Sodini, Microelectronics: An Integrated Approach, PrenticeHall Inc. 1997.		
<b>4.</b>	Jacob Millman, and C.C. Halkias, “Electronic devices and circuits”, TMH Publications		
<b>5.</b>	Ben G. Streetman, Solid State Electronic Devices, PHI, 5th Ed, 2001		
<b>Useful Links</b>			
<b>1.</b>	<a href="http://web.iitd.ac.in/~shouri/ee201/lectures.php">http://web.iitd.ac.in/~shouri/ee201/lectures.php</a>		
<b>2.</b>	<a href="http://www.daenotes.com/electronics/digital-electronics">http://www.daenotes.com/electronics/digital-electronics</a>		
<b>3.</b>	<a href="https://onlinecourses.nptel.ac.in/noc24_ee30/preview">https://onlinecourses.nptel.ac.in/noc24_ee30/preview</a> Prof. Amit Jain IIT Delhi.		
<b>4.</b>	<a href="https://onlinecourses.nptel.ac.in/noc22_ee53/preview">https://onlinecourses.nptel.ac.in/noc22_ee53/preview</a> Prof. Amit Jain IIT Delhi		

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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

<b>Government College of Engineering, Karad</b>					
<b>Final Year (Sem – VIII) MDM-Electrical Vehicle (Electrical Engineering- Institute Level-Industrial)</b>					
<b>IMI3817: EV PCB Design &amp; Data Analytics</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>			
Lectures	02 Hrs/week	MSE	20		
Tutorials	00 Hrs/week	ISE	20		
Total Credits	02	ESE	60		
		<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>		
<b>Prerequisite :</b> Basics of Analog and Digital Electronics					
<b>Course Outcomes (CO):</b> Students will be able to					
<b>CO1</b>	Discuss the basics of PCB Design and its components.				
<b>CO2</b>	Organize and execute hierarchical schematics of EV				
<b>CO3</b>	Explore ideas about data visualization.				
<b>CO4</b>	Analyze data for electric and autonomous vehicles.				
<b>Course Contents</b>				<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Basics of PCB Design:</b> Overview, Basic Ideas, Different Technologies, Understanding Schematic Capture.			<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Component Working:</b> Symbol and Nets, Creating Hierarchical Schematic, Multi Sheet Design, Generating Netlist and Bill of Material.			<b>CO2</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Design Applications :</b> Design for Analog and Digital Circuits, Design for Power Electronics, Design for Microwave circuits.			<b>CO1</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Data Analytics:</b> Introduction, Data Collection, Preprocessing, Data Collection Techniques in Electric Vehicle.			<b>CO4</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Data Visualization:</b> Introduction to Data Visualization Technique, Data Exploration, Data Exploration for EV.			<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Overview and Application of Data Analysis:</b> Overview of Data Analysis Techniques, Regression Analysis, Clustering, Application in EV Electrical System, Data Analysis Platform for EV System.			<b>CO4</b>	<b>(05)</b>
<b>Handbook</b>					
<b>1.</b>	“P-CAD PCB User’s Guide”, p-cad PCB layout system from Altum,2006.				
<b>Reference Books</b>					
<b>1.</b>	“IPC-PCB Design Desk Reference 2022 Edition”, IPC design,2022.				
<b>2.</b>	Sai Kiran “PCB Designing E- Learning Book”, Digimind 2009.				
<b>Useful Links</b>					
<b>1.</b>	<a href="https://resources.pcb.cadence.com/ebooks-white-papers">https://resources.pcb.cadence.com/ebooks-white-papers</a>				

### 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
<b>CO 1</b>	2	2	3	2	2	-	1	-	-	-	-	2	-	-
<b>CO 2</b>	1	2	2	-	-	-	1	-	-	-	-	2	-	-
<b>CO 3</b>	1	1	1	2	-	-	1	-	-	-	-	2	-	-
<b>CO 4</b>	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	-
<b>TOTAL</b>	<b>20</b>	<b>20</b>	<b>60</b>

## 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	
<b>Prerequisite :</b> Mathematics basics				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Understand the image fundamentals			
<b>CO2</b>	Study the Image perception			
<b>CO3</b>	Explain different operations applied to Medical Images			
<b>CO4</b>	Apply various image transformation procedures used in health care			
<b>Course Contents</b>				
		<b>CO</b>	<b>Hours</b>	
<b>Unit 1</b>	<b>Fundamentals of Image :</b> Fundamentals of Image and Pictures, Analog image and Digital Image, Elements of Visual perception, Image sampling and quantization,	<b>CO1</b>	<b>(04)</b>	
<b>Unit 2</b>	<b>Different Types of Image:</b> Image Perception, Greyscale Images, RGB Images, Indexed Colour Images, Medical Images.	<b>CO1, CO2</b>	<b>(04)</b>	
<b>Unit 3</b>	<b>Representation of Image:</b> Camera Models , Imaging Geometry, Basics Of Image Display, Data Types And Conversions	<b>CO1, CO2</b>	<b>(04)</b>	
<b>Unit 4</b>	<b>Image Operations:</b> Neighborhood Pixel Relationships, Basic Image Operations - Arithmetic, Geometric And Morphological	<b>CO3</b>	<b>(04)</b>	
<b>Unit 5</b>	<b>Transformation:</b> Image Transform: 2d Dft- Discrete Cosine, Sine , Haar Transform, Walsh Transform.	<b>CO4</b>	<b>(05)</b>	
<b>Unit 6</b>	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.	<b>CO4</b>	<b>(05)</b>	
<b>Text Books</b>				
<b>1.</b>	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.			
<b>2.</b>	Anil Jain K. “Fundamentals of Digital Image Processing”, PHI Learning Pvt. Ltd., 2011 An Introduction to Digital Image Processing with Matlab, Alasdair McAndrew			
<b>References</b>				
<b>1.</b>	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.			
<b>2.</b>	William K Pratt, “Digital Image Processing”, John Willey, 2002.			
<b>3.</b>	Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.			
<b>Useful Links</b>				
<b>1.</b>	<a href="https://onlinecourses.nptel.ac.in/noc19_ee55/preview">https://onlinecourses.nptel.ac.in/noc19_ee55/preview</a>			
<b>2.</b>	<a href="https://www.coursera.org/specializations/image-processing">https://www.coursera.org/specializations/image-processing</a>			
<b>3.</b>	<a href="https://www.coursera.org/learn/introduction-image-processing">https://www.coursera.org/learn/introduction-image-processing</a>			

### 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

<b>Government College of Engineering, Karad</b>			
<b>Second Year (Sem – IV) MDM- Image Processing (ETC- Institute Level-Industrial)</b>			
<b>IMI3422: Basics of Image Processing for Healthcare</b>			
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Lectures	02 Hrs/week	MSE	20
Tutorials	--	ISE	20
Total Credits	02	ESE	60
		<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>
<b>Prerequisite :</b> Digital Signal Processing basics			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Study digital image fundamentals.		
<b>CO2</b>	Explain image enhancement and restoration, compression, segmentation techniques		
	<b>Course Contents</b>	<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Fundamentals of Image Processing:</b> Digital Image Representation – Fundamental Steps In Image Processing, Components Of An Image Processing System.	<b>CO1</b>	<b>(03)</b>
<b>Unit 2</b>	<b>Image Enhancement In The Spatial Domain:</b> Some Basic Gray Level Transformation, Histogram Processing, Enhancement Using Arithmetic/Logic Operations, Basics Of Spatial Filtering, Smoothing Spatial Filters, Sharpening Spatial Filters.	<b>CO1, CO2</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Image Enhancement In The Frequency Domain:</b> Introduction To The Fourier Transform And The Frequency Domain, Smoothing Frequency-Domain Filters, Sharpening Frequency-Domain Filters, Homomorphic Filtering.	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Image Restoration:</b> 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	<b>CO2</b>	<b>(06)</b>
<b>Unit 5</b>	<b>Image Compression and segmentation:</b> Image Compression Models, Error-Free Compression, Lossy Compression, Image Compression Standards, Detection Of Discontinuities, Edge Linking And Boundary Detection, Thresholding, Region-Based Segmentation	<b>CO2</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Object Representation And Description:</b> Various Schemes For Representation, Boundary Descriptors, And Regional Descriptors	<b>CO2</b>	<b>(04)</b>
<b>Text Books</b>			
<b>1.</b>	Rafael C. Gonzales, Richard E. Woods, “Digital Image Processing”, Third Edition, Pearson Education, 2010.		
<b>References</b>			
<b>1.</b>	Rafael C. Gonzalez, Richard E. Woods, Steven L. Eddins, “Digital Image Processing Using MATLAB”, Third Edition Tata Mc Graw Hill Pvt. Ltd., 2011.		
<b>2.</b>	Malay K. Pakhira, “Digital Image Processing and Pattern Recognition”, First Edition, PHI Learning Pvt. Ltd., 2011.		
<b>Useful Links</b>			
<b>1.</b>	<a href="https://onlinecourses.nptel.ac.in/noc19_ee55/preview">https://onlinecourses.nptel.ac.in/noc19_ee55/preview</a>		
<b>2.</b>	<a href="https://www.coursera.org/learn/introduction-computer-vision-watson-opencv">https://www.coursera.org/learn/introduction-computer-vision-watson-opencv</a>		

### 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

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

**Course Contents**

		CO	Hours
<b>Unit 1</b>	Principles of Particle Size Analysis	CO1	(05)
<b>Unit 2</b>	Techniques in Particle Size Measurement	CO1, CO2	(07)
<b>Unit 3</b>	Interpretation of Particle Size Distribution Data	CO3	(07)
<b>Unit 4</b>	Particle Morphology Analysis	CO3, CO4	(07)
<b>Unit 5</b>	Particle Size Analysis in health care medical system and Biomedical Samples	CO3	(07)
<b>Unit 6</b>	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, Bhagwathicharan 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

<b>Government College of Engineering, Karad</b>				
<b>Third Year (Sem – V) MDM- Image Processing (ETC- Institute Level-Industrial)</b>				
<b>IMI3524: Particle Size Analysis using Image Processing Lab</b>				
<b>Teaching Scheme</b>				<b>Examination Scheme</b>
Lectures	02 Hrs/week			MSE
Tutorials	-			ISE
Total Credits	01			ESE
				-
<b>Course Contents</b>				
<b>Prerequisite :</b> Basics of Image Processing				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Identify and describe the different tools and instruments used in particle characterization and formulation analysis.			
<b>CO2</b>	Prepare and organize the laboratory environment, ensuring all equipment is correctly set up for experiments.			
<b>CO3</b>	Execute particle characterization and morphological analysis procedures independently, demonstrating proficiency and accuracy.			
	<b>Course Contents</b>			
<b>Experiment 1</b>	Principles of Particle Characterization in Formulations			
<b>Experiment 2</b>	Techniques in Reverse Engineering of Formulations			
<b>Experiment 3</b>	Classification Analysis of Formulated Products, Morphological Characterization of Formulations			
<b>Experiment 4</b>	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
<b>Task I</b>	15	15	15	15	15
<b>Task II</b>	5	5	5	5	5
<b>Task III</b>	5	5	5	5	5
<b>ISE</b>	25	25	25	25	25

<b>Government College of Engineering, Karad</b>				
<b>Third Year (Sem – VI) MDM- Image Processing (ETC- Institute Level-Industrial)</b>				
<b>IMI3625: Particle Characterization in Healthcare</b>				
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		
Lectures	02 Hrs/week	MSE	20	
Tutorials	-	ISE	20	
Total Credits	02	ESE	60	
		<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>	
<b>Prerequisite :</b> Basics of Image processing				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Understand of particle characterization techniques used in the health care sector.			
<b>CO2</b>	Analyse the morphology, structure, and properties of particles.			
<b>CO3</b>	Apply particle characterization techniques in health care medical research, formulation development, and quality control.			
	<b>Course Contents</b>		<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	Fundamentals of Particle Characterization		<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	Techniques in Particle Morphology Analysis		<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	Analysis of API Particles		<b>CO1,CO2</b>	<b>(04)</b>
<b>Unit 4</b>	Microscopy Techniques for Characterization		<b>CO3</b>	<b>(04)</b>
<b>Unit 5</b>	Impurities Analysis and Detection		<b>CO3,</b>	<b>(05)</b>
<b>Unit 6</b>	Advanced Topics in Particle Characterization for health care applications.		<b>CO3</b>	<b>(05)</b>

### 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
<b>CO 1</b>	-	2	3	3	3	-	-	-	-	1	-	1	-	2	1
<b>CO 2</b>	-	3	3	2	2	1	-	-	-	-	1	1	1	2	1
<b>CO 3</b>	-	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	-	-	-
<b>TOTAL</b>	<b>20</b>	<b>20</b>	<b>60</b>

<b>Government College of Engineering, Karad</b>					
<b>Final Year (Sem – VII)MDM- Image Processing (ETC- Institute Level-Industrial)</b>					
<b>IMI3726: Particle Characterization in Formulation and Reverse Engineering</b>					
<b>Teaching Scheme</b>			<b>Examination Scheme</b>		
Practical	2 Hrs/week		MSE	20	
Tutorials	-		ISE	20	
Total Credits	02		ESE	60	
			<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>	
<b>Prerequisite :</b> Basics of image processing					
<b>Course Outcomes (CO):</b> Students will be able to					
<b>CO1</b>	Explain the advanced knowledge and skills in particle characterization techniques applicable to health care image analysis.				
<b>CO2</b>	Illustrate the reverse engineering methods for analysing complex formulations and identifying key components				
<b>CO3</b>	Explain the techniques for microscopy image analytics for formulation characterization.				
<b>CO4</b>	Apply the particle characterization techniques in formulation development, optimization, and quality control.				
<b>Course Contents</b>					
				<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	Principles of Particle Characterization in Formulations			<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	Techniques in Reverse Engineering of Formulations			<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	Classification Analysis of Formulated Products			<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	Morphological Characterization of Formulations			<b>CO3</b>	<b>(05)</b>
<b>Unit 5</b>	Microscopic Analysis of Formulated Products			<b>CO3</b>	<b>(05)</b>
<b>Unit 6</b>	Advanced Topics in Formulation Characterization			<b>CO4</b>	<b>(04)</b>

### 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	-	-	-
<b>TOTAL</b>	<b>20</b>	<b>20</b>	<b>60</b>

<b>Government College of Engineering, Karad</b>					
<b>Final Year (Sem – VIII) MDM- Image Processing (ETC- Institute Level-Industrial)</b>					
<b>IMI3827:Project/Internship</b>					
<b>Teaching Scheme</b>			<b>Examination Scheme</b>		
Practical	04 Hrs/week		ISE		-
Tutorials	-		ESE		100
Total Credits	02				
<b>Prerequisite -</b>					
<b>Course Outcomes (CO): Students will be able to</b>					
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.				
<b>Course Contents</b>			<b>CO</b>		
Project /Internship based on the completion of previous courses.			<b>CO1,CO2,CO3</b>		

### 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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Introduction to EV:</b> Explaining EV technology and summarize Automotive revolution, explore Electrical Requirement of a vehicle.	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>EV layout and components:</b> Exploring different types of EV layouts and basic components of Electric Vehicle	<b>CO1</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Introduction to Hybrid electric vehicle:</b> Defining Hybrid Vehicle working principles and architecture, Introduction, Battery chemistry ,Efficiency ,Definition and parameters for Hybrid Systems	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Layout and component of hybrid electric vehicle :</b> Electric Motors ,Generators , and Power electronics for Hybrid systems, control systems, Hybrid electric vehicle operation	<b>CO2</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Identify and demonstrate Battery Technology and charging station infrastructure:</b> Defining Battery Technology, recognize different types of batteries and components of Battery, describing EV charging Infrastructure	<b>CO3</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Advanced EV:</b> 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	<b>CO4</b>	<b>(05)</b>

#### Reference Books

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

#### Reference links

<b>1.</b>	<a href="https://www.carbodydesign.com/">https://www.carbodydesign.com/</a>
<b>2.</b>	<a href="https://www.team-bhp.com/">https://www.team-bhp.com/</a>
<b>3.</b>	<a href="https://autoprotoaway.com/automotive-design-process/">https://autoprotoaway.com/automotive-design-process/</a>
<b>4.</b>	<a href="https://www.carbodydesign.com/">https://www.carbodydesign.com/</a>

### 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
<b>Unit 1</b>	<b>Introduction to vehicle dynamics:</b> Fundamentals of vehicle dynamics, different mechanisms and dynamics involved in wheels, fundamentals of Hybrid vehicle dynamics.	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Aerodynamics and power train system:</b> Basics of aerodynamics, principles of aerodynamics, fluid mechanics and airflow dynamics, Suspension and Braking system, Vehicle stability control and vehicle safety,	<b>CO1</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Sketching of automotive EV design:</b> Introduction to Automotive sketching software, Overview of vehicle design process and Automotive sketching, Basic sketching techniques.	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Software for EV drafting and designing</b> Basic sketching techniques and tools in the software, sketching car exteriors, interiors and details. creating different views and angles of vehicle	<b>CO3</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Advance EV modeling techniques using Solidworks :</b> 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.	<b>CO4</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Advance EV analysis using different data analysis software:</b> Analyse the EV designed in modeling software using advance data analysis software, setting up modeling environment.	<b>CO4</b>	<b>(04)</b>

**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; 2<sup>nd</sup> edition, July 2002.
3. Seth Leitman, Bob Brant, Leitman Seth; Build Your Own Electric Vehicle: Publisher: McGraw-Hill, 3<sup>rd</sup> 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
<b>CO 1</b>	3	-	-	-	1	-	2	-	-	2	-	3
<b>CO 2</b>	2	-	2	-	2	-	1	-	-	1	-	2
<b>CO 3</b>	3	3	3	3	3	1	3	1	2	2	-	3
<b>CO 4</b>	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
<b>Unit 1</b>	<b>Essential for designing and simulation using MATLAB:</b> 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	<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>Fundamentals of EV system using MATLAB:</b> DC motor characteristics, induction to motor characteristics, Simulink model to calculate vehicle configuration, Solar PV based charger, DC-DC converter, motor controller design,	<b>CO1</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Design and modeling of EV system using MATLAB:</b> Designing DC motor and induction motor, multilevel inverter designing,	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Modeling of EV power train in Solid works:</b> Introduction to EV Power train, Modeling architecture of EV Powertrain, Modeling of EV powertrain components. Battery pack modeling in solidworks	<b>CO2</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Analysis of EV power train components:</b> Modeling and simulation of EV powertrain components in ANSYS,	<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Simulation of Thermal management system for EV:</b> Battery management system modeling, simulation li-ion battery pack using MATLAB	<b>CO4</b>	<b>(04)</b>

**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; 2 <sup>nd</sup> edition, July 2002.
3.	Seth Leitman, Bob Brant, Leitman Seth, "Build Your Own Electric Vehicle", McGraw-Hill, 3 <sup>rd</sup> edition, 2013.

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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 – 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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Introduction to Business management:</b> 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	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Business plan and product launch:</b> Process of making business plans, different marketing methods, product launch ideation and executions	<b>CO1</b>	<b>(04)</b>
<b>Unit 3</b>	<b>EV testing and Homologation:</b> FAME India and manufacturing guidelines,, EV certification process, standards for EV charging and retrofitting, EV motor parameter guidelines, batter selection criteria.	<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Product development methods:</b> 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.	<b>CO3</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Introduction to Hydrogen vehicle:</b> 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.	<b>CO4</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Fuel cell in Hybrid electric vehicle:</b> 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.	<b>CO4</b>	<b>(05)</b>

**Reference Books**

<b>1.</b>	Julian Happian-Smith,“Introduction to Modern Vehicle Design”, Transport Research Laboratory (TRL) ,Elsevier- edition, 2001
<b>2.</b>	Heinz Heisler; “Advanced Vehicle Technology”, Butterworth-Heinemann Ltd; 2 <sup>nd</sup> edition, July 2002.
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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	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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>EV design and structural analysis:</b> Theory of FEA/CAE, Procedure of implementing FEA /CAE analysis, Introduction to hyper mesh, creating and modifying geometry, Geometry cleanup and defeature,	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Mesh model development using Hyper mesh:</b> Introduction to 2D meshing,3D meshing ,element Quality, Mesh Edit, Introduction to plastic mesh, Introduction 1D meshing ,Modal analysis	<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	<b>FEA analysis for EV engineering with Abaqus:</b> 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.	<b>CO2</b>	<b>(05)</b>
<b>Unit 4</b>	<b>Analyze EV dynamic and simulation:</b> 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	<b>CO2</b>	<b>(05)</b>
<b>Unit 5</b>	<b>CFD analysis for EV:</b> Basics of Computational Fluid Dynamics, Simulation of Battery Thermal Management in Electric Vehicle, Vibration and Fatigue Analysis of Battery Pack,	<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Thermal analysis of EV:</b> Thermal Analysis of Liquid-Cooled Radiator, CFD Study of External Cooling Mechanism for Battery Pack.	<b>CO4</b>	<b>(04)</b>

**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; 2 <sup>nd</sup> edition, July 2002.
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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	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

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

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

**Reference Books**

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

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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
<b>CO 1</b>	2	-	-	-	-	2	3	2	-	1	-	1
<b>CO 2</b>	2	-	-	-	2	2	2	3	-	2	-	2
<b>CO 3</b>	2	-	-	-	-	3	3	2	-	3	-	3
<b>CO 4</b>	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**

<b>Government College of Engineering, Karad</b>			
<b>Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIDSML</b>			
<b>IOE3311: Open Elective I Foundations of AI, Data Science, and Data Engineering</b>			
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Lectures	03 Hrs/week	ISE	50
Tutorials	00 Hrs/week	ESE	50
Total Credits	03	Duration of ESE	As applicable
<b>Prerequisite :</b> Mathematics, Programming for problem solving			
<b>Course Outcomes:</b> Students will be able to			
<b>CO1</b>	Understand foundational concepts of AI and Data Science.		
<b>CO2</b>	Apply programming skills in Python for data manipulation.		
<b>CO3</b>	Demonstrate proficiency in mathematical foundations for AI and ML applications.		
<b>CO4</b>	Utilize various techniques for data wrangling, cleaning, visualization, inferential statistics, regression analysis, and SQL database management.		
<b>Course Contents</b>			<b>CO</b>
			<b>Hours</b>
<b>Unit 1</b>	<b>Introduction to AI &amp; Data Science:</b> Overview of AI and Data Science, The data science workflow, AI applications across various industries, Ethical considerations in AI and data science	<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>Programming Fundamentals for AI &amp; Data Science</b> 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	<b>CO2</b>	<b>(07)</b>
<b>Unit 3</b>	<b>Mathematical Foundations for AI &amp; ML:</b> Linear algebra basics: vectors, matrices, and operations, Calculus essentials: derivatives and integrals, Probability and statistics for data science.	<b>CO3</b>	<b>(07)</b>
<b>Unit 4</b>	<b>Data Wrangling &amp; Cleaning:</b> Techniques for handling missing values, Addressing outliers and inconsistencies in data Data transformation and normalization.	<b>CO4</b>	<b>(06)</b>
<b>Unit 5</b>	<b>Data Visualization and Inferential Statistics:</b> Data exploration and visualization techniques, Understanding data distributions, Inferential statistics: hypothesis testing, confidence intervals, and statistical tests for comparisons.	<b>CO4</b>	<b>(08)</b>
<b>Unit 6</b>	<b>Regression Analysis and SQL Database Management:</b> Linear regression concepts, Time series analysis, Model building, evaluation, and interpretation, SQL for database management, Data analysis with SQL, ETL processes (Extract, Transform, Load).	<b>CO4</b>	<b>(07)</b>
<b>Text Books</b>			
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 & Francis CRC press 2021.		
4	Alan Beaulieu - "Learning SQL: Generate, Manipulate, and Retrieve Data" - O'Reilly Media 2009.		
<b>Reference Books</b>			
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.		
<b>Useful Links</b>			
1.	<a href="https://onlinecourses.nptel.ac.in/noc21_cs69/preview">https://onlinecourses.nptel.ac.in/noc21_cs69/preview</a>		
2.	<a href="https://onlinecourses.nptel.ac.in/noc22_cs32/preview">https://onlinecourses.nptel.ac.in/noc22_cs32/preview</a>		
3.	<a href="https://nptel.ac.in/courses/106106226/">https://nptel.ac.in/courses/106106226/</a>		

\*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
<b>CO 1</b>	3	2	2	1	3	-	-	-	2	2	-	1
<b>CO 2</b>	2	2	2	2	3	-	-	-	2	1	-	2
<b>CO 3</b>	3	3	3	3	3	1	2	-	2	1	-	3
<b>CO 4</b>	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	-	-
<b>TOTAL</b>	<b>50</b>	<b>50</b>



<b>Government College of Engineering, Karad</b>					
<b>Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- AIDSML</b>					
<b>IOE3413: Open Elective II Advanced AI Integration</b>					
<b>Teaching Scheme</b>		<b>Examination Scheme</b>			
Lectures	02 Hrs/week		ISE	50	
Tutorials	00 Hrs/week		ESE	50	
Total Credits	02		Duration of ESE	As applicable	
<b>Prerequisite :</b> Foundations of AI, Data Science, and Data Engineering					
<b>Course Outcomes (CO):</b> Students will be able to					
<b>CO1</b>	Implement supervised and unsupervised algorithms using Scikit-learn.				
<b>CO2</b>	Enhance model performance through feature engineering and model selection.				
<b>CO3</b>	Develop and apply CNNs and RNNs for deep learning and NLP tasks.				
<b>CO4</b>	Utilize advanced data mining techniques and big data platforms for analytics.				
<b>Course Contents</b>				<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Introduction to Machine Learning:</b> 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.			<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Machine Learning with Python:</b> 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.			<b>CO1</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Feature Engineering &amp; Model Selection:</b> 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.			<b>CO2</b>	<b>(05)</b>
<b>Unit 4</b>	<b>Deep Learning Fundamentals:</b> Basics of neural networks, activation functions, and architectures., Convolutional Neural Networks (CNNs), Recurrent Neural Networks (RNNs): Structure, applications, and implementation basics			<b>CO3</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Natural Language Processing (NLP) and Computer Vision:</b> Text processing, sentiment analysis, and building chatbots.,Computer Vision Fundamentals: Image processing techniques, object detection, and recognition.			<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Big Data Fundamentals and Advanced Data Mining Techniques:</b> 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.			<b>CO4</b>	<b>(04)</b>
<b>Text Books</b>					
<b>1.</b>	Ethem Alpaydin - "Introduction to Machine Learning" - MIT Press (2020)				
<b>2.</b>	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media (2019)				
<b>3.</b>	Richard Szeliski - "Computer Vision: Algorithms and Applications" - Springer (2010)				
<b>4</b>	Nathan Marz and James Warren - "Big Data: Principles and Best Practices of Scalable Realtime Data Systems" - Manning Publications (2015)				
<b>Reference Books</b>					
<b>1.</b>	Jiawei Han, Micheline Kamber, and Jian Pei - "Data Mining: Concepts and Techniques" - Morgan Kaufmann (2011)				
<b>2.</b>	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
<b>Useful Links</b>	
1.	<a href="https://nptel.ac.in/courses/106102220/">https://nptel.ac.in/courses/106102220/</a>
2.	<a href="https://nptel.ac.in/courses/106106145/">https://nptel.ac.in/courses/106106145/</a>
3.	<a href="https://nptel.ac.in/courses/106106212/">https://nptel.ac.in/courses/106106212/</a>
4.	<a href="https://nptel.ac.in/courses/106105152/">https://nptel.ac.in/courses/106105152/</a>

**\*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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Reinforcement Learning and Autonomous Systems:</b> 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.	<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Generative Adversarial Networks (GANs) and Creative AI:</b> 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.	<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Explainable AI (XAI) and Ethical AI:</b> 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.	<b>CO3</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Edge AI and Internet of Things (IoT) Integration:</b> 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.	<b>CO4</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Quantum Machine Learning and Quantum Computing:</b> 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.	<b>CO1</b>	<b>(05)</b>
<b>Unit 6</b>	<b>AI for Healthcare and Biomedical Applications:</b> 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.	<b>CO4</b>	<b>(04)</b>

**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.	<a href="https://nptel.ac.in/courses/106106139/">https://nptel.ac.in/courses/106106139/</a>
2.	<a href="https://nptel.ac.in/courses/106105215/">https://nptel.ac.in/courses/106105215/</a>
2.	<a href="https://nptel.ac.in/courses/106106143/">https://nptel.ac.in/courses/106106143/</a>
3.	<a href="https://nptel.ac.in/courses/106105158/">https://nptel.ac.in/courses/106105158/</a>
4.	<a href="https://nptel.ac.in/courses/106106213/">https://nptel.ac.in/courses/106106213/</a>

**\*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
<b>CO 1</b>	3	2	3	3	3	3	-	-	2	2	1	3
<b>CO 2</b>	2	3	1	2	3	-	-	-	3	-	3	2
<b>CO 3</b>	2	2	2	3	3	3	1	3	3	3	3	3
<b>CO 4</b>	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

<b>Government College of Engineering, Karad</b>					
<b>Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- AIOT</b>					
<b>IOE3321: Open Elective I IoT Hardware and Sensors</b>					
<b>Teaching Scheme</b>			<b>Examination Scheme</b>		
Lectures	03 Hrs/week		ISE	50	
Tutorials	00 Hrs/week		ESE	50	
Total Credits	03		Duration of ESE	As applicable	
<b>Prerequisite :</b> Mathematics, Programming for problem solving/Computer fundamentals					
<b>Course Outcomes (CO):</b> Students will be able to					
<b>CO1</b>	Understand the foundational principles and hardware of IoT				
<b>CO2</b>	Apply IoT circuit and programming software:				
<b>CO3</b>	Develop AI models and integrate with IoT:				
<b>CO4</b>	Analyze and implement AIoT applications:				
<b>Course Contents</b>				<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Introduction to IoT Hardware:</b> 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.			<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>IoT Circuit and Programming Software:</b> 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			<b>CO2</b>	<b>(07)</b>
<b>Unit 3</b>	<b>AI and Python Programming Software:</b> 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.			<b>CO3</b>	<b>(06)</b>
<b>Unit 4</b>	<b>Introduction to Artificial Intelligence and Internet of Things (AIoT)</b> 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.			<b>CO4</b>	<b>(09)</b>
<b>Unit 5</b>	<b>Connecting Mobile Devices to IoT Gateways</b> 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.			<b>CO1</b>	<b>(06)</b>
<b>Unit 6</b>	<b>Sensor Technologies and Academic Concepts</b> 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.			<b>CO4</b>	<b>(07)</b>
<b>Text Books</b>					
<b>1.</b>	Matt Richardson and Shawn Wallace - "Getting Started with Raspberry Pi" - O'Reilly Media - 2016				
<b>2.</b>	Eric Matthes - "Python Crash Course" - No Starch Press - 2019				
<b>3.</b>	Arshdeep Bahga and Vijay Madisetti - "Internet of Things: A Hands-On Approach" - VPT - 2014				
<b>Reference Books</b>					
<b>1.</b>	Michael Margolis - "Arduino Cookbook" - O'Reilly Media - 2011				
<b>2.</b>	Patrick F. Dunn - "Fundamentals of Sensors for Engineering and Science" - CRC Press - 2010				
<b>3.</b>	Aurélien Géron - "Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow" - O'Reilly Media – 2019				

<b>Useful Links</b>			
1.	<a href="https://nptel.ac.in/courses/106105195">https://nptel.ac.in/courses/106105195</a>		
2.	<a href="https://www.coursera.org/learn/iot">https://www.coursera.org/learn/iot</a>		
3.	<a href="https://www.tinkercad.com/things?type=circuits&amp;sort=staff&amp;view_mode=small">https://www.tinkercad.com/things?type=circuits&amp;sort=staff&amp;view_mode=small</a>		

**\*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



<b>Government College of Engineering, Karad</b>			
<b>Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- AIOT</b>			
<b>IOE3423: Open Elective II Fundamentals of AIoT</b>			
<b>Teaching Scheme</b>		<b>Examination Scheme</b>	
Lectures	02 Hrs/week	ISE	50
Tutorials	00 Hrs/week	ESE	50
Total Credits	02	Duration of ESE	As applicable
<b>Prerequisite :</b> IoT Hardware & Sensors, Programming for problem solving			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Understand the concepts of AIoT and their significance in modern industries.		
<b>CO2</b>	Apply techniques to connect mobile devices to IoT gateways, bridging the gap between different networks.		
<b>CO3</b>	Analyze sensor technologies in IoT and their academic foundations to showcase practical understanding.		
<b>CO4</b>	Develop and Evaluate AIoT applications to address real-world challenges.		
<b>Course Contents</b>			<b>CO</b>
			<b>Hours</b>
<b>Unit 1</b>	<b>Introduction to Artificial Intelligence and Internet of Things (AIoT)</b> 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.	<b>CO1, CO2</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Connecting Mobile Devices to IoT Gateways</b> 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.	<b>CO1, CO2</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Sensor Technologies and Academic Concepts</b> 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.	<b>CO3</b>	<b>(04)</b>
<b>Unit 4</b>	<b>AIoT Application Development</b> 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.	<b>CO4</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Unit 5: Weather Forecasting with AIoT</b> 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.	<b>CO4</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Unit 6: Smart Solutions Development</b> 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.	<b>CO4</b>	<b>(05)</b>
<b>Text Books</b>			
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		
<b>Reference Books</b>			
1.	Chandra Singh, Sairam, Niranjana N Chiplunkar, Rathishchandra R Gatti Create citation, "Self-Powered Aiot Systems": <a href="#">Apple Academic Press</a> 2024		
2.	Kashif Naseer Qureshi, Thomas Newe Artificial Intelligence of Things (AIoT): New Standards, Technologies and Communication Systems, CRC Press 2024		
<b>Useful Links</b>			
1.	<a href="https://www.linkedin.com/learning/ai-in-connected-products-aiot">https://www.linkedin.com/learning/ai-in-connected-products-aiot</a>		
2.	<a href="https://www.coursera.org/learn/iot">https://www.coursera.org/learn/iot</a>		
3.	<a href="https://www.tinkercad.com/things?type=circuits&amp;sort=staff&amp;view_mode=small">https://www.tinkercad.com/things?type=circuits&amp;sort=staff&amp;view_mode=small</a>		

**\*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

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

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

**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.	<a href="https://www.udemy.com/course/exploring-aws-iot/">https://www.udemy.com/course/exploring-aws-iot/</a>
2.	<a href="https://www.coursera.org/specializations/mlops-machine-learning-duke">https://www.coursera.org/specializations/mlops-machine-learning-duke</a>
3.	<a href="https://learn.microsoft.com/en-us/training/paths/microsoft-azure-architect-design-prerequisites/">https://learn.microsoft.com/en-us/training/paths/microsoft-azure-architect-design-prerequisites/</a>

**\*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

<b>Government College of Engineering, Karad</b>					
<b>Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- ARVR</b>					
<b>IOE3331: Open Elective I AR/VR Application Development</b>					
<b>Teaching Scheme</b>			<b>Examination Scheme</b>		
Lectures	03 Hrs/week		ISE	50	
Tutorials	00 Hrs/week		ESE	50	
Total Credits	03		Duration of ESE	As applicable	
<b>Prerequisite :</b> Mathematics, Programming for problem solving/Computer fundamentals					
<b>Course Outcomes (CO):</b> Students will be able to					
<b>CO1</b>	Recall fundamentals and real-time 3D content creation basics & scripting.				
<b>CO2</b>	Understand software interface and tools for scene creation and optimization.				
<b>CO3</b>	Apply 3D modeling, animation, and physics in 3d design tool.				
<b>CO4</b>	Analyze and optimize audio, visual effects using hardware and performance in software.				
<b>Course Contents</b>				<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Introduction to Real-time 3D Content &amp; Unity Game Engine:</b> 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.			<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>Fundamentals of Unity Game Engine:</b> 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.			<b>CO2</b>	<b>(07)</b>
<b>Unit 3</b>	<b>3D Modelling, Animation, and Physics:</b> 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.			<b>CO3</b>	<b>(07)</b>
<b>Unit 4</b>	<b>User Interface Design &amp; Application Scripting:</b> 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.			<b>CO1</b>	<b>(08)</b>
<b>Unit 5</b>	<b>Audio, Visual Effects, and Optimization:</b> 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.			<b>CO4</b>	<b>(06)</b>
<b>Unit 6</b>	<b>Augmented Reality &amp; Virtual Reality Development:</b> 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.			<b>CO4</b>	<b>(07)</b>
<b>Text Books</b>					
<b>1.</b>	Mastering Unity 2D Game Development - Second Edition, Ashley Godbold, Simon Jackson, Packt Publishing, October 2016, ISBN: 9781786463456				
<b>2.</b>	Zeynep Tacgin, "Virtual and Augmented Reality: An Educational Handbook", Cambridge Scholars Publisher, 2020				
<b>3</b>	Joe Hocking, Unity in Action: Multiplatform Game Development in C# with Unity, Manning Publications, 2018				
<b>4</b>	Alan Craig, William Sherman and Jeffrey Will, "Developing Virtual Reality Applications, Foundations of Effective Design", Morgan Kaufmann, 2009				
<b>Reference Books</b>					
<b>1.</b>	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
<b>Useful Links</b>	
1.	<a href="https://stanford.edu/class/ee267/syllabus.html">https://stanford.edu/class/ee267/syllabus.html</a> Prof. Ivan Sutherland, Standford University
2.	<a href="https://nptel.ac.in/courses/106/106/106106138/">https://nptel.ac.in/courses/106/106/106106138/</a> Prof. Steve Lavalle,IIT Madras.
3.	<a href="https://nptel.ac.in/courses/121/106/121106013/">https://nptel.ac.in/courses/121/106/121106013/</a> 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

<b>Government College of Engineering, Karad</b>				
<b>Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective-ARVR</b>				
<b>IOE3332: Open Elective -01 Lab - AR/VR Application Development Lab</b>				
<b>Laboratory Scheme:</b>			<b>Examination Scheme:</b>	
Practical	02 Hrs/week		ISE	25
Total Credits	01		ESE	25
<b>Prerequisite :</b> Mathematics, Programming for problem solving				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Apply real-time 3D scene creation with basic physics interactions.			
<b>CO2</b>	Design user interfaces utilizing UI system for game or application prototypes.			
<b>CO3</b>	Develop and test C# scripts to control game behaviour and player interactions.			
<b>CO4</b>	Integrate audio-visual effects and optimize performance.			
<b>Course Contents</b>				<b>CO</b>
<b>Implementation of following concepts</b>				
<b>Experiment 1</b>	Create a real-time 3D scene in Unity incorporating basic physics interactions.			<b>CO1</b>
<b>Experiment 2</b>	Design and implement a user interface for a game or application prototype using Unity's UI system.			<b>CO2</b>
<b>Experiment 3</b>	Write and test scripts in C# to control game behavior, such as player movement and object interactions.			<b>CO3</b>
<b>Experiment 4</b>	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.			<b>CO4</b>
<b>Experiment 5</b>	Experiment with augmented reality using Unity's AR Foundation package to develop basic AR interactions.			<b>CO1</b>
<b>Experiment 6</b>	Develop a VR experience for the Meta Quest platform, implementing VR interactions like grabbing and teleportation.			<b>CO1</b>
<b>Experiment 7</b>	Develop a simple web-based mini-game using Unity WebGL, incorporating basic gameplay mechanics and visual effects.			<b>CO1</b>
<b>Experiment 8</b>	Create an AR sample app for Android devices using Unity and AR Foundation.			<b>CO2</b>
<b>Experiment 9</b>	Implement AR features such as plane detection, object placement, and basic interactions like tapping to spawn virtual objects.			<b>CO3</b>
<b>Experiment 10</b>	Develop a VR sample app for the Meta Quest platform using Unity and Oculus integration.			<b>CO4</b>
<b>Experiment 11</b>	Design immersive VR environments and implement VR interactions using Oculus controllers.			<b>CO4</b>
<b>Experiment 12</b>	Optimize the VR experience for smooth performance on the Meta Quest headset, considering factors like frame rate and rendering quality			<b>CO4</b>
<b>List of Submission:</b>				
	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
<b>CO 1</b>	3	2	2	2	3	1	1	2	-	-	1	2
<b>CO 2</b>	2	1	3	2	3	2	2	1	2	2	2	2
<b>CO 3</b>	3	2	3	2	3	-	1	2	1	2	3	2
<b>CO 4</b>	2	3	2	3	3	2	2	-	2	2	1	2

1: Slight (Low)

2: Moderate (Medium)

3: Substantial (High)



**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

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

Course Contents		CO	Hours
<b>Unit 1</b>	<b>Introduction to Virtual Production:</b> Historical overview and evolution of virtual production techniques. Applications and benefits of virtual production in film, television, and other media industries..	<b>CO1</b>	<b>(03)</b>
<b>Unit 2</b>	<b>Fundamentals of Green Studio:</b> Exploring Green Screen Studios, exploring green screen technology and its significance in virtual production. Setup and operation of green screen studios and Lighting techniques.	<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Unity for Virtual Production:</b> Overview of Unity Game Engine and its role in virtual production. Importing assets and setting up virtual environments in Unity for production purposes.	<b>CO3</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Real-time Rendering &amp; Visualisation:</b> 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.	<b>CO4</b>	<b>(05)</b>
<b>Unit 5</b>	<b>Virtual Design:</b> 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..	<b>CO1, CO4</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Virtual Camera system and Scene composition:</b> 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.	<b>CO2, CO3</b>	<b>(05)</b>

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

**\*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

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

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

**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.	<a href="https://www.udemy.com/course/unrealcourse/">https://www.udemy.com/course/unrealcourse/</a> <a href="https://archive.nptel.ac.in/courses/121/106/121106013/">https://archive.nptel.ac.in/courses/121/106/121106013/</a>
2.	<a href="https://www.udemy.com/course/unreal-engine-5-the-complete-beginners-course/">https://www.udemy.com/course/unreal-engine-5-the-complete-beginners-course/</a>
3.	<a href="https://www.coursera.org/specializations/cplusplusunrealgamedevelopment">https://www.coursera.org/specializations/cplusplusunrealgamedevelopment</a>

**\*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

<b>Government College of Engineering, Karad</b>					
<b>Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective- ERP-SAP</b>					
<b>IOE3341: Open Elective- I- ABAP Programming for SAP HANA</b>					
<b>Teaching Scheme</b>			<b>Examination Scheme</b>		
Lectures	03 Hrs/week		ISE	50	
Tutorials	00 Hrs/week		ESE	50	
Total Credits	03				
			Duration of ESE	As applicable	
<b>Prerequisite :</b> Database Management System					
<b>Course Outcomes (CO):</b> Students will be able to					
<b>CO1</b>	Understand SAP HANA concepts, key technologies, and use of SAP HANA Studio and ADT				
<b>CO2</b>	Identify and address ABAP code performance issues and understand SAP HANA's technical requirements and deployment options				
<b>CO3</b>	Utilize Enhanced Open SQL, Core Data Services (CDS), and develop with SAP HANA Native SQL and ABAP Managed Database Procedures				
<b>CO4</b>	Integrate SAP HANA models into ABAP, transport objects, and optimize reports with Full Text Search and ALV IDA.				
	<b>Course Contents</b>			<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	<b>Introduction:</b> 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.			<b>CO 1</b>	<b>(08)</b>
<b>Unit 2</b>	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.			<b>CO 2</b>	<b>(07)</b>
<b>Unit 3</b>	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.			<b>CO 3</b>	<b>(07)</b>
<b>Unit 4</b>	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			<b>CO 4</b>	<b>(07)</b>
<b>Unit 5</b>	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.			<b>CO 1</b>	<b>(07)</b>
<b>Unit 6</b>	Technical Requirements of SAP HANA, Technical Deployment Options High Availability and Disaster tolerance, SAP HANA Lifecycle Management Tools			<b>CO 2</b>	<b>(04)</b>
<b>Text Books</b>					
<b>1.</b>	Hermann Gahm, Thorsten Schneider, Christiaan Swanepoel, Eric Westenberger, “ABAP Programming for SAP HANA”, SAP Press, ISBN-13: 978-1493213049, 3rd Edition				
<b>2.</b>	Hermann Gahm, Thorsten Schneider, Eric Westenberger, Thomas Jung , “SAP HANA for ABAP Developers”, SAP Press, ISBN-13: 978-1592298789, 2nd Edition				
<b>3.</b>	Paul Hardy , “ABAP to the Future: Advanced, Modern ABAP 7.5x Programming Techniques”, Espresso Tutorials, ISBN-13: 978-1946390073, 1st Edition				
<b>Reference Books</b>					
<b>1.</b>	Rehan Zaidi , “SAP ABAP Advanced Cookbook”,Packt Publishing, ISBN-13: 978-1782176440 1 <sup>st</sup> Edition				
<b>Useful Links</b>					
<b>1.</b>	<a href="https://www.linkedin.com/learning/topics/sap">https://www.linkedin.com/learning/topics/sap</a>				
<b>2.</b>	<a href="https://community.sap.com/t5/enterprise-resource-planning/ct-p/erp">https://community.sap.com/t5/enterprise-resource-planning/ct-p/erp</a>				

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
<b>TOTAL</b>	<b>50</b>	<b>50</b>

<b>Government College of Engineering, Karad</b>			
<b>Second Year (Sem – III) OE- Institute Level- Industrial orientated Open Elective-ERP-SAP</b>			
<b>IOE3342 : OE I Lab- ABAP programming in Eclipse LAB</b>			
<b>Laboratory Scheme:</b>		<b>Examination Scheme:</b>	
<b>Practical</b>	2 Hrs/week	<b>ISE</b>	25
<b>Total Credits</b>	<b>1</b>	<b>ESE</b>	25
<b>Prerequisite :</b> Database Management System			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Explain the role and functionality of Eclipse in SAP development, including installation and navigation		
<b>CO2</b>	Develop ABAP projects by creating, editing, and debugging repository objects using Eclipse		
<b>CO3</b>	Assess ABAP code performance and quality using static testing tools, ABAP Unit Tests, and the ABAP Profiler within Eclipse		
<b>CO4</b>	Design and implement advanced SAP applications, including Web Dynpro components and ABAP Dictionary Objects, utilizing Eclipse's development environment		
<b>Course Contents</b>			<b>CO</b>
<b>Experiment 1</b>	Introduction to Eclipse, Understanding How SAP Uses Eclipse, Installing Eclipse		<b>CO 1</b>
<b>Experiment 2</b>	Defining an ABAP Project, Organizing Work with the Eclipse Workbench, The ABAP Development Cycle in Eclipse.		<b>CO 2</b>
<b>Experiment 3</b>	Creating Repository Objects, Editing a Repository Object, Debugging ABAP in Eclipse.		<b>CO 2</b>
<b>Experiment 4</b>	Function Groups and Function Modules.		<b>CO 2</b>
<b>Experiment 5</b>	ABAP Dictionary Objects in Eclipse, Working With Data Element, Working With Structures, Modelling Views with ABAP Core Data Services		<b>CO 4</b>
<b>Experiment 6</b>	ABAP Objects and Eclipse, Creating a Global Class, Refactoring		<b>CO 4</b>
<b>Experiment 7</b>	Web Dynpro Development, Creating Web Dynpro Components		<b>CO 4</b>
<b>Experiment 8</b>	Navigating in Eclipse, Searching in Eclipse		<b>CO 1</b>
<b>Experiment 9</b>	Managing Version Control, Identifying Sources of Help and Information		<b>CO 1</b>
<b>Experiment 10</b>	Testing and Analysis, Performing Static Testing with the Syntax Check, Performing Static Testing with the ABAP Test Cockpit.		<b>CO 3</b>
<b>Experiment 11</b>	Performing ABAP Unit Tests, Analysing Performance with the ABAP Profiler.		<b>CO 3</b>
<b>Experiment 12</b>	Eclipse: An Extensible Toolkit, Lesson: Extending Eclipse Functionality with Other SAP Tools.		<b>CO 1</b>
<b>List of Submission:</b>			
3.	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)



<b>Government College of Engineering, Karad</b>												
<b>Second Year (Sem – IV) OE- Institute Level- Industrial orientated Open Elective- ERP-SAP</b>												
<b>IOE3443: OE II- SAP HANA</b>												
<b>Teaching Scheme</b>						<b>Examination Scheme</b>						
Lectures	02 Hrs/week					ISE	50					
Tutorials	00 Hrs/week					ESE	50					
Total Credits	02											
						<b>Duration of ESE</b>	<b>As applicable</b>					
<b>Prerequisite :</b> Basics of ABAP programming												
<b>Course Outcomes (CO):</b> Students will be able to												
<b>CO1</b>	Describe the fundamentals of analytical processing, data management, and advanced analytics in SAP HANA											
<b>CO2</b>	Develop calculation views, custom SQL data warehouses, and applications on SAP HANA											
<b>CO3</b>	Evaluate the performance and integration of SAP Business Intelligence tools and SAP Business Warehouse with SAP HANA											
<b>CO4</b>	Design and implement data tiring strategies, SAP Data Warehouse Cloud solutions, and enterprise suite applications on SAP HANA											
	<b>Course Contents</b>										<b>CO</b>	<b>Hours</b>
<b>Unit 1</b>	Analytical Processing with SAP HANA, Developing Calculation Views with SAP HANA, Advanced Analytics with SAP HANA.										<b>CO 1, CO 2</b>	<b>(04)</b>
<b>Unit 2</b>	Connecting SAP Business Intelligence Tools to SAP HANA, Data Management with SAP HANA, Data Tiering with SAP HANA, Describing Data Acquisition Tools.										<b>CO 1, CO 3, CO 4</b>	<b>(05)</b>
<b>Unit 3</b>	Powering Data Warehouses with SAP HANA, Running SAP Business Warehouse on SAP HANA.										<b>CO3,</b>	<b>(05)</b>
<b>Unit 4</b>	Developing Custom SQL Data Warehouses with SAP HANA, SAP Data Warehouse Cloud.										<b>CO 2, CO 4</b>	<b>(04)</b>
<b>Unit 5</b>	Running SAP Enterprise Suites on SAP HANA, Running SAP Enterprise Suites on SAP HANA.										<b>CO 4</b>	<b>(04)</b>
<b>Unit 6</b>	Developing Applications on SAP HANA, Developing ABAP applications for SAP HANA, Developing Native SAP HANA Applications.										<b>CO 2, CO 4</b>	<b>(04)</b>
<b>Text Books</b>												
<b>1.</b>	Hermann Gahm, Thorsten Schneider, Christiaan Swanepoel, Eric Westenberger, “ABAP Programming for SAP HANA”, SAP Press, ISBN-13: 978-1493213049, 3rd Edition											
<b>2.</b>	Hermann Gahm, Thorsten Schneider, Eric Westenberger, Thomas Jung , “SAP HANA for ABAP Developers”, SAP Press, ISBN-13: 978-1592298789, 2nd Edition											
<b>3.</b>	Paul Hardy , “ABAP to the Future: Advanced, Modern ABAP 7.5x Programming Techniques”, Espresso Tutorials, ISBN-13: 978-1946390073, 1st Edition											
<b>Reference Books</b>												
<b>1.</b>	Rehan Zaidi , “SAP ABAP Advanced Cookbook”,Packt Publishing, 1 <sup>st</sup> edition, ISBN-13: 978-1782176440.											
<b>Useful Links</b>												
<b>1.</b>	<a href="https://www.linkedin.com/learning/topics/sap">https://www.linkedin.com/learning/topics/sap</a>											
<b>2.</b>	<a href="https://community.sap.com/t5/enterprise-resource-planning/ct-p/erp">https://community.sap.com/t5/enterprise-resource-planning/ct-p/erp</a>											
<b>3.</b>	<a href="https://open.sap.com/">https://open.sap.com/</a>											

**\*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
<b>CO 1</b>	3	-	-	-	1	-	-	-	1	2	-	-
<b>CO 2</b>	3	3	3	3	3	1	-	1	2	2	1	1
<b>CO 3</b>	3	3	3	3	3	1	-	1	3	2	2	1
<b>CO 4</b>	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
<b>TOTAL</b>	<b>50</b>	<b>50</b>

**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
<b>Prerequisite :</b> Knowledge of SAP HANA			
<b>Course Outcomes (CO):</b> Students will be able to			
<b>CO1</b>	Perform detail literature survey on the research topic of work.		
<b>CO2</b>	Carry out detailed mathematical modelling or experimental validation.		
<b>CO3</b>	Draw inferences from the findings and present conclusion.		
<b>CO4</b>	Develop presentation and technical report writing skills.		
	<b>Course Contents</b>		<b>CO</b>
	<p>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..</p> <ul style="list-style-type: none"> <li>Students will prepare a technical report in prescribed format based on their work.</li> <li>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.</li> <li>The students will present their project work before the committee. The presentation of the project shall be of 45 min followed by viva voce.</li> <li>The project guide will award the marks to the individual student depending on the group average awarded by the committee.</li> </ul> <p>Each Project Guide shall be allotted maximum TWO groups for guidance. Each group will submit the copies of the completed project report.</p>		<b>CO 1, CO 2, CO 3, CO 4</b>
	<b>Submission: Project report in standard format.</b>		

**\*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
<b>TOTAL</b>	<b>50</b>	<b>50</b>

## 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			
<b>Lectures</b>	02 Hrs/Week	<b>MSE</b>	20		
<b>Tutorials</b>	00 Hrs/Week	<b>ISE</b>	20		
<b>Total Credits</b>	02	<b>ESE</b>	60		
		<b>Duration of ESE</b>	02 Hrs 30 Min		
<b>Prerequisite :</b> Basics of legal concepts and civics					
<b>Course Outcomes :</b> Students will be able to					
<b>CO1</b>	Know about the contribution of constituent assembly and role of Dr. B. R. Ambedkar in shaping the constitution of India.				
<b>CO2</b>	Know about the structure of the constitution.				
<b>CO3</b>	Know the significance of fundamental rights and duties in order to sensitize towards the constitutional goals which every citizen shall cherish and preserve.				
<b>CO4</b>	Know the composition of parliament, judiciary and emergency provisions.				
		Course Contents		CO	Hrs
<b>Unit 1</b>	<b>Making of constitution and features</b> Making of Indian Constitution ,Nature of constitution, Salient Features of the Indian Constitution .Preamble			<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Fundamental rights</b> 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).			<b>CO2</b>	<b>(05)</b>
<b>Unit 3</b>	<b>Directive principles, fundamental duties and social justice (art 35-51a)</b> Underlying object and significance of Directive Principles, Classification of Directives, Fundamental Right and Directive principles- Interrelationship, Fundamental Duties.			<b>CO3</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Parliament</b> 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.			<b>CO3</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Emergency provisions</b> 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			<b>CO4</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Judiciary under constitution</b> 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.			<b>CO, CO4</b>	<b>(05)</b>
<b>Text Books</b>					
<b>1.</b>	Dr. Pandey J.N. :“Constitutional Law of India”. Central Law Agency, 2007.				
<b>2.</b>	D.D. Basu :“Shorter Constitution of India” : Prentice Hall of India, Delhi,1996.				
<b>3.</b>	M.P.Jain “Indian Constitutional Law”, Wadhwa.				
<b>Reference Books</b>					
<b>1.</b>	H.M. Seervai: “Constitution of India” Vol. 1-3 , Tripathi, Bombay, 1992.				
<b>2.</b>	D.D. Basu :“Shorter Constitution of India”Prentice Hall of India, Delhi,1996.				
<b>3.</b>	Constituent Assembly Debates Vol. 1 to 12 (1989)				
<b>4.</b>	M.P.Singh (ed) V.N. Shukla :“Constitutional Law of India”Oxford,2000.				
<b>5.</b>	P.M.Bakshi, “Constitution of India”, Universal.				
<b>6.</b>	The Framing of India’s Constitution in Six Volumes (B.Shiva Rao)				
<b>Useful Links</b>					
<b>1.</b>	<a href="https://www.constitutionofindia.net/constitution-assembly-debates/">https://www.constitutionofindia.net/constitution-assembly-debates/</a>				
<b>2.</b>	<a href="https://constitutionnet.org/">https://constitutionnet.org/</a>				
<b>3.</b>	<a href="https://www.india.gov.in/my-government/constitution-india">https://www.india.gov.in/my-government/constitution-india</a>				

## 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

<b>Government College of Engineering, Karad</b>				
<b>Second Year (Sem – IV) MDM-(Other Discipline) – Law</b>				
<b>IMO3412: Human Rights and International Laws</b>				
<b>Teaching Scheme</b>		<b>Examination Scheme</b>		
<b>Lectures</b>	02 Hrs/Week	<b>MSE</b>	20	
<b>Tutorials</b>	00 Hrs/Week	<b>ISE</b>	20	
<b>Total Credits</b>	02	<b>ESE</b>	60	
		<b>Duration of ESE</b>	<b>02 Hrs 30 Min</b>	
<b>Prerequisite :</b> Basics of legal concepts and civics				
<b>Course Outcomes :</b> Students will be able to				
<b>CO1</b>	Understand the development and sources of international laws.			
<b>CO2</b>	Know the role of international agencies like UN in creation and maintenance of international law in order to maintain the peace and safety.			
<b>CO3</b>	Know the concept and development of human rights.			
<b>CO4</b>	Know the rights of vulnerable sections of the society and mechanism to protect the rights.			
	<b>Course Contents</b>		<b>CO</b>	<b>Hrs</b>
<b>Unit 1</b>	<b>The concept, nature, and history of international law</b> Definitions and Nature of International Law, Historical Development of International Law , Basis of International Law, Relationship between International Law and Municipal Law.		<b>CO1</b>	<b>(04)</b>
<b>Unit 2</b>	<b>Sources of international law</b> Customs and Usages, Treaties – In general, Judicial Decisions, Other Sources – Writings of Jurists, Equity, Resolutions of General Assembly, etc.		<b>CO2</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Role of united nations in international law</b> Historical background, Organs of United Nations, Preamble and Purposes of United Nations, The Principles of United Nations.		<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Concept and development of human rights</b> Meaning, Definition, Importance and Scope of Human Rights, Kinds of Human Rights, Human Rights in India –Constitutional provisions, Role of NHRC, SHRC in India.		<b>CO3</b>	<b>(04)</b>
<b>Unit 5</b>	<b>International bill of rights</b> 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.		<b>CO4</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Human rights and vulnerable groups</b> Women and human rights, children and human rights, aged persons and human rights, disabled persons and human rights.		<b>CO, CO4</b>	<b>(05)</b>
<b>Text Books</b>				
<b>1.</b>	H. O. Agarwal: “International Law and Human Rights” Central Law Agency, Allahabad			
<b>2.</b>	S. K. Kapoor, “Public International Law”, Central Law Agency, Allahabad.			
<b>3.</b>	M. P. Tondon, “Public International Law” 2024.			
<b>Reference Books</b>				
<b>1.</b>	Dr. S. K. Kapoor, “International Law” 2021.			
<b>2.</b>	S. K. Varma, “Public International Law” Prentice-Hall Pub., New Delhi, 1998.			
<b>3.</b>	J. G. Starke, “Introduction to International Law”, : Aditya Books, 10 <sup>th</sup> edition, 1989.			
<b>4.</b>	J. B. Brierly “The Law of Nations” Oxford Publications, London.			
<b>5.</b>	Ian Brownlie “Principles of Public International Law” Oxford Publications, London.			
<b>6.</b>	N. K. Jaykumar, “International Law & Human Rights” Lexis Nexis.			
<b>Useful Links</b>				
<b>1.</b>	<a href="https://www.un.org/en/global-issues/human-rights">https://www.un.org/en/global-issues/human-rights</a>			
<b>2.</b>	<a href="https://www.ohchr.org/en/what-are-human-rights">https://www.ohchr.org/en/what-are-human-rights</a>			
<b>3.</b>	<a href="https://nhrc.nic.in/">https://nhrc.nic.in/</a>			

## 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	
<b>Prerequisite :</b> Mathematics, Computer Fundamentals				
<b>Course Outcomes (CO):</b> Students will be able to				
<b>CO1</b>	Apply the principles of microeconomics in real time scenarios.			
<b>CO2</b>	Use supply and demand diagrams to analyze the impact of overall changes in supply and demand on price and quantity.			
<b>CO3</b>	Identify the impact of changes in price and income on a consumer’s decision via shifting income and substitution effects.			
<b>CO4</b>	Analyze the behavior of firms in a perfectly competitive market in the short-run and the long-run			
Course Contents			CO	Hours
<b>Unit 1</b>	<b>Basic of microeconomics:</b> 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.		<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>Consumer behaviour:</b> 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		<b>CO1</b>	<b>(04)</b>
<b>Unit 3</b>	<b>Demand analysis:</b> 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		<b>CO2</b>	<b>(04)</b>
<b>Unit 4</b>	<b>Production and cost:</b> 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.		<b>CO2</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Different market structures:</b> 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		<b>CO3</b>	<b>(05)</b>
<b>Unit 6</b>	<b>Personal economics:</b> Compound interest and credit, financial markets, human capital and insurance, money management/ budgeting, risk and return, saving and investing, ( <b>self-study:</b> role of it in financial market, it economics and data mining in stock market).		<b>CO4</b>	<b>(04)</b>
<b>Text Books</b>				
<b>1.</b>	D.N.Dwivedi, “Microeconomics”, Pearson Publication, New Delhi, 2011. (Unit 1,2,3,4,5)			
<b>2.</b>	Rachel Siegel, Carol Yacht, “Personal finance”, Publisher Saylor Foundation ISBN 13: 9780982361863, 2009. (Unit 6)			
<b>Reference Books</b>				
<b>1.</b>	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
<b>Useful Links</b>	
1.	<a href="https://nptel.ac.in/courses/112/107/112107209/">https://nptel.ac.in/courses/112/107/112107209/</a> Dr. P. K. Jha IIT Roorkee
2.	<a href="https://nptel.ac.in/courses/109/104/109104073/">https://nptel.ac.in/courses/109/104/109104073/</a> Dr. S. Sinha IIT Kanpur
3.	<a href="https://www.econlib.org/library/Topics/HighSchool/HighSchoolTopics.html">https://www.econlib.org/library/Topics/HighSchool/HighSchoolTopics.html</a>

### 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	02Hrs/week	MSE	20
Tutorials	-	ISE	20
TotalCredits	02	ESE	60
		DurationofESE	02 Hrs 30Min

**CourseOutcomes(CO):**Students will be able to

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

CourseContents		COs	Hours
<b>Unit 1</b>	<b>Introduction to CSR:</b> 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.	<b>CO1</b>	<b>(05)</b>
<b>Unit 2</b>	<b>International framework for corporate social Responsibility:</b> 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.	<b>CO2</b>	<b>(05)</b>
<b>Unit 3</b>	<b>CSR-Legislation In India &amp; the world.:</b> 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.	<b>CO3</b>	<b>(04)</b>
<b>Unit 4</b>	<b>The Drivers of CSR in India:</b> Market based pressure and incentives civil society pressure, the regulatory environment in India Counter trends. Performance in major business and programs. Voluntarism Judicial activism.	<b>CO4</b>	<b>(04)</b>
<b>Unit 5</b>	<b>Identifying key stakeholders of CSR &amp; their roles:</b> 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.	<b>CO3</b>	<b>(04)</b>
<b>Unit 6</b>	<b>Review current trends and opportunities in CSR:</b> CSR as a Strategic Business tool for Sustainable development. Review of successful corporate initiatives & challenges of CSR. Case Studies of Major CSR Initiatives.	<b>CO4</b>	<b>(04)</b>

**TextBooks**

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

**ReferenceBooks**

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](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

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