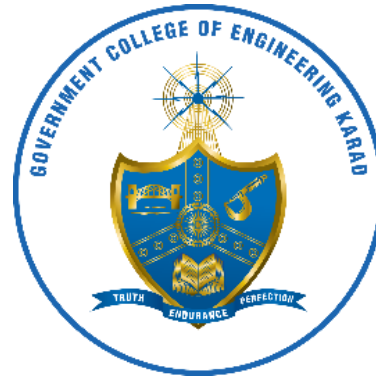


GOVERNMENT COLLEGE OF ENGINEERING KARAD

(An Autonomous Institute of Government of Maharashtra)



DEPARTMENT OF MECHANICAL ENGINEERING

PROPOSED SCHEME OF INSTRUCTION FOR
ADDITIONAL CREDIT COURSES (Offline Mode)
(Honours, Honours with Research and Double Minor)

AS PER NEP-2020

W.E.F

AY 2024-25

GOVERNMENT COLLEGE OF ENGINEERING KARAD

(An Autonomous Institute of Government of Maharashtra)

DEPARTMENT OF MECHANICAL ENGINEERING

INSTITUTE VISION

To emerge as a technical Institute of national repute driven by excellence in imparting value based education and innovation in research to face the Global needs of profession.

INSTITUTE MISSION

To create professionally competent engineers driven with the sense of responsibility towards nature and society.

DEPARTMENT VISION

"Be a nationally recognized mechanical engineering department that provides right academic ambience and nurtures innate talent of students"

DEPARTMENT MISSION

"Prepare engineering students for successful career by imparting knowledge, skills & right attitude."

GOVERNMENT COLLEGE OF ENGINEERING KARAD

(An Autonomous Institute of Government of Maharashtra)

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAMME EDUCATIONAL OBJECTIVES (PEO)

PEO1	Solve problems related with mechanical engineering using knowledge of mathematics, basic sciences, mechanical and relevant engineering disciplines and skills developed during graduation studies
PEO2	Demonstrate an understanding about selected specific areas of mechanical engineering as a critical step in career development
PEO3	Function and communicate effectively, both individually and with multidisciplinary teams using professional ethics, social awareness and environmental concern
PEO4	Engage in lifelong learning for successful adaptation to technological changes due to research

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1	Able to exhibit skills to cater industry requirements..
PSO2	Able to create a knowledge through project based learning
PSO3	Able to excel in multidisciplinary environment.

GOVERNMENT COLLEGE OF ENGINEERING KARAD

(An Autonomous Institute of Government of Maharashtra)

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAMME OUTCOMES (PO)

PO1	Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	Problem analysis: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO3	Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO4	Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO5	Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO6	The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO7	Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO8	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO11	Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO12	Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Scheme of Instructions for

‘Honors’

Offline Mode

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: B.Tech Mechanical Honors (Industrial Product Design) (wef 2024-25)

Guidelines

Students will take up 5-6 additional courses in the same Engineering/ Technology discipline of 18 credits distributed over semester III –VIII. These 18 credits will be over and above the 176 credits prescribed for four year Multidisciplinary Bachelor's degree in Engg/Tech Program.

Minor: Semester – I (Major: Semester – IV)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEHO-0401	Fundamentals of Product design and process	03	--	03	03	20	30	50
2	MEHO-0402	Product design techniques lab	--	02	02	01	-	50	50
		Total	03	02	05	04	20	80	100

Minor: Semester – II (Major: Semester – V)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEHO-0501	Product packaging and Materials	03	--	03	03	20	30	50
2	MEHO-0502	Product packaging CAD lab	--	02	02	01	--	50	50
		Total	03	02	05	04	20	80	100

L- Lecture

P-Practical

FA-I- Formative Assessment

SA - Summative Assessment (For Laboratory End Semester performance)

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: B.Tech Mechanical Honors (Industrial Product Design)

Minor: Semester – III (Major: Semester – VI)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEHO-0601	Product Ergonomics	03	--	03	03	20	30	50
2	MEHO-0602	Design for medical and agriculture applications lab	--	02	02	01	--	50	50
		Total	03	02	05	04	20	80	100

Minor: Semester – IV (Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEHO-0701	Product estimation and costing	02	--	02	02	20	30	50
2	MEHO-0702	Prototyping Techniques lab	--	02	02	01	--	50	50
		Total	02	02	04	03	20	80	100

L- Lecture

P-Practical

FA- Formative Assessment-

SA - Summative Assessment (For Laboratory End Semester performance)

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: B.Tech Mechanical Honors (Industrial Product Design)

Minor: Semester – V (Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	MEHO-0801	Major Capstone Project (Design & Development)	--	6	6	3	50	50	100
		Total	--	6	6	3	50	50	100

L- Lecture

P-Practical

SA - Summative Assessment (For Laboratory End Semester performance)

PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Scheme of Instructions for
Honors with Research
Offline Mode

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: B.Tech Mechanical Honors with Research (wef 2026-27)

Guidelines

Students will work on research project for 18 credits in the semester VII –VIII in the respective Major Engineering/Technology discipline. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program.

Minor: Semester – I (Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	MEHRO-0701	Research Project Phase -I	--	18	18	09	100	100	200
		Total	--	18	18	09	100	100	200

Minor: Semester – II (Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	MEHRO-0801	Research Project Phase -II	--	18	18	09	100	100	200
		Total	--	18	18	09	100	100	200

L- Lecture

P-Practical

FA-I- Formative Assessment-I

FA-II- Formative Assessment-II

SA - Summative Assessment (For Laboratory End Semester performance)

PBE-I- Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Scheme of Instructions for

‘Double Minor’

Offline Mode

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: B.Tech Mechanical with Double Minors (wef 2024-25)

Guidelines

Students will take up 5-6 additional courses in another Engineering/ Technology/ Emerging Area of Specialization of 18 credit distributed over semester III – VIII. These 18 credits will be over and above the 176 credits prescribed for four year multidisciplinary bachelor's degree in Engg/Tech Program

Minor: Semester – I (Major: Semester – III)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEDO-0301	Material Science	02	--	02	02	50	50	100
		Total	02	00	02	02	50	50	100

Minor: Semester – II (Major: Semester – IV)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEDO-0401	Analysis of Mechanical elements	02	--	02	02	50	50	100
		Total	02	00	02	02	50	50	100

L- Lecture

P-Practical

FA- Formative Assessment-I

SA - Summative Assessment (For Laboratory End Semester performance)

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Double Minors

Minor: Semester – III (Major: Semester – V)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEDO-0501	Thermal Engineering	03	--	03	03	50	50	100
2	MEDO-0502	Mechanical Engineering Lab	--	02	02	01	50	--	50
		Total	03	02	05	04	100	50	150

Minor: Semester – IV (Major: Semester – VI)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEDO-0601	Manufacturing Engineering	02	--	02	02	50	50	100
		Total	02	00	02	02	50	50	100

Government College of Engineering, Karad

PROPOSED SCHEME OF INSTRUCTION

Programme: Double Minors

Minor: Semester – V (Major: Semester – VII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							FA	SA	TOTAL
1	MEDO-0701	Energy Conservation and Management	02	--	02	02	50	50	100
		Total	02	00	02	02	50	50	100

Minor: Semester – V (Major: Semester – VIII)

Sr. No.	Course Code	Course Title	L	P	Contact Hrs/Wk	Course Credits	EXAM SCHEME		
							PBE-I	PBE-II	TOTAL
1	MEDO-0801	Mechanical System Design	2	--	2	2	50	50	100
2	MEDO-0802	Major Capstone Project (Design & Development)	--	8	8	4	50	50	100
		Total	2	8	10	6	100	100	200

L- Lecture

P-Practical

SA - Summative Assessment (For Laboratory End Semester performance)

PBE-I– Project-based Examination (For Laboratory Mid Semester Performance)

PBE- II Project-based Examination (For Laboratory End Semester Performance)

PROGRESSIVE TOTAL CREDITS: 18

Government College of Engineering, Karad

Programme: B.Tech Mechanical Honors (Industrial Product Design)

MEHO-401 : Fundamentals of Product design and process

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

Prerequisite: Any department enthusiast interested to Product design.

Course Outcomes (CO): Students will be able to

CO1	Develop logical and creative thinking for the solutions of Product Design.
CO2	Conceptualize products by understanding various Trends.
CO3	Implement deep knowledge of Product Design, Technology in the industries
CO4	Inherit, analyse and solve various kinds of existing problems and create solution

Course Contents		CO	Hours
Unit 1	Industrial Design Principles Design principles like functionality, innovation aesthetics, simplicity etc.	CO1	(08)
Unit 2	Elements of design: Understanding different elements of design such as symmetry, continuity, contrast, balance, emphasis, proportion, hierarchy, repetition, rhythm, pattern, white space, Movement, variety, unity etc. Concept of visual language and visual design, Gestalt Laws, composition and figure and ground relationships. Introduction to concept of Negative space, Color circle, hue and saturation. Color in traditions and Interpretation of colors..	CO2	(07)
Unit 3	Conceptualization and Ideation: Methods and techniques to start ideation such as metaphors, inspirations, Brainstorming sessions etc. Introduction to 2 dimensional and 3 dimensional form. Radii manipulation in 2D and 3D form. Exploration of surface textures in different Materials. Expressions in Form like soft, hard, warm, cold, precise, gross ,delicate , strong, fragile, rugged etc.	CO2	(05)
Unit 4	Design for manufacturing and assembly: Different aspects of modular designs in interior and exterior of vehicle by understand user needs, Product Prototyping techniques, Understanding different ways of platform sharing to increase the variants as permarket needs, benefits and limitations of platform sharing etc.	CO2	(07)
Unit 5	CAD in product design Understanding importance of CAD can help to faster design iterations, improve accuracy, efficiency, increase productivity etc.	CO2, CO3	(06)
Unit 6	Product Planning and Marketing: Process of making business plans, different marketing methods, product launch ideation and executions, Design feasibility, Selection of off the shelf parts, product design validation, design for manufacturing, product planning, segment selection, product design plan, product specification, product development methods, prototyping methods.	CO4	(07)

Reference Books

1.	The Industrial Design Reference & Specification Book: Dan Cuffaro, Isaac Zaksenberg Rockport Publishers, 15 Sept 2013
2.	The Aesthetics of Industrial Design: Seeing, Designing and Making: Richard Harriot

Useful Links

1.	https://dribbble.com/tags/product-design
2.	https://99designs.com/inspiration/websites/product-design
3.	www.behance.net/

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

1: Slight(Low)

2: Moderate(Medium)

3: Substantial(High)

Assessment Pattern (with revised Bloom's Taxonomy)

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

Government College of Engineering, Karad

Programme: B.Tech Mechanical with Double Minors

MEDO 0301: (MDM I)- Material Science

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

Pre-Requisite: Nil

Course Outcomes: students will be able to -

CO1	Understand basic of solidification, different types of nucleation, cooling curve and draw phase diagrams
CO2	Comprehend the knowledge about ferrous, non-ferrous metal and their heat treatment process
CO3	Outline and appreciate the advancements in materials engineering related to composites, ceramics, and plastics
CO4	Analyze and select materials for specific applications.

Course Contents		CO	Hours
Unit 1	Introduction to Material Science Metallic and Non-metallic materials and its classification(metals/alloys, polymers and composites), Crystal systems , a) Types of Dislocations; Slip Systems; Plastic Deformation by Slip and Twinning in single crystal and polycrystalline material, Strain hardening Cold working, Recovery and Recrystallization b) Solid solutions and intermediate phases ,Gibbs phase rule	CO1	(5)
Unit 2	Engineering Materials Ferrous materials Introduction to Fe-Fe ₃ C equilibrium diagram, Steel, Plain carbons steel , Alloy steel a) Free cutting steels, HSLA high carbon low alloy steels, Maraging steels, Creep resisting steels, Stainless steels-different types. Tool steels-types, HSS b) Specifications based on -IS, BS, SAE, AISI Cast Irons-Classification, properties and production process	CO2	(4)
Unit 3	Non-ferrous materials Study of non-ferrous materials	CO2	(4)
Unit 4	Principles of heat treatment TTT –Diagram and CCT -Diagrams -significance a) Heat treatment of steels b) Heat treatment of Non-ferrous Alloys	CO2	(4)
Unit 5	Advance Materials Composite material:- Introduction to Composite, Classification of composites, , Mechanical properties of composites Bio- Materials:- Classes of materials used in medicine ,and Application of materials in medicine Smart materials:- classification , specific types : Shape Memory Alloys, Piezoelectric Materials, Magnetostrictive Materials, Magneto-Rheological Fluids, Electro-Rheological Fluids	CO3	(5)
Unit 6	Properties of materials and its selection Properties of materials :- Mechanical Properties, Electrical properties, Thermal properties, Magnetic properties, Optical properties, Material selection for engineering Materials Exploring materials using materials property charts, Materials selection process: Translation, Screening ,Ranking, Selecting materials: materials indices, Case studies	CO4	(4)

Assignment:- Assignment based Selection of material for specific application

Text Books

1.	V.D. Kodgire, “Material science and metallurgy for engineers”, Everest Publishers Pune,44 th 2018
2.	W. D Callister, “Material science and engineering”, Wiley India Pvt. Ltd., 5 th Edition.
3.	T.V. Rajan / C.P. Sharma, “Heat Treatments Principles and Practices”, Prentice Hall of India Pvt Ltd, New Delhi

Reference Books

1.	R.A. Higgins, “Engineering Metallurgy”, Viva Books Pvt. Ltd., New Delhi, 1 st Edition,
2.	S.H. Avner, “Introduction to physical metallurgy”, Mcgraw Hill Book Company Inc, 2 nd edition (1 July 2017)

3.	Michael F. Ashby “Materials Selection in Mechanical Design” Fourth Edition • 2011 Butterworth-Heinemann publication
4.	D. S. Clark, W. R. Varney, “Physical Metallurgy for Engineers”, AN East West Press Pvt. Ltd., New Delhi, 2 nd Edition, 1962
5.	V Raghwan, “Material Science and Engineering”, Prentice Hall of India Pvt. Ltd., New Delhi ,6 th Edition, 2015.
6.	J L Smith and SC Bhatia, “Heat Treatment of Metals”, CBS Publishers and distributors, New Delhi, 1 st edition, 2008.

Useful Links

1.	https://archive.nptel.ac.in/courses/113/102/113102080/
2.	https://archive.nptel.ac.in/courses/112/108/112108150/

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

Assessment Pattern (with revised Bloom’s Taxonomy)

Knowledge Level	MSE	ISE	ESE
Remember	5	4	10
Understand	-	4	10
Apply	5	4	15
Analyse	5	4	10
Evaluate	5	4	15
Create	-	-	-
TOTAL	20	20	60

Government College of Engineering, Karad
Second Year (Sem – IV) Mechanical Engineering Minor

MEDO-0401 (DM-II): Analysis of Mechanical Elements (MDM-2)

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

Pre-Requisite: Nil

Course Outcomes: students will be able to -

CO1	Understand basic requirements for design of components.
CO2	Understand failure criteria for given machine element.
CO3	Evalute Bending and shear stresses in beams subjected to different loadings for different machine parts
CO4	Analyse stress and strains in various machine elements such as simple machine components, beams, shafts etc.

Course Contents		CO	Hours
Unit 1	Overview of Design Selection of materials , Design Process, Evolution of design design criteria, Concurrent design,	CO1	(04)
Unit 2	Deformation in Solids and Principal Stresses Concept of stress and strain- tension, compression and shear stresses, Hooke’s law, Poisson’s ratio, elastic constants and their relations- volumetric, linear and shear strains- principal stresses	CO3,4	(05)
Unit 3	Introduction to Stresses SFD, BMD, Bending, Shear, Torsional stresses	CO3,4	(04)
Unit 4	Product life cycle Product design, Product development life cycle, learning from failures.	CO4	(04)
Unit 5	Ergonomics Introduction and Overview of Ergonomics, Tools and techniques for Ergonomics	CO1	(04)
Unit 6	Failure Analysis Case studies-failure analysis of mechanical components, Forensic analysis	CO4	(05)

Text Books

1.	Gere and Timoshenko, “Mechanics of Materials”, CBS Publications, 2 nd edition, 2008.
2.	S. S. Rattan - Strength of Materials, Tata Mcgraw Hill, 2 nd edition, 2016.
3.	Rattan, Ramamurtham, “A Textbook of Strength of Materials”, Laxmi Publications, 6 th edition, 2017

Reference Books

1.	Ferdinand Beer, Jr., E. Russell Johnston, John DeWolf, David Mazurek - Mechanics of Materials-McGraw-Hill Education, 9 th edition, 2014
2.	Mott Robert L, Applied Strength of Materials, 4th edition, 2006

Useful Links

1.	https://nptel.ac.in/courses/112107147
2.	https://onlinecourses.nptel.ac.in/noc23_ce80/preview

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	-	1
CO 2	2	-	-	2	-	-	-	-	-	-	-	2	1	-	1
CO 3	1	2	1	3	-	-	-	-	-	-	-	1	1	-	2
CO 4	2	1	2	3	-	-	-	-	-	-	-	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	-	4	10
Understand	5	4	10
Apply	5	4	15
Analyse	5	4	10
Evaluate	5	4	15
Create	-	-	-
TOTAL	20	20	60

