

MECHANICAL ENGINEERING DEPARTMENT

FACULTY OF TECHNOLOGY AND

ENGINEERING (KALABHAVAN)

Bachelor of Engineering Syllabus



VISION

To emerge as a center of excellence in Mechanical Engineering Education, Research and Innovations for Sustainable Development.

MISSION

1. Build ecosystem for academic excellence and innovative research in Technology and Engineering.
2. Foster Collaborations with Institutes and Industries.
3. Contribute towards holistic and

sustainable development.

PROGRAMME OUTCOMES (POs)

PO 1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 2. Problem Analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO 3. 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.

PO 4. 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 for complex problems.

PO 5. 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.

PO 6. 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.

PO 7. 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.

PO 8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9. Individual and Teamwork: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10. 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.

PO 11. 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.

PO 12. 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.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

PSO 1. Apply fundamentals of design, thermo-fluids and production engineering knowledge for innovative and critical thinking, problem-solving and experimental skills with integrity and inclusivity in professional engineering practice or business.

PSO 2. Achieve further career development through graduate education, professional development courses and/or on-the-job training and experience.

PSO 3. Develop leadership and collaborative roles in their careers.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO 1. To prepare professionals to cater to industry, academia, research organizations, government set ups and consulting firms.

PEO 2. To prepare graduates who will contribute to society as responsible citizens.

PEO 3. To prepare graduates who will get recognition, through demonstration of good analytical, design and implementation skills and lifelong learning.

Bloom's Taxonomy Levels:	1. Remember	2. Understand	3. Application	4. Analysis	5. Evaluation	6. Creation
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UG TEACHING SCHEME

DEPARTMENT OF
MECHANICAL
ENGINEERING



THE MAHARAJA SAYJIRAO UNIVERSITY OF BARODA, VADODARA										
FACULTY OF TECHNOLOGY AND ENGINEERING										
DEPARTMENT OF MECHANICAL ENGINEERING										
Existing Teaching and Examination scheme										
	NAME OF THE DEGREE/DIPLOMA PROGRAMM	SUBJECT CODE THEORY	SUBJECT CODE T.W./VIVA/PRA	SUBJECT	THEORY	T.W./VIVA/PRA	TOTAL MARKS	LEC HOUR/WEEK	LAB HOUR/WEEK	TUTORIAL HOUR/WEEK
F I R S T Y E A R	FSBE I	AMA1101		Applied Mathematics I	100		100	3	0	1
		APH101	APH101 L	Applied Physics I	100	50	150	3	3	1
		MEC 1101	MEC 1101 L	Engineering Drawing I	100	50	150	2	4	1
		CE1104	CE1104 L	Fundamentals of Civil Engineering	100	50	150	3	3	1
		MET1101		Material Science	100		100	4	0	0
		MEC 1102		Workshop Practice I		50	50	0	3	0
		TOTAL			500	200	700	15	13	4
	SSBE I	AMA1201		Applied Mathematics II	100		100	3	0	1
		AM1201	AM121 L	Applied Mechanics	100	50	150	3	3	1
		ELE1203	ELE1203	Electrotechniques I	100		100	3	2	1
		MEC 1201	MEC1201L	Engineering Drawing II	100	50	150	2	4	1
		MEC 1203	NO LAB	Thermodynamics	100		100	3	0	1
		MEC 1204	NO LAB	Workshop Practice II		50	50	0	3	0
		TOTAL			500	150	650	14	10	5
S E C O N D Y E A R	FSBE II	MEC 1303		Alternative Energy Sources	100		100	4	0	0
		AMA211		Applied Mathematics III	100		100	3	0	1
		MEC 1304	MEC 1304 L	Dynamics of Machines I	100	50	150	4	2	0
		ELE1309	ELE1309 L	Electrotechniques II	100	50	150	3	2	1
		APM 1303	AMP 1303	Materials and Structures	100	50	150	3	4	1
		MEC 1302	MEC 1302 L	Thermal Engineering I	100	50	150	4	2	0
		TOTAL			600	200	800	21	10	3
	SSBE II	MEC 1403	MEC 1403 L	Dynamics of Incompressible Flow	100	50	150	4	2	0
		MEC 1402	MEC 1402 L	Dynamics of Machines II	100	50	150	4	2	0
		ELE 1410	ELE1410 L	Electronics	100	50	150	3	3	1
		MEC 1405	MEC 1405 L	Mechanical Measurements	100	50	150	4	2	0
		MEC 1404	MEC 1404 L	Production Technology I	100	50	150	4	2	0
		TOTAL			500	250	750	19	11	1
T H I R D Y E A R	FSBE III	MEC 1502	MEC 1502 L	Heat and Mass Transfer	100	50	150	4	2	0
		MEC 1501	MEC 1501 L	Hydraulics Machines	100	50	150	4	2	0
		MEC 1504	MEC 1504 L	Industrial Engineering I	100	50	150	4	2	0
		MEC 1503	MEC 1503 L	Machine Design I	100	50	150	4	3	0
		MEC 1505	MEC 1505 L	Production Technology II	100	50	150	4	2	0
		TOTAL			500	250	750	20	11	0
	SSBE III	MEC 1604	MEC 1604 L	Computational Techniques and Programming Languages	100	50	150	4	3	0
		MEC 1602	MEC 1602 L	Industrial Engineering II	100	50	150	4	2	0
		MEC 1601	MEC 1601 L	Machine Design II	100	50	150	4	3	0
		MEC 1605	MEC 1605 L	Production Technology III	100	50	150	4	2	0
		MEC 1603	MEC 1603 L	Thermal Engineering II	100	50	150	4	2	0
		TOTAL			500	250	750	20	12	0
F O U R T H Y E A R B E	FSBE IV	MEC1702		Industrial Management and Engineering Economics	100		100	4	0	0
		MEC1704	MEC1704 L	Thermal Engineering III	100	50	150	4	2	0
		MEC1701	MEC1701 L	Dynamics of Compressible Flow	100	50	150	4	2	0
		MEC 1703	MEC 17030L	Production Technology IV	100	50	150	4	2	0
		MEC1705	MEC1705 L	Elective-subject 1	100	50	150	4	2	0
		MEC 1709	MEC 1709 L	Elective- subject 2						
		TOTAL			500	300	800	20	12	0
	SSBE IV	MEC 1803	MEC 1803 L	Operation Research and Optimization Techniques	100	50	150	4	2	0
		MEC 1806		Project-term Work including Viva		100	100		6	0
		MEC 1805	MEC 1805L	TURBOMACHINES	100	50	150	4	2	0
		MEC1808	MEC1808 L	Product Design and Value Engineering	100	50	150	4	2	0
		MEC 1801	MEC 1801 L	Elective-subject 1	100	50	150	4	2	0
		MEC1804	MEC 1804 L	Elective- subject 2						
		TOTAL			400	300	700	16	14	0

B.E. Mechanical Engineering 1ST Year



	NAME OF THE DEGREE/DIPLOMA PROGRAMM	SUBJECT CODE THEORY	SUBJECT CODE T.W./VIVA/PRA	SUBJECT	THEORY	T.W./VIVA/PRA	TOTAL MARKS	LEC HOUR/WEEK	LAB HOUR/WEEK	TUTORIAL HOUR/WEEK
F I R S T B E Y E A R	FSBE I	AMA1101		Applied Mathematics I	100		100	3	0	1
		APH101	APH101 L	Applied Physics I	100	50	150	3	3	1
		MEC 1101	MEC 1101 L	Engineering Drawing I	100	50	150	2	4	1
		CE1104	CE1104 L	Fundamentals of Civil Engineering	100	50	150	3	3	1
		MET1101		Material Science	100		100	4	0	0
		MEC 1102		Workshop Practice I		50	50	0	3	0
		TOTAL			500	200	700	15	13	4
	SSBE I	AMA1201		Applied Mathematics II	100		100	3	0	1
		AM1201	AM121 L	Applied Mechanics	100	50	150	3	3	1
		ELE1203	ELE1203	Electrotechniques I	100	50	100	3	2	1
		MEC 1201	MEC1201L	Engineering Drawing II	100	50	150	2	4	1
		MEC 1203	NO LAB	Thermodynamics	100		100	3	0	1
		MEC 1204	NO LAB	Workshop Practice II		50	50	0	3	0
		TOTAL			500	150	650	14	10	5

Engineering drawing I

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering				Academic Year				2021-22		
	B.E. Mechanical : Regular Programme										
Year	I	Core / Elective / Foundation MEC 1101: Engineering Drawing I				Credits / Hours per week			Lectures: 04 Practical:- 04		
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006				Maximum Marks / Grade			Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction		Lectures and practical									
	Course Outcome (CO) MEC 1101 CO1 Use the drawing instruments effectively and how to use the dimensioning methods. CO 2 Observe, analyze and correlate two-dimensional (Orthographic view) and three dimensional (Isometric view) CO 3 Construct and application of various engineering curves in engineering practice CO 4 Apply the knowledge of Projection of points, Lines and Planes in engineering CO 5 Create freehand sketches of basic machine components										
Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)	

1.	Introduction to Engineering Curves: Introduction to conic sections, types of conic	08	20	1,2,6	C O 3	PO1,PO3	PSO1	Emp, Ent, SD	L,N,R,G	G, ES, HV, PE
	sections, eccentricity, construction of conic sections(parabola, ellipse , hyperbola) by different methods, Construction of involutes, construction of cycloid, epicycloids and hypocycloid, construction of spiral, construction of normal and tangent to all curves.									
2.	Free hand sketches: Parts of screw thread and its types, conventional representation of threads, screwed fastening- types of nuts, bolts, set screws, locking arrangement of nuts, foundation bolts, riveted and welded joints, forms and proportions of rivet heads, representation of welded joints, shaft keys and couplings- types of keys, cotter joint, knuckle joint, double cotter/sleeve joint, types of couplings.	08	10	1,2,6	C O 5	PO1, PO2, PO3, PO12	PSO1			

3.	Projection of Point and Line Introduction to principal planes of projections, projections of points located with respect to reference planes (in different quadrants), Projection of Lines, Line	08	20	3,4,6	C O 4	PO1, PO2, PO3, PO12	PSO1			
	parallel to reference planes, Line parallel to one reference plane and inclined to other reference plane, Line inclined to both the reference planes, Application of all variants									
4.	Projection of Planes Projection of Planes (Polygons, circle, semi-circle, ellipse etc.). Plane parallel to one reference plane and inclined to other, Plane inclined to both the reference plane, Concept of auxiliary plane method for projection of plane.	08	10	1,2,4	C O 4	PO1, PO2, PO3, PO12	PSO1			

5.	Orthographic projection Fundamental of projection along with classification, Projections from the pictorial view of the object on the principal planes for view from front, top and sides using first angle projection method and third angle projection method, full sectional view	10	20	2,3,5	C O 2	PO1, PO2, PO3, PO12	PSO1			
6	Isometric Projections and Isometric View or Drawing: Isometric Scale, Conversion of orthographic views into isometric projection,	10	20	2,4,5	C O 2	PO1, PO2, PO3, PO12	PSO1			

		52	100							
	Reference book									
1.	Bhatt, N.D., ‘Engineering Drawing’,									
2.	Shah, P. J., ‘Engineering Drawing’,									
3.	Bhatt, N.D., ‘Machine Drawing’,									
4.	Dhawan, R.K., ‘A Textbook of Engineering Drawing’,									
5.	Venugopal, K., ‘Engineering Drawing and Graphics’									
6.	M. Raja Roy, B.V.R. Gupta, ‘Engineering Drawing with AutoCAD’,									

Workshop Practice I

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year	2019-20
B. E. (Civil, Mechanical, Electrical, Electronics, IWM, Computer, Metallurgy, Chemical, Text Engg., Text. Tech., Text. Processing): Regular Programme Workshop Practice I				
Year	I ME CH	Core Workshop Practice I MEC 1102	Credits / Hours per week	Lectures: 00 Practical-: 03 Hours
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006	Maximum Marks / Grade	Theory: NILL PR/TW/VI VA: 50
Mode of Transaction: Practical				
Course Outcome (CO) MEC 1102 CO1 Understand importance of workshop practices in Engineering CO2Realize the importance of safety precautions in different shops. CO3Observe use of various marking, measuring, cutting and inspection tools in carpentry, fitting, smithy and molding shop. CO4Visualize different operations for production in carpentry, fitting, smithy and molding shop. CO5 Hands on practice and job making in carpentry, fitting, smithy and molding shop				

Unit No.	Topic	Contact Hours	W	BT Level	C O	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD) Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)
1	Carpentry Shop: Introduction to different tools of carpentry shop, understanding drawing of the job to be made, making of finished job as per drawing out of the given raw material of wood.	12	27	1,2,3	CO 1, CO 2, CO 3, CO 4, CO 5	PO 1, PO 5, PO 6, PO 9, PO 12	Emp, Ent, SD	L,N,R,G	G, ES, HV, PE
2	Fitting Shop: Introduction to different tools of fitting shop, understanding drawing of the job to be made, making of finished job as per drawing out of the given raw material.	12	27	1,2,3	CO 1, CO 2, CO 3, CO 4, CO 5	PO 1, PO 5, PO 6, PO 9, PO 12			
3	Smithy Shop:	12	27	1,2,3	CO	PO			

	Introduction to different tools of smithy shop, understanding drawing of the job to be made, making of finished job as per drawing out of the given raw material.				1, CO 2, CO 3, CO 4, CO 5	1, PO 5, PO 6, PO 9, PO 12			
4	Moulding Practice: Introduction to different tools of moulding shop, Demonstration of moulding process, Preparation of mould assembly as per pattern.	9	19	1,2,3	CO 1, CO 2, CO 3, CO	PO 1, PO 5, PO 6, PO			
					4, CO 5	9, PO 12			
		45	100						
Reference Books:									
1.	Workshop Technology-I. W.A. J. Chapman Taylor & Francis								
2.	Comprehensive Workshop Technology (Manufacturing Processes). S.K. Garg Laxmi publications								
3.	Workshop practice manual. K.Venkata Reddy B.S.Publications.								
4.	Workshop Technology-I. Hazra and Chaudhary Media promoters & Publisher private limited								

Applied Mathematics-I

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Mathematics		Academic Year	2020-21
Year	I	Core / Elective / Foundation AMT 1101: APPLIED MATHEMATICS-I	Credits / Hours per week	04
Semester	I	Year of Introduction: 2010 Year of Syllabus Revision: 2016	Maximum Marks / Grade	100
Mode of Transaction		Lecture		
Course Outcome (CO) (AMT1101) CO1 Evaluate successive differentiation of given function and solve identities involving higher order derivatives, evaluate radius of curvature, obtain Taylor & Maclaurin series expansion of function of single variable. Evaluate limits of indeterminate forms. CO2 Test for convergence sequences and positive term series using various tests like comparison test, ratio test. Also find the convergence, absolute and conditional convergence for alternating series. CO3 Understand the requirement of complex numbers their various representations, Demovier's theorem and its applications. Logarithm of complex numbers. Evaluate and use circular functions, hyperbolic functions. CO4 Classify the differential equations with respect to their order and linearity, explain the meaning of different types of solutions of a differential equation. CO5 Identify and solve the 1 st order differential equations.				

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional
									Ethics (PE)
1	Calculus: Reorientation, Functions of one variable Application of derivatives, Curvature, Successive differentiation, Partial derivatives, Leibnitz rule for the nth order derivative of a function, Techniques of partial derivatives.	8	16.67	1,2,3,5	CO1				
2	Infinite Series: Sequence and their convergence , convergence and divergence of infinite series, Geometric series, P – Series ,Necessary condition for convergence, Comparison test, ratio test Absolute convergence and conditional convergence of alternating series, Maclaurin's & Taylor's expansion with reminder form, Indeterminate forms L'Hospital's rule	8	16.67	1,2,3,4	CO2				

3	Complex Numbers: Complex numbers & their geometrical representation, Complex numbers in polar form, Demoivre's theorem and its applications, Exponential, logarithmic, trigonometric & hyperbolic functions.	8	16.67	1,2,3,4	CO3		Emp, SD	G	PE
4	Differential Equations Reorientation, Modeling of engineering systems pertaining to first order differential equations, Exact differential equations, integrating factors, Unified approach to first order ordinary differential equations, Equations of first order and higher degree.	8	16.67	1,2,3,5	CO4 CO5 CO1				
5	Linear differential equations of higher order with constant coefficients and with variable coefficients Models of higher order differential equations, Method of variation of parameters, Simultaneous linear differential equations Method of solution in series	10	20.83	1,2,3,5	CO2 CO3 CO4 CO5				
6	Bessel and Legendre's equations, Properties of Bessel functions Introduction to Legendre polynomials	6	12.5	1,4,5	CO5				

Reference Books

1.	Erwin Kreyszing	:	Advanced Engineering Mathematics, (6th edition) John Wiley & Sons., 1988
2.	Donald Greenspan	:	Introduction to Partial Differential Equations, Mc. Graw – Hill Inc., 2012
3.	C. R. Wylie	:	Advanced Engineering Mathematics, Mc. Graw – Hill Inc., 1986
4.	G. B. Thomas, R. L. Finney	:	Calculus and Analytic Geometry, Addison-Wesley Publishing Co., 2010
5.	J. W. Brown, R. V. Churchill	:	Complex variables and Applications, McGraw-Hill Higher Education, 2013.
6.	P. V. O'Neil	:	Advanced Engineering Mathematics, Cengage Learning (India edition), 1991.
7.	B. V. Ramana	:	Higher Engineering Mathematics, Tata Mc. Graw – Hill. (Core Engineering Series), 2006.
8.	David V. Widder	:	Advanced Calculus, Prentice Hall of India Pvt. Ltd., 1986.

Applied Physics

 सत्यं शिवं सुन्दरम्	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics	Academic Year	2022-23
B.E.(Civil, Mechanical, Civil-Irrigation and Water Management): Regular Programme			
Year	I	Core / Elective /Foundation APH1110CS:Applied Physics	Credits/Hours per week (credits (03–Lecture, 01- Tutorial, 02 - Practical)
Semester	I	Year of Introduction: 2022 Year of Syllabus Revision: 2022	Maximum Marks /Grade 100(Theory)+ 50(Practical)
Course Outcome(CO)APH1110 CO1 Understand the basics of laws governing physical world CO2 Understanding the basics of solar photo voltaic system CO3 Understanding the basics of sound and electromagnetic waves CO4 Application of physical laws in various engineering applications CO5 Application of physical laws for experimental work			

Unit No.	Topic/Unit	Contact Hours	Weightage (%)	B T L e v e l	CO	P S O	Elements of Employability (Emp)/Entrepreneurship(Ent)/Skill Development(SD)	Relevance to Local(L)/ National(N)/ Regional(R)/ Global(G) development al needs	Relation to Gender(G), Environment and Sustainability(ES), Human Values(HV)and Professional Ethics(PE)
1.	Electromagnetic Waves:	09	23	1,	C	PS	Emp. Ent	L,N,R,G	ES
	Basic laws and equations. Application for devices and instrumentation, Microscopes, Telescopes and camera, Resolution and magnifications ,Optical vibration and correction.			2	O 1 C O 3 CO4	O 1P S O 2			
2.	LASER and Matter Waves: Fundamentals,Generation,Spontaneousandstimulatedemission,conditionsforlasingaction,populationinversion,TypesandEngineeringapplications – Laser and electron beam machining and other instruments	08	21	1 , 2	C O 1 C O 4	P S O 1 P S O 2	Emp.Ent	L,N,R,G	ES

3.	Sound Waves: Sound waves characteristic and properties ,Velocity ,frequency, wavelength, intensity, loudness (expression), timber ,reflection ,echo ,reverberation. Sabine's formula ,remedies over reverberation ;Absorption of sound, absorbent materials ;Criteria for good acoustics of a building; Ultrasonic:Productionofultrasoni cwaves,Detectionofultrasonics;E ngineeringapplicationsofUltrason ics(Non-destructivetesting,Infrasound– Seismology(conceptonly))	09	23	1,2,3,4	C O 1 C O 3	P S O 1 P S O 2	Emp.Ent	L,N,R,G	ES
4	Solar cells Principle of working, conversion efficiency, Single ,multi-junction solar cells, Photovoltaic system engineering ,Thermo- photovoltaic generation in	09	23	1,2,	C O 1 C	P S O 1 P S	Emp,Ent	L,N,R,G,	ES
	electricity, Concentration and storage of electrical energy ,Photovoltaic–systems and applications			3,4	O 5	O 2			

5.	Introduction to physics of Buildings Heat transfer and air circulation in buildings, effects of thermal expansion	04	10	1 , 2 , 3 , 4	C O C O C O 4	P S O 1 P S O 2	Emo,Ent	L,N,R,G,	ES		
Suggested Reference Books:											
1.	EngineeringPhysics:byR.K.GaurandS.L.Gupta,DhanpatRaiPublications(P)Ltd.8 th Edition.										
2.	Modem Engineering Physics: by A.S. Vasudeva, S.ChandandCompanyLtd.										
3.	FundamentalsofPhysics:byD.Halliday,RResnickandJ.Walker,AsianBooksPvt.Ltd.8 th Edition										
4.	BuildingPhysics:Heat,AirandMoisture,3 rd edition,HugoS.L,Hens,Wiley										
5.	StephenJ.Fonash,“SolarCellDevicePhysics”,2 nd edition,AcademicPress,2003.										
	Experiment				BT Level		CO	PSO	Eleme nts of Emplo yabilit y(Emp)/Entre preneu rship(E nt)/Ski ll Develo pment(SD)	Relev ance to Local(L)/ Natio nal(N)/ Regi onal (R)/ Glo bal(G) deve lop men tal	Relatio n to Gend er(G) , Enviro nment and Sustain ability(ES), Human Values (HV)a nd Profess ional Ethics(PE)

							needs	
1	Microscope:-To determine the average separation between consecutive wires of A given grid using travelling Microscope	02	1, 2	CO 1, CO 2	PSO1, PSO2	SD	G	PE
2	Telescope: - To determine the resolving power of given Telescope using Raleigh Criteria of Resolution	02	2	CO 1 CO 2	PSO1, PSO2			
3	Frequency of AC Mains: To determine the frequency of A. C. Mains	02	2, 3	CO 3 CO 4	PSO1, PSO2			
4	Sound Waves: To determine the velocity of sound wave in air using resonance Tube	02	3, 4	CO 4	PSO1, PSO3			
5	Ultrasonic Waves: To determine the frequency of Ultrasonic waves and find out the velocity of Ultrasonic wave in air by using the interference theory of longitudinal wave.	02	2, 3	CO 1 CO 2	PSO1, PSO4			
6	Solar Cell: Study of I-V characteristics and determine the various parameters of given solar cell	02	2, 3	CO 4	PSO1, PSO3			
7	Laser Parameters: To determine the full angular divergence of the given gas laser	02	3, 4	CO 4	PSO1, PSO3			
8	Wavelength of Laser: To determine the wavelength of the given laser source using diffraction	02	3, 4	CO 4	PSO1, PSO3			
9.	Temperature Sensor: To study the nature of different temperature (NTC/PTC/Pt-100)	02	4, 5	CO 1	PSO1, PSO3			

10.	Young's Modulus: To determine the Young's Modulus of a given object	02	4, 6	CO 1	PSO1, PSO3			
	References							
1.	Engineering Physics, R.K.Gaur and S.L.Gupta Dhanpatrai Paublication Ltd. 8th Edition							
2.	Fundamentals of Physics, D.Haliday, R.Resnik aand J.Walker Asisan Books Pvt Ltd, 8th Edition							
3.	Practical Physics, C.L.Arora S.Chand Publications							

Fundamentals of Civil Engineering

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Civil Engineering	Academic Year	2022-23							
B.E.((Civil,Mech.,Elec.,Chem.,Met.&MatSci.,Electronics,IWM,Comp.Sc.&Engg.,Text.Engg.,Text.Tech,Text.Processing..))										
:Regular Program										
Year	I	Core/Elective/Foundation CE1104 : FUNDAMENTALS OF CIVIL ENGINEERING	Credits/Hours per week (Lecture-Tutorial-Practical)					3-1-3		
Semester	I	YearofIntroduction:2018 YearofSyllabusRevision:2019	Maximum Marks/Grade					150		
Mode of Transaction		Lectures:3 Tutorial:1								
Course Outcome CO1To impart brief fundamental concept related to various materials and their use in building construction CO2To study environmental pollution comprehensively and CO3Students will know concept of linear and angular measurements CO4Students will be aware of various constructional practices CO5 Students will be aware of practical application										
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Emp, Ent, SD	Relevance to L,N,R,G	Relation to G, ES, H V	

									(P E)
1	Building Material Stone-Introduction to stone–Uses of stone– Characteristics of good building stone – Availability, suitability and properties of different stone. Bricks - Comparison between stone work and brick work – Advantages of bricks – Characteristics of good brick – Standard test for brick along with field test for brick .Lime-Classification of Lime, Precautions in handling Lime .Cement - Basic ingredient of ordinary cement – Physical properties of cement – Field examinations of cement – Storing of cement and its uses. Timber - Introduction to timber – Importance of seasoning – Wood base product. Steel - Introduction – Use of different form of steel – Marketable forms of steel. Aggregates. Bitumen. FRP. Optical fiber. Plastic - Properties of plastics–Types and uses of plastic.	12	25	2,3	CO1	PSO2	(Emp), (Ent) , (SD)	(L), (N), (R), (G)	(E S) , (P E)
2	Environmental Science and Sustainable Development Introductory Environmental Engineering Terminology— Introduction to various types of pollution- Water and land pollution and remedial measures for control ,water and waste water quality criteria–Disposal of wastes – Air pollution and remedial for control – Ecology, Environmental Protection and legislation. Hydrologic cycle, Rain water harvesting, Green building, Solid waste management, Environment Impact Assessment, Basic environmental chemistry, Sustainable development – clean development mechanism, Global Warming ,Ozone layer depletion ,Acid rain ,and Climate change.	12	25	2,3	CO2	PSO2			

3	Surveying and Leveling Surveying - Introduction – Principle – Object of survey – Classification–Basic instruments of linear and angular measurements – chain, tape, Offsetting, Types of offsets, Ranging methods. Prismatic compass, Types of meridians, Types of bearings. Traverse survey: open and closed Examples based on compass. Leveling – Definitions–Computation of reduced levels–Introduction to contour, Methods of leveling and Examples on Level. Modern tools: Introduction to Theodolite ,Total station–Introduction to GPS,GIS, Remote sensing.	14	30	2,3,4,5	CO3	PSO 1 PSO 2			
4	Building Construction Building Construction & Infrastructures: Types of constructions – roads, pipelines, transmission lines – Typical details of load bearing and framed structures – Brief discussion and illustrational sketches of typical important building components – Foundation – Functions, Types of foundations such as Spread footing, Stepped footing ,Isolated and Combined column footing, Raft, and Grillage foundation. Lintels– Function, Types of lintel. Flooring, Roofing .Mortar and concrete specifications– Ingredients for mortar and concrete–classification of mortar and concrete – selection of mortar and its uses – precaution in using mortar – Pre-stressed concrete – grades of concrete, Internet of Things for buildings ,Hydro power plants.	10	20	1,2,3	CO4 CO5	PSO 1 PSO 2			

No	Experiment	Contact Hours	BT Level	CO	PSO
1	Conventional signs and symbols ,scale ,topographic-sheet	2	1,2,3	CO3	PSO1
2	Linear measurements :tape ,ranging, offsets	4	2,3	CO3	PSO1
3	Compass :Introduction ,Bearings	2	2,3,4	CO3	PSO1
4	Auto level :Introduction ,HI ,Rise and fall	6	2,3,4,5	CO3	PSO1
5	GPS: Introduction ,and demonstration	2	2,3,4	CO3	PSO1
6	Theodolite and Total Station demonstration	6	2,3,4,5	CO3	PSO1
7	Any other term- work based on syllabus	2	1,2	CO1 CO4	PSO1,PSO2

Reference Books

1	Arora S.P.and Bindra S.P.(2012),A textbook of Building Construction Publishers. ,Dhanpat rai and Sons,
2	Rangwala S.C.(2012),A textbook of Building Construction,Charotar Publishing House,India.
3	Gilbert M Masters,(2006),Introduction to Environmental Engineering & Science ,Prentice Hall of India Pvt .Ltd .New Delhi
4	Deshpande P.D.,(2009) Basic Civil Engineering ,Nirali Prakashan Pune.
5	G.S.Birdie, Water supply & Sanitary Engg., Dhanpat rai & Sons.
6	S.C. Rangwala ,Engg .Materials ,Charotar Books Staff ,Anand.
7	Janardan Jha Building Material
8	Surendra Singh,Building Material,Vikas Pub.Pvt.New Delhi.
9	D.N.Ghose,Material of Construction,Tata McGraw Hill Pub.Co.Ltd.New Delhi
10	Surveying & Levelling –Kanetkar & Kulkarni Vol-IA.V.G.Prakashan,Puna.
11	Elementary Survey –B.C.Punmia Vol-I.Laxmi Pub.Dariya Gunj,New Delhi.
12	Surveying & Levelling –S.C.Rangwala,Charotar Pub.House,Anand.

Material Science

		The Maharaja Sayajirao University of Baroda Faculty of Technology and Engineering Department of Metallurgical and Materials Engineering		Academic Year			2022-2023			
SS of BE-I Mechanical Engineering										
Year	I	Core / Elective / Foundation : Code: MET1101 Subject Name : Material Science		Credits / Hours per Week			03(Theory)			
Semester	I	Year of Introduction :		Maximum Marks / Grade			100 (Theory)			
Mode of Transactions		Lectures and Tutorials								
Course Outcome (CO) / MET1101 CO-1:Understanding of materials and their classification CO-2:Study about crystals and lattices parameters CO-3: Studies of phase important with their diagrams and materials defects CO-4:Learning about ceramics and glasses materials CO-5: Understanding briefly causes and types of corrosions and their protection methods										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	[1]BT Level	CO	PSO	[2]Elements of EMP/ENT/SD	[3]Relevance to L/R/N/G	[4]Relation to GN/ES/HV/PE
1	Introduction of Engineering Materials Metalica Materials, Ceramic Material, Polymers, Composite and Nano-materials.		02	10%	1/2/3/4	CO1		SD	G	ES
2	Crystal Structure Crystallography, Atomic structure and; Structure of crystalline solids; Lattices, unit cells; Crystal systems, Bravaislattices; Indexing		06	20%	1/2/3/5	CO2		SD	G	ES

	of directions and planes, notations, Inter-planar spacings and angles, co-ordination number, packing factors stacking sequence in BCC, FCC and HCP.								
3	Phase diagram Gibbs phase rule, Binary phase diagram its types, solid solution – Hume Rothery Rules. Imperfections: Point defects, Line defects and surface defects – grain boundary, tilt boundary and twin boundary, Grain, Grain size number. Burgers vector and its representation. Fe-Fe ₃ C phase diagram. lever rule	12	20%	1/2/3	CO3		SD	G	ES
4	Ceramic and Composite Materials Ceramic Material : Introduction and Properties of glasses and Refractory's; Composite Materials: Introduction, classification, metal-matrix, ceramic-matrix and polymer matrix composites.	06	20%	1/2	CO4		SD	G	ES
5	Corrosion Types of corrosion – Dry and Wet corrosion,	06	15%	1/2/3	CO5		SD	G	ES

	Electro chemical and oxidation (Chemical) corrosion. Corrosion prevention – anodic and cathodic protection & coatings								
6	Advanced Materials Nano Materials & its application, Metallic glasses, Super conducting material, optic fibers, smart materials.	06	15%	1/2	CO5		SD	G	ES
		38	100%						
Text Books or Reference Books:									
1.	Askeland D.R., & P. P. Fullay (2007), The Science and Engineering of Materials –4th Cengage Learning Publishers								
2.	William D. Callister, Jr (2008), Callister’s Materials Science and Engineering, (Adopted by R. Balasubramaniam) Wiley-Eastern								
3.	A.S. Edelstein and R.C. Cammarata Ed.(1998), Nano Materials: Synthesis, Properties and Applications, Inst. Of Physics Publishing, UK								
4.	Raghavan V (2007), Materials Science and Engineering - A First Course, Prentice Hall, India								
5.	James F. Shackelford (1996), Introduction to Materials Science for Engineers, Prentice Hall, India								

Engineering Drawing II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2021-22			
		B.E. Chemical, Metallurgical: Regular Programme										
Year	I	Core / Elective / Foundation MEC 1201: Engineering Drawing II			Credits / Hours per week				Lectures: 03 Practical:- 04			
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50			
Mode of Transaction		Lectures										
		Course Outcome (CO) MEC 1201 CO1 Understand different kind of machine drawing and their components. CO2 Observe, analyze and correlate two-dimensional (Orthographic view) and three dimensional (Isometric view) CO3 Construct and application of various Solid Geometry, also study geometry in autocad software with multiple drawing view.CO4 Apply the knowledge of Section of solids by different planes and their conventions, partial and revolved sections. CO5 Create freehand sketches of basic machine components.										
Unit No.	Topic/Unit			Contact Hours	Weightage (%)	BT Level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) / Global (G) development needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)
1.	Solid Geometry – Projection of simple solids such as prism, pyramid, cylinders, cones and regular of oblique.			02	10	1,2,6	CO3	PO8, PO10	PSO1			

2.	Section of solids by different planes and their conventions, partial and revolved sections.	03	10	1,2,6	CO5	PO8	PSO 2	Emp, Ent, SD	L,N,R,G	G, ES, HV, PE	
3.	Interpenetration of simple solids such as prism, pyramid, cylinders, cones, spheres.	05	10	3,4,6	CO4	PO3	PSO 2				
4.	Development of lateral surfaces of solids and combined solids.	05	10	1,2,4	CO4	PO3	PSO 1				
5.	Missing views and interpretation of views with sections, oblique projections, details of assembly drawings, surface finish and tolerances, approach to production drawing.	05	10	2,3,5	CO2	PO1	PSO 1				
6	Introduction to Nomograph.	05	10	2,4,5	CO2	PO3	PSO 2				
7.	AutoCAD up to 2D drawing.	05	20	1,2,6	CO3	PO5	PSO 2				
8.	Machine drawing and sketches of: a) Bearings, pipe fittings and pipe joints, b) Power transmission systems like belt drives c) Flat belt, V-belt, rope and variable speed belts, and pulleys d) Positive drive, gear drive like spur, helical, worm wheel, bevel with their basic terms of definition e) Chain drive with basic terms of definition f) Variable speed drive g) I.C. engine parts like piston, connecting rod, bearing, valves, etc.	09	20	2,4,6	CO5	PO1 2	PSO 1				
		39	100								
	Experiments										
1.	Solid Geometry – Projection of simple solids	02	10	1,2,6	CO3	PO8, PO10	PSO 1				

2.	Section of solids by different planes and their conventions.	03	10	1,2,6	CO5	PO8	PSO 2	Emp, Ent, SD	L,N,R,G	G, ES, HV, PE
3.	Interpenetration of simple solids such as prism, pyramid, cylinders, cones, spheres etc.	05	10	3,4,6	CO4	PO3	PSO 1			
4.	Development of lateral surfaces of solids.	05	10	1,2,4	CO4	PO3	PSO 1			
5.	Oblique projections and details of assembly drawings.	05	10	2,3,5	CO2	PO12	PSO 2			
6.	Introduction to Nomograph.	05	10	2,4,5	CO2	PO3	PSO 1			
7.	AutoCAD upto 2D drawing.	05	20	1,2,6	CO3	PO5	PSO 1			
8.	Machine drawing and freehand sketches.	10	20	2,4,6	CO5	PO12	PSO 2			
		52	100							
	Reference book									
1.	Bhatt, N.D., ‘Engineering Drawing’,									
2.	Shah, P. J., ‘Engineering Drawing’,									
3.	Bhatt, N.D., ‘Machine Drawing’,									
4.	Dhawan, R.K., ‘A Textbook of Engineering Drawing’,									
5.	Venugopal, K., ‘Engineering Drawing and Graphics’									
6.	M. Raja Roy, B.V.R. Gupta, ‘Engineering Drawing with AutoCAD’,									

Thermodynamics

 THE MAHARAJA SAYAJIRAO UNIVERSITY OF BARODA सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2021-22		
		B. E. (Mechanical Engineering): Regular Programme									
Year	I MECH	Core MEC 1203 : Thermodynamics			Credits / Hours per week				Lectures: 04 Practical:- Nill		
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: Nill		
Mode of Transaction: Lectures											
		Course Outcome (CO) MEC 1110CS CO1 Understand basic terms used in thermodynamics. CO2 Understand laws of thermodynamics and its applications. CO3 Comprehend the concept and applications of energy, entropy and exergy.CO4 Understand various gas and vapour power cycles. CO5 Understand the properties of gas mixtures									
Unit No .	To pic		Con tact Hou rs	Weight age (%)	BT Le v el	CO	PO	PSO	Elemen ts of Employ ability (Emp)/ Entrepr e neurshi p(Ent)/ Skill Develo pment (SD)	Releva nce to Local (L)/ Nation al (N)/ Region al(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1	Basic Concepts & Definitions Classical (Equilibrium) and Statistical thermodynamics – macroscopic and microscopic points of view, thermodynamic system,	10	17	1,2,3	CO1 , CO2	PO1, PO2, PO3	PSO1	ALL	ALL	ALL
	surroundings, system boundary, control mass and control volume – thermodynamic properties, processes and cycles, thermal equilibrium, quasi-static process – pure substance, continuum concept. Matter – its phases of occurrence in matter, working medium/substance/agent – its definition, phase/form used in thermodynamics, definition of various equilibrium – mechanical, thermal, chemical, thermodynamic, representation of thermodynamic processes and cycles on 2-property plots.									
2	Temperature Zeroth law of thermodynamics – reproducible reference points – ideal gas temperature and ideal gas thermometer	5	8	1,2,3	CO1 , CO2	PO1 , PO2 ,	PSO1, PSO2			
3	Energy Interactions Thermodynamic definitions of work and heat – displacement of p-dV work and other types of work interactions – net work done by a system, free expansion with zero work done, work interaction: a path function, Energy – its definitions, various forms of its occurrence in various fields – mechanical, electrical, electronics, chemical, atomic, nuclear, thermal, -the units of energy measurements and their equivalents	10	17	2,3,4	CO3	PO1 , PO2 , PO3	PSO1			

4	First Law Analysis Statements of first law of thermodynamics for a closed system undergoing a cycle and a change of state – consequence of the first law – heat is a path function, energy as a thermodynamic property, perpetual motion machine of first kind, different forms of energy – enthalpy – specific heat at constant pressure and constant volume, First law analysis of elementary processes such as isochoric, isobaric, isothermal, adiabatic and polytropic undergone by an ideal gas First law applied to flow processes – mass and energy balance in simple steady flow process – application of steady flow energy equation to systems like nozzle, diffuser, throttling devices, pumps, compressors, turbine and heat exchanger – general form of energy equation.	10	17	2,4	CO ₂ , CO ₃	PO1, PO2, PO3	PSO 1, PSO 2			
5	Second Law Analysis Thermodynamic definition of heat engine, direct and reverse heat engine, diagrammatic representation of heat engine, performance parameters of direct and reverse heat engine – statement of second law of thermodynamics – Kelvin-Planck and Celsius statement – equivalence of the statements – perpetual motion machine of the second kind – Concept of reversibility, reversible process and reversible cycle - conditions of reversibility – irreversibility – factors that render a process irreversible – concept of reversible heat transfer process – examples – Carnot reversible cycle – Carnot theorem and its consequences – definition of thermodynamic (Absolute) temperature scale using the concept of reversible engines Inequality of Clausius – definition of entropy as property – temperature – entropy diagram – entropy change during irreversible adiabatic	10	17	2,4	CO ₂ , CO ₃	PO1, PO2, PO3	PSO 1			

	process – reversible adiabatic process – entropy principle – application of entropy principle - change of entropy during processes undergone by ideal gas. Concept of available work & non-available work									
6	Equation of State for Real Gases and Fluids Ideal gas equation – Van-der-waal equation of state, Berthelot equation of state, Dieterici equation of state, Beattie-Bridgeman equation of state, virtual expansion etc. – Amagat isotherms – compressibility factor – compressibility chart	5	8	2,4,6	CO4, CO5	PO2, PO3, PO4	PSO 1			
7	Thermodynamic Relations Maxwell relation, T-dS relations, specific heat relations, Joule-Thompson coefficient and their relation, Clausius-Clapeyron equation	5	8	2,4,6	CO4, CO5	PO2, PO3, PO4	PSO 1			
8	Properties of Pure Substances P-V-T surfaces, P-V, P-T, T-S and h-S diagrams of pure substance, use of steam tables and charts.	5	8	2,4,6	CO4, CO5	PO2, PO3, PO4	PSO 1			
		60	100							

EXPERIMENTS

NIL

REFERENCE BOOKS

1.	Engineering Thermodynamics by P.K. Nag, McGraw-Hill Education
2.	Fundamentals of Thermodynamics by Borgnakke & Sonntag, 7th Ed. Wiley India (P) Ltd
3.	Thermodynamics – An Engineering Approach by Yunus Cengel & Boles, McGraw-Hill Education
4.	Engineering Thermodynamics by Krieth, CRC Press

Workshop Practice II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year				2019-20		
B. E. (Mechanical Engineering): Regular Programme Workshop Practice II										
Year	I MECH	Core Workshop Practice I MEC 1204		Credits / Hours per week				Lectures: 00 Practical:- 03 Hours		
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006		Maximum Marks / Grade				Theory: NIL PR/TW/VIVA: 50		
Mode of Transaction: Practical										
Course Outcome (CO) MEC 1204 CO1 Understand importance of patternmaking, joining processes and machine shop in Engineering CO2 Realize the importance of safety precautions in fitting, welding, carpentry and machine shop. CO3 Observe use of various marking, measuring, cutting and inspection tools in carpentry, fitting, welding and machine shop. CO4 Visualize different operations for production in carpentry, fitting, welding and machine shop. CO5 Hands on practice and job making in patternmaking, fitting, welding and turning shop										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD) Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Pattern making Shop: Introduction to different tools of carpentry shop, understand the appropriate usage of tool as per the drawing given, understanding drawing of the pattern to be made, hands on practice and making of finished job as per drawing out of the given raw		15	33	1,2,3	CO1, CO2, CO3, CO4, CO5	PO1, PO5, PO6, PO9, PO12	Emp, Ent, SD	L,N,R,G	G, ES, HV, PE

	material of wood.								
2	Welding Shop: Introduction to different tools of welding shop, Understand usage of different tools in welding shop, Demonstration of welding process, Hands on practice and job making as per instruction.	9	20	1,2,3	CO1, CO2, CO3, CO4, CO5	PO1, PO5, PO6, PO9, PO12			
3	Fitting Shop: Introduction to different tools of fitting shop, understand the appropriate usage of tool as per the drawing given, understanding drawing of the job to be made, making of finished job as per drawing out of the given raw material.	6	14	1,2,3	CO1, CO2, CO3, CO4, CO5	PO1, PO5, PO6, PO9, PO12			
4	Turning Shop: Introduction to lathe machine, understand basic parts and their functions, understanding drawing of the job to be made, hands on practice and making of finished job as per drawing out of the given raw material.	15	33	1,2,3	CO1, CO2, CO3, CO4, CO5	PO1, PO5, PO6, PO9, PO12			
		45	100						
Reference Books:									
1.	Workshop Technology-I. W.A. J. Chapman Taylor & Francis								
2.	Comprehensive Workshop Technology (Manufacturing Processes). S.K. Garg Laxmi publications								
3.	Workshop Technology-I. Hazra and Chaudhary Media promoters & Publisher private limited								

Applied Mathematics-II

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics	Academic Year	2020-21						
B.E.-I (Civil, IWM, Mech., Elect., Electro., Comp., Chem., Met., TP): Regular Programme									
Year	I	Core / Elective / Foundation AMT1201: Applied Mathematics - II	Credits / Hours per week (Lecture)	04					
Semester	II	Year of Introduction: Year of Syllabus Revision:	Maximum Marks / Grade	100					
Mode of Transaction		Lectures							
Course Outcome (CO) CO1 Understand and apply the concept of multivariable functions , its differentiability concept and applications of partial derivatives in various engineering problems. CO2 Able to focus on understanding and applications of gradient, curl and divergence in engineering problems. CO3 Apply the concept of surfaces and level curves in solid geometry which helps in solving various application of engineering. CO4 Understand and implement the methods of curve tracing in two – dimensional space. CO5 Implement various concepts of matrices in engineering problems and able to solve system of linear equations using matrices.									
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and

									Professional Ethics (PE)
1	Partial Differentiation: Function of two variables – Definition, limit, continuity and partial derivatives Chain rule Euler's theorem, implicit functions differentials Applications of partial derivatives (Tangent plane and normal line, approximation, maxima and minima, Lagrange's multiplier's method), Jacobians and transformations	12	24	1,2,3	CO1		Emp / Ent	N / G	PE
2	Vector Calculus: Reorientation, scalar and vector fields gradient of a scalar function, Directional derivative divergence and curl of a vector field and their applications	05	11	1,2,3	CO2				
3	Analytical Geometry: Reorientation, curvilinear coordinates (polar, cylindrical and spherical), cone, cylinder Conicoids, Surfaces and solids of revolutions	10	20	2, 3, 4,5	CO3, CO4				
4	Tangent planes and normal lines to above surfaces (by calculus method) Tracing of curves: Cardioid, cycloid, lemniscuses, spiral, four leaved rose	07	15	2, 3, 4,5					
5	Rank of a matrix solution of homogeneous and non – homogeneous systems of linear equations Eigen values and Eigen vectors of a matrix Cayley – Hamilton theorem	07	15	1, 2, 3,5	CO5				
6	Laplace Transforms Laplace transforms of elementary functions inverse Laplace transforms, linearity property, first and second shifting theorem. Laplace transforms of derivatives and integrals, applications of Laplace transform in solving ordinary	07	15	1,2,3,4,5	CO5				

	Differential equations.								
Reference Books									
1.	Erwin Kreyszig: Advanced Engineering Mathematics, (6th edition) John-Wiley & Sons.								
2.	Srivastava, Dhavan : Text Book of Engineering Mathematics, Dhanpat Rai & Sons.								
3.	Shantinakaran : Differential Calculus, S. Chand & Co. New Delhi.								
4.	Willfred Kaplan : Advanced Calculus, Addison Wesley Publ. Company, Inc.								
5.	C. R. Wylie : Advanced Engineering Mathematics, Mc. Graw – Hill, Inc.								

Applied Mechanics

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Mechanics		Academic Year				2019-20			
B.E. (Mechanical) : Regular Programme										
Year	I	Core / Elective / Foundation AM1201: APPLIED MECHANICS	Credits / Hours per week				04			
Semester	II	Year of Introduction: 1984 Year of Syllabus Revision: 2010	Maximum Marks / Grade				100			
Mode of Transaction		Lectures								
Course Outcome (CO) AM1201 CO1: Student will learn different various types of forces and force system. Effect of Force system and Equilibrium condition the factor affecting the Equilibrium. CO2: Understanding of the axial forces in Plane and Space truss. Analysis of problems by analytical and Graphical Method. CO3: Student will be able to learn of the Center of Gravity and Moment of Inertia of any type of the section of the body. CO4: Refreshes the basics of theory of machine. CO5: Analysis and evaluation of number of Teeth on the wheel and its rotation in the body.										
Unit No.	Topic/Unit		Contact Hours	Weightage (%)	BT Level	CO	PS O	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics(

									PE)
1	Statics: Introduction, Forces and Force system Introduction to the subject of applied mechanics and its various branches. SI units. Coplanar, concurrent and non-concurrent force systems. Resultant and Resolutions, Forces in space. Vectors. Operations on forces using vectors. Moment of force, Varignon's theorem, Couple and its properties, Resultant of a coplanar force system. Concentrated and uniform loads. Resultant of a spatial force system. Wrench resultant, Equilibrium of a particle. External & internal forces, Equilibrium of rigid Body, Types of supports. Structural members and beams. Reactions of beams, Determinateness. Connected bodies. Two force and three force members. Trusses, Method of joints. Method of sections. Determinateness of truss. Rigid and non-rigid frames. Simple mechanisms. Space frames.	15	25	1,2,3,4,5,	CO1 CO2	PS O1, 2	SD,EM P	G	ES
2	Statics Center of Gravity, Moment of Inertia and Friction: Centre of gravity. Centroids of lines and of basic and composite areas, Built-up sections, Product of inertias. Mass moment of inertia, Types of friction. Characteristics of dry friction. Equilibrium on rough inclined plane. The wedge-The screw-The screw Jack-general bearing, Axle friction, Thrust bearing-Disc friction-Clutches.	15	25	1,2,4	CO3, CO4	PS O1, 2			
3	Statics: Transmission of power Lifting Machine, Basic machines, The differential principle, Linearlaw, Belt drive, Velocity ratio. Compound belt drive-length of belt. Transmission of power, Gearings, Trains of wheels. Epicyclic gearing. Speed reduction gear. Differential types of gear.	15	25	2,3,4,5	CO4, CO5	PS O1, 2			
4	Dynamics: Strength and Elasticity of Materials Review of kinematics of a particle. Force, mass and acceleration, Rectilinear and curvilinear motion. D'Alembert's principle, work, power and energy, Impulse and momentum, Equations of motion. Translation. Fixed axis rotation. Problems Involving friction, Simple stresses and strains. Hook's law. Elastic limit. Ultimate stress.	15	25	1,2,3,4,5	CO4, CO5	PS O1, 2			

	Factor of safety, Lateral strain. Poisson's ratio. Stress concentration idea. Temperature stress. Simple shear, Elastic moduli relations.								
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Reference Books

1.	Applied Mechanics by S. B. Junnarkar and H. J. Shah, Charotar Pub.
2.	Engineering Mechanics by Merum and Kraige, John Wiley & Sons.
3.	Vector Mechanics by Beer and E. R. Johnstons, McGraw-Hill Book Co.
4.	Engineering Mechanics by Huges and Martin, E.L.B.S. and Macmillan.
5.	Engineering Mechanics by R. S. Kumar.

No.	<u>EXPERIMENT</u>	Conta ct hours	%Weightage	BT Lev el	CO	PSO
1	LAW OF PARALLELOGRAM OF FORCES	3	6.66	2,3	CO1	PSO1,2
2	LAW OF POLYGON	2	4.44	2,3	CO1	PSO1,2
3	SIMPLE BEAM	2	4.44	2,3	CO2	PSO1,2
4	JIB CRANE	2	4.44	2,3	CO2	PSO1,2
5	THEORY OF LIFTING MACHINE	3	6.66	2	CO4	PSO1,2
6	ROPE AND PULLEY BLOCK	2	4.44	2,3	CO4	PSO1,2
7	SCREW JACK	2	4.44	2,3	CO4	PSO1,2
8	DIFFERENTIAL AXLE	2	4.44	2,3	CO4	PSO1,2
9	WORM AND WORM WHEEL	2	4.44	2,3	CO5	PSO1,2
10	MOMENT OF INERTIA OF FLY WHEEL	2	4.44	2,3	CO3	PSO1,2
11	RADIUS OF GYRATION OF COMPOUND PENDULUM	2	4.44	2,3	CO3	PSO1,2
GRAPHICS						
12	COPLANAR CONCURRENT FORCE SYSTEM-1	3	6.66	2	CO1	PSO1,2
13	COPLANAR CONCURRENT FORCE SYSTEM-2	2	4.44	2	CO1	PSO1,2
14	COPLANAR NON-CONCURRENT FORCE SYSTEM-1	2	4.44	2	CO1	PSO1,2
15	COPLANAR NON-CONCURRENT FORCE SYSTEM-2	2	4.44	2	CO1	PSO1,2
16	REACTION OF BEAMS-1	2	4.44	2	CO2	PSO1,2
17	REACTION OF BEAMS-2	2	4.44	2	CO2	PSO1,2
18	ANALYSIS OF ROOF TRUSS FOR SIMPLY SUPPORTED	2	4.44	2	CO1	PSO1,2
19	ANALYSIS OF ROOF TRUSS FOR CANTILEVER	2	4.44	2	CO1	PSO1,2
20	WEDGE BLOCK FRICTION	2	4.44	2	CO5	PSO1,2
21	CENTROID OF PLANE LAMINA	2	4.44	2	CO3	PSO1,2

Electro techniques-I

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering		Academic Year		2019-20		
B.E. Mechanical Engineering: Regular Programme								
Year	I	Core / Elective / Foundation ELE 1203:Electrotechniques -I	Credits / Hours per week			04+02		
Semester	II	Year of Introduction: 2003-04 Year of Syllabus Revision: 2017-18	Maximum Marks / Grade			100+50		
Mode of Transaction		Lectures and Practical's						
Course Outcome (CO) ELE 1203 CO1 Understanding the DC Circuit Theorems CO2 Understanding the Magnetic Circuit Fundamentals CO3 Understanding energy storage in Inductive and Capacitive circuits CO4 Understanding the AC Circuit fundamentals CO5 Understanding the concepts of series and parallel combinations AC circuits								
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	PO
1	DC circuit: Ohm's law, Division of current, Kirchoff's Laws, Superposition theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem, Delta-star & Star-delta Transformation.		7	25	1, 2, 3, 4	CO1	1	PO1 PO2 PO4 PO12
2	Magnetic circuit:Flux, Flux-density, Intensity of Magnetization, Permeability, Magneto motive force, Magnetic Field strength, Reluctance, Laws of magnetic circuits, Ampere-turns for a magnetic circuits, Magnetic leakage, Fringing effect, Faraday's Law & Lenz's law, Statically & dynamically induced emfs, Self & Mutual Induction& their coefficient.		7	15	1, 2, 3, 4	CO2	1	PO1 PO2 PO4 PO12
3	Dc transients: Growth & decay of current in inductive and capacitive circuits, Energy stored in inductor and Capacitor.		6	10	1, 2, 3, 4	CO3	1	PO1 PO2 PO4 PO12

4	Ac fundamental: Production of alternating voltage, phase & phase difference, Representation of alternating Quantities by a phasor, R.M.S. & Average value, Peak & Form factor, Addition, Subtraction, multiplication & division of A.C. Quantities. Using vector and polar method.	7	10	1, 2, 3, 4	CO4	1	PO1 PO2 PO4 PO12
5	Ac series circuits: Voltage, Current & Power relationships in purely resistive, Inductive & Capacitive circuits. A.C. through R-L, R-C, R-L-C series circuits & power factor, active reactive & apparent power of such circuits. Resonance in R-L-C series circuit.	6	15	1, 2, 3, 4	CO5	1	PO1 PO2 PO4 PO12
6	Ac parallel circuit: Fundamental of parallel circuit,, Solution of parallel circuits, Resonance in parallel circuits, Solution of combined series & parallel circuits using vector & polar method.	5	15	1, 2, 3, 4	CO5	1	PO1 PO2 PO4 PO12
7	Single phase transformer: Operating principle, Construction, EMF equation, Transformation ratios, Transformer on No Load, Leakage reactance, Transformer on load, Equivalent circuit, O.C. & S.C. test, efficiency, regulation, Autotransformer	7	10	1, 2, 3, 4, 5	CO4	1	PO1 PO2 PO4 PO12

No .	Experiment	Contact hrs.	%Weightage	BT Level	CO	PO	PSO
1	Study of Laboratory apparatus.	2	100%	1,2,3	1,4	1	1
2	Verification of Kirchhoff's laws.	2		3,4,5	1,2,4	1,2,12	1
3	Verification of Superposition theorem.	2		3,4,5	1,2,4	1,2,12	1
4	Verification of Thevenin's theorem.	2		3,4,5	1,2,4	1,2,12	1
5	Verification of Norton's theorem.	2		3,4,5	1,2,4	1,2,12	1
6	Verification of Maximum power transfer theorem.	2		3,4,5	1,2,4	1,2,12	1
7	R-L Series Circuit.	2		3,4,5	1,2,4	1,2,12	1

8	R-L-C Series Circuit.	2		3,4, 5	1.2, 4	1,2,12	1
9	Self and Mutual Inductance	2		3,4, 5	1.2, 4	1,2,12	1
10	Hysteresis loop.	2		3,4, 5	1.2, 4	1,2,12	1
11	Open circuit and Short circuit test on single phase Transformer.	2		3,4, 5	3,4	1,2,12	1
12	Power Measurement in a 1-phase circuit by 3 voltmeter method.	2		3,4, 5	1.2, 4	1,2,12	1
13	Power Measurement in a 1-phase circuit by 3 ammeter method.	2		3,4, 5	1.2, 4	1,2,12	1
14	DC transients.	2		3,4, 5	1.2, 4	1,2,12	1
15	AC Parallel circuit.	2		3,4, 5	1.2, 4	1,2,12	1

Reference Books	
1.	Basic Electrical Engineering By V.N. Mittle
2.	Electrical Technology By B.L. Theraja
3.	Problems in Electrical Engineering By Parker & Smith.

B.E. Mechanical Engineering 2nd Year



	NAME OF THE DEGREE/DIPLOMA PROGRAMM	SUBJECT CODE THEORY	SUBJECT CODE T.W./VIVA/PRA	SUBJECT	THEORY	T.W./VIVA/PRA	TOTAL MARKS	LEC HOUR/WEEK	LAB HOUR/WEEK	TUTORIAL HOUR/WEEK
S E C O N D E Y E A R	FSBE II	MEC 1303		Alternative Energy Sources	100		100	4	0	0
		AMA211		Applied Mathematics III	100		100	3	0	1
		MEC 1304	MEC 1304 L	Dynamics of Machines I	100	50	150	4	2	0
		ELE1309	ELE1309 L	Electro techniques II	100	50	150	3	2	1
		APM 1303	AMP 1303	Materials and Structures	100	50	150	3	4	1
		MEC 1302	MEC 1302 L	Thermal Engineering I	100	50	150	4	2	0
		TOTAL			600	200	800	21	10	3
	SSBE II	MEC 1403	MEC 1403 L	Dynamics of Incompressible Flow	100	50	150	4	2	0
		MEC 1402	MEC 1402 L	Dynamics of Machines II	100	50	150	4	2	0
		ELE 1410	ELE1410 L	Electronics	100	50	150	3	3	1
		MEC 1405	MEC 1405 L	Mechanical Measurements	100	50	150	4	2	0
		MEC 1404	MEC 1404 L	Production Technology I	100	50	150	4	2	0
		TOTAL			500	250	750	19	11	1

Alternative Energy Sources

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics							Academic Year			2019-20	
		B. E. (Mechanical Engineering): Regular Programme											
Year		II	Core / Elective / Foundation MEC 1303: Alternative Energy Sources				Credits / Hours per week					Lectures: 04 Practicals: 00	
Semester		I	Year of Introduction: Year of Syllabus Revision: 2006				Maximum Marks / Grade					Theory: 100 PR/TW/VIVA: 00	
Mode of Transaction: Lectures													
		Course Outcome (CO) MEC 1303 CO1 Make students familiar with current energy scenario in India as well as the world. Also make them able to comprehend and analyze data on this. CO2 Understand energy conversion principles and analysis CO3 Know, understand and evaluate the availability of solar radiation and the parameters affecting it. Solar thermal applications and equipment. Evaluate performance of such equipment CO4 Know and understand technologies for conversion of energy from ocean and biomass. Evaluate the potential for energy production and performance parameters CO5 Know and understand technologies for conversion of energy from wind and geothermal energy sources. Evaluate the potential for energy production and performance parameters											
Un it No.	Topic			Contact Hours	Weightag e (%)	BT Level	C O	P O	PS O	Elements of Employabili ty (Emp)/ Entrepreneu rship (Ent)/ Skill Developme nt (SD)	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G)	Relatio n to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)	

1	Energy Scenario Energy scenario for world and India. Basic explanation of various sources of energy – Fossil fuels, hydro energy, nuclear energy. Contribution of various sources in global and Indian energy supply: Primary energy and electrical energy. Estimation of fossil fuel reserves and consumption pattern, Energy options for future from various energy resources, future forecasts, Need for alternative energy sources	05	09	1, 2, 3, 4	CO1	PO1, PO6, PO7, PO10	PSO1	EMP, ENT	All	All
2	Direct Energy Conversion Options: Fuel cell: Basic principles, various designs of fuel cells, prospects as energy conversion devices; Solar photovoltaic cells: Principle of operation, I-V and P-V characteristics, PV system components for on-grid and off-grid technologies, materials for PV cells; Magneto hydrodynamic (MHD) power plant: Principle of working, open cycle plant, closed cycle plant, liquid metal system, advantages and limitations	06	11	1, 2, 3, 4, 5	CO2	PO1, PO2, PO6, PO7	PSO1	EMP, ENT	All	All
3	Solar Thermal Energy A. Solar radiation – extra-terrestrial solar radiation flux, solar constant, solar radiation on earth's surface Sun-earth geometry: various angles to evaluate availability of solar radiation at a given place, Solar radiation measurement instruments: pyranometer, pyr heliometer, sunshine recorder. B. Solar thermal collectors: Principle and constructional features of solar flat plate collectors and concentrating collectors,	14	25	1, 2, 3, 4, 5	CO2 CO3	PO1, PO2, PO6, PO7	PSO1	EMP, ENT, SD	All	All

	Energy loss mechanisms in collectors and means to minimize the same, calculation of efficiency, Solar thermal collectors: solar water heater, solar air heater, solar still, solar dryer, solar process heating and cooling, solar pond, solar cooker									
4	Biomass Energy Biofuels: biomass conversion routes, gasification, bio-ethanol and biodiesel Bio-gas plants: Basic principles and constructional details of bio-gas plants, bio-gas applications, advantages and limitations, potential as alternative energy in India	08	14	1, 2, 3	CO4	PO1, PO2, PO6, PO7	PSO1	EMP, ENT,SD	All	All
5	Geothermal Energy Geothermal energy, geothermal field and sources, electrical power generation from geothermal energy, vapour dominated and liquid dominated systems, hybrid plants, power generation potential of geothermal energy: world over and in India	06	11	1, 2, 3	CO5	PO1, PO2, PO6, PO7	PSO1	EMP, ENT,SD	All	All
6	Energy from Ocean Ocean thermal energy conversion (OTEC) systems, principle, site selection, methods of	08	14	1, 2, 3	CO4	PO1,	PSO1	EMP, ENT,SD	All	All

Dynamics of Machine-I

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year							2022-23		
		B. E. (Mechanical Engineering): Regular Programme										
Year	II	Core / Elective / Foundation MEC 1304:Dynamics of Machines - I		Credits / Hours per week							Lectures: 04 Practicals: 02	
Semester	I	Year of Introduction: Year of Syllabus Revision: 2018		Maximum Marks / Grade							Theory: 100 PR/TW/VIVA: 50	
Mode of Transaction: Lectures and Practicals												
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)		
1	Introduction to Mechanisms and	07	13	1, 2, 3	CO 1		PO1, PO1	SD		ES		

	Machines Kinematics and dynamics of machines; Kinematic pairs and chains in planer mechanism; Degree of freedom and Mobility criterion; Inversions of mechanisms; Straight-line, Pantograph, Steering and Universal joint mechanisms; Transmission angle and Mechanical advantage.					PSO 1	2			
2	Analysis of Mechanisms Position, Displacement, Velocity and Acceleration analysis by graphical and analytical techniques.	10	16	2, 3, 4	CO 2	PSO 1	PO1, PO2, PO3			
3	Synthesis of Mechanisms Dimensional synthesis of four-links and crank-slider mechanism for motion; Path	07	14	3, 4, 6	CO 3	PSO 1	PO2, PO3, PO4			

	and function generation by graphical and analytical methods; Chebychev spacing and Freudenstein's equation for two and three position synthesis for function generation.									
4	Cams and Cam Dynamics Types of cams and followers; Synthesis of profiles; Kinematics and Dynamics of Cam and Followers.	06	14	1, 2, 4, 6	CO 3	PSO 1	PO1, PO3, PO4			
5	Gears and Gear Trains Law of gearing; Tooth profiles and Terminologies; Contact ratio; Interference and Undercutting; Spur, Helical, Bevel and Worm gears; Simple, Compound, Reverted and Epicyclic Gear Trains.	10	22	1, 2, 3	CO 4	PSO 1	PO1, PO4, PO5, PO1 2			
6	Friction Friction in	10	17	2, 3, 5	CO 5	PSO	PO1, PO2,			

	kinematic pairs; Friction Belt Drives; Thrust Bearings; Brakes, Dynamometers and Clutches.					1	PO3			
	Course Outcome (CO) MEC 1304 01 Understand different mechanisms used in real life application. 02 Analyze velocity and acceleration of mechanisms. 03 Synthesis mechanisms for particular application. 04 Understand power transmission arrangement for different orientation, speed, torque and application. 05 Understand and Analyze friction and utilizing it for engineering application.									
	Experiments									
1.	Inversion of four-bar chain, single slider crank and double slider crank mechanism	02	10	1, 2, 3	CO1	PSO1	PO1, PO2			
2.	To find co-efficient of friction between metallic surfaces using oscillating motion	02	10	3, 4	CO5	PSO1	PO1, PO2			
3.	To find out mass moment of inertia of connecting rod using compound pendulum method	02	10	3, 4	CO4	PSO1	PO1			
4.	To find out mass moment of inertia of connecting rod using bifilar suspension method	02	10	3, 4	CO4	PSO1	PO1			
5.	Verification of mass moment of inertia of connecting rod using tri-filler pendulum method	02	10	3, 4	CO4	PSO1	PO1			
6.	To generate Gear Profiles	04	10	2, 3	CO4	PSO1	PO1, PO2			

7.	To analyze velocities in the mechanisms graphically.	02	10	2, 4, 5	CO2	PSO1	PO2, PO3			
8.	To analyze acceleration in the mechanism graphically.	02	10	2, 4, 5	CO2	PSO1	PO2, PO3			
9.	To synthesize and draw Cam profile	04	10	4, 5, 6	CO3	PSO1	PO3			
10.	To synthesize four bar mechanism for function generation	02	10	4, 5, 6	CO3	PSO1	PO3			
		Reference Books								
1.		Thomas, B., ‘Theory of Machines’, Pearson								
2.		Uicker, J. J., ‘Theory of Machines and Mechanisms’, Oxford University Press								
3.		Rattan, S. S., ‘Theory of Machines’, Tata McGraw Hill								
4.		Myszka, D. H., ‘Machines and Mechanisms’, Prentice Hall								

Thermal Engineering - I

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year				2021-22			
		B. E. (Mechanical Engineering): Regular Programme									
Year	II	Core / Elective / Foundation MEC 1302: Thermal Engineering - I			Credits / Hours per week				Lectures: 04 Practicals: 02		
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade				Theory: 100 PR/TW/VIV A: 50		
Mode of Transaction: Lectures and Practical's											
		Course Outcome (CO) MEC 1302 CO1 Understand and Remember basics of Boilers, types of Boilers and their working. CO2 Understand and Analyze Efficiency and performance of Boilers, Heat Balance Sheet, Boiler draught. CO3 Understand Concept of Engine, I C Engine and its components and terminology. Application of I C Engines, Understand Otto and Diesel cycles and thermodynamic Analysis of I C Engines. CO4 Understand Concept of Positive displacement type of Compressors, Reciprocating Compressors, its working and thermodynamic Analysis. CO5 Understand various systems of I C Engines, Performance Analysis of I C Engines.									
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1	Boilers: Classification, Cochran, Lancashire, Locomotive and Babcock and Wilcox boiler, Functioning of different mountings and accessories Equivalent evaporation and efficiency of boilers, Heat balance sheet and performance of Boilers, Types of boiler draughts, Height of chimney.	08	20	1,2	CO 1 & CO 2	PS O1	PO 1, PO 2 PO 3			
2	Concept of power producing systems and power absorbing systems. Introduction of IC Engine, Basic components, and terminology of IC engines, working of four stroke/two stroke - petrol/diesel engine, classification, and application of IC engines.	04	5	2,3,4	CO 3	PS O1	PO 1, PO 2, PO 3			
3	Positive Displacement Compressors: Reciprocating Compressors, Various Parts, operations, work done during isothermal, polytropic & adiabatic compression process, PV diagram, Multistage compressors.	04	10	2,4	CO 4	PS O1	PO 1, PO 2, PO 3			
4	Analysis of Reciprocating Compressor: Isothermal, Volumetric and Mechanical efficiency, effect of clearance, condition for minimum work input, capacity control, actual indicator diagram. Single stage compressor, indicator diagram and power requirement, effect of clearance volume, volumetric efficiency, indicator diagram with and without clearance, effect of intercooling, power requirement, mean effective pressure.	08	15	2,4	CO 4	PS O1	PO 1, PO 3, PO 4			
5	Air standard Cycles and Actual Cycles of I C Engine: Assumptions, dissociation, comparison of different cycles, effect of operating variables, effect of time loss, heat loss and exhaust loss in Petrol and Diesel engines, valve and port timing	06	15	2,4	CO 5	PS O1	PO 1, PO 2, PO			

	diagrams, engine performance and emission parameters						4			
6	Various systems of I C Engines: Fuels and its supply system for SI and CI engine, Important qualities of IC engine fuels, rating of fuels, Carburation, mixture requirement for different loads and speeds, simple carburetor and its working, types of carburetors, MPFI, types of injection systems in CI engine, fuel pumps and injectors, types of nozzles, spray formation, Ignition and Governing System, Battery and magneto ignition system, spark plug, firing order, quality, quantity & hit and miss governing, Cooling systems of I C Engines	08	15	2,4	CO 5	PS O1	PO 1, PO 2, PO 3			
7	Combustion in SI and CI Engines: Stages of combustion in SI engines, abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking, combustion chambers for SI engines, Stages of combustion in CI engines, detonation in C.I. engines, factors affecting detonation, controlling detonation	06	15	1,2,3	CO 5	PS O1	PO 1, PO 2, PO 3			
8	IC Engine Emission and their control: Air pollution due to IC engines, Euro I to VI norms, HC, CO and NOx emission, catalytic convertor	04	5	1,4,5	CO 5	PS O1	PO 1, PO 2, PO 6 PO 7			
	Total	48	100%							

	Experiments									
1.	Mountings and Accessories of the boilers	04	15	2,3	CO1	PSO1	PO1,PO 2			
2.	Cochran Boiler	02	10	2,3	CO1	PSO1	PO1,PO 2			
3.	Lancashire Boiler	02	10	2,3	CO1	PSO1	PO1,PO 2			
4.	Babcock and Wilcox Boiler	02	10	2,3	CO1	PSO1	PO1,PO 2			
5.	Internal Combustion Engine	04	15	2,3,4	CO1, CO2	PSO1	PO1,PO 2			
6.	Valve Timing Diagram	04	15	2,3,4	CO1, CO2	PSO1	PO1,PO 2			
7.	Reciprocating Air Compressor	04	15	2,3,4	CO1, CO2	PSO1	PO1,PO 2			
8.	Gas Producer	02	10	2,3	CO1	PSO1	PO1,PO 2			
	Total	24	100%							
	Reference Books									
1.	I C Engines by Mathur and Sharma Dhanpatrai Publication									
2.	Internal Combustion Engines by V Ganesan Tata McGraw Hills									
3.	Thermal Engineering by R K Rajput Laxmi Publications									
4.	Basic Engineering Thermodynamics by Rayner Joel by Pearson Education									
5.	A Course in Thermal Engineering by Domkundwar and Kothandaraman by Dhanpatrai Publication									

Applied Mathematics-III

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Applied Physics	Academic Year					2020-21				
B.E.-II (<u>Mechanical</u>): Regular Programme											
Year	II	Core / Elective / Foundation AMA211:Applied Mathematics-III		Credits / Hours per week (Lecture+Tutorial)				03+01			
Semester	I	Year of Introduction: Year of Syllabus Revision:		Maximum Marks / Grade				100			
Mode of Transaction		Lectures and Tutorials									
Course Outcome (CO) CO1 Understands the concept of different types of line integrals with evaluation techniques. CO2 Understands the Double, Triple integrations and can apply it appropriately, to evaluate Volume, Mass, Area, C.G. and M.I. CO3 Through various integral theorems, understands the relationships between various kinds of multiple integrals, line integral and apply these concepts in solving engineering problems related to area, mass volume, flow problems, work done etc. CO4 Understand a given complex valued function and determine whether it is differentiable, analytical, harmonic, and harmonic conjugate. CO5 Demonstrate Fourier series to study the behavior of periodic functions.											
Unit No.	Topic			Contact Hours	Weightage (%)	BT Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics

									(PE)
1	Multiple Integrals: Reorientation of concept of integrals, line integrals, double and triple integrals-evaluation techniques, change of order of integration, Integrals in polar and cylindrical coordinates-transformation of multiple integrals, application of double and triple integrals for evaluation of Area, Volume and Mass	9	19	1,2,3	CO1 CO2	PO1 PO2	SD	G	PE
2	Vector Calculus: Surface integrals, Green's theorem Stoke's theorem, Gauss divergence theorem, applications of integral theorem.	6	12	1,2,3	CO3	PO1 PO2			
3	Functions of Complex Variables: Limit, continuity and derivative of functions of a complex variable. Analytic functions and their applications, Harmonic, conjugate harmonic and potential functions.	7	14.5	2, 3, 4	CO4	PO1 PO2			
4	Fourier Series: Fourier expansion of periodic functions with period 2π , Fourier series of even and odd functions. Half range series, Fourier series of functions with arbitrary period, conditions of convergence of Fourier series.	7	14.5	1, 2, 3,5	CO5	PO1 PO2			
5	Special Functions: Properties of Bessel's functions and Legendre polynomials Examples of differential equations leading to Bessel functions and Legendre polynomial.	9	19	1,2,3,4	CO5	PO1 PO2			
6	Partial Differential Equations: Models leading to second order partial differential equations, Sturm – Liouville problem, Boundary value problems with second order partial differential equations, Heat wave and Laplace equations, illustrations of similarity transformations of boundary value problems.	10	21	2,3,4,5	CO4	PO1 PO2			
Reference Books:									
1.	Erwin Kreyszig, Advanced Engineering Mathematics, (6th edition) John-Wiley & Sons.								
2.	Donald Greenspan, Introduction to Partial Differential Equations, Mc. Graw – Hill Inc.								
3.	C.R.Wylie, Advanced Engineering Mathematics, Mc. Graw– Hill, Inc.								

Materials and Structures

	The Maharaja Sayajirao University of BarodaFaculty Technology and Engineering Department of Applied Mechanics					Academic Year				2021-22		
	B.E. (Mechanical) : Regular Programme											
Year	II	Core / Elective / FoundationAPM1303 : Materials and Structures					Credits / Hours per week (Lecture + Practical +Tutorial)				03+04+01	
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:					Maximum Marks / Grade				Theory-100 Practical-50	
Mode of Transaction		Lectures and Tutorial										
Course Outcome (CO) APM 1303 CO1: Determine the material properties, shear force, bending moment, slope and deflection in beam and apply for further analysis and design of structures. CO2: Calculate the shear stress and bending stress in different cross section of beams. CO3: Determine the Principal stresses and strains analytically and graphically and analyze and design thin shells and bolted connections. CO4: Apply strain energy concept to determine stress due to gradual, sudden and Impact loading. CO5: Analyze column under axial and eccentric load and determine direct and bending stresses in chimney, dam and retaining wall.												
Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global(G) developmental needs	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)		

1	Shear force, Bending moment diagrams for Beams and beam stresses: Diagram of bending moment and shearing force in cantilever and simply supported beams under static loads-analytically with varying, distributed loads and couples <i>and verifying solutions to problems in mobile application.</i> Theory of simple bending: Distribution of normal stress due to bending, moment of resistance, Beam of uniform strength, Flitched beam, Built up section under bending, <i>verifying solutions to problems in FEM software and design of safe and economic beam section for residential and public buildings.</i> Distribution of shear stress across various cross sections. Curvature, slope and deflection of cantilever and simply supported beams including overhang beams, <i>Macaulay's Method, its maxima as per codal conditions</i> , Carriage springs	18	30	1,2,3,4,5	CO 1, CO 2,	PSO 1		SD	G	ES
2	Principal stresses and strains and thin shells Ellipse and circle of stresses, Principal planes, Principal stresses and strains, Mohr's stress and strain circle for various applications of compound stress <i>and verifying solutions to problems in FEM software</i> Resilience of sudden, impact and shock loading, Stresses in thin cylinders subjected to internal pressure, Cylindrical shell with hemispherical ends, Spherical shell, <i>design of safe and economic blast resistant vessel in the industry.</i> Bolted joints, types of failure and load transfer in bolted joint, Design of bolted connections <i>as per codal conditions</i>	18	30	2,3,4,5	CO 3, CO 4	PSO 1				

3	Columns subjected to axial and eccentric loading Eccentric loading on column, Tension or compression combined with bending, <i>design of solid, hollow and engineered material column, economic aspect of column and verifying solutions to problems in FEM software</i> , Middle third rule, Wind pressure on walls and chimney, Water pressure on dam. Simple strut theory - Euler's and Rankine's Formula.	12	20	2,3,4,5	CO 5	PSO 1			
4	Torsion of Circular shaft Torsion of circular shafts of uniform sections. Torsional resilience. Distribution of torsional stress- Angle of twist, Power transmissions from shafts, Combined Bending and Torsion including theories of failure, <i>economic aspect of shaft, verifying solutions to problems in FEM software</i> , Helical spring under axial force.	12	20	2,3,4,5	CO 5	PSO 1			

No.	<u>EXPERIMENT</u>	Contact Hours	% Weightage	PO	BT Level	CO	PSO
1	COPMLETE TENSILE TEST ON MILD STEEL (MS)	3	10		2,3	CO1, CO2	PSO1
2	MODULUS OF ELASTICITY FOR MS	3	10		2,3	CO1, CO2	PSO1
3	DIRECT SHEAR TEST ON MS	3	10		2,3	CO1, CO3	PSO1
4	COPMRESSION TEST ON MS AND CAST IRON (CI)	3	10		2,3	CO1, CO5	PSO1
5	COMPRESSION TEST ON TIMBER	3	10		2,3	CO1, CO5	PSO1
6	IZOD IMPACT TEST ON CI, MS AND BRASS	3	10		2,3	CO1, CO4	PSO1
7	HARDNESS TEST ON MS, CI AND BRASS	3	10		2,3	CO1	PSO1
8	TORSION TEST ON MS AND CI	3	10		2,3	CO1, CO6	PSO1
9	MODULUS OF RUPTURE OF TIMBER	3	10		2,3	CO1, CO2	PSO1
10	MODULUS OF ELSTICITY OF TIMBER	3	10		2,3	CO1,	PSO1

						CO2	
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	Reference Books
1	Mechanics of Structures Vol. I by S.B. Junnarkar and H. J. Shah.
2	Introduction to Mechanics of Solids by I.P. Kapila and S.N. Agnihotri.
3	Elementary Strength of Materials by S. Timonshenko.
4	Strength of Materials by Ramamrutham.
5	Strength of Materials by R.C. Patel , T.D. Bhagia, & B.M. Patel.

Electro techniques-II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering						Academic Year		2019-20	
				B.E. Mechanical Engineering: Regular Programme							
Year	II	Core / Elective / Foundation ELE 1309 : ELECTROTECHNIQUES-II						Credits / Hours per week (Lecture + Practical)		04+03	
Semester	I	Year of Introduction: Year of Syllabus Revision:		2003-04 2017-18				Maximum Marks / Grade		100+50	
Mode of Transaction		Lectures and Practicals									
Course Outcome (CO) ELE 1309 CO1 Explain the fundamentals of poly phase systems & Electrical Machines. CO2 Apply various methods to solve poly phase systems. CO3 Analyze characteristics of various DC generators & motors. CO4 Evaluate operation & performance measures of poly phase transformer. CO5 Evaluate operation & performance of Induction Motor.											
Unit No.	Topic	Contact Hours	Weightagee (%)	B T Level	CO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)	PO	
1	Poly phase systems: Generation of 3Φ-phase EMF, Type of connections, Relation between phase values & line	10	19.23%	1, 2, 3, 4, 5	CO1, CO2	PSO1 , PSO2 ,	SD	G	PE	PO1, PO2, PO3, PO4, PO6, PO12	

	Values of currents and Voltage. Power & power factor in Poly phase systems. Measurement of power in 3 phases circuit by one wattmeter, two watt meters and three watt meters. Reactive power its measurement.					PSO3					
2	DC Machines: Construction details, Induced emf, Armature winding, Simple lap & waves windings, Characteristics of different types of generators and their Uses. Armature Reaction, Commutation Production of torque in DC Motors. Performance and torque and speed characteristics of series shunt and compound motors. Principle applications of each type, Speed control. Starting of series and shunt motors.	12	23.07%	1, 2, 3, 4	CO1, CO3	PSO1 , PSO3					PO1, PO2, PO3, PO4, PO12
3	Poly phase Transformer: Poly phase transformer using 3 single phase transformers and 3 phase transformer. Wave shape of current, voltage and flux waves. Different types of connections & Application of various types of transformers	10	19.23%	1, 2, 3, 4	CO1, CO4	PSO1 , PSO2 , PSO3					PO1, PO2, PO3, PO4,PO12
4	3 phase Induction Motor : Construction, Production of rotating magnetic field, Slip, Frequency of rotor current, Relation between torque &	10	19.23%	1, 2, 3, 4	CO1, CO5	PSO1 , PSO2 , PSO3					PO1, PO2, PO3, PO4, PO12

	Rotor p.f., Slip-torque characteristics, losses & efficiency, speed- control. Single-phase Induction Motor : Principle of operation, types, applications.									
5	Alternator : Construction, EMF equation, Regulation, OC & SC test, Synchronization of alternators. Synchronous Motor : Principle of working, Methods of starting, 'V' curves, applications.;	10	19.23%	1,2,3, 4	CO1, CO5	PSO1 , PSO2 , PSO3				PO1, PO2, PO3, PO4, PO12

List of Experiments										
Unit No.	Topic/Unit	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)
1	Study of DC machines.	3	100	1,2	CO1 CO5	PSO1	PO1, PO2, PO8, PO9, PO10, PO12			
2	Plot the characteristics of DC series generator.	3	100	1,2	CO1 CO2 CO5	PSO1	PO1, PO2, PO8, PO9, PO10, PO12			

3	Plot the characteristics of DC shunt generator.	3	100	1,2	CO1 CO2 CO5	PSO1	PO1, PO8, PO9, PO10, PO12	SD	G	PE
4	Plot the characteristics of DC compound generator.	3	100	1,2	CO1 CO2 CO5	PSO1	PO1, PO2, PO8, PO9, PO10, PO12			
5	Speed control of DC shunt motor.	3	100	1,2	CO1 CO2 CO5	PSO1	PO1, PO2, PO8, PO9, PO10, PO12			
6	Swin burn's test.	3	100	3,4,5	CO1 CO2 CO5	PSO1	PO1, PO8, PO9, PO10, PO12			
7	Power measurement in a 3-phase circuit using two wattmeter method.	3	100	3,4,5	CO1 CO3 CO5	PSO1	PO1, PO8, PO9, PO10, PO12			
8	Load test on 3- Φ Induction Motor	3	100	3,4,5	CO1 CO4 CO5	PSO1	PO1, PO8, PO9, PO10, PO12			
9	Effect of voltage variation on 3- Φ Induction Motor	3	100	3,4,5	CO1 CO4 CO5	PSO1	PO1, PO8, PO9, PO10, PO12			

10	O.C. & S.C. Test on on 3- Φ Alternator	3	100	3,4,5	CO1 CO4 CO5	PSO1	PO1, PO8, PO9, PO10, PO12			
11	V-curves of 3- Φ Synchronous motor	3	100	3,4,5	CO1 CO4 CO5	PSO1	PO1, PO8, PO9, PO10, PO12			

Reference Books	
1.	Applied Electricity-H.Cotton
2.	Electrical Technology- B.L. Theraja
3.	Advance Electrical Technology- H.Cotton
4.	Problems in Electrical Engg.- Parker and smith

Dynamics of Machine-II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022-23		
B. E. (Mechanical Engineering): Regular Programme											
Year	II	Core / Elective / Foundation MEC 1402:Dynamics of Machines - II			Credits / Hours per week				Lectures: 04 Practicals: 02		
Semester	II	Year of Introduction: Year of Syllabus Revision: 2018			Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and Practical's											
Un it No.	Topic		Contact Hours	Weig htage %	BT Level	C O	PSO	PO	Elements of Employabi lity (Emp)/ Entreprene urship (Ent)/ Skill Developm ent (SD)	Relev ance to Local (L)/ Natio nal (N)/ Regio nal(R) /Glob al (G)	Relation to Gender (G), Environmen t and Sustainabilit y (ES), Human Values (HV)and Professional Ethics (PE)
1	Static Force Analysis Graphical and analytical methods for static force analysis, principle of super position, method of virtual works, friction in mechanisms.		8	15	2, 3, 4	CO 1	PSO 1	PO 1, PO 2	SD	L,N,R ,G	ES
2	Dynamic Force Analysis Alembert principles, Graphical and analytical methods for dynamic force Analysis.		8	15	2, 3, 4	CO 1	PSO 1	PO 1, PO 2			
3	Balancing Balancing of rotating masses, Static and		8	15	2, 3, 4,	CO 2	PSO	PO 1,			

	dynamic balancing, Graphical and analytical methods, balancing of reciprocating masses, Balancing Machines.					1	PO 2, PO 7			
4	Vibrations Classification of vibrations, Terminology of vibrations, Un damped force vibration analysis; Equivalent spring, Dashpots and shaft length; Damped force Vibration; Logarithmic decrement; Forced vibrations; Vibration isolation and transmissibility; Whirling of shafts; Critical speed; Longitudinal and transverse vibration; Torsional vibration.	12	24	1, 2, 3, 4, 5, 6	CO 2, CO 3	PSO 1	PO 1, PO 2, PO 7			
5	Gyroscope Gyroscopic couple, Gyroscopic effect on airplane and ship, Stability analysis of four wheel and two wheel vehicles, Gyroscopic ship stabilization.	07	13	2, 3, 4	CO 4	PSO 1	PO 1, PO 2			
6	Governors Type of governors, Terminology of governors, Watt governors, Porter governor, Proell governor, Inertia governor, Quality of governors.	07	13	1, 2, 3, 5	CO 5	PSO 1	PO 1, PO 2			
		60	100							
	Course Outcome (CO) MEC 1408 C01 Analyze static and dynamic forces. C02 Analyze the effects of unbalanced masses. C03 Analyze vibration and its effect in mechanical systems. C04 Evaluate gyroscopic couple and using it for stability for different vehicles. C05 Understand the need and working of governor									
	Experiments									
1.	To determine the natural frequency of free torsional vibration using single rotor system.	02	10	2, 3	CO3	PSO1	PO1	SD	L,N,R, G	ES
2.	To find node position of free torsional vibration for	02	10	2, 3	CO3	PSO1	PO1			

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Electronics

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Electrical Engineering					Academic Year:			2021-22
		B.E. (Mechanical): Regular Programme								
Year	II	Core / Elective / Foundation ELE 1410: Electronics				Credits / Hours per week Lecture + Practical + Tutorial			03+03+01	
Semester	II	Year of Introduction: 2007 Year of Syllabus Revision: 2021				Maximum Marks / Grade			100 +50	
Mode of Transaction		Lectures and Tutorials, Laboratory								
	Course Outcomes: CO1: Outline working of various semi-conductor devices, their characteristics and applications. CO2: Analyze dc circuits and ac circuits of semiconductor devices with their physical Operation. CO3: Compare various biasing and stabilization methods. CO4: Apply the knowledge of electronics devices and different power amplifier circuits. CO5: Analyze difference oscillator circuits and Oscilloscope.									
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)
1	Qualitative Semiconductor	5	10	2	CO1	PSO 1	PO1			

	Theory: Intrinsic and extrinsic semiconductors. Qualitative study of P.N., N.P.N. and P.N.P junctions and their characteristics.							SD	G	PE
2	Diode Circuits: P.N. junction diode and its characteristics. The diode as a circuit element. Diode resistance. Junction capacitance. The load line concept. The piecewise linear diode model. Zener diode and its working as regulator. Semiconductor photo diode and photovoltaic effect. Light emitting diode. Half wave, full wave and bridge rectifier, C, L and π type filters. Diode application like clipper and clamper circuit.	8	15	2,3	CO1, CO2	PSO 1	PO1 PO2 PO4 PO1 2			

3	Transistors (BJTs): Construction & symbol. Cut-off, active and saturation regions. Phototransistors. Transistor circuits (BJTs): Low Frequency Transistor circuit. Graphical analysis of the CE configuration. Transistor hybrid model, h-parameter, r-parameter etc. Transistor Biasing (BJTs): Bias stability, various biasing scheme. Stabilization against variation in I_{CO} , V_{BE} and bias compensation.	10	19	2,3	CO1 , CO2 , CO3	PSO 1	PO1 PO2 PO4 PO1 2			
4	Amplifiers: Analysis of CB, CE and CC and amplifier circuits and their compensation. High input resistance circuits. RC	12	23	2,3,4	CO1, CO2, CO3, CO4,	PSO 1	PO1 PO2 PO4 PO1 2			

	coupled-transformer coupled amplifier circuit diagram, working and their characteristics (no analysis), power amplifiers, class A single ended and push pull amplifier circuit and working (no analysis).									
5	Feedback Amplifiers & Oscillators: Various feedback amplifier configurations using BJT– their analysis, phase and frequency considerations. Basic principle of oscillation, RC phase shift oscillator.	7	13	4	CO5	PSO 1	PO1 PO2 PO4 PO1 2			
6	Electronic Instruments: Basic block diagram of Cathode ray tube (CRO) and it's working. Measurement of voltage, current, frequency, phase	6	12	4	C05	PSO 1	PO1 PO2 PO4 PO1 2			

	etc. using C.R.O. VTVM: Basic circuit diagrams of various types of VTVM, D.C. and A. C. measurement and their working. Multimeters, Digital readouts for meters.									
7	Modulation-Demodulation: Introduction to principles of modulation and demodulation. Elementary theory and circuits for AM, FM and demodulation.	4	8	6	C04	PSO 1	PO1 PO2 PO4 PO1 2			

Unit No.	List of Experiments	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Introduction to Multi sim online simulator.	3	100	2	CO1	PSO1	PO1 PO5			

2	To study CRO.	3	100	3	CO1	PSO1	PO1	SD	G	PE
3	To study the diode characteristics: PN diode, Zener diode and LED.	3	100	3,2	CO1 CO3	PSO1	PO1 PO2			
4	To study the characteristics of NPN transistor.	6	100	3,2	CO1 CO3	PSO1	PO1 PO2			
5	To study clipper and clamper.	3	100	3,4	CO1 CO4	PSO1	PO1 PO2			
6	To study half wave rectifier, center tap rectifier and bridge rectifier.	6	100	3,4	CO1 CO4	PSO1	PO1 PO2			
7	To study common Emitter amplifier.	6	100	3,4	CO1 CO4	PSO1	PO1 PO2			
8	To study common collector amplifier.	3	100	3,4	CO1 CO4	PSO1	PO1 PO2			
9	Electronics laboratory assessment	6	-----	-----	-----	-----				

Reference Books:		
1.		Integrated Electronics: Millman & Halkias
2.		Electronic Devices and Circuits: Applied Electronics: G. K. Mittal
3.		Electronic Communication Systems: George Kennedy, Brendan Davis
4.		Principles of Electronics-S. Chand V. K. Mehta, Rohit Mehta
5.		Electronic Devices and Circuit Theory: by Robert Boylestad and Louis Nashelsky

Production Technology -1

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering				Academic Year			2021-22		
		B. E. (Mechanical Engineering): Regular Programme									
Year		II	Core / Elective / Foundation MEC 1404 :Production Technology -1			Credits / Hours per week			Lectures : 04 Practical : 02		
Semester		II	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade			Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and Practical											
		Course Outcome (CO) MEC 1404 CO1 Acquire knowledge about ferrous & nonferrous metals& their manufacturing processes CO2 Understanding different heat treatment processes, TTT & CCT diagrams, subzero treatment of steels CO3 To study sand casting processes CO4 Understanding types, mechanism, accessories & attachments of general purpose M/C tools. CO5 To study hot & cold working processes.									
Unitt No.	Topic		Contact Hours	Weight age (%)	B T Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)
1	Engineering Materials Ferrous Metals : pig iron, wrought iron, cast iron, steels, Types, production, characteristics, composition, furnaces, blast furnace, cupola, crucible, open hearth Bessemer converter, electric arc furnace, induction furnaces, alloy steel,		15	29	1, 2, 3	CO1	PSO	PO1			

	purpose of alloying, general effects of alloying elements, coding of steels as per ASME, BIS, DIN, ISO standards, tool steels, classification, properties, IS codification, types, applications, non-ferrous metals & alloys, Copper, Aluminium, Magnesium, Nickel, Lead, Titanium : general properties of pure metals, Effect of alloying elements, types of alloys & application					1				
2	Heat Treatment of Metals Iron- Iron Carbide equilibrium diagram, transformation at different composition, plain carbon steels & its classification, TTT & CCT diagram, hardenability, alloy steel & effect of alloying elements, heat treatment (annealing, normalizing, hardening, martempering, austempering, tempering), case hardening (carburizing, Nitriding, cyaniding), surface hardening (flame hardening , induction hardening), definition, aim, types, properties, applications, processes, factors affecting, common defects, subzero treatment of steels heat treatment of cutting tools, heat treatment furnaces.	11	21	1, 2, 3	CO2	PSO 1	PO1			
3	Foundry Technology Introduction : brief history, advantage and limitations, applications, principles of sand casting, steps in casting process, sand moulding processes, behavior of cast metal, patterns, pattern materials, allowances, types of pattern, colour code scheme, pattern layout, sand casting, green & dry sand casting processes, types of moulding sand & its properties, moulding sand composition, cores, use material, types of cores, advantages & limitations, core prints, chaplets, gating & risering systems, elements of gating systems, types of gates, casting defects, causes & remedies of defects, cleaning of casting, testing & inspection of casting, melting practices (furnaces	08	15	1, 2, 3	CO3	PSO 1	PO1			

	covered in Engineering Materials Chapter 1 of PT1)									
4	General Purpose Machine Tools Specification, types, mechanisms, accessories, work holding devices, attachments, tools, operations, applications, speed feed & depth of cut, machining time calculation for lathe, milling, shaping, planning, slotting, drilling, boring, grinding machines, grinding, grinding wheels, specification, material, bond, shapes, selection, mounting & balancing, loading & glazing, truing & dressing	12	23	1, 2, 3,	CO4	PSO 1	PO1, PO2			
5	Mechanical Working Metal forming processes : classification, introduction to plastic deformation, analysis of stress-strain, strain rate, hot working, cold working & annealing, bulk deformation processes, rolling, classification, elementary analysis of strip rolling, rolling variables rolling load calculations, defects in rolled products, extrusion , classification, elementary analysis, defects in extruded products, hydrostatic extrusion, extrusion of tubing, drawing : types, elementary analysis, load calculation, forging, classification, elementary analysis, forging defects.	06	12	1, 2, 3	CO5	PSO 1	PO1			
	Total	52	100							
	Experiments									
1	Study of general purpose Machine tools	2	10	1, 2, 3	CO4	PSO 1	PO1, PO2			
2	Mechanism used in general purpose Machine tools	2	10	1, 2, 3	CO4		PO1, PO2			
3	Attachments & accessories used in general purpose Machine tools	4	10	1, 2,	CO4		PO1, PO2			

				3						
4	Operation performed in general purpose Machine tools	2	10	1, 2, 3	CO4		PO1, PO2			
5	Calculation of cutting speed,feed & depth of cut, machining time for thread cutting & taper turning operation	2	10	1, 2, 3	CO4		PO1, PO2			
6	Methods of indexing & their problems	4	10	1, 2, 3, 5	CO4		PO1, PO2			
7	Study of various forming processes	2	10	1, 2, 3	CO5		PO1			
8	Study of metal casting	2	10	1, 2, 3, 6	CO3		PO1			
9	Study of foundry techniques	2	10	1, 2, 3	CO3	PO1				
10	Project	2	10	1, 2, 3	CO1 TO CO5	PO1				

Text & Reference Books

1		Manufacturing processes for Engineering materials	by	Scope kalpakjian
2		Fundamental of Modern Manufacturing	by	M. P. Groover
3		Workshop Technology Vol. I & II	by	Raghuvanshi
4		Workshop Technology Vol. I & II	by	S. K. HajraChaudhri& S. K. Bose
5		Textbook of production Technology	by	P. C. Sharma
6		Production Technology	by	R. K. Jain
7		Workshop Technology	by	R. S. Khurmi

Dynamics of Incompressible Flow

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering				Academic Year		2021-22				
		B. E. (Mechanical Engineering): Regular Programme										
Year	II	Core / Elective / Foundation MEC 1403: Dynamics of Incompressible Flow				Credits / Hours per week		Lectures: 04 Practicals: 02				
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision: 2006				Maximum Marks / Grade		Theory: 100 PR/TW/VIVA: 50				
Mode of Transaction: Lectures and Practicals												
		Course Outcome (CO) MEC 1403 CO1 Remember basics of fluid flow and its properties. CO2 Understand principles of conservation and energy equation. CO3 Analyze kinematic behavior of two-dimensional flow and wave equation. CO4 Understand dimensional analysis and similitude. CO5 Analyze basics of laminar flow, turbulent flow, boundary layer, and flow losses.										
Un it No.	Topic			Conta ct Hours	Weight age (%)	BT Level	C O	PSO	PO	Elements of Employabi lity (Emp)/ Entreprene urship (Ent)/ Skill Developm ent (SD)	Relev ance to Local (L)/ Natio nal (N)/ Regio nal(R) /Glob al (G)	Relation to Gender (G), Environm ent and Sustainabi lity (ES), Human Values (HV)and Profession al Ethics (PE)

1	Introduction: Concepts- fluid flows, properties, fluid continuum, control volume, surface & mass, fluid element, locating coordinate systems, external actions, effects of external actions, - motions, methods for describing the flows, stresses, stress tensors, rates of strains, total derivatives of properties and parameters, Stokes laws of viscosity & related assumptions, flow lines, stream functions, velocity potential function, concept of rotational fluid flows, vorticity, angular velocity circulation, various vectorial theorems, their uses, Reynolds's transport theorem.	08	15	1, 2, 3	C O 1	PSO 1	PO 1, PO 2, PO 3	EMP, ENT	All	All
2	Various principles of conservation, resulting differential equation, various momentum equations, Bernoulli's equation and various energy equations – K.E. equation, M.E equation, thermal energy equation, flow energy equation, rate of entropy production, fluid static concept, one-dimensional applications, floating bodies, Boussinesq approximation, need of Boussinesq approximation, flow condition for application of Bousinesq approximation, Air flow treated with Boussinesq approximation.	08	15	2, 3,4	C O 2	PSO 1, PSO 2	PO 2, PO 3	EMP, ENT	All	All
3	Kinematic considerations of Vortex flows, vorticity dynamics, Kelvin's circulation theorem, Irrotational flows, complex velocity, sources and sinks, doublet. Flows past immersed bodies, without circulation, with circulation with consideration of Superimposition of rectilinear flow and source sinks, uniqueness of irrotational flow, flow around an arbitrary body of revolution	08	15	2,3,4,5, 6	C O 3	PSO 1, PSO 2	PO 1, PO 2	EMP, ENT	All	All
4	Two-dimensional flows without rotation- flow between parallel flat plates, Couette flow, plane Pousuelle flow, flow through pipes, Hagen Pousuelle flow, the wave equation, wave parameters, surface gravity waves, approximation for deep and	08	15	2, 4,5	C O 3	PSO 1, PSO 2	PO 1, PO 3, PO	EMP, ENT, SD	All	All

	shallow water, standing waves.						4			
5	Dimensional analysis and similitude: Physical quantities in fluid flow, dimensionally homogenous equations and their characteristics, Buckingham's theory, calculation of dimensionless parameters and their physical significance, similitude, model scales.	08	15	3, 4,5	CO4	PSO1, PSO2	PO1, PO2,	EMP, ENT, SD	All	All
6	Elementary idea about Laminar flow, Turbulent flow and boundary layer.	5	10	1,2, 3	CO5	PSO2	PO1, PO2, PO3	EMP, ENT	All	All
7	Fluid flow in pipes and bends, study of various losses.	5	10	1,4,5	CO5	PSO2	PO1, PO2	EMP, ENT, SD	All	All
Experiments										
1.	Study of fluid and fluid's property.	04	17	1,2,3	CO1	PSO1	PO1,PO2	EMP, ENT	All	All
2.	To study Reynolds experiment.	04	17	1,2,3	CO1	PSO2	PO1,PO2	EMP, ENT, SD	All	All
3.	To study verification of Bernoulli's equation.	04	17	2,3	CO2	PSO2	PO1,PO2	EMP, ENT, SD	All	All
4.	To determine friction factor in pipe flow.	04	17	1,2,3	CO7	PSO2	PO1,PO2	EMP, ENT, SD	All	All

5.	To study metacentre and metacentric height.	04	17	1,2,3	CO3	PSO2	PO1,PO 2	EM P, ENT , SD	All	All
6.	Study of method of images.	04	17	2,3	CO6	PSO2	PO1,PO 2	EM P, ENT	All	All
Reference Books										
1.	Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S K Katariaans Sons.									
2.	Fluid Mechanics and Hydraulic machines by R. K. Bansal, Laxmi publication.									
3.	Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.									

Mechanical Measurements

 सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022-23		
		B. E. (Mechanical Engineering): Regular Programme									
Year	II	Core / Elective / Foundation MEC 1405: Mechanical measurements		Credits / Hours per week				Lectures : 04 Practical : 02			
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006		Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50			
Mode of Transaction: Lectures and Practical											
	Course Outcome (CO) MEC 1405 CO1 Understand basic of mechanical measurement system along with generalized measurement system. CO2 Understand basic about analysis of experimental data. CO3 Understand basic of stress-strain and displacement measurement. CO4 Understand basic of force, Torque, power and pressure measurement. CO5 Understand basic of flow and temperature measurement.										
Unit No.	Topic		Contact Hours	Weight age (%)	BT Level	CO	PSO	P O	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Basic Concepts of Mechanical Measurements System: Significance of mechanical measurements,		4	8	1,2,3	CO1	PSO1	P O	EMP, ENT, SD	All	All

	definitions of readability, sensitivity, accuracy precision, calibration.						1, P O 2, P O 3			
2	Generalized Measurement Systems: Elementary concepts of sensing elements- transducers: Primary and secondary transducers, mechanical members as transducers, electrical transducer elements- variable resistance, sliding contact, resistance strain gauge, thermistors, thermocouple, variable inductance, differential transformer, variable reluctance, variable capacitance, piezoelectric elects, electronic transducer elements, ionization, photoelectric cells. Intermediate modifying systems: Mechanical systems, electrical systems, Hydraulic pneumatic systems, and optical systems. Terminating stage: Indicators-Displacement type, digital type, Recorders-digital printing, pen and chart, hot stylus and chart, light beam and photographic film, magnetic recording controllers- general considerations.	7	13	1,2,3	CO1	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
3	Analysis of Experimental Data: Error analysis on a commonsense basis, uncertainty analysis by Kline and McClinton method. Statistical analysis of experimental data, probability distribution, Gaussian and Poisson's distribution Chauvenet's criterion of rejecting reading, Chi square test, method of least squares.	4	8	2,3	CO2	PSO1, PSO2	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
4	Displacement Measurement: Different methods of displacement measurement Stress Strain Measurement:	4	8	2,3,	CO3	PSO1	P O 1, P O	EMP, ENT, SD	All	All

							2, P O 3			
5	Stress Strain Measurement: Requirements of ideal strain gauge, types of gauges, gauge factor, grid material requirement, cement potentiometers & Wheat Stone Bridge circuits, temperature compensation, paper orientation of gauges.	7	13	2,3	CO3	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
6	Force, Torque, Speed and Power Measurements: Different methods of measuring the above quantities.	6	12	2,3	CO4	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
7	Measurement of Pressure: Pressure measuring systems, Different methods of measuring high and low pressure, Calibration of pressure measuring devices.	7	13	2,3	CO4	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
8	Measurement of Flow: Introduction, positive displacement methods, flow obstruction meters, Hot wire anemometer, magnetic flow meters, pressure probes.	6	12	2,3	CO5	PSO1	P O 1, P O 2,	EMP, ENT, SD	All	All

							P O 3			
9	Measurement of Temperature: Introduction, temperature measurement by mechanical effects, liquid in glass thermometers, bimetallic strip, pressure thermometers Temperature measurement by electrical effects, electrical resistance thermometers, thermistors, thermocouples. Law of intermediate metals, law of intermediate temperatures. Pyrometers- Optical & radiation pyrometers. High-speed temperature measurements.	7	13	2,3	CO5	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
	Experiments									
1	Calibration of bourdon tube type pressure gauge.	02	13	1,2,3	CO4	PSO1	P O 1, P O 2,PO 3	ENT, SD	All	All
2	Rotational speed measurement by stroboscope.	02	13	1,2,3	CO3	PSO1	P O 1, P O 2,P O3	EMP, SD	All	All
3	Calibration of Rota meter for flow measurement.	02	13	1,2,3	CO5	PSO1	PO1,P O	EMP, ENT, SD	All	All

							2, P O 3			
4	Calibration of pressure gauge with help of mercury U tube manometer	02	13	1,2,3	CO4	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
5	Measurement of temperature with help of mercury thermometer, RTD and thermistors.	02	13	1,2,3	CO5	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
6	Study of different low pressure measuring instruments.	04	13	1,2,3	CO4	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
7	Study of flow measuring instruments like orifice meters, flow nozzles and venturimeter.	04	13	1,2,3	CO5	PSO1	P O 1, P O 2,	EMP, ENT, SD	All	All

							P O 3			
8	Study of some miscellaneous measurement like liquid level, liquid viscosity, liquid density.	04	13	1,2,3	CO5	PSO1	P O 1, P O 2, P O 3	EMP, ENT, SD	All	All
Text & Reference Books										
1		Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press								
2		Engineering Metrology and Measurements, Bentley, Pearson Education								
3		Mechanical Measurement and Metrology by R K Jain, Khanna Publisher Mechanical Measurement & Control by D.S. Kumar.								
4		Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry McGraw-Hill								

B.E. Mechanical Engineering 3rd Year



	NAME OF THE DEGREE/DIPLOMA PROGRAMM	SUBJECT CODE THEORY	SUBJECT CODE T.W./VIVA/PRA	SUBJECT	THEORY	T.W./VIVA/PRA	TOTAL MARKS	LEC HOUR/WEEK	LAB HOUR/WEEK	TUTORIAL HOUR/WEEK
T H I R D B E Y E A R	FSBE III	MEC 1502	MEC 1502 L	Heat and Mass Transfer	100	50	150	4	2	0
		MEC 1501	MEC 1501 L	Hydraulics Machines	100	50	150	4	2	0
		MEC 1504	MEC 1504 L	Industrial Engineering I	100	50	150	4	2	0
		MEC 1503	MEC 1503 L	Machine Design I	100	50	150	4	3	0
		MEC 1505	MEC 1505 L	Production Technology II	100	50	150	4	2	0
		TOTAL			500	250	750	20	11	0
	SSBE III	MEC 1604	MEC 1604 L	Computational Techniques and Programming Languages	100	50	150	4	3	0
		MEC 1602	MEC 1602 L	Industrial Engineering II	100	50	150	4	2	0
		MEC 1601	MEC 1601 L	Machine Design II	100	50	150	4	3	0
		MEC 1605	MEC 1605 L	Production Technology III	100	50	150	4	2	0
		MEC 1603	MEC 1603 L	Thermal Engineering II	100	50	150	4	2	0
		TOTAL			500	250	750	20	12	0

Hydraulics Machines

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022-23			
			B. E. (Mechanical Engineering): Regular Programme								
Year	III		Core MEC 1501 :Hydraulics Machines			Credits / Hours per week			Lectures: 04 Practical:- 02		
Semester	I		Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade			Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and Practical											
			Course Outcome (CO) MEC 1501 CO 1 Determine the forces exerted by a jet of fluid on stationary and moving vanes of different shapes. CO 2 Distinguish different classes of turbines and further analyze their working principles. CO 3 Assess the performance of hydraulic turbines CO 4 Distinguish between different classes of pumps, their construction features and further Analyze their performance. CO 5 Explain the working principles of various hydraulic systems, hydraulic control systems and fluidics and select a suitable hydraulic device for a particular application.								
Un it No .	Topic		Cont act Hour s	Weight age (%)	BT Level	CO	PO	PSO	Elements of Employabilit y (Emp)/ Entrepreneur ship (Ent)/ Skill Developmen t (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environmen t and Sustainabilit y (ES), Human Values (HV)and Professional Ethics (PE)

1	Positive Displacement Pumps: Reciprocating pumps, types, constructional features, expressions for pressure developed by and work done on the pump, effects of fluid friction and plunger acceleration on pump performance, air vessel and its use, Negative slip, testing of reciprocating pumps. Rotary Pumps: Types, constructional features, performance characteristics.	10	20	2,4	CO4	PO2 ,PO3	PSO1	ALL	All	ES,HV,PE
2	Centrifugal Pumps: Types, constructional features, expression for pressure developed by and work done on the pump, minimum starting speed of the impeller, similarity principles, specific speed and model testing, testing of centrifugal pumps. Selection and sizing of centrifugal pumps, pumping installations, parallel and series operations, servicing and maintenance.	10	20	1,2,3,4	CO4	PO2, PO5	PSO1			
3	Hydraulic Turbines: Historical review, classifications,	8	20	2,3,5	CO1, CO2, CO3	PO2,PO3,P O4				

	constructional features, mass, momentum and energy equations for reaction and impulse turbines, Water hammer, speed rise, Determination of power, cavitations and run away speed of turbine wheel, governing of hydraulic turbines, similarity principles, specific speed and model testing, unit quantities and characteristics curves, testing of hydraulic turbines, selection and sizing of hydraulic turbines, turbine installations, servicing and maintenance, pumped storage plants.						PSO1			
4	Miscellaneous Hydraulic Machines: Constructional features and working of machines like accumulator, intensifier, lift, crane, press, hydro ram.	8	15	1,2	CO1,C O5	PO2,PO3	PSO1			

5	Hydraulic Metering Instruments & Hydraulic Power Transmission: Current meters, orifice meters, venturi meters, pitot tubes, notches weirs, tracer methods, elementary idea about hydraulic power transmission systems like fluid coupling, torque converters etc., Hydraulic power plants.	8	15	2,4,6	CO5	PO4,PO5	PSO1			
6	Hydraulic Sealing: Static and dynamic sealing requirements, gaskets, O-rings, lip seals, soft packing, face seals or mechanical seals, clearance seals or labyrinth seals.	8	10	1,2	CO5	PO4,PO5	PSO1			
		52	100							
		Experiments								
1.	Study of Amsler’s pitot tube	4	15	1,2	CO1	PO2 ,PO3	PSO1	All	All	ES,HV, PE
2.	Study of Cup type current meter	4	15	1,2,3	CO1	PO2, Po3	PSO1			
3.	Trial on two stage reciprocating pump	4	15	2,3	CO4	PO3, PO4	PSO1			
4.	Study and performance of single stage centrifugal pump	4	10	2,3,5	CO4	PO3,PO4	PSO1			
5.	Study and performance of double stage centrifugal pump	2	10	1,5	CO4	PO3,PO4	PSO1			

6.	Study of Water wheels & hydraulic turbines	2	10	2,6	CO2,C O3	PO1,PO2	PSO1			
7.	Detailed study of hydroelectric Power plant	2	15	3,6	CO1	PO1,PO2	PSO1			
8.	Performance of Hydraulic Ram	4	10	1,4	CO5	PO3,PO4	PSO1			
		26	100							
Reference Books										
1.		“Fluid Mechanics and Hydraulic Machines” by R.K. Bansal, Laxmi Publications								
2.		“Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand & Co.								
3.		“Fluid Mechanics Fundamentals and Applications”, by Yunus A.Cengel, McGraw Hill Publishing Company Ltd.								

Heat and Mass Transfer

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year			2022-23				
		B. E. (Mechanical Engineering): Regular Programme										
Year	III MECH	Core MEC 1502 : Heat and Mass Transfer			Credits / Hours per week			Lectures: 04 Practical:- 02				
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade			Theory: 100 PR/TW/VIVA: 50				
Mode of Transaction: Lectures and Practical												
		Course Outcome (CO) MEC 1502 CO1. Understand the basic laws of heat transfer. CO2. Understand the fundamentals of different modes of heat transfer process. CO3. Analyze problems involving steady state as well as transient in nature for simple geometries. CO4. Obtain numerical solutions for different industrial heat transfer process. CO5. Evaluate thermal performance of different modes of heat transfer process.										
Unit No.	Topic			Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Heat Conduction: General Equation: Modes of heat transfer, conduction, convection and radiation, Fourier's			7	15	1,2,3,	CO1, CO2,	PS01	PO1,PO2,PO3	ALL	ALL	ES,HV,PE

	law of heat conduction and thermal conductivity, General heat conduction equation (Unsteady three dimensional heat conduction equation with generation) in Cartesian coordinates, thermal diffusivity, Reduction of general equation for various cases of unsteady and steady heat conduction with and without heat generation. General heat conduction equation in cylindrical and spherical coordinates.									
2	Steady State Heat Conduction: One dimensional steady state heat conduction through simple or composite plane, cylindrical and spherical walls with uniform non - uniform thermal conductivity without heat generation, Thermal contact resistance, one dimensional steady state, heat conduction in plane, cylindrical and spherical bodies with heat generation. Heat transfer between fluids separated by simple or composite plane, cylindrical and spherical walls, Overall heat transfer co-efficient, heat insulation, materials for heat insulation, critical thickness of insulation on cylindrical and spherical systems, extended surfaces- Fins, types of fins, heat transfer from straight fin of uniform cross section, effectiveness and efficiency of fins.	7	20	2,4, 5,	CO1, CO2	PS01	PO2,PO 3,			
3	Unsteady State Heat Conduction: Unsteady state heat conduction process, Heating or cooling with known temperature distribution, unsteady state system with negligible internal thermal resistance (Lumped heat capacity analysis). Transient heat conduction in bodies with finite internal and surface resistance.	6	15	2,3	CO3, CO4	PS01	PO3,PO 4			
4	Convection: Mechanism of convection, free and forced	8	20	4,6	CO3, CO4	PS01	PO5,PO 4			

	convection, Film theory and Newton's law of cooling, Laminar and turbulent flows, Hydrodynamic boundary layer, Buckingham theorem, Dimensional analysis for free and forced convection, Dimensionless numbers, Experimental results and correlation for free and forced convection, Reynolds analogy between friction and heat transfer Theory of condensation and boiling.									
5	Heat Exchangers: Types of heat exchangers, LMTD method for parallel and counter-flow heat exchangers, Mean temperature difference for cross flow, Heat exchanger effectiveness, Effectiveness-NTU method, fouling factor, Heat exchanger design considerations.	6	10	1,5,6	CO4 CO5	PS01/PS02	PO5			
6	Radiation: Electromagnetic spectrum and thermal radiation, Absorptivity, Reflectivity and Transitivity, Black, white, transparent and opaque bodies, specular diffuse reflection, Emissive power, Monochromatic emissive power, Planck's law Wien's displacement law, Stefan-Boltzmann's law, Emissivity, Monochromatic emissivity, Gray Body, Kirchoff's law, solid angle and radiation intensity, Lambert's cosine law, heat exchange by radiation between two infinite parallel surfaces, two infinitely long concentric cylinders, and two concentric spheres, Heat exchange by radiation between two finite surfaces, shape factor and its properties, Radiation shields.	10	10	2,5	CO4, CO5	PS01	PO2,PO3,PO5			

7	Mass Transfer: Mass transfer process, classification of mass transfer operations, Molecular diffusion, Fick's law of diffusion, Molecular diffusion in solids, liquids and gases, Diffusion in binary gas mixtures, Equimolar counter diffusion in gases, Analogy between transport phenomena, Momentum, Heat and Mass Transfer.	8	10	5,6	CO4, CO5	PSO1	PO2,PO 4			
		52	100							
Experiments										
1.	Experiment On Thermal Conductivity Of Oil	2	10	1	CO1, CO2,	PSO1, PSO2	PO1,PO 2,PO3	All	All	ES,HV ,PE
2.	Determination Of Thermal Conductivity Of Metallic Rod	2	10	1,2	CO2, CO3	PSO1, PSO2	PO3,PO 4			
3.	Thermal Conductivity Of Powder Material	2	10	2	CO1, CO2,	PSO1, PSO2	PO1,PO 2,PO3			
4.	Experiments With Thermal Radiation Using Electric Bulb	4	10	2	CO2, CO3	PSO1, PSO2	PO5			
5.	Determination Of Emissivity Of Metallic Material	2	10	1,2, 3,4	CO3, CO4, CO5	PSO1, PSO2	PO2,PO 3,			
6.	Heat Exchanger Analysis	4	10	3,4	CO1, CO2,	PSO1, PSO2	PO1,PO 2,PO3			
7.	Predicting Nature Convection Heat Transfer Coefficient Using Condensation Of Steam	2	10	4,6	CO1, CO2,	PSO1, PSO 3	PO1,PO 2,PO3			
8.	Natural Convection Experiment	4	10	2,1	CO4, CO5	PSO1, PSO 3	PO5			
9.	Pin Fin Analysis	2	10	2,5	CO4, CO5	PSO1, PSO 3	PO2,PO 3,PO5			
10.	Transient Convection	2	10	5	CO4, CO5, CO1, CO2	PSO1, PSO 3	PO2,PO 4			
		26	100							

		Reference Books
1.		Heat & Mass Transfer by P.K. Nag, McGraw Hill
2.		Heat and Mass Transfer: Fundamentals and Application by YunusCengel, McGraw Hill
3.		Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley Publication
4.		Heat and Mass Transfer by R K Rajput, S.Chand Publication

Industrial Engineering -1

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year		2021-22					
		B. E. (Mechanical Engineering): Regular Programme									
Year	III	Core / Elective / Foundation MEC 1504 :Industrial Engineering -1		Credits / Hours per week		Lectures : 04 Practical : 02					
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006		Maximum Marks / Grade		Theory: 100 PR/TW/VIVA: 50					
Mode of Transaction: Lectures and Practicals											
Course Outcome (CO) MEC 1504 CO1 Recognizing importance of productivity and its improvement technique, method study & its chart. CO2 Understanding method study and work measurement and ergonomics CO3 Discussing plant layout and plant location, importance. CO4 Discuss importance of human safety in industry & factors affecting health of the worker CO5 Describe different industrial acts & its necessity and various maintenance methods for reducing down time for machines &equipment's											
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1	Introduction to Industrial Engineering Industrial Engineering : Introduction, Scope, history, Functions, applications, Productivity, Importance, Types, Measurement techniques, Means of increasing, Factors affecting, Reliance of various ratios, Reducing work content, management techniques, Japanese approach for Productivity enhancement.	07	12	1, 2, 3	CO1	PSO 1	PO1, PO5	ALL	ALL	ALL
2	Method Study: Method study: Basic procedures/steps; Process Chart: Recording techniques, Various information depicted & inferences, Operation, Flow Process, Flow diagrams, String diagrams, Travel, Gang Process, Two Handed, SIMO, Multiple Activity Chart ,Man & Machine Chart; Micro motion & Memo Motion study: Therblings, Principles of motion economy, Design of work station, Photographic techniques needed in work simplification, Cyclegraph&Chrono cycle graph.	07	16	1,2, 6	CO1	PSO 3	PO1			
3	Work Measurement: Work measurement Techniques, Procedure, Equipments; Time study forms, Allowances, Performance Rating, Various techniques of rating (Westing house method, synthetic rating method, etc), Estimation of standard time, Work Sampling, Production study, Predetermined Motion Time & Systems (PMTS), Method Time Measurement (MTM), Synthesis of work study data, Use of time study data in wage incentives.	07	14	1,2,3	CO2	PSO 3	PO1			

4	Ergonomics: Definition & Concept, Objectives, Areas Covered, Systems approach of ergonomics model; Man machine system: Characteristics; Man Vs machine; Work capabilities of industrial worker, Control members: Types of Displays, Location (shape & size, coding & control size etc.), Ergonomic design consideration; Anthropometry functional anatomy data; Working environment (Light, Humidly Fatigue, Noise, Thermal Conditions, Radiation etc.).	08	14	1,2,3	CO2	PSO 2	PO1, PO3, PO7			
5	Plant Location and Plant Layout: Plant Location: importance, Factors for selection; Plant Layout: Objectives, Principles, Types, Advantages & Limitations, Effects of automation, Symptoms of bad layout; Types of flow (I, S, O, U etc.); Factory Building: Types, Single storage Vs Multistoried storage, Types of construction.	07	08	1,2,3	CO3	PSO 2	PO1			
6	Material Handling: Introduction, Functions, Factors, Principle, Equipment, Selection of material handling Equipment; Relationship to Plant Layout; Warehousing & distribution.	08	12	1,2, 3	CO3	PSO 2	PO1			
7	Plant Maintenance and Replacement: Types (Corrective, Preventive, Predictive, Scheduled etc) Scope, Advantages, Planning & scheduling; Total Productive Maintenance (evolution of TPM , Basic concept of TPM, Various. losses, OEE; MAPI Method.	08	12	1,2,3,5	CO5	PSO 2	PO1			
8	Industrial Safety and Occupational Health: Safety: Introduction, Legal & social aspects, Accidents & accident prevention; Health: Occupational health & Industrial hygiene.	05	07	1,2,3	CO4	PSO 3	PO1, PO7, PO8, PO12			

9	Industry and Legislation: Necessity, Features & Provisions of various Acts, Indian Factory Act 1948, The Employees State Insurance Act 1948, Workmen's Compensation Act 1923, The Industrial Disputes Act 1947, The Payment of Wages Act 1936, The Minimum Wages Act 1948, The Apprentice Act 1961, The Employee Provident Fund & Family Pension Act 1952, Employee's Family Pension Scheme 1971, Trade Union.	03	05	1,2,3	CO5	PSO 3	PO1			
		60	100							
	Experiments									
1	Pin board Study	02	16	1,2,3	CO1 , CO2		PO1, PO5, PO9	ALL	ALL	ALL
2	Normal & maximum working area	02	10	1,2,3	CO1		PO1, PO9			
3	Study of 'Pressure' & 'Hooks' grasp	04	16	2,3	CO1 , CO2		PO1, PO5, PO9			
4	Assembly of bolt, washer & nut	04	16	2,3	CO1 , CO2		PO1, PO5, PO9			
5	Rating study of walking	02	07	2,3	CO1 , CO2		PO1, PO5			
6	Study of different charts	02	07	1,2,3	CO1		PO1			
7	Study of material handling & warehouses	02	07	1,2,3	CO5		PO1			
8	Study of industrial safety & occupational health	02	07	2,3	CO5		PO1, PO7			
9	Study of plant layout & location	03	07	2,3	CO4		PO1			
10	Industrial acts	03	07	1,2,3	CO5		PO1			
		26	100							
Text & Reference Books										
1	Introduction to work study	Edited by George Knawaty, ILO Geneva								
2	Industrial engineering & management	O. P. Khanna, Dhanpat Rai Publication								

3	Motion & Time study	Benjamin W. Niebel, R. D. Irwin publications
5	Motion & Time study: Design and Measurement of Work	Ralph M. Barnes, wiley& sons publication
6	Motion & Time study: Improving Productivity	Mundel, Marvin E., Prentice Hall
7	Ergonomics & work design: emerging issues in organizational sciences	New Age International (p) ltd
8	Total Productive Maintenance	Industrial press inc., new york

Machine Design - I

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering					Academic Year				2022-23		
B. E. (Mechanical Engineering): Regular Program													
Year		III MECH	MEC 1503: Machine Design - I				Credits / Hours per week				Lectures: 04 Practical:- 03		
Semester		I	Year of Introduction: 1960 Year of Syllabus Revision: 2005, 2012, 2018, 2021				Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and Practical													
Course Outcome (CO) MEC 1503													
CO 1 Retrieving basics of mechanics, materials, manufacturing & considerations for design of machine components applications.													
CO 2 Understanding functional analysis, geometry required, failure modes, and force & stress for synthesis of dimensions.													
CO 3 Analyzing and solving simple design problems like mechanical joining of parts; selection basis and finding critical dimensions.													
CO 4 Evaluation of designs involving more parts; shafts and related components viz. bearings, hubs, keys, and couplings.													
CO 5 Understanding various springs types & design, selecting, calculating dimensions, and building modules for applications.													
Unit No.	Topic				Contact Hours	Weightage(%)	BTL level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1	Machine elements basics: Machines & components; General design procedure and considerations; Functional geometries, dimensions, materials of construction; standards& codes; Manufacturing & assembly criteria.	10	14	1, 2, 3	1, 2	1, 2, 3, 12	1,2,3	Emp, Ent, SD	L, N, R, G	G, ES, HV, PE
2	Failure prevention: Failure modes; Strength & stiffness of parts against static & dynamic loading; Offset & curved beams; Factor of safety; Theories of static and fatigue failures.	10	18	1, 2, 3	1, 2	1, 2, 3, 4	1,2			
3	Mechanically joined elements: Joining by pin, bolt, and weld; Threaded fasteners and power screws. Specialty fasteners and Adhesives.	12	24	All	3, 4	1, 2, 3, 4	1,2			
4	Shafts & related components: Power transmission shafts, axles, and spindles; Sliding and rolling contact bearings; Lubrication; Hub-shaft locking: keys, splines, and keyless; Couplings.	18	24	All	3, 4	1, 2, 3, 4	1,2			
5	Springs: Helical compression, tension, and torsion springs; Spiral, leaf, disk, and specialty springs. Application techniques.	10	20	All	3, 4	1, 2, 3, 4	1,2			
		60	100							
Experiments										
1.	Drawing sheet on parts and assembly of a simple device	6	10	All	1	1, 10	1,2	Emp, Ent, SD	L, N, R, G	G, ES, HV, PE
2.	Design of pin jointed links: Sketch, calculations and drawing on sheet	9	30	All	3, 4	1, 2, 3, 10	1,2			
3.	Design of a jacking devices: Sketch, calculations and drawing on sheet	12	30	All	3, 4	1, 2, 3, 10	1,2			
4.	ICT based learning and reporting of various machine components	9	15	All	All	1, 2, 10, 12	1,2			
5.	Extended assignments on component design in small groups	9	15	All	All	1, 2, 10, 12	1,2			

[illegible]

Reference Books

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	--	--	--	1	--	2	--	--	3	3	1	2
CO2	3	3	3	--	--	--	1	--	1	--	--	3	3	2	1
CO3	3	3	3	--	--	--	2	--	1	--	--	3	3	2	--
CO4	3	3	3	--	--	--	2	--	2	--	--	3	3	2	--
CO5	3	3	3	--	--	--	1	--	1	--	--	3	3	2	--

CO	PO	Weightage	Justification
1	1	3	Application of engineering basics for the design of machine elements
1	2	2	Identification and formulation of design problems at moderate level
1	3	2	Developing solutions of design problems at moderate level
1	7	1	Develop understanding of sustainability and environmental effect as important design considerations,
1	9	2	Preparing students for both individual and teamwork ready at medium level
1	12	3	Teaching methodology aims for lifelong learning
2	1	3	Application of engineering basics for the design of machine elements
2	2	3	Identification and formulation of design problems at moderate level
2	3	3	Developing solutions of design problems at moderate level
2	7	1	Develop understanding of sustainability and environmental effect as important design considerations,
2	9	1	Preparing students for both individual and teamwork ready at medium level
2	12	3	Teaching methodology aims for lifelong learning
3	1	3	Application of engineering basics for the design of machine elements

3	2	3	Identification and formulation of design problems at moderate level
3	3	3	Developing solutions of design problems at moderate level
3	7	2	Develop understanding of sustainability and environmental effect as important design considerations,
3	9	1	Preparing students for both individual and teamwork ready at medium level
3	12	3	Teaching methodology aims for lifelong learning
4	1	3	Application of engineering basics for the design of machine elements
4	2	3	Identification and formulation of design problems at moderate level
4	3	3	Developing solutions of design problems at moderate level
4	7	2	Develop understanding of sustainability and environmental effect as important design considerations,
4	9	2	Preparing students for both individual and teamwork ready at medium level
4	12	3	Teaching methodology aims for lifelong learning
5	1	3	Application of engineering basics for the design of machine elements
5	2	3	Identification and formulation of design problems at moderate level
5	3	3	Developing solutions of design problems at moderate level
5	7	1	Develop understanding of sustainability and environmental effect as important design considerations,
5	9	1	Preparing students for both individual and teamwork ready at medium level
5	12	3	Teaching methodology aims for lifelong learning

Production Technology-II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering					Academic Year			2022-23		
		B. E. (Mechanical Engineering): Regular Programme										
Year	III MEC H	Core MEC 1505 : Production Technology II				Credits / Hours per week				Lectures: 04 Practical:- 02		
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2022				Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and Practical												
		Course Outcome (CO) MEC 1505 CO1 Select appropriate Joining Processes CO2 Understand importance of surface characteristics and select suitable surface modification process. CO3 Understand the applicability and use of special purpose machines CO4 Understand and select appropriate method for production of plastic components. CO5 Understand and select appropriate coating method.										
Uni t No.	Topic			Conta ct Hours	Weighta ge (%)	BT Level	CO	PO	PS O	Elements of Employability (Emp)/ Entrepreneurs hip (Ent)/	Relevance to Local (L)/ National (N)/ Regional(R)/Glo bal (G)	Relation to Gender (G), Environme nt and Sustainabili

								Skill Development (SD)		ty (ES), Human Values (HV)and Professiona l Ethics (PE)
1	Specific Purpose Machines: Capstan lathes, Turret lathes, single spindle and multi-spindle automatic lathe, Broaching machines, Honing, lapping and super finishing machines, Gear manufacturing machines.	7	20	1,2,3	CO1,CO 3	PO2		ALL	ALL	ES,HV,PE
2	Soldering, Brazing and Welding: Soft and hard soldering, Brazing types- Gas welding & cutting, arc and resistance welding, welding electrodes, welding equipment- welding defects and their remedies, welding of ferrous and non ferrous metals. Advance welding techniques.	10	20	1,5,6,	CO1	PO3				

3	Special Foundry Techniques: Die casting, investment casting, centrifugal casting, vacuum moulding, magnetic moulding, full mould process.	7	10	2,3,5	CO2	PO5				
4	Plastic Technology: Introduction, classification of their properties, additives, Processing technology of thermoplastics, injection moulding, Extrusions thin film and pipe extrusion, Calendaring, thermoforming, Processing technologies of thermosetting, compression moulding, compressive molding, Transfer molding, rotational molding and casting	10	20	1,2	CO4	PO6,P O5				
5	Surface finishes and surface treatment processes.	7	10	1,2,3	CO2,CO 5	PO4,P O5				

6	Cleaning and coating process: Cleaning process, purpose, different methods in brief, coating processes, classification, process and application of electroplating, vapor deposition, hot dipping, galvanizing, fin plating, metalizing, electro less plating, phosphate, chromate, Oxide and anodic coating	11	20	1,2,4,5	CO4,CO5	PO4				
		52	100							
		Experiments								
1.	Study Of Semi-Automatic Lathe	2	5		CO1,	PO2		ALL	ALL	ALL
2.	Tool Layout For semi-Automatic Lathe	2	5		CO1	PO4,PO5				
3.	Gas Welding & Cutting	2	5		CO1	PO4,PO5				
4.	Sheilded Metal Arc Welding	2	5		CO1	PO5				
5.	Study Of Single Spindle Automates	2	10		CO1,C O3	PO6,PO5				
6.	Cam Design For Single Spindle Automat	2	10		CO1,C O3	PO3				
7.	Welding Standards & Welding Symbols	2	10		CO1,C O3	PO2				
8.	Electrode selection &	2	10		CO1	PO3				

	specification									
9.	Welding defects	2	10		CO1	PO3				
10.	Inspection of welded joints	2	10		CO1	PO5				
11.	Weld procedure specification	3	10		CO1	PO3				
12.	Survey of finishing processes	3	10		CO2	PO4				
		26	100							
Reference Books										
1.		Metal Cutting principles, by M C Shaw, Oxford University press								
2.		Production Technology - H.M.T. By HMT								
3.		Tool Design by Donaldson, Tata McGraw Hill Pub.								
4.		Metal cutting Principles by Trent McGraw Hill Pub								

Thermal Engineering-II

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year					2022-23		
	B. E. (Mechanical Engineering): Regular Programme										
Year	III	Core / Elective / Foundation MEC 1603: Thermal Engineering - II			Credits / Hours per week					Lectures: 04 Practicals: 02	
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade					Theory: 100 PR/TW/VIV A: 50	
Mode of Transaction: Lectures and Practicals											
	Course Outcome (CO) MEC 1603 CO1 Understand the thermodynamic basis of variation of specific heat and finding the same with charts and tables; Understand the fuelsand its combustion phenomenon CO2 Understand different types of IC engines and its applications; understand IC engine systems CO3 Analyze gas turbine cycle, system and its modifications; Evaluate performance parameters like efficiency and work ratio CO4Analyze Refrigeration cycles like vapour compression, vapour absorption and air refrigeration; Evaluate the performance parameters like COP and capacity CO5 Apply principles of psychometrics for analysis of air conditioning processes; Know and understand various air conditioning systems										
Unit No.	Topic		Contact Hours	Weighta ge (%)	BT Level	CO	PO	PSO	Element s of Employ ability (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment (SD)	Relev a nce to Local (L)/ Nationa l (N)/ Region al(R)/G lobal (G)	Relation to Gender (G), Environmen t and Sustainabilit y (ES), Human Values (HV)and Professional Ethics (PE)

1	Variable Specific Heat: Factors affecting specification of a gas, Atomacy of gases, degrees of freedom, the law of equipartition of energy and variation in Cp, Cv and ratio of Cp, &Cv, Integration method, gas tables method & t-u-s chart method for considering variation of specific heats	04	08	1, 2, 3	CO1	PO1 PO2	PSO 1	ALL	ALL	ALL
2	Fuels and Combustion Phenomena in I.C. Engines: Normal combustion in S. I. And C. I. Engines, Abnormal combustion in S. I. And C. I. Engines, Effects of working parameters on knocking. Effect of knocking on engine performance, Reduction of knocking, Forms of combustion chamber of S.I. and C.I. engines and their relative merits and demerits. Rating of fuels, Additives.	08	15	2, 4,	CO1	PO1 PO3 PO7	PSO 1			
3	Types of I. C. Engines: Stationary, vehicular, locomotive, marine and aircraft engines, Inline, V, opposed cylinder, opposed piston and radial engines, single acting and double acting engines, Rotary piston engines, Free piston engine, Naturally aspirated and supercharged engines.	04	08	3, 4,	CO2	PO1 PO3 PO7	PSO 1			
4	System of I. C. Engines: Fuel system, carburetors, Governing system, Lubricants and lubricating system, cooling system.	08	15	1, 2, 3	CO2	PO1 PO3 PO4	PSO 1			
5	Gas Turbines and Jet Propulsion: Gas turbine cycles, classification of gas turbine plants, open and closed cycle gas turbine plants, Main components and their constructional details, Methods of improving gas turbine plant efficiency, Power and efficiency of gas turbine plants, jet propulsion engines- Classification, atmospheric jet engines and rockets, turboprop, turbofan, turbojet, ramjet and pulse-jet engines, cycles, components,	14	26	1, 2, 3, 5	CO3	PO1 PO2 PO3 PO4	PSO 1			

	working and performance of turbojet engine.									
6	Refrigeration and Air- conditioning: Refrigeration and air conditioning applications, units of refrigeration, coefficient of performance, Types of refrigeration system, air refrigeration, Bell- Coleman cycle and aircraft cooling, Vapour compression refrigeration and its analysis with the help of tables and p-h charts, vapour absorption refrigeration system, Desirable properties of a refrigerant (ideal refrigerant), common refrigerants. Objectives and parameters of air conditioning, Psychometric properties of moist air, psychrometer, psychometric charts and tables, Basic psychometric processes and their analysis with the aid of charts and tables.	14	28	2, 3, 4, 5	CO4 CO5	PO 1 PO 2 PO 3 PO 4	PSO 1			
		52	100							
	Experiments									
1.	Performance evaluation of Vapour Compression Refrigeration System.	04	15	2, 5	CO4	PO1	PSO1	ALL	ALL	ALL
2.	Performance evaluation of Water Chilling Plant alongwith field visit	04	15	1, 2, 3, 5	CO4	PO3	PSO1 PSO2 PSO3			
3.	Performance evaluation of Room Air Conditioning System.	04	15	3, 4, 5	CO5	PO2	PSO1			
4.	Performance evaluation of Evaporative Cooling System.	04	15	3, 4, 5	CO4	PO2	PSO1			
5.	Study of VCR system components along with field visit	02	10	2	CO4	PO1	PSO1 PSO2 PSO3			
6.	Study of Himalux Refrigerator.	02	10	2	CO4	PO2	PSO1			

7.	Study of AHU and Cooling Tower along with field visit	02	10	2, 3	CO5	PO1	PSO1 PSO2 PSO3			
8.	Study of Combustion chambers in I.C. Engine.	04	10	1,2	CO1	PO5	PSO1			
		26	100							
Reference Books										
1.	Ganesan,v. ,Internal Combustion Engines, Tata McGraw Hill									
2.	Arora &Domkundwar, Power Plant Engineering, Dhanpat Rai & Sons									
3.	Arora,C.P., Refrigeration and Air Conditioning, Tata McGraw Hill									
4.	Dossat, R.D. Principle of Refrigeration, Prentice Hall									

Industrial engineering -II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year		2022-23			
		B. E. (Mechanical Engineering): Regular Programme								
Year	III	Core MEC 1602:Industrial engineering -II			Credits / Hours per week			Lectures: 04 Practicals: 02		
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade			Theory: 100 PR/TW/V IVA: 50		
Mode of Transaction: Lectures and Practicals										
Course Outcome (CO) MEC 1602										
CO1Understanding the concept and functions of Production, Planning and Control										
CO2 Discussing Market Research, Marketing and Sales forecasting techniques										
CO3 Study and analyzing Inventory Control and wage incentive plans										
CO4 Interpretation of Statistical Quality Control (SQC) and acceptance sampling plans										
CO5 Understand Total Quality Management philosophy and concept of budgetary control										
Unit No.	Topic	Contact Hours	Weight age (%)	BT Level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)

1	Production Planning and Control: Production Planning : types function & objective, organization Structure; Planning: Prerequisites, Steps, Factors affecting, Selection Sheet; Make/Buy decision; Production control; Routing &Scheduling: Machine loading, Dispatching, Loading & Scheduling techniques; Gantt Chart/Bar Chart; Plant capacity: Planning Advances in Production Planning & Control MRP,MRP-II, ERP,SCM	10	17	1, 2, 3	CO1	1,2,3, 4,5,6, 11	1,2,3	ALL	ALL	ALL
2	Market Research And Sales Forecasting: Marketing: Evaluation, Modern Concept, Function, System, Strategies, Marketing Mix, Consumer Behavior Product Mix & Product line, Channels Of Distribution, Sales Promotion, Adverting, Pricing, Market Research: Surveys, Sources Of Collecting Data , Sampling & Its Techniques ; Sales Forecasting: Process, Objective, Advantages & Limitations, Factors Affecting, Market Potential, Method (July, Delphi, Collective Opinion Method, Time Series, Analysis, Method of Least Squares, Moving Average Method, Exponential Smoothing	8	13	1,2,3, 4	CO2	1,2,3, 5,6,9	1,2,3			

	Method)									
3	Inventory Control: Inventory Control: Characteristics, Importance, Types, Reason For Holding, Causes of Poor Inventory, Function, Cost Factor, Factor Affecting, Advantages; Procurements Cost/Cost of Ordering, Set Up Cost/ Cost of Manufacturing, Inventory Carrying Cost, Cost of Shortages, Term & Definition: Demand, Lead Time, Quality Discount, Safety Stock, Lot Size or Economics Order Quantity (EOQ), Procedure For Setting Up Inventory, Control System, Selective Inventory Control, ABC Analysis, VGD Analysis, Factor Affecting Inventory Control Policy Of Organization: Manufacturing Characteristic, Amount of Protection Against Shortages, Organizational Factor, Miscellaneous Factor, Introduction Of Inventory Model (Only I.E. No Detail Analytical Treatment)	10	17	1,2 ,3, 4	CO3	1,2,3	1,2			
4	Wages Incentives: Factor influencing wage rates, Wage incentive plan: Essential characteristic method; Direct and Indirect labor: (i) Time wage system(Suitability, advantages& limitation), (ii)	2	3	1,2	CO3	1,6,8	1			

	Place wage system; Wage incentives and its classification: (i) Financial Plans, (ii) Non-financial plans; Time base plans: (i) Taylor's differential piece rate plan, (ii) Gantt's task a Bonus; Group incentive plan: characteristic, Objective, Advantages, Limitation, Basic Principle of success (i) Suitability, (ii) Types of group incentive plans, (iii) Profit sharing, (iv) Limitation and Benefits of group incentive plans.									
5	Quality Control: Definition, Introduction to SQC, Principle of quality control, Statistical Process Control, Process Capability, and Control charts for Variables & attributes.	10	17	1, 2, 3, 4	CO4	1,2,3, 4,12	1,2			
6	Quality Control Acceptance sampling: Various terms, OC curve, AQL, LTPD, AOQ, AOQL, Single, Multiple, Sequential and Standardized Sampling Plan	8	13	1, 2, 3, 4	CO4	1,2,3, 6	1,2			
7	Quality Management: ISO9000, ISO14000, TQM & it's tools: Curve & Effect diagram, Pareto analysis on Pareto diagram, Histogram, Baer chat, Run chart, Pie chart, Correlation or Scatter diagram, Poka-Yoka/JIT/Kaizen/Zero defect programme/Concurrent engineering; Introduction to Six	8	13	1,2,3	CO5	1,3,4, 6,9,12	1,2,3	ALL	ALL	ALL

	Sigma, Red X									
8	Budget and Budgetary Control: Budget: Definition & Concept, Objective; Budgetary Control: Preparation, advantage, Limitation, Types & Process.	4	7	1,2	CO5	1,4,11	1,2	ALL	ALL	ALL
	Total	60								

List of Experiments

		Conta ct Hours	Weig htage (%)	BT Level	CO	PO	PS O			
1.	Network Analysis	4	13	1,2,3,5	CO 1	PO2,PO1 1	1,2	ALL	ALL	ALL
2.	Market Research & Marketing	4	13	1,2,3	CO 2	PO2,PO9	1,2			
3.	Sales forecasting	2	7	1,2,3,5	CO 2	PO2,PO4	1,2			
4.	MRP, MRP-II ,AND ERP	2	7	1,2,3	CO 1	PO2,PO3	1,2			
5.	Sequencing Problem	4	13	1,2,3,5	CO 1	PO2,PO3 ,PO4	1,2			
6.	Inventory control with example	2	7	1,2,3,5	CO 3	PO2,PO4	1,2			
7.	7 M' S	2	7	1,2,3	CO 1	PO1,PO6	1,2			
8.	Six Sigma	2	7	1,2,3	CO 4	PO1,PO1 2	1,2			
9.	TQM	2	7	1,2,3	CO 5	PO1,PO1 2	1,2, 3			
10.	ISO 9000, ISO 14000	2	7	1,2,3	CO 5	PO3,PO1 1,PO12	1,2			
11.	Problem on control chart	4	13	1,2,3,5	CO 4	PO2,PO3	1,2			

Reference Books		
1.		Elements of Production Planning & Control By Samuel Eilon, Navneet Prakashans Ltd
2.		Industrial Engineering & Management, O.P. Khanna, Dhanpat Rai Publications
3.		Introduction to Material Management, Tony Arlond & Stephen N. Chapman, Person Education
4.		Quality Engineering Handbook, Thomas Pyzdek & Roger W. Berger, Tata McGraw Hill Publishing Co.
5.		Quality Control Handbook, J.M. Juran, Dr. Frank M. Gryna, Jr & R.S. Bingham Jr., McGraw Hill Book Company
6.		Production Forecasting, Planning & Control, E.H. MacNiece, John Wiley & Sons.
7.		The Principles of Production Control, John L. Burbidge, The Eng. Language Book Society & McDonald & Evans Ltd., London

Machine Design - II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering					Academic Year				2022-23		
B. E. (Mechanical Engineering): Regular Program													
Year		III MECH	MEC 1601: Machine Design - II				Credits / Hours per week				Lectures: 04 Practical: 03		
Semester		II	Year of Introduction: 1960 Year of Syllabus Revision: 2005, 2012, 2018, 2021				Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and Practical													
Course Outcome (CO) MEC 1601 CO 1 Reviewing construction & parts of internal combustion engines, along with reciprocating pumps & compressors and their design basis, CO 2 Understanding types of automotive brakes and clutches, actuation mechanism, analysis for design and application CO 3 Evaluation and analysis of mechanical drives viz. electric motors. belt and gear drives. Devising Electric vehicle drive trains. CO 4 Analysis and application of hydrodynamic &hydrostatic bearings, lubricating systems, and sealing techniques of fluid joints CO 5 Designing & building of Unfired pressured vessels, openings, and supports using standards/codes													
Unit No.	Topic				Contact Hours	Weightage (%)	BT Level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Internal combustion engine parts: Piston, cylinder-block, head, connecting rod, crank shaft, valve train, &flywheel. Similarity with reciprocating pumps &				14	25	All	1, 2, 3	1, 2, 3, 12	All	Emp, Ent, SD	L, N, R, G	G, ES, HV, PE

	compressors.									
2	Clutches: Cone, single & multi disk, and centrifugal; Brakes: block, band, internally expanding shoes on drum, and disk brakes; Actuation techniques.	10	15	All	2, 3	1, 2, 3	All			
3	Power transmission drives: Gears; spur, helical, bevel & worm & gear trains; Belts & pulleys; Flat, V, & toothed. Electric motors & power train for Electric Vehicles.	14	25	All	2, 3	3, 5	All			
4	Film lubricated bearings: Hydrodynamic & Hydrostatic bearings for machines and systems of lubrication; Mechanical sealing of static & dynamic pressurized fluid joints.	12	20	All	2, 3	1, 3, 4	All			
5	Pressured vessels: Design of unfired pressure vessels as per ASME BPVC/IS 2825-1969, openings, and supports. Building and Testing.	10	15	All	4	1, 4, 5, 12	All			
		60	100							
Experiments										
1.	Drawing sheet on parts and assembly of a mechanical device	6	10	1, 2	1	1, 10	All	Emp, Ent, SD	L, N, R, G	G, ES, HV, PE
2.	Design of piston and connecting rod	12	30	1, 2, 3	3, 4	1, 2, 3, 10				
3.	Design of a hand operated drum brake.	12	30	3, 4	3, 4	1, 2, 3, 10				
4.	ICT based learning and reporting of various automobile components.	6	15	3, 4	All	1, 2, 10, 12				
5.	Extended assignments on simple machines in small groups.	3	15	3, 4	All	1, 2, 10, 12				
		39	100							

Course Outcome (CO) MEC 1601L

1601L.01 Understanding and making drawings of parts and assemblies of various devices & machines

1601L.02 Qualitative analysis, considerations, & synthesis for general shapes of components for functionality and selection of material of construction.

1601L.03 Quantitative analysis & synthesis of component dimensions to prevent failure using strength equations and properties of construction material.

1601L.04 Synthesis & building of unfired pressure vessels geometry & dimensions.

1503L.05 Analysis of machines, devices, and components in surrounding.

Reference Books

1.	Basshuysen R., 'Internal Combustion Engine Handbook', S.A.E. International
2.	Bhandari V. B., 'Machine Design'; McGraw-Hill
3.	Norton R. L., "Machine Design, An Integrated Approach"; Pearson
4.	Schmidt S. R., 'Fundamentals of Machine Elements', CRC Press
5.	Chau K.T., 'Electric Vehicle Machines and Drives: Design, Analysis and Application', Wiley
6.	Moss D. R., 'Pressure Vessel Design Manual', Butterworth-Heinemann

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	-	1	--	2	-	-	3	3	3	2
CO2	3	3	3	-	-	-	1	--	1	-	-	3	3	2	2
CO3	3	3	3	-	-	-	2	--	1	-	-	3	3	3	2
CO4	3	3	3	-	-	-	2	--	2	-	-	3	3	3	2
CO5	3	3	3	-	-	-	1	--	1	-	-	3	3	3	2

3 – Most

2 – Medium

1 - Less

CO	PO	Weightage	Justification
1	1	3	Application of engineering basics for the design of machine elements
1	2	2	Identification and formulation of design problems at moderate level
1	3	2	Developing solutions of design problems at moderate level
1	7	1	Develop understanding of sustainability and environmental effect as important design considerations,
1	9	2	Preparing students for both individual and teamwork ready at medium level
1	12	3	Teaching methodology aims for lifelong learning
2	1	3	Application of engineering basics for the design of machine elements
2	2	3	Identification and formulation of design problems at moderate level
2	3	3	Developing solutions of design problems at moderate level
2	7	1	Develop understanding of sustainability and environmental effect as important design considerations,

2	9	1	Preparing students for both individual and teamwork ready at medium level
2	12	3	Teaching methodology aims for lifelong learning
3	1	3	Application of engineering basics for the design of machine elements
3	2	3	Identification and formulation of design problems at moderate level
3	3	3	Developing solutions of design problems at moderate level
3	7	2	Develop understanding of sustainability and environmental effect as important design considerations,
3	9	1	Preparing students for both individual and teamwork ready at medium level
3	12	3	Teaching methodology aims for lifelong learning
4	1	3	Application of engineering basics for the design of machine elements
4	2	3	Identification and formulation of design problems at moderate level
4	3	3	Developing solutions of design problems at moderate level
4	7	2	Develop understanding of sustainability and environmental effect as important design considerations,
4	9	2	Preparing students for both individual and teamwork ready at medium level
4	12	3	Teaching methodology aims for lifelong learning
5	1	3	Application of engineering basics for the design of machine elements
5	2	3	Identification and formulation of design problems at moderate level
5	3	3	Developing solutions of design problems at moderate level
5	7	1	Develop understanding of sustainability and environmental effect as important design considerations,
5	9	1	Preparing students for both individual and teamwork ready at medium level
5	12	3	Teaching methodology aims for lifelong learning

Computational Techniques and Programming Languages

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year	2020-21			
	B. E. (Mechanical Engineering): Regular Programme							
Year	III	Core MEC 1604 : Computational Techniques and Programming Languages	Credits / Hours per week	Lectures: 04 Practical:- 03				
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006	Maximum Marks / Grade	Theory: 100 PR/TW/VIVA:50				
Mode of Transaction: Lectures and Practical								
	Course Outcome (CO) MEC 1604 CO1 Understand and apply liner and non liner equation solving methods. CO2 Understand and apply numerical integration, differentiation, optimization and other problem solving approaches CO3 Develop ability to apply the computational techniques for solving models of engineering problems CO4 Understand the process of compiling, linking, and running a program CO5 Develop algorithms and programs for applying computational techniques using computers for solving technical problems in program Disciplines.							

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)
1	Revision of Basic Concepts of Computer Systems: Digital computer Architecture; Peripheral devices; Operating systems - Classification, functions; Programming Languages – language hierarchy, translator programs; Tools for algorithm development.	2	10	1,2,3	1,4,5	PSO 1 PSO 2	PO1	SD		
2	Revision of Basic Concepts of Programming: Concepts of constants, variables and data types; input and	7	10	1,4,5	3,4,5	PSO 1 PSO 2	PO1 , PO2	Emp,		

	output; arithmetic operations; logical operations; repetitive computation procedures; implementation syntax for these aspects in Fortran and C									
3	Concept of Modular & Structured Programming: Subroutine and sub programming concept/functions; Data structures - dimensions and arrays, structures, hash tables, enumerations and other data structures; lists and sorting of lists, Files - input and output to files, sequential and random file access; implementation syntax for these aspects in ForTran and C	14	10	3,4,5	3,4,5	PSO 1 PSO 2	PO2 , PO3	Emp, Ent, SD	N	
4	Introduction to Computational Techniques:	1	10	1,2	1,2,3	PSO 1 PSO	PO3	Emp, Ent, SD		

	Algorithms, definition, classification, features, static and dynamic complexities, stability; Errors, sources of error in computation, effect of rounding and number systems, handling of numbers.					2				
5	Linear simultaneous Algebraic Equations: Non-homogeneous Equations, Ill conditioned systems, Exact solution Algorithms- Gaussian Elimination, Gauss Jordan, Choleskey Method, Croute Procedure, Approximate solution Algorithms - Jacobi Method, Gauss Siedel method; Homogeneous Equations, Eigen value problems,	3	10	2,3,4,5	1,2,3	PSO 1 PSO 2	PO1	Emp, Ent, SD		

	algorithm for largest and smallest Eigen value and corresponding vector .									
6	Non linear equations: Roots of equation, Bracketing Methods - Methods of halving, Method of chord or linear interpolation open methods, Open Methods - Newton Raphson Method, Secant Method; System of Non-linear equations, Newton-Raphson method for solving system of non-linear system of equations.	2	10	2,3,56	1,2,3	PSO 1 PSO 2	PO3 , PO4	Emp, Ent, SD		
7	Boundary Value Problems: Initial Value Problems, Point collocation method, sub-domain method, weighted residual approach; Boundary value Problems,	4	10	1,2,3	2,3,4	PSO 1 PSO 2	PO1	Emp, Ent, SD		

	Lagranges Interpolation, Richardson's extrapolation, finite difference methods for ordinary and partial differential equations of first, second and fourth order.									
8	Numerical Integration and Differentiation: Numerical Integration, Simpson rule, Trapezoidal rule, Newton cotes formula, Waddle's rule for simple and double integration; Numerical Differentiation, Euler and Runge-Kutta Methods.	2	5	2,3,4,5,6	1,2,3	PSO 1 PSO 2	PO3 , PO4	Emp, Ent, SD		
9	Introduction to Finite Element Methods: General Process, Solution of 1D, 2D and 3D problems using the general procedure, GNU open general	5	5	2,1,3	1,2,3	PSO 1 PSO 2	PO5	Emp, Ent, SD		

	license codes and softwares like ANSYS									
10	Introduction to Computational Fluid Dynamics: Methods for CFD analysis, Identification and meshing of flow fields, solution of basic problems in 1D and 2D.	3	5	3,4,6	2,3	PSO 1 PSO 2	PO4 , PO5	Emp, Ent, SD	N	
11	Optimization: Single objective and multi-objective optimization, constrained and unconstrained optimization, traditional techniques like GRG and non-traditional optimization techniques like Genetic algorithms	3	5	4,6	2,3	PSO 1 PSO 2	PO6	Emp, Ent, SD		G, ES, HV, PE
12	Advanced Techniques in Engineering: Introduction to Monte-Carlo Simulation, Fast Fourier Transforms,	2	2	1,5	2,3	PSO 1 PSO 2	PO3	Emp, Ent, SD		

	Wavelet Transforms, Discrete Fourier Transforms.									
		52	100							
Experiments										
1.	Introduction to computer systems	4	10		1		PO3			
2.	Operating systems	4	10		1		PO3			
3.	Number systems	4	10		2		PO1			
4.	Translator programs	4	10		2		PO3 , PO4			
5.	Program Logic Representation	4	10		2		PO5			
6.	Programming in C	7	20		3		PO5			
7.	Programming in ForTran	4	10		3		PO3			
8.	Assignments on Computational Techniques	4	10				PO3			
9.	Programming in SciLab	4	10		45		PO3 , PO6			
		39	100							
Reference Books										
1.		Programming in ANSI C, by Balagurusamy, Publisher - Tata Mcgraw Hill								
2.		C: The Complete Reference, by Herbert Schildt, Publisher –								

		Tata Mcgraw Hill.			
3.		Numerical Methods for Engineers , by Chapra S.C, Canale, R P, Tata Mcgraw Hill, 2003			
4.		Advanced engineering mathematics(8th edition), E. Kreyszig, John Wiley (1999)			
5.		Numerical Methods in Fortran, by John M. McCormick and Mario G. Salvadori. Prentice-Hall, Inc			
6.		Numerical methods and FORTRAN programming with applications in engineering and science, by Daniel D. McCracken and William S. Dorn, Wiley,			

Production Technology-III

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering	Academic Year				2022-23			
B. E. (Mechanical Engineering): Regular Programme										
Year	III	Core / Elective / Foundation MEC1605: Production Technology III	Credits / Hours per week				Lectures: 04 Practicals: 02			
Semester	II	Year of Introduction: 1960 Year of Syllabus revision: 2006	Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50			
Mode of Transaction: Lectures and Practical										
Course Outcome (CO) MEC 1605 CO 01 To understand Principles of Metal Machining. CO 02 To study Press Tools and various press operations. CO 03 To study Jigs and Fixtures. CO 04 To study and understand Limits, Fits, Tolerances and Gauges CO 05 To study different measurements of Metrology.										
Un it No.	Topic		Contact Hours	Weight age (%)	B T Le ve l	CO	PS O	Employa bility (Emp)/ Entrepren eurship (Ent)/ Skill Develop ment (SD)	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G)	Relation to Gender (G), Environmen t and Sustainabili ty (ES), Human Values (HV)and Professional Ethics (PE)
1	Principles of Metal Machining: Mechanics of Chip Formation, Orthogonal & Oblique Cutting, Types of Chips, Tool Geometry, Tool Signature, Tool Material & Cutting Fluids; Mechanics of Single Point Cutting Tool, Merchant's Analysis, Cutting Forces & Power Calculations; Machinability, Tool Life, Tool Wear		16	27	2, 3, 4	CO1	PSO 1	Emp Ent SD	L N R	ES PE

	&Economics of machining.							G	
2	Press and Press Tools for Presses and Press Working: Press Operations, Types of Presses; Major Components of Mechanical Press; Die Assembly & Types of Dies; Blank Size Calculations, Strip Layout, clearances, Methods of reducing cutting forces.	08	13	2, 3, 4	CO2	PSO 1			
3	Jigs and Fixtures: Principles of Location & Clamping; Clamping Devices; Types of Jigs; Design & Development of Jigs & Fixtures.	06	10	2, 3, 4	CO3	PSO 1			
4	Limits, Fits, Tolerances and Gauges: Dimensional & Geometrical Tolerances, Standards for Limits & Fits, Size Calculations, Concept of Selective Assembly, Interchangeability; Scales: Meso, Micro, Nano; Gauges: Types, Taylor's Principle & Gauge Design.	08	13	1, 2, 3, 4	CO4	PSO 1			
5	Metrology: Linear, Angular, Straightness, Flatness & Circularity Measurement, Interferometry; Comparators: Principles, Applications and Types (Mechanical, Optical, Pneumatic, Electrical); Surface Roughness: Terms, Parameters, Standards & Measuring Instruments (Contact & non-contact); Measurement of Gear: Errors in Gears, Gear Tooth Vernier & Micrometer, Composite Error Testing of Gear; Screw Thread Measurement: Errors in Screw Threads, Screw Thread Micrometer, Two & Three Wire System of Measurement; Machine Vision & its Applications in Metrology; Co-ordinate Measuring Machines: Types, Applications.	22	36	2, 3, 4	CO5	PSO 1			
	Total	60	100						
Lab exercises list (Study exercises/Performance experiments)									
1.	Demonstration on power tools.	04	1, 2, 3	CO1	PSO1, 2	PO1, 12	Emp	L	ES
2.	Study and Performance on linear measurement instruments	04	1, 2, 3	CO5	PSO1	PO1,1	Ent	N	PE

						2	SD	R G	
3.	Study and Performance on angular measurement instruments	04	1, 2, 3	CO5	PSO1	PO1,1 2			
4.	Demonstration on press working operations	04	1, 2, 3	CO2	PSO1, 2	PO1,1 2			
5.	Exercise on Jig and Fixture	02	2, 3	CO3	PSO1	PO1,2			
6.	Exercise on Tool signature and merchant circle diagram	04	2, 3	CO1	PSO1	PO1,2			
7.	Exercise on limits, fits and tolerance	04	1, 2, 3	CO4	PSO1	PO1,2			
8.	Study on different types of cutting tool material	02	1, 2, 3	CO1	PSO1, 2	PO1,1 2			
9.	Study on different types of inserts and ISO designation	02	1, 2, 3	CO1	PSO1	PO1,1 2			
	Total	30	100						
Reference Books:									
1	Fundamental of Modern Manufacturing, M.P. Groover, 2nd Edition John Wiley.								
2	A Textbook of Production Technology, Dr. P.C. Pandey, C.K. Singh, Balbir Singh, Standard Publisher.								
3	Jig and Fixtures, Kempster.								
4	Metrology for Engineers, Gayler and Shotbolt.								
5.	A Textbook of Engineering Metrology, I.C. Gupta.								

B.E. Mechanical Engineering 4th Year



	NAME OF THE DEGREE/DIPLOMA PROGRAMM	SUBJECT CODE THEORY	SUBJECT CODE T.W./VIVA/PRA	SUBJECT	THEORY	T.W./VIVA/PRA	TOTAL MARKS	LEC HOUR/WEEK	LAB HOUR/WEEK	TUTORIAL HOUR/WEEK
F O U R T H Y E A R B E	FSBE IV	MEC1702	MEC1702L	Industrial Management and Engineering Economics	100		100	4	0	0
		MEC1704	MEC1704 L	Thermal Engineering III	100	50	150	4	2	0
		MEC1701	MEC1701 L	Dynamics of Compressible Flow	100	50	150	4	2	0
		MEC 1703	MEC 17030L	Production Technology IV	100	50	150	4	2	0
		MEC1705	MEC1705 L	Elective-subject 1	100	50	150	4	2	0
		MEC 1709	MEC 1709 L	Elective- subject 2						
		TOTAL			500	300	800	20	12	0
	SSBE IV	MEC 1803	MEC 1803 L	Operation Research and Optimization Techniques	100	50	150	4	2	0
		MEC 1806	MEC 1806L	Project-term Work including Viva		100	100		6	0
		MEC 1805	MEC 1805L	TURBOMACHINES	100	50	150	4	2	0
		MEC1808	MEC1808 L	Product Design and Value Engineering	100	50	150	4	2	0
		MEC 1801	MEC 1801 L	Elective-subject 1	100	50	150	4	2	0
		MEC1804	MEC 1804 L	Elective- subject 2						
		TOTAL			400	300	700	16	14	0

Automobile engineering-I

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022 -23		
		B. E. (Mechanical Engineering): Regular Programme									
Year	IV	Elective MEC 1705:Automobile engineering-I			Credits / Hours per week				Lectures: 04 Practical: 02		
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade				Theory: 100 PR/TW/V IVA: 50		
Mode of Transaction: Lectures and practical's											
	Course Outcome (CO) MEC 1705 CO1 Remember basic concepts of an automobile CO2 Analyze performance characteristics of an automobile. CO3 Understand Design aspects of IC Engine. CO4 Analyze cooling , lubrication and carburetion in IC Engine. CO5 Apply knowledge of IC Engine in garages and service station.										
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PS O	PO	Element s of Employa bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment	Releva nce to Local (L)/ Nationa l (N)/ Region al(R)/G lobal (G)	Relation to Gender (G), Environm ent and Sustainabi lity (ES), Human Values (HV)and Profession	

								(SD)		al Ethics (PE)
1	Introductory Topics: Layout of an automobile chassis & body. Functions of main components and assemblies. Development of the automobile. Classification and types of automobile vehicles. General and technical information regarding cars, passengers, trucks, three wheelers, two wheelers (motor cycles, scooters, mopeds etc.) and tractors.	06	10	1, 2, 3	CO1	PS O1	PO 1 PO 3	Emp Ent SD	L N R G	ES PE
2	Performance of Vehicles: Resistance to motion – air, rolling and grade resistance. Power requirement. Traction and tractive effort. Road performance curves. Equivalent weight, gear ratio for maximum acceleration etc. and their calculations.	06	10	2, 3, 4	CO2	PS O1 PS O2	PO 1			
3	Power Unit: Characteristics and comparison of SI and CI engines. Testing and performance of I.C. engines, power, fuel consumption, efficiencies and heat balance sheet. Friction power and its measurement. Performance	10	15	3, 4, 5	CO2	PS O1 PS O2	PO 1			

	parameters. Performance curves for variable load and variable speed operation of SI and CI engines. Supercharging and use of supercharged engines in automobile. Gas turbine plant for automobile.									
4	Design Aspects of I.C. Engines: Design parameters, Thermal design and determination of main dimensions of SI and CI engines. Design, constructional features and materials of important components of I.C. engines, such as piston, cylinder, connecting rod, etc.	08	13	3, 4, 5	CO3	PS O1 PS O2	PO 1 PO 3			
5	Electrical Systems and Accessories: Battery coil ignition and its components. Magnet ignition system and its components. Distributors, spark plugs. Electronic Ignition Systems Storage battery-construction, chemical actions, testing, charging and maintenance. Generator, starter, regulator, bendix drive, charging and generator output, Head light, Side light, rear light etc. Horns, windscreen wiper, turn signals, etc.	07	13	3, 4, 5	CO3	PS O1 PS O2	PO 1 PO 2 PO 3			
6	Carburetion and Injection: Automotive fuels and rating of fuels – CFR engine, HUCR, octane and cetane numbers, carburetors, Air fuel ratio requirement of an automotive SI engine, Fuel supply systems of CI engines – fuel pumps	08	13	3, 4, 5	CO4	PS O1 PS O2	PO 1 PO 2			

	and injectors.									
7	Cooling and Lubricating System: Necessity of cooling of I.C. engines, Water-cooling systems, radiation, thermostats, and antifreeze compounds, Air cooling system, Constructional features of air-cooled engines, Comparison of air and water-cooling system. Engine friction, functions of a lubricating system. Properties of lubricating oil, SAE number and VI numbers. Additives, Lubricating oils, Lubricating systems, oil dilution, Water sludge formation. Oil filters, oil pumps.	08	13	3,4,6	CO4	PS O1 PS O2	PO 1 PO 2 PO 3			
8	Garages and Service Stations: Scope of a garage, Types of garages, Layout of a garage, Scope of a service station and its layout, Equipment and tools for garages and service stations. Works and services carried out in garages and service stations.	07	13	3,4,5	CO5	PS O3	PO 1 PO 7			

Experiments

1.	Technical specification of automobile.	04	15	1,2,3	CO1	PSO1 PSO2	PO1, PO2			
2.	Thermal design of IC engine	04	15	1,2,3	CO3	PSO1 PSO2	PO1, PO2			
3.	Study of fuel injection system.	04	14	1,2,3	CO3	PSO1 PSO2	PO1, PO2			

4.	Study of cooling system in automobile.	04	14	1,2,3	CO4	PSO1 PSO2	PO1, PO2			
5.	Study of lubrication system in automobile.	04	14	1,2,3	CO4	PSO1 PSO2	PO1, PO2			
6.	Study of ignition system.	04	14	1,2,3	CO4	PSO1 PSO2	PO1, PO2			
7.	Garage's layout and work carried out in service station.	04	14	2,3	CO5	PSO3	PO1, PO2			

Reference Books

1	Automobile Technology, N.K. Giri, Khanna Publishers, 2011.
2	Automobile Mechanical and Electrical Systems Automotive Technology: Vehicle Maintenance and Repair, Tom Denton, Butterworth Heinemann, 2011.
3	Clutches and Brakes, W C Orthwein, Marcel Dekker.
4	Automotive Mechanics by William H Crouse.
5	Automobile Technology, N.K. Giri, Khanna Publishers, 2011.

Industrial Management & Engineering Economics

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year					2021-22			
		B. E. (Mechanical Engineering): Regular Programme										
Year	IV	Core / Elective / Foundation MEC 1702:Industrial Management & Engineering Economics		Credits / Hours per week					Lectures: 04			
Semester	I	Year of Introduction: 2023 Year of Syllabus Revision:2006		Maximum Marks / Grade					Theory: 100 PR/TW/VIVA: ----			
Mode of Transaction: Lectures												
Course Outcome (CO) MEC 1702												
CO1 Understanding the organization Managements functions art & science. & MBO												
CO2 Finding out methods, evaluation appraisal standardization												
CO3 Understanding basic economics, principles and application of it.												
CO4 Importance of money, methods of finding costs, value & worth.												
CO5 Analysis of situation of profit & loss and find out reasons to sort out problems												
Uni t No.	Topic			Contact Hours	Weight age (%)	BT Level	CO	PO	PSO	Element s of Employa bility (Emp)/ Entrepre neurship (Ent)/ Skill Develop ment (SD)	Releva nce to Local (L)/ Nationa l (N)/ Region al(R)/G lobal (G)	Relation to Gender (G), Environmen t and Sustainabili ty (ES), Human Values (HV)and Professional Ethics (PE)
1	ORGANIZATION & MANAGEMENT Organization; Types & Structure; Management functions in Organization :Planning ,Organizing,			08	15	1, 2, 3	CO1	P O8, PO 09, PO 10	PSO1	ALL	ALL	ALL

	Staffing, Directing ,Coordination ,Control & Development. Managing changes etc. Levels & skills of manager,: Leadrship, Communication: Art & Science of management process Management by objectives(MBO)Concept, Nature & Process, Advantages& Limitations, Challenges faced by management.									
2	PRODUCTION MANAGEMENT Objective, Scope and activities, Relationship with other functions, material management: Objective, Scope, Integrated approach, Organisation , purchase: classification,ObjectivesImportance,5 R's of purchasing, centralized v/s decentralized purchasing, Stores function: Objective & functions of store keeping, Centralised v/s decentralized storing, Method of pricing material issued, Stores ledger & account.	07	13	1,2, 3, 4	CO1	PO2, PO3, PO4	PSO1			
3	PERSONNEL(HUMAN RESOURCE) MANAGEMENT Objectives, functions & Process of HRM: Recruitment, Policy, Sources, Selection process, Training & Development, Four 'C' model of evaluation, Industrial Psychology: Foundation & application Motivation: Importance, Nature and types of motivation& Types of motivation; Motivation Theories: Maslow's hierarchy of needs, Heizberg's two factor theory	08	15	1,2,3	CO1 CO4	PO 9, PO 10	PSO1			
4	PROJECT MANAGEMENT: Characteristic of project, Project development life cycle, project identification, Sources of Project ideas project feasibility, Market feasibility(Appraisal)Technical Appraisal, Financial & Economic feasibility, project appraisal criteria and Project planning, Tools & techniques of project management, Introduction to PERT & CPM; R& D activity	04	8	2, 3, 4,5	CO1	PO10, PO11, PO12	PSO1			
5	FINANCE MANAGEMENT: Classification, Functions, Scope; Capital structure	07	13	2, 3, 4, 5	CO5	PO 08, PO11,	PSO1			

	Methods of calculating total capital, Over & under Capitalization: Sources of Finance: Shares, Debentures, Public Deposits, ploughing back of profit, loans from Financial Institutions; Funds flow analysis; Working Capital, Financial ratios, Advantages & limitations; Methods of comparison; Financial Statement: Balance Sheet Profit & Loss account					PO12				
6	MANAGERIAL ECONOMICS: Macro & Micro Economics(Meaning only) Basic economic concepts; Good, Value, Price Wealth, Wants Capital, Money, Income, Margin ,Utility, Commodity, Welfare, Demand & supply :Equilibrium of Supply & Demand; Production function ,Law of Diminishing Utility, Law of diminishing returns.	07	13	1,2, 3, 5	CO3	PO 7, PO 8, PO 09 PO 12	PSO1			
7	TIME VALU OF MONEY: Interest rates, Future worth of present investments, Present worth of future investments Annuity; Cash flow & Discounted cash flows	03	06	2,3,4,5	CO4	PO 11, PO,12	PSO1			
8	COSTING METHOD & LIFE CYCLE COSTING: Element of cost: Overheads & allocation methods; Costing types: Standard process, MARGINAL COSTING, Life cycle costing: Definitions, Economic Principles; Types & use of Life Cycle costing Benefits of cost Analysis, Learning curve.	03	06	3,4,5	CO4	PO11	PSO1			
9	BREAK EVEN ANALYSIS: Assumptions in Break Even Analysis, Break-Even Point(BEP)Margin of safety and Angle of Incidence ;Methods of lowering BEP; Applications of BEP, Cost of Volume profit Analysis.	02	04	2,3,4,5	CO3 , CO2	PO 09 PO 11	PSO1			
10	DEPRECIATION: Types of Depreciation, Reasons of Depreciation ,methods of Computing depreciation	02	04	3,4,,5	CO3 CO2	PO 01 PO 06 PO 12	PSO1			
11	EVALUATION CRITERIA FOR INVESTMENT DECISION Pay Back Method ,Average Rate of Return(ARR),Net	02	04	3,4,5	CO2 CO3	PO 02 PO,05	PSO1			

	present Value(NPV)Benefit to Cost Ratio(BCR)Internal rate of return(IRR) Method									
	Text & Reference Books									
1		Kooutz & Others	Essentials of Management							Tata McGraw Hill Publications
2		Chary S N	Production & Opeations Management							Tata McGraw Hill Publications
3		Martand T Telsang	Industrial & Business Management							S Chand & Co.
4		Dr Sharma S K	Industrial Engineering & Operations Management							S K Kotaria & Sons
5		Dr Agarwal L N & Dr.Jain K.C.	Production Management							Khanna Publishers
6		Dr O P Khanna	Industrial Engineering & Management							Dhanpat Rai Publishing Company
7		Bhushan Y K	Fundamentals of Business Organisation & Management							
8		S.C Kudhal	Financial Management							

Computer Applications in Mechanical Engineering- I

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year					2022-23		
B. E. (Mechanical Engineering): Regular Program											
Year	I V	Core/ Elective/Foundation MEC1706:Computer Applications in Mechanical Engineering I		Credits / Hours per week					Lectures: 04 Practicals: 02		
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006		Maximum Marks / Grade					Theory: 100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and Practicals											
Course Outcome (CO) MEC 1706 CO1 Understand basic of software and programming languages used in Mechanical Engineering Systems. CO2 Understand basic of microprocessor based system. CO3 Synthesize, create and use different types of data and databases in mechanical engineering. CO4 Understand Computer Graphics concepts and apply them with CAD systems and graphics programming. CO5 Understand basics of AI and their applications in mechanical engineering systems.											
Unit No.	Topic		Contact Hours	Weig htage (%)	B T L e v el	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurshi p (Ent)/ Skill Development (SD)	Relevan ce to Local (L)/ National (N)/ Regional (R)/Glob al (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	PART A Softwares		19	33	1,	CO1	PO1	PSO			

	Software for Microprocessor based systems M/c code Hex programming Language, Assembly Language. Compilers and analysis software – FEM analysis softwares, C++ Language, LISP, dBase and relational data base query language – SQL.			2, 3, 4		PO2, PO3, PO5	1			
2	PART B Microprocessor, types of Bit slice, general purpose, micro controller, fuzzy processor, Neural processor. Microprocessor based systems, complete study of a general purpose CPU instruction set, architecture, T states, interrupts, Timing diagram, Input/output techniques, Memory mapping, Bus types STD, IBM-PC, SICO, IEEE 488, ISA, ESI, PCI.	22	34	2, 3, 4	CO2, CO5	PO1, PO2', PO5	PSO 1			
3	PART C Application Tools Artificial intelligence – basic elements, hardware requirements, knowledge representation and modeling, search methods, pattern recognition, knowledge engineering,	19	33	2, 3, 4	CO3, CO4	PO1 PO3, PO5	PSO 1			

	inference engine. Computer Graphics – use of matrices, 2D & 3D Transformations, wire frame surface solid modeling.									
	Experiments									
1.	Study of Microprocessor with 8085	0 2	9	1, 2	CO2	PO1				
2.	Study of Microcontroller with 8051	0 2	9	1, 2, 3	CO2	PO3				
3.	Study of timer and counters	0 2	9	3, 4	CO2	PO2				
4.	Study of interrupts	0 2	9	3, 4	CO2	PO2				
5.	Assignments for Assembly Programming	0 2	9	3, 4	CO2	PO1				
6.	Assignments in CAD Modelling	0 2	9	2, 3	CO3	PO2				
7.	Assignments for Programming in C++	0 2	9	2, 3	CO1	PO1				
8.	Assignments for Computer Graphics	0 2	9	2, 3	CO3	PO5				
9.	Assignments for RDBMS and SQL	0 2	9	4, 5	CO1	PO5				
10.	Assignments for CAE	0 2	9	4, 5	CO3	PO5				
11.	Assignments related to AI	0 2	1 0	4, 5, 6	CO3	PO5				
	Reference Books									
1.	Ibrahim Zied, CAD / CAM: Theory and Practice, McGraw-Hill									
2.	Hearn E J and Baker M P, Computer Graphics, Pearson.									
3.	CAD/CAM: computer aided design and manufacturing, Groover Mikell P, Zimmer W Emory, Prentice Hall 2011									
4.	Programming in ANSI C by Balaguruswamy									

Dynamics of Compressible Flow

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year			2022-23			
		B. E. (Mechanical Engineering): Regular Programme									
Year	IV	Core / Elective / Foundation MEC 1701:Dynamics of Compressible Flow				Credits / Hours per week			Lectures:04 Practical: 02		
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006				Maximum Marks / Grade			Theory:100 PR/TW/VIVA: 50		
Mode of Transaction: Lectures and practical's											
Course Outcome (CO) MEC 1701 CO1 Describe the fundamental of compressible flow and effect of compressibility of fluids. CO2 Analysis of one dimensional isentropic flow under variable area conditions. CO3 Circumstances of occurrence of Normal Shock and its after effects. CO4 Identify Practical flow situations of Fanno flow and Rayleigh flow processes. CO5 Evaluate lift and drag for various bodies under different flow phenomena.											
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship(Ent)/ Skill	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)	

								Dev elop ment (SD)		
1	Basic Concepts: Thermodynamics, properties of the continuum, the first law of thermodynamics for control volume, steady flow energy equation, the second law of thermodynamics for a control volume, general 3-dimensional continuity momentum and energy equations, concept of rotational flow	07	12	1, 2, 3	CO1	PSO1 PSO2	PO1, PO2	Emp Ent SD	L N R G	ES PE
2	Introductory Concepts to Compressible Flow: The velocity of sound, physical differences between incompressible and compressible flows, subsonic and supersonic flows, the Mach number, Mach angle and Mach cone, Domain of Continuum, Karman's Rule for supersonic flow, classification of compressible flows	10	15	2, 3, 4	CO1	PSO1 PSO2	PO1, PO2, PO3			
3	One Dimensional Isentropic Flow: General features of Isentropic flow, their governing and working relations, flow of a perfect gas, Isentropic flow of a perfect gas, operation of convergent and convergent-divergent nozzles under varying flow conditions, Choking in isentropic flow, performance of blades nozzles, diffusers, flow through curved channels and turbine blades.	10	15	2, 3, 4, 5	CO1, CO2	PSO1 PSO2	PO1, PO2, PO3			
4	Shocks: Classification of shocks, governing relations of the normal	06	12	2, 3, 4, 5	CO1, CO3	PSO1	PO1, PO3, PO4			

	shocks, working formulas, tables, charts, moving shock waves, supersonic pitot tubes, brief idea about oblique and curved shocks					PSO2					
5	Flow with Friction in a Constant Area Duct: Introduction, governing equations, assumptions, analysis of Fanno line on h-s diagram, working equations, parameters related to fluid friction, effect of friction on various parameters, working formulas, tables, duct length limitations and choking due to friction.	07	12	2, 3, 4, 5	CO1, CO4	PSO1 PSO2	PO1, PO2, PO3, PO4				
6	Flow with Heating and Cooling in a Constant Area Duct: Introduction, governing equations, assumptions, analysis of Rayleigh line on the h-s diagram, working equations, working formulas and tables, effects of changes in stagnation temperature, Analysis of normal shock, Fanno line and Rayleigh line on h-s diagram.	07	12	2, 3, 4, 5	CO1, CO4	PSO1 PSO2	PO1, PO2, PO3, PO4				
7	Boundary Layer: Application of boundary layer theory to fluid flow problems.	06	12	2, 3,4, 5	CO5	PSO1 PSO2	PO1, PO2, PO3, PO4				
8	Forces on Immersed Bodies: Types of drag – deformation drag, friction drag and form drag, drag on a sphere, cylinder, flat plate and aerofoil, definition of lift and drag coefficients.	07	12	2, 3,4,5	CO5	PSO1 PSO2	PO1, PO2, PO3, PO4				
Experiments											
1.	Study of various types of Wind Tunnels		02	10	1, 2	CO1 CO2	PSO1 PSO2	PO1, PO2			
2.	Determination of variation of static pressure, stagnation pressure and velocity in a subsonic wind tunnel		02	10	1, 2, 3, 4	CO2	PSO1 PSO2	PO3			

3.	Performance of nozzles with varying back pressure, keeping inlet pressure constant	02	10	2, 4, 5	CO2 CO3	PSO1 PSO2	PO2			
4.	Performance of nozzles with varying inlet pressure, keeping back pressure constant	02	10	2, 4, 5	CO2 CO3	PSO1 PSO2	PO2			
5.	Determination of Nozzle Efficiency at different pressure ratios	02	10	3, 4	CO2	PSO1 PSO2	PO1			
6.	Shock Visualization and Mach number determination in Supersonic wind tunnel	02	10	2, 3,4	CO3	PSO1 PSO2	PO2, PO5			
7.	Plotting of Fanno flow lines for air at different mass fluxes	02	10	2, 3, 4	CO4	PSO1 PSO2	PO1, PO2			
8.	Plotting of Fanno flow line, Rayleigh flow line and Normal Shock line for Superheated steam on Mollier chart	02	10	2, 3, 4	CO3 CO4	PSO1 PSO2	PO1, PO2			
9.	To find Drag Coefficient for flow over a circular cylinder	02	10	3,4, 5	CO5	PSO1 PSO2	PO1, PO2			
10.	Study of Flow Visualization Techniques	02	10	2, 3	CO1	PSO1 PSO2	PO5			

Reference Books

1	Anderson, J.D., 'Modern Compressible Flow with Historical Perspective' , Mc-Graw Hill
2	Yahya, S.M., 'Fundamentals of Compressible Flow with Aircraft and Rocket Propulsion', New Age International Publishers
3	Balachandran, P., 'Fundamentals of Compressible Fluid Dynamics', Prentice-Hall India
4	Shapiro, A.H., 'The Dynamics and Thermodynamics of Compressible Fluid Flow Volume – I, II ', Ronald Press
5	White, F.M., 'Fluid Mechanics' , Tata Mc-Graw Hill
6	Rathakrishnan, E., 'Gas Tables', Universities Press

Power engineering -I

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year			2021-22		
		B. E. (Mechanical Engineering): Regular Programme								
Year	IV	Elective MEC 1708:Power engineering -I			Credits / Hours per week				Lectures: 04 Practicals: 02	
Semester	I	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade				Theory: 100 PR/TW/V IVA: 50	
Mode of Transaction: Lectures and Practicals										
		Course Outcome (CO) MEC 1708 CO1 Understand basic performance measurements and performance parameters of IC engine. CO2 Comprehend basic of supercharging, turbo charging, cooling and lubrication of IC engine.. CO3 Appreciate knowledge of fuels for SI and CI engine and their emission control. CO4 Realization of Thermal design of IC engine and operating parameters for that. CO5 Acknowledge Recent development in IC engine and diesel power plants.								
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Performance of I.C. engines, Basic performance parameters, calculation of performance parameters and heat balance	7	13	1, 2, 3	CO 1	PO 1 PO 3	PS 2	Emp, Ent, SD	L N G	ES

	sheet, performance curves, comparison of S.I. & C.I. engines.											
2	Measurement of performance parameters of I.C. engines, Basic measurement parameters, Measurement of air fuel, speed, exhaust emission and smoke, F.P., I.P, B.P.	7	13	2, 3	CO 1	PO 1	P S O 1					
3	Supercharging and Turbo charging – objects, Thermodynamic cycles, supercharging of S.I. & C.I. engines, superchargers, parameters of supercharging, comparison of power of supercharged and undercharged engines, Turbo charging.	7	13	2, 3	CO 2	PO 1	P S O 1					
4	Cooling and Lubrication of I.C. engines, necessity of cooling, effect of over cooling, heat transfer, cooling systems, water cooling methods, effect of various parameters on piston temperature, Lubricating functions, principles of lubrication, properties of Lubricants, Lubricating Systems.	7	13	1, 2, 3	CO 2	PO 1 PO 3	P S O 2					
5	Fuels for S.I. & C.I. engines, L.P.G. as S.I. engine fuel, non-petroleum fuels, additives.	4	8	1, 2, 3	CO 3	PO 1 PO 2 PO	P S O 1					

						3				
6	I.C. engine emission and its control.	4	8	2, 3, 4	CO 3	PO 1 PO 2	P S O 1			
7	Principle of similitude, operating parameters for I.C. engine design.	6	8	2,3, 4, 5	CO 4	PO 1 PO 2 PO 3	P S O 2	Ent	L	ES
8	Thermal design of I.C. engines & design of main components of I.C. engines.	6	8	1,2	CO 4	PO 1 PO 7	P S O 2	Emp	N	ES
9	Diesel power plants and its economics.	6	8	1,2, 4	CO 5	PO 1 PO 2	P S O 2	Emp	N	ES
10	Recent developments in I.C. engines.	6	8	1,2, 4	CO 5	PO 1 PO 2	P S O 1	Ent	G	ES

List of Experiments

		Contact Hours	Weightage (%)	BT Level	CO	PO				
1.	Performance of IC engine	04	17	2,3,4	CO1	PO1 PO2 PO3				
2.	Measurement of performance parameters of IC engine	04	17	2,3,4	CO1	PO1 PO2 PO3				
3.	Supercharging and turbo charging	04	17	2,3,4	CO2	PO2 PO3				

4.	Cooling and lubrication of IC engine	04	17	2,3,4	CO2	PO1 PO2 PO3				
5.	Fuels for SI and CI engine	04	17	2,3,4	CO3	PO1 PO2 PO3				
6.	IC engine emission and its control	04	17	2,3,4	CO3	PO1 PO2				

Reference Books

1.	Thermal Engineering by R. K. Rajput, Laxmi publication.
2.	Nag, P.K. Power Plant Engineering, Tata McGraw Hill
3.	Arora & Domkundwar, Power Plant Engineering, Dhanpat Rai & Sons

Production Technology IV

		The Maharaja Sayajirao University of Baroda			Academic Year	2020-21
		Faculty Technology and Engineering				
		Department of Mechanical Engineering				
B. E. (Mechanical Engineering): Regular Programme						
Year	IV	Core MEC 1703: Production Technology IV		Credits / Hours per week	Lecture s: 04 Practica ls: 02	
Semester	I	Year of Introduction: Year of Syllabus Revision: 2018		Maximum Marks / Grade	Theory: 100 PR/TW/ VIVA: 50	
Mode of Transaction: Lectures and Practicals						
Course Outcome (CO) MEC 1703						
CO1 To study gear manufacturing techniques						
CO2 Learning and operating of CNC machines						
CO3 Understand about machine tool testing and commissioning.						
CO4 Comprehend the application of powder metallurgy and other Miscellaneous fabrication process.						
CO5 To study about unconventional machining processes and to understand about composite material.						

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV) and Professional Ethics (PE)	
1	Gear Manufacturing Processes Survey of gear manufacturing methods, Gear cutting methods: Milling, Hobbing, Shaping, Tools and processes, Advantages and limitations. Gear finishing techniques: Grinding and Shaving processes.	8	15	1, 2, 3	CO1	PSO 2	PO 1, PO 1 2, PO 5	Emp Ent		L N	ES
2	Introduction to CNC Machines History, development and current status of NC/CNC technology. Machine tool programming. Numerical Control : Basic components, type of control, Axes designation, Tooling: Part programming techniques. Manual part programming for turning and machining centers, Use of canned cycle.	10	20	2, 3, 4	CO2	PSO 2	PO 1, PO 2, PO 3	SD		R G	PE

3	Machine tool testing and commissioning Acceptance test for lathe, drilling and milling machines, general procedures and standard test charts; commissioning of machine tools, foundation types, foundation plan, Preparing the foundation.	8	15	3, 4, 5,6	CO3	PSO 1	P O 3, P O 5			
4	Powder metallurgy Advantages and limitations of powder Metallurgy, Manufacturing of Metal powders and their characteristics, Mixing and blending, Compacting, Sintering, Secondary Operations, Applications of powder Metallurgy parts, Design for powder Metallurgy parts for production.	6	10	3, 4, 5	CO4	PSO 1	P O 1, P O 3, P O 4			
5	Unconventional machining processes Need for non-Traditional Manufacturing, Classification, Process selection, Principles, Advantages, Limitations, Process parameters and applications for different Unconventional Processes like: Abrasive jet machining, Ultrasonic machining, Electro discharge machining, Laser beam machining, Electron beam machining, Ion beam machining Electromagnetic forming, water jet Machining.	10	20	3, 4, 5,6	CO5	PSO 1	P O 1, P O 4, P O 5, P O 1 2			

6	Composite material Types, Forms, Manufacturing Methods, Compression moulding, Vacuum Bag Moulding, Pultrusion and filament Winding.	5	10	3, 4, 5,6	CO5	PSO 1	P O 1, P O 2, P O 3			
7	Manufacturing methods for glasses, Rubber and Ceramic products in brief.	5	10	3,4,6	CO4	PSO 2	P O 1, P O 4			
	Total	52	100							

List of Experiments										
1.	Study of foundation of machine tools	02	10	1, 2	CO3	PSO1	PO5	Emp	L N R	ES PE
2.	Installation and acceptance testing of machine tools	02	10	1, 2, 3	CO3	PSO2	PO5			
3.	Introduction of NC and CNC machine tools	02	10	3, 4	CO2	PSO1	PO1, PO2	Ent		
4.	CNC part programming	04	15	3, 4	CO2	PSO2	PO1, PO2	SD		
5.	Study of gear manufacturing	02	15	3, 4	CO1	PSO2	PO1, PO2			

6.	Study of non-traditional machining processes.	04	10	2, 3	CO5	PSO1	PO1, PO2		G	
7.	Study of powder metallurgy	02	10	2, 3	CO4	PSO1	PO1, PO2			
8.	Study of composite material and processes	04	10	3	CO5	PSO1	PO1, PO2			
9.	Study of high energy rate forming processes.	02	10	4, 5	CO5	PSO2	PO1, PO2			
		24	100							

Reference Books

1	Manufacturing processes for engineering Materials by Serope kalpakjian.
2	Fundamentals of Modern Manufacturing by M.P. Groover
3	CNC Manufacturing by M.P. Berry Leathman Jones
4	Non-Traditional machining By P K Mishra
5	Non-Traditional machining By V K Jain
6	Workshop Technology Volume I and II by Raghuvanshi B.S.

Thermal Engineering - III

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022-23		
		B. E. (Mechanical Engineering): Regular Programme									
Year		IV	Core / Elective/Foundation MEC 1704:Thermal Engineering - III			Credits / Hours per week				Lectures: 04 Practical: 02	
Semester		I	Year of Introduction:1960 Year of Syllabus Revision:2006			Maximum Marks / Grade				Theory: 100 PR/TW/VIV A: 50	
Mode of Transaction:			Lectures and practical's								
		Course Outcome (CO) MEC 1704 CO1 Analyze the steam cycles on P-V, T-S, H-S diagram. CO2 Evaluate performance parameters, layout and components in a power plant. CO3 Understand performance parameters, load curves and tariff calculations. CO4 Analyze power plant economics, environmental hazard CO5 Understand how fuel is handled in a power plant.									
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional (R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Modern Steam Boilers:		08	13	1, 2, 3	CO1	PSO	PO	Emp	L	ES

	Behaviour of steam at critical and super critical pressures, thermodynamic principles underlying working of high pressure boilers such as forced circulation, generation of steam at critical and above pressures, indirect heating and circulation of flue gases at supersonic velocity. Study of La Mont, Benson, Loeffler and Velox boilers. Location of heat transfer units and efficient heat transfer, trial of boilers and heat balance sheet.				CO2	1 PSO 2	1 PO 3	Ent SD	N R G	PE
2	Draught Equipment: Types of draughts used and calculation of resistance offered, Natural draught and its calculation, various chimneys, Artificial draught – forced, induced and balanced, choice of fan, power required to drive the fan.	05	8	2, 3	CO2	PSO 1 PSO 2	PO 1			
3	Pulverized Fuel: Classification of solid fuel firing, pulverized fuel and its advantages and disadvantages, pulverized fuel handling (firing) systems – unit and bin (or central), pulverizing mills, pulverized fuel burners (furnaces) and dust collectors.	07	12	2, 3	CO5	PSO 1 PSO 2	PO 1			
4	Binary Vapour Cycle: Desirable properties of working medium for vapour power cycle, steam & mercury	06	10	1, 2, 3	CO2	PSO 1 PSO 2	PO 1 PO 3			

	as working medium, possible combinations of working mediums & their limitations, flow & t-s diagram, rate of flow of vapour, power & efficiency of Binary vapour cycle									
5	Nuclear Power: Nuclear fusion and fission, Fission chain reaction, components of a nuclear reactor, nuclear fuels, fertile materials, main types of reactors and their operation	08	13	1, 2, 3	CO2	PSO 1 PSO 2	PO 1 PO 2 PO 3			
6	Steam Nozzles: Flow of steam in convergent and in convergent-divergent nozzles, pressure of steam at throat for maximum discharge with initially wet, saturated and superheated steam, effect of friction, effect of variation of back pressure, supersaturated flow of steam in nozzles, Wilson line.	06	10	2, 3, 4	CO1 CO2	PSO 1 PSO 2	PO 1 PO 2			
7	Steam Turbines: Principles of working, main types and their salient features, compounding velocity diagrams for velocity compounded impulse turbines and reaction turbines, Axial thrust, work done and efficiencies, Rankine cycle with internal and external irreversibility, Reheat factor, Reheating, Regeneration feed	14	24	2,3,4,5	CO1 CO2 CO4	PSO 1 PSO 2	PO 1 PO 2 PO 3			

	heating, Effect of important parameters on performance of turbines, Methods of governing and their limitations, Back pressure and pass out turbines, Constructional features – Methods of fixing blades, materials for blades and rotors, construction of rotors, Types of glands used, balancing of thrust.									
8	Power Plant Economics.	06	10	1,2	CO4 CO5	PSO 3	PO 1 PO 7			

Experiments

1.	Study and performance of Centrifugal Blower.	04	13	1,2 ,3	CO 2	PSO1 PSO2	PO1, PO2			
2.	Study of High Pressure Boiler.	06	20	1,2 ,3	CO 3	PSO1 PSO2	PO1, PO2			
3.	Study of Nuclear Power Plant.	06	20	1,2 ,3	CO 4	PSO1 PSO2	PO1, PO2			
4.	Study of Losses in Steam Turbine.	04	14	1,2 ,3	CO 4	PSO1 PSO2	PO1, PO2			
5.	Study of Ash Handling and Dust Collection system.	06	20	1,2 ,3	CO 4	PSO1 PSO2	PO1, PO2			
6.	Study of Pulverised fuel, its handling system and burners.	04	13	2,3	CO 5	PSO1 PSO2	PO1, PO2			

Reference Books	
1	Nag, P.K. Power Plant Engineering, Tata McGraw Hill
2	Arora & Domkundwar, Power Plant Engineering, Dhanpat Rai & Sons
3	Rajput, R. K. , Power Plant Engineering

Machine Tool Engineering-I

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering				Academic Year				2022-23			
	B. E. (Mechanical Engineering): Regular Programme											
Year	IV	Elective MEC 1709: Machine tool engineering-I		Credits / Hours per week				Lectures: 04 Practicals: 02				
Semester	I	Year of Introduction: 2024 Year of Syllabus Revision:2006		Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50				
Mode of Transaction: Lectures and Practicals												
Course Outcome (CO) MEC 1709 CO1 To study basic of general purpose machine tool and there various mechanisms. CO2 To Understand different stepped and staples drives used in general purpose machine tool. CO3 To Understand design of spindle, guide ways, bearings and man machine interface used in various general purpose machine tools. CO4 To study design of basic structural component like gear box, bed and column in general purpose machine tool. CO5 To know installation, testing and maintenance of machine tools.												
Uni t No.	Topic			Contact Hours	Weighta ge (%)	BT Level	CO	PSO	PO	Elements of Employabilit y (Emp)/ Entrepreneur ship (Ent)/ Skill Development (SD)	Releva nce to Local (L)/ Nationa l (N)/ Region al(R)/G lobal (G)	Relation to Gender (G), Environmen t and Sustainabilit y (ES), Human Values (HV)and Professional Ethics (PE)
1	Introduction to machine tool: Machine tools types and their classification, frames of beds, slides & carriage, tool & job holder spindle & guide ways, determining design specification of			12	20	1,2	CO1	PSO 1	PO1	ALL	ALL	ALL

	machine tool.									
2	Drives in machine tools: Selection of drives, stepped drives; design of speed box, types of feed boxes, stepless mechanical, electrical & hydraulic drives	16	28	1,2,3	CO2	PSO 1	PO1 PO3			
3	Machine Tool Spindles and Spindle design	6	10	1,2	CO3	PSO 1, PSO 2	PO1 PO3			
4	Man Machine Interface Design Criteria: Noise emission: Basic concept (Define Sound pressure level, its measurement), Sources of noise in machine tool, measures for noise reduction; Fume emission & its control; protection and safety devices.	2	3	1,2	CO3	PSO 1	PO1			
5	Machine Tool Guideways and Bearings: Tribology in machine tools, Slideways, Stick-slip phenomenon, types of slideways & design, Slideway adjustment & protecting devices; Rolling element & Hydrostatic guideways; Bearing selection for Machine tool, Preloading to Anti-friction bearings; Recirculating Ball Screw	10	16	1,2,3	CO3	PSO 1, PSO 2	PO1			
6	Machine Tool Structure: Types of machine tool structures; Components of machine tool structures; Structural design considerations for static, dynamic & thermal loading; Machine tool dynamics: Model analysis; Fundamentals of FEM for static & dynamic analysis of structures	10	16	1,2,3	CO4	PSO 1, PSO 2	PO1 PO12			
7	Installation, Testing and Maintenance of Machine Tools: Introduction, Location & Foundation for machine tools, Different types of machine tool foundations, Factors affecting the type & size of foundation, Foundation plan. Preparing the foundation; Performance testing of machine tools, Maintenance of machine tools (Theory discussed in IE-I, Maintenance	4	7	1,2	CO5	PSO 1	PO1			

	to be discussed in practical class)									
	Total	60	100							
List of Experiments:										
1.	Study of functional requirement of machine tools.									
2.	Study of working and auxiliary motion of machine tools.									
3.	Study of different mechanisms used for transforming rotary motion into translatory motion									
4.	Study of different types of bearing used in machine tools.									
5.	Study of stepped regulation of feed in conventional machine tools									
6.	Gear box design									
7.	Study of steeples regulation of speed in machine tool									
8.	Free body diagrams of traditional machine tools.									
	Reference Books									
1.	Acharkan. N., Machine Tool Design Vol. 1 to 4, MIR Publication,2000									
2.	M. Week, Handbook of Machine Tools Vol-I,II,III,IV, Jonh Willey									
3.	Sen & Bhattacharya, Design of Machine Tools, New Central Book Agency									
4.	N. K. Mehta, Machine Tool Design, 3rd Edition Tata Mc Graw Hill									
5.	Hiromu Nakazawa, Principles of Precision Engineering, Oxford University Press									
6.	A. Slocum, Precision Machine Design, Prentice Hall									
7.	S. K. Basu & Pal, Machine Tool Design, Oxford & IBH Pubin.									

Automobile Engineering-II

 सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022-23	
		B. E. (Mechanical Engineering): Regular Programme								
Year	IV	Elective MEC 1801:Automobile engineering-II				Credits / Hours per week				Lectures: 04 Practical: 02
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006				Maximum Marks / Grade				Theory: 100 PR/TW/V IVA: 50
Mode of Transaction: Lectures and practical's										
	Course Outcome (CO) MEC 1801 CO1 Analyze transmission and braking system of automobile. CO2 Remember about Wheels and tyres. CO3 Evaluate suspension system of automobile. CO4 Understand wheel alignment and steering system. CO5 Apply body safety consideration and miscellaneous topics of automobile.									
Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Transmission System: Its purposes and components, Clutch – its function, principle working, types of clutch, single plate, multi-plate wet and dry, semi-centrifugal, centrifugal and diaphragm clutch,	08	13	1, 2, 3	CO1	PSO2	PO 1 PO 3	Emp Ent SD	L N R G	ES PE

	Necessity, basic requirements, sprung and unsprung weights, Conventional and independent suspension systems, Advantages of independent suspension, Spring – Leaf, coil & torsion bars, Helix springs, Shock absorbers, Stabilizer or anti roll device, Bouncing, pitching and rolling of a motor vehicle						1 PO 3			
5	Wheel Alignment and Steering System: Front axle assembly – axle beam, stubs axle and wheel. Front and geometry – camber, king pin inclination, included angle, caster. Toe-in and Toe-out, necessity of steering, Ackerman and Davis steering mechanism, Steering linkages, Power steering, fundamental condition for true rolling and steering calculations.	09	15	3, 4, 5	CO4	PSO2	PO 1 PO 2 PO 3			
6	Body and Safety Considerations: Vehicle body, requirements of body design, streamlining of vehicle body, types of bodies, rust protection, safety considerations	08	13	3, 4, 5	CO5	PSO2	PO 1 PO 2			
7	Miscellaneous Topics: Automobile air conditioning requirements, Car and bus air conditioning – components, layout and working, Laboratory testing and road testing of	09	15	3,4,6	CO4	PSO2	PO 1 PO 2 PO 3			

	motor vehicles, R.T.O. rules, Automobile emission and emission control										
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Experiments

1.	To study Suspension system	06	20	2,3	CO1	PSO2	PO1, PO2			
2.	To study Gearbox (Transmission) system	06	20	2,3	CO1	PSO2	PO1, PO2			
3.	To study propeller shaft	06	20	2,3	CO1	PPSO 2	PO1, PO2			
4.	To study braking system.	04	13	2,3	CO1	PSO2	PO1, PO2			
5.	To study wheel and tyre.	04	13	2,3	CO2	PSO2	PO1, PO2			
6.	To study emission control in automobile.	04	14	2,3	CO5	PSO2	PO1, PO2			

Reference Books

1	Automobile Technology, N.K. Giri, Khanna Publishers, 2011.
2	Automobile Mechanical and Electrical Systems Automotive Technology: Vehicle Maintenance and Repair, Tom Denton, Butterworth Heinemann, 2011.
3	Clutches and Brakes, W C Orthwein, Marcel Dekker.
4	Automotive Mechanics by William H Crouse.
5	Automobile Technology, N.K. Giri, Khanna Publishers, 2011.

Computer Applications in Mechanical Engineering-II

 सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022-23												
		B. E. (Mechanical Engineering): Regular Program																			
Year		IV		Core-/ Elective/Foundation MEC 1807: Computer applications in mechanical engineering-II				Credits / Hours per week				Lectures: 04 Practicals: 02									
Semester		II		Year of Introduction: 1960 Year of Syllabus Revision:2006				Maximum Marks / Grade				Theory: 100 PR/TW/VIVA: 50									
Mode of Transaction: Lectures and Practicals																					
		Course Outcome (CO) MEC 1807 CO1 Understand a interfacing of analog and digital devices CO2 Application of Software and programming tools for design, analysis and automation of Mechanical Engineering Systems. CO3 Application of Artificial intelligence to Mechanical Engineering Systems. CO4 Understand tools and methods used in CAD/CAM integration. CO5 Understand components and working of FMS.																			
Unit No .		Topic		Contact Hours		Weightage (%)		BT Level		CO		PO		PSO		Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)		Relevance to Local (L)/ National (N)/ Regional(R)/Global (G)		Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)	

1	PART A – Computer Interfacing Digital Interfacing – Parallel & Serial Communication RS232C, RS432, Centronic, Modems. Analog Interfacing – sampling, ADC, DAC, types of ADC & DAC, Hardware & software ADC. Computers & Mfg. Devices interfacing – Network - LAN, MAN, WAN, OSI standard, Internet, TCP/IP Protocols, MAP/TOP for factory networking.	17	28	1, 2.5	CO 1	PO 1, PO 2, PO 5	PSO 1	Emp Ent SD	L N R G	ES HV PE
2	PART B – Software Applications Programming applications of C++, JAVA Compiler, Auto LISP, Dbase Rdbms for factory database, process planning, production planning, Design applications – optimization, FEA, in Mechanical Engineering.	09	15	2, 3, 4	CO 2	PO 1, PO 2, PO 5, PO 6	PSO 1			
3	PART C 1 – Artificial Intelligence Applications Robotics, types of kinematic analysis, applications. AGV types, construction, operation. Computer vision – basics, operation, applications. Expert systems, fuzzy logic & neural network in decision-making, design & control.	17	27	2, 3, 4, 5	CO 3	PO 1, PO 3, PO 5	PSO 1			
4	PART C 2 – CAD/CAM Integration	9	15	2,3, 4	CO 4	PO 1, PO 3, PO 5	PSO 1			

5	FMS – Chief Feature, Automated Factory.	8	15	2,3,4	CO 5	PO 1, PO 4, PO 5	P S O 1				
	Experiments										
1.	Study of Serial Interfacing	0 2	9	1, 2	CO 1	PO 1					
2.	Study of Parallel Interfacing	0 2	9	1, 2, 3	CO 2	PO 3					
3.	Study of NC/CNC Interpolators	0 2	9	3, 4	CO 3	PO 2					
4.	Exercises for Advanced CNC Part Programming	0 2	9	3, 4	CO 1	PO 2					
5.	Exercises for PLC Programming	0 2	9	3, 4	CO 1	PO 1					
6.	Mechanism Simulation for Kinematic Assemblies	0 2	9	2, 3	CO 2	PO 2					
7.	Assignments for Programming in C++	0 2	9	2, 3	CO 3	PO 1					
8.	Assignments for Programming in CAD	0 2	9	2, 3	CO 1	PO 5					
9.	Assignments for Engineering Optimization	0 2	9	4, 5	CO 2	PO 5					
10.	Assignments for CAE	0 2	9	4, 5	CO 3	PO 5					
11.	Assignments related to ADC and DAC	0 2	10	4, 5, 6	CO 2	PO 5					
	Reference Books										
1.		Ibrahim Zied, CAD / CAM: Theory and Practice, McGraw-Hill									
2.		Hearn E J and Baker M P, Computer Graphics, Pearson.									
3.		CAD/CAM: computer aided design and manufacturing, GrooverMikell P, Zimmered W Emory, Prentice Hall 2011									
4.		Programming in ANSI C by Balaguruswamy									

Operation Research and Optimization Techniques

	The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering		Academic Year	2022-23
	B. E. (Mechanical Engineering): Regular Programme			
Year	IV	Elective MEC 1803: Operation Research and Optimization Techniques	Credits / Hours per week	Lecture: 04 Practical: 02
Semester	II	Year of Introduction: N.A. Year of Syllabus Revision: 2015	Maximum Marks / Grade	Theory: 100 PR/TW/VIVA: 50
Mode of Transaction: Lectures and Practical				
	Course Outcome (CO) MEC 1803 CO1 To know the background and importance of optimization and operation research. CO2 To understand Linear programming problem applications and solutions. CO3 To study Dynamic programming, Decision theory and Game theory. CO4 To understand Inventory models and Replacement theory. CO5 To study Queuing theory models.			

Unit No.	Topic	Contact Hours	Weightage (%)	BT Level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R)/ Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Introduction to Optimization and Operations Research: Concept of optimization, Classification of optimization problems, Single and Multi-objective optimization, Overview of Optimization Algorithms. History, Characteristics, Phases of O.R., Scope of O. R. in industry, Model building, Types of O. R. Models, Use of software for solving O.R. problems.	5	8	1,2	01	01, 02, 05	01	Emp, Ent, SD	L N G	ES

2	Linear Programming: Convex sets and Linear programming theory, Simplex method, Big-M method, Two-phase method, Degeneracy, Unbounded solution, Multiple Optimal solutions, Duality in Linear programming, Transportation Problems, Algorithms for Solving transportation Problems and Special situations, Assignment problems, Hungarian Method.	20	34	2,3,4	02	01,02	02,03			
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3	Dynamic Programming, Decision Theory and Game Theory: Characteristics of Dynamic programming, Bellman's principle of optimality, Recursive equations with backward and forward treatments. Decision making under certainty, uncertainty and under risk, Decision tree, Expected Value of perfect information, Expected value of sample information, Posterior probabilities and Bayesian Analysis. Two-person-zero-sum games, Pure and mixed strategies games, Minimax theorem, Arithmetic, Graphical, Algebraic, Method of Sub game, Matrix and Simplex methods..	18	31	2,3,4	03	01,02	02,03			
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4	Inventory Models and Replacement Theory: Inventory costs, E.O.Q., E.B.Q., Deterministic models without and with shortages, Effect of discount on E.O.Q. Equipment replacement policy, Money values not changing with time and money value changing with time considerations.	12	19	2,3,4	04	01,02	02,03			
5	Queuing Theory: Queue discipline, Service mechanism, Kendall's notations, M/M/1, M/M/S models.	5	8	2,3,4	05	01,02	02,03			
	Total	60	100							

List of Exercises:

		Contact Hours	Weightage (%)	BT Level	CO	PO	PSO			
1.	Linear programming Formulation and modeling exercise	02		2,3,4	02	01,02	02,03			
2.	Linear programming, Graphical and simplex method problems	02		2,3,4,5	02	01,02	02,03			
3.	Linear programming, Big-M and Two phase method problems	02		2,4,5	02	01,02	02,03			

4.	Linear programming, Duality and economic interpretation problems	02		2,3,4,5	02	01,02	02,03			
5.	Transportation model problems	02		2,3,4	02	01,02	02,03			
6.	Assignment model problems	02		2,3,4	02	01,02	02,03			
7	Dynamic programming problems	02		2,3,4	03	01,02	02,03			
8	Inventory model problems	02		2,3,4,5	04	01,02	02, 03			
9	Queuing Theory problems	02		2,3,4	05	01,02	02, 03			
10	Decision theory problems	02		2,3,4	05	01,02	02, 03			
11	Game theory problems	02		2,3,4,5	05	01,02	02, 03			
12	Replacement model problems	02		2,3,4	05	01,02	02, 03			
	Total	24								

Reference Books

1.	Winston Wyne L., Operations Research applications and Algorithms. 4th Ed. Duxbury publ.
2.	Taha Hamdy A., Introduction to operations research 8th Edition Prentice Hall.
3.	Hillier F.S., Lieberman G.J., Introduction to Operations Research, 8th Ed. McGraw-Hill

Power Engineering-II

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering						Academic Year		2022-23					
				B. E. (Mechanical Engineering): Regular Programme											
Year		I V		Elective MEC 1804: Power Engineering-II Year of Introduction: 1960 Year of Syllabus Revision:2006				Credits / Hours per week				Lectures: 04 Practicals: 02 Theory: 100 PR/TW/VIVA: 50			
Semester		II						Maximum Marks / Grade							
Mode of Transaction: Lectures and Practicals															
		Course Outcome (CO) MEC 1804 CO1 Comprehend basic of gas turbine plant and it's combustion chamber. CO2 Understanding role of Compressors in power plant. CO3 Acknowledge importance of jet propulsion engines. CO4 Realization of steam turbine plant and combined cycle plants. CO5 Appreciate importance of nuclear power plant in power generation regard to conventional sources.													
Unit No.	Topic			Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)		Relevance to Local (L)/ National (N) / Regional(R)/ Global (G)		Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)	

1	Gas Turbine Plants: Review of gas turbine cycles and gas turbine plants, Analysis of gas turbine plants, Analysis of gas turbine cycles, performance curves, Actual gas turbine plants, Determination of output and efficiency, Applications, Economics of Gas turbine plants.	8	14	1, 2	CO1	PSO1	PO1 , PO1 2, PO5	Emp Ent SD	L N R G	ES HV PE	
2	Combustion Chambers of Gas Turbines: Process of combustion, types of combustion chamber – performance and operating characteristics of combustion chambers.	9	15	2, 3, 4	CO1	PSO2	PO1 , PO2 , PO3			ES	
3	Compressors; Axial & radial flow compressors, effect of various parameters on	8	13	1,2	CO2	PSO1	PO1 , PO3 , PO5			PE	

	power consumption, Determination of power required to drive the compressor.										
4	Jet Propulsion Engines: Air breathing engines and Rocket engines, types of Jet engine, Fuels, Determination of thrust and propulsion efficiency performance curves.	9	15	2, 4, 5	CO3	PSO1	PO1 , PO3 , PO1 1			PE	
5	Steam Turbine Plants; Review of steam turbine cycles and general layout of steam power plants, Dual purpose steam turbines, Applications, economics of steam power plants.	8	13	2, 4, 5	CO4	PSO2	PO1 , PO4			ES	
6	Combined Gas – Steam Power Plants:	9	15	2, 4, 5	CO4	PSO1	PO1 , PO2			ES	

	Advantages, applications, power developed and efficiency, economics of such plants.						, PO3				
7	Nuclear Power Plants: Components, Types of reactors, Waste disposal, economics of such plants.	9	15	1,2,6	CO5	PSO2	PO1 PO3	Emp	N	ES	

List of Experiments

		Contact Hours	Weightage (%)	BT Level	CO	PO				
1.	Study of jet engines, it's classification and Performance characteristics.	06	20	2,4,5	CO3	PO1, PO2 PO1, PO2 PO1, PO2 PO1, PO2				
2.	Study of different types of combustion Chamber used in jet engines.	04	20	2,4,5	CO3					
3.	Study of gas turbine power plant and experimental determination of thermal performance.	04	20	2,4,5	CO1					
4.	Thermal performance of steam turbine test rig.	04	20	2,4,5	CO4					
5.	Study of nuclear power plants.	06	20	1,2,4	CO5					

Reference Books

1.		Thermal Engineering by R. K. Rajput, Laxmi publication.
2.		Nag, P.K. Power Plant Engineering, Tata McGraw Hill
3.		Arora & Domkundwar, Power Plant Engineering, Dhanpat Rai & Sons

Product Design and Value Engineering

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year				2022-23			
		B. E. (Mechanical Engineering): Regular Programme										
Year	IV	Core / Elective / Foundation MEC 1808: Product design and value engineering				Credits / Hours per week				Lecture s: 04 Practica ls: 02		
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006				Maximum Marks / Grade				Theory: 100 PR/TW/ VIVA: 50		
Mode of Transaction: Lectures and Practicals												
		Course Outcome (CO): CO1 To understand basic of product design process, quality function development and concept generation. CO2 To know concepts of design for reliability and quality for product design. CO3 To study the value engineering job plan and value analysis. CO4 To understand modeling in design, embodiment design and material selection in design. CO5 To know general design guidelines of design for manufacture and design for assembly.										
Uni t No.	Topic			Contact Hours	Weightage (%)	BT Level	CO	PO	PSO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Releva nce to Local (L)/ Nationa l (N)/ Region al(R)/G lobal (G)	Relation to Gender (G), Environmen t and Sustainabili ty (ES), Human Values (HV)and Professional Ethics (PE)
1	Product Specification: Need Identification, Customer requirements,			6	10	1, 2,3	CO1	PO1 PO2	PSO1	Emp	L	ES

	Quality function development (QFD), Product design specifications.			,4				Ent SD	N R G	HV PE
2	Concept Generation and Evaluation: Generating design concepts, creativity and problem solving, Definition of creativity, Creative process, psychological basis of creativity, Creativity methods, Theory of inventive problem solving (TRIZ), Evaluation methods.	2	3	1,2	CO1	PO1, PO2	PSO1			
3	Quality Engineering in Design: Quality engineering in design, Taguchi methods, Robust design, Design optimization, Reliability in engineering design, Reliability models (series, parallel systems), Terms related to reliability.	8	14	1,2 ,3	CO2	PO1, PO3, PO4	PSO1			
4	Value Engineering: Introduction to value engineering, Value analysis, History, Types of value, VE job plan, Phases in VE, Functional analysis and FAST diagram, Quantitative analysis of value, Case studies.	20	33	1,2 ,3, 4	CO3	PO1, PO2 PO3, PO4, PO9	PSO1 PSO2			
5	Product Design Process: Definition of product, Type of product, Product design process phases, Design morphology (ASIMOV's Model), Compatibility matrix, Technological innovations and design process, Product and process cycles, Intellectual property (patents and copy rights).	6	10	1,2 ,3	CO1	PO1, PO3 PO4 PO5, PO9, PO1 2	PSO1 PSO2			
6	Modeling and Simulation in Design: Role of models in design, Mathematical modeling, Geometric modeling, Finite element analysis and rapid prototyping.	2	3	1,2 ,3	CO4	PO1, PO2, PO3, PO5	PSO1			
7	Embodiment Design and Axonometric Design:	4	6	1,2	CO4	PO1,	PSO1			

	Product architecture, Configuration design, Parametric design, Industrial design, Human factors and design for environment, Axonometric design			,3		PO3					
8	Materials Selection in Engineering Design: General criteria for selection, Performance characteristics of materials, Ashby charts, Design for fatigue, corrosion, creep resistance etc.	2	3	1,2 ,3	CO4	PO3, PO1 2	PSO1				
9	Design for Manufacture: Design for machining, Design for casting, Design for welding, Design for assembly etc. Design for safety and maintainability, Design for plastic product (only design consideration point).	10	18	1,2 ,3	CO5	PO1, PO2, PO3, PO4, PO1 1, PO1 2	PSO1 PSO2				
Total		60	100								
	Experiments										
1.	Introduction to value engineering.	02	9	2,3	CO3	PO1, PO2 PO3, PO9	PSO1				
2.	To study value engineering job plan.	02	9	2,3	CO3	PO1, PO2 PO3, PO4, PO9	PSO1				
3.	To study design for reliability.	02	9	2,4,6	CO2	PO1, PO3, PO4	PSO1				
4.	Function analysis: case studies	02	9	2,4,6	CO3	PO1, PO2 PO3, PO4, PO9	PSO1 PSO2				
5.	To study various techniques used in creative phase.	02	9	3,4	CO3	PO1,	PSO1				

						PO2 PO3, PO4, PO9	PSO2			
6.	To understand role of computers in product design.	02	9	2,3	CO4	PO4, PO5, PO12	PSO1 PSO2			
7.	A product design approach: Concurrent engineering	02	9	2,3	CO1	PO1, PO3 PO4 PO5, PO9, PO12	PSO1			
8.	Exercises on Quality Function Deployment (QFD).	02	10	2,3,4,6	CO1	PO1, PO3 PO4 PO5, PO9, PO12	PSO1			
9.	Human factors in product design: Case studies	02	9	2,4,3	CO4	PO3, PO12	PSO1 PSO2			
10.	Analytical approach on FMEA (Failure Mode and Effect Analysis)	02	9	2,3,4,6	CO4	PO1, PO2, PO3, PO5	PSO1 PSO2			
11.	Examples on design consideration of design for manufacturing assembly.	02	9	2,3,4	CO5	PO1, PO2, PO3, PO4, PO11, PO12	PSO1 PSO2			

Reference Books

1.	Engineering Design, George E Dieter, McGraw Hill Publication
2.	Process and Design for Manufacturing, Sheriff D, El Wakil, 2 nd Edition, McGraw Hill Publication
3.	Handbook of Product Design for Manufacturing, James G Bralla, McGraw Hill Co. 1988
4.	Product Design and Manufacturing, A. K. Chittle and R. C. Gupta, Prentice Hall of India, 1997
5.	Product Design and Development, Ulrich, Karl T, Tata McGraw Hill Publication

Turbo Machines

		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year					2022-23	
		B. E. (Mechanical Engineering): Regular Programme									
Year	IV	Core / Elective / Foundation MEC 1805:TURBOMACHINES				Credits / Hours per week					Lectures: 04 Practicals : 02
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006				Maximum Marks / Grade					Theory: 100 PR/TW/V IVA: 50
Mode of Transaction: Lectures and Practicals											
	Course Outcome (CO) MEC 1805 CO1Understand the applications of turbo machines for various industrial requirements. CO2 Analyze and justify the behavior of turbo machine under design and off-design operating conditions. CO3 Illustrate the loss mechanism in single and multistage turbo machines. CO4 Preliminary Design procedures for Pumps Compressors and Turbines. CO5 Explain power transmission arrangements for different orientation, speed, torque and application.										
Unit No.	Topic		Contact Hours	Weightage (%)	BT Level	CO	PSO	PO	Elements of Employability (Emp)/ Entrepreneurship (Ent)/ Skill Development (SD)	Relevance to Local (L)/ National (N)/ Regional(R) /Global (G)	Relation to Gender (G), Environment and Sustainability (ES), Human Values (HV)and Professional Ethics (PE)
1	Dimensional Analysis and performance Characteristics:		10	15	1, 2, 3	CO1		PO1, PO2,	Emp	L	ES

	Definition of a turbo machine, Positive displacement machines and turbo machines, Basic terminology and classification of turbo machines, Dimensional analysis, Laws of modelling, the Cordier diagram. Compressibility effects, Reynolds number and scale effects. Specific speed, Different efficiencies, Performance characteristics of various turbo machines.					PSO1 PSO2	PO4	Ent SD	N R G	HV PE
2	Energy Transfer in Turbo machines: Energy transfer between fluid and rotor, Euler turbine equation and its limitations and applications. Components of energy transfer and their concepts. Impulse and reaction, Analysis of a turbomachine with radial flow, Radial flow pumps and compressors, theoretical head-capacity relationship, axial flow pumps and compressors. Turbines – utilization factor, vane, hydraulic, mechanical and overall efficiencies, Utilization factor for radial flow turbines, Utilization factor for axial flow impulse and reaction turbines.	08	13	2, 3, 4	CO2 CO5	PSO1 PSO2	PO1, PO2, PO3, PO4			
3	Flow of fluids in Turbomachines: Review of flow through pipe, nozzle and diffuser and round a bend, Flow over immersed bodies, Flow over flat plate, sphere and air foil, Pressure distribution over a symmetrical and inclined air foil, Blade terminology, Blade cascades and nomenclature, Lift and drag characteristics, Elementary concept of three-dimensional flow,	08	13	3, 4, 5	CO2	PSO1 PSO2	PO1, PO2, PO4			

	Free vortex and forced vortex.										
4	Energy Losses in Turbo machines: Loss mechanisms, Concept of boundary layer loss coefficients, Reynolds criteria, Losses in radial flow machines, Losses in axial flow machines, General idea of factors affecting losses	07	12	1, 2, 4	CO3	PSO1 PSO2	PO1, PO3, PO4				
5	Constructional features and general design considerations of turbo machines handling incompressible fluids: Pumps and Hydraulic turbines.	07	12	2, 5, 6	CO4	PSO1 PSO2	PO1, PO3, PO4, PO5				
6	Constructional features and general design considerations of turbo machines handling compressible fluids: Centrifugal compressors, Axial Flow compressors, Axial flow steam turbines, Axial flow gas turbines.	07	12	2, 5, 6	CO4	PSO1 PSO2	PO1, PO2, PO3, PO5				
7	Power transmitting turbo machines: Introduction, application and theory of fluid coupling and torque converter.	06	11	1,2,4	CO5	PSO1 PSO2	PO1 PO2				
8	Testing of turbo machines: Wind tunnel, types of wind tunnels, Testing of components, models and cascades, Instruments. Flow visualization, Testing of turbo machines Performance evaluation.	07	12	2,3,5	CO5	PSO1 PSO2	PO2 PO5				
Experiments											
1.	Study and plotting of NACA Aero foils		02	11	1, 2	CO1	PSO1 PSO2	PO1, PO2			
2.	Performance Characteristics of a Centrifugal Blower		02	11	1, 2, 3	CO2	PSO1 PSO2	PO3, PO4			
3.	Test on Flow systems of Centrifugal Blower		02	11	3, 4	CO2	PSO1 PSO2	PO1, PO2			
4.	Non-dimensional Performance presentation for a Ducted Axial Flow Fan		02	11	3, 4	CO2	PSO1 PSO2	PO2			

5.	Performance Analysis of Radial Flow Gas Turbine	02	11	3, 4	CO2	PSO1 PSO2	PO2, PO4			
6.	Construction of an Uncambered aero foil using conformal transformation	02	11	2, 3,5	CO4	PSO1 PSO2	PO2, PO4			
7.	Construction of a Cambered aerofoil using conformal transformation	02	11	2, 3, 5	CO4	PSO1 PSO2	PO2, PO4			
8.	Effect of angle of attack on Drag and Lift coefficients for flow around an aerofoil	02	11	2, 4, 5	CO3	PSO1 PSO2	PO2, PO4			
9.	Study of Cascaded Wind tunnel	02	11	2, 3, 4, 5	CO1	PSO1 PSO2	PO5			
	Reference Books									
1.		Dixon, S.L., ‘Fluid Mechanics, Thermodynamics of Turbomachinery’, Butterworth Heinemann								
2.		Cohen. Rogers, C.F.G., Sarvanamuttoo, H.I.H., ‘Gas Turbine Theory’, Pearson Edu.								
3.		Yahya, S.M., ‘Turbines, Compressors and Fans’, McGraw Hill								
4.		KadambiV., Manohar Prasad, ‘An Introduction to Energy Conversion, Volume-III, Turbomachinery’, Wiley Eastern								

Machine Tool Engineering-II

 सत्यं शिवं सुन्दरम्		The Maharaja Sayajirao University of Baroda Faculty Technology and Engineering Department of Mechanical Engineering			Academic Year			2022-23				
B. E. (Mechanical Engineering): Regular Programme												
Year	IV	Elective MEC 1810:Machine ToolEngineering II			Credits / Hours per week			Lectures: 04 Practicals: 02				
Semester	II	Year of Introduction: 1960 Year of Syllabus Revision:2006			Maximum Marks / Grade			Theory: 100 PR/TW/VIVA: 50				
Mode of Transaction: Lectures and Practicals												
Course Outcome (CO) MEC 1810 CO1 Understand basic about precision engineering and CNC technology for machine tool. CO2 To know control technology of CNC machine tool. CO3 To Understand elements of hydraulic and pneumatic system. CO4 Application of hydraulic and pneumatic circuit for machine tool CO5 To know work and tool holding devices for CNC machine tool.												
Un it No .	Top ic			Conta ct Hours	Weightag e(%)	BT Level	CO	PSO	PO	Elements of Employabi lity (Emp)/ Entreprene urship (Ent)/ Skill Developm ent (SD)	Relev ance to Local (L)/ Natio nal (N)/ Regi o nal(R) /Glob al (G)	Relation toGender (G), Environmen tt and Sustainabil ityty (ES), Human Values (HV)and Professiona lEthics (PE)
1	Precision Engineering for Machine Tool Design: Kinematic precision; Principles of Kinematics; Principlesof Zero Play & Guiding Mechanism; Principles of SmoothMotion; Abbe's Principle &			4	6	1,2	CO1	PS O1	PO1	ALL	ALL	AL

[illegible]

4.	N. K. Mehta, Machine Tool Design, 3rd Edition Tata Mc Graw Hill
5.	Hiromu Nakazawa, Principles of Precision Engineering, Oxford University Press
6.	A. Slocum, Precision Machine Design, Prentice Hall
7.	S. K. Basu & Pal, Machine Tool Design, Oxford & IBH Pubin.