RCOEM

Shri Ramdeobaba College of
Engineering and Management, Nagpur

SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2023 – 2024

B. Tech. (MECHANICAL ENGINEERING)

Published By

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ISO 9001 : 2015 CERTIFIED ORGANISATION

Department Vision

Department of Mechanical Engineering aims to inculcate in students, a flair for excellence to become technological leader in industry and society.

Department Mission

1. To create the learning environment that stimulates students & faculty to enhance the knowledge in Mechanical Engineering.
2. To prepare the students to carry out research intended to cater the needs of the industry and society.
3. To march ahead with dedication, zeal and with a system responsive to the needs of all the stakeholders.

Program Educational Objectives

1. The graduates shall be capable to accept challenges in Engineering industries.
2. The graduates shall demonstrate core competency to design, analyze and evaluate various engineering systems.
3. The graduates shall be able to apply computational and professional skills in corporate world.
4. The program shall prepare the graduates for higher studies, entrepreneurship and create awareness about lifelong learning.

Program Outcomes

Engineering Graduates will be able to :

1) **Engineering Knowledge :** Apply the knowledge of Mathematics, Science, Engineering fundamentals, and engineering specialization to the solution of complex engineering problems.
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.
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.
4) **Conduct investigation 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.
5) **Modern Tool Usage :** Create, select and apply appropriate techniques resources and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

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.

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.

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

9) **Individual and Team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.

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 documentations, make effective presentations, and give and receive clear instructions.

11) **Project management and Finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to ones own work, as a member and leader in a team to manage projects and in multidisciplinary environment.

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

1) Graduates will stand for design, production and operations in core mechanical domain and management of interdisciplinary applications.

2) Graduates will be capable of carrying out the analysis of mechanical and allied systems and provide numerical and computer based solution.

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Enginnering)

Semester - I

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	BSC	PHT1005	Physics for Mechanical Engineering	2	1	0	3	50	50	100	3
2.	BSC	PHP1005	Physics for Mechanical Engineering Lab	0	0	2	1	25+25	-	50	-
3.	BSC	MAT1001	Applied Mathematics - I	2	1	0	3	50	50	100	3
4.	BSC	MAP1001	Computational Mathematics Lab	0	0	2	1	25+25	-	50	-
5.	ESC	MET1001	Mechanical Marvels	1	0	0	1	50	50	100	1*
6.	ESC	MET1002	Engineering Mechanics	3	0	0	3	50	50	100	3
7.	ESC	MET1003	Engineering Graphics	2	0	0	2	50	50	100	3
8.	VSEC	MEP1003	Engineering Graphics Lab	0	0	4	2	50+50	-	100	-
9.	AEC-1	HUT1002	English for Professional Communication	2	0	0	2	50	50	100	2
10.	AEC-1	HUP1002	English for Professional Communication Lab	0	0	2	1	25+25	-	50	-
11.	CCA	HUP1003-1 to 10/ PEP0001-21 to 22/ CHP0001-31 to 32	Liberal/Performing Arts Lab	0	0	2	1	25+25	-	50	-
12.	VEC	HUT1004	Universal Human Values	1	0	0	1	50	-	50	1*
			TOTAL	**13**	**2**	**12**	**21**			**950**	

NOTE : Liberal/Performing Arts Lab - To be selected from the basket of Liberal/Performing Arts.

Sr. No.	Course Code	Course Name	Department
1	HUP1003-1	Fundamentals of Indian Classical Dance: Bharatnatayam	Humanities
2	HUP1003-2	Fundamentals of Indian Classical Dance: Kathak	Humanities
3	HUP1003-3	Introduction to Digital Photography	Humanities
4	HUP1003-4	Introduction to Japanese Language and Culture	Humanities
5	HUP1003-5	Art of Theatre	Humanities
6	HUP1003-6	Introduction to French Language	Humanities
7	HUP1003-7	Introduction to Spanish Language	Humanities
8	HUP1003-8	Art of Painting	Humanities
9	HUP1003-9	Art of Drawing	Humanities
10	HUP1003-10	Nature camp	Humanities
11	PEP0001-21	Disaster Management through Adventure Sports	Physical Education
12	PEP0001-22	Self-defence Essentials and Basics Knowledge of Defence Forces	Physical Education
13	CHP0001-31	Art of Indian Traditional Cuisine	Chemistry
14	CHP0001-32	Introduction to Remedies by Ayurveda	Chemistry

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Engineering)

Semester - II

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	BSC	CHT2004	Chemistry for Mechanical Engineers	2	0	0	2	50	50	100	3
2.	BSC	CHP2004	Chemistry Lab for Mechanical Engineers	0	0	2	1	25+25	-	50	-
3.	BSC	MAT2001	Applied Mathematics - II	2	1	0	3	50	50	100	3
4.	PCC	MET2001	Thermal and Fluid Sciences	3	0	0	3	50	50	100	3
5.	PCC	MET2002	Theory of Mechanisms & Elasticity	3	0	0	3	50	50	100	3
6.	ESC	EET2001	Basics of Electrical & Electronics Systems	3	0	0	3	50	50	100	3
7.	ESC	MET2003	Programming for Problem Solving	1	0	0	1	50	-	50	-
8.	ESC	MEP2003	Programming for Problem Solving Lab	0	0	2	1	25+25	-	50	-
9.	IKS	HUT2001	Foundational Literature of Indian Civilization	2	0	0	2	50	50	100	2
10.	VSEC	MET2004	Fab Lab - I	1	0	0	1	50	50	100	1*
11.	VSEC	MEP2004	Fab Lab - I	0	0	2	1	25+25	-	50	-
12.	CCA	PET2001	Sports-Yoga-Recreation	1	0	0	1	50	50	100	-
	CCA	PEP2001	Sports-Yoga-Recreation Lab	0	0	2	1	25+25	-	50	-
			TOTAL	**18**	**1**	**8**	**23**			**1050**	

Exit option 1 : Finishing School Certificate for a UG certificate course on Industry 4.0 Technologies			
In association with TATA-Technologies Ltd (Additional 8 Credits)			
	1	Certificate courses in association with TATA- Technologies Ltd on	Offline certification Course offered by RCOEM-TATA-CIIIT (RTC)
	RTC01	Basics of Solid Modeling	13 Hrs. -1 Credit each (any 8 to be selected)
	RTC02	3-D Printing	
	RTC03	Reverse Engineering	
	RTC04	Multi Body Dynamics (MBD)	
	RTC05	Internet of Things	
	RTC06	CNC Operations and Programming	
	RTC07	Finite Element Analysis	
	RTC08	Manufacturing Execution System	
	RTC09	Robotic Welding	
	RTC10	AutoCAD Drafting	
	RTC11	Profile engraving and Laser cutting (SIL)	
	RTC12	Electro Discharge Machining (P 20)	
	RTC13	Solar Technician	
	RTC14	Computer proficiency	
OR	2	One Month Internship at Industry	As prescribed by Industry
OR	3	Project Work (one month)	As prescribed by Industry/Institute

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Engineering)

Semester - III

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	MDM	MAT3001	Statistics for Engineers	2	0	0	2	50	50	100	2
	MDM	MAP3001	Statistics for Engineers	0	0	2	1	25+25	-	50	-
2.	PCC	MET3001	Mechanics of Solids	3	0	0	3	50	50	100	3
3.	PCC	MEP3002	Mechanical Engineering Software Lab	0	0	4	2	25+25	-	50	-
4.	PCC	MET3003	Manufacturing Engineering	3	0	0	3	50	50	100	3
5.	VSEC	MEP3004	Fab Lab-II	0	0	4	2	25+25	-	50	-
6.	OE	MET2980	Open Elective-I OR MOOC Course	2	0	0	2	50	50	100	2
7.	MGT	HUT3005	Engineering Economics	2	0	0	2	50	50	100	2
8.	FP	MEP3005	Field Project- Rural Technology	0	0	4	2	25+25	-	50	-
9.	VEC	CHT3001	Environmental Science	2	0	0	2	50	50	100	-
			TOTAL	14	0	14	21			800	

Open Elective - I	
Course Code	**Course Name**
MET2980-1	Solar Energy Utilization
MET2980-2	Product Design and 3D Printing
MET2980-3	Mechanical Engineering in Daily Life

Teaching Scheme and Examination for Bachelor of Technology
(Mechanical Engineering)
Semester - IV

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	MDM	MET4001	Material Science and Testing	1	0	0	1	50	50	100	1
2.	MDM	MEP4001	Material Science and Testing Lab	0	0	2	1	25+25	-	50	-
3.	PCC	MET4002	Design of Machine Elements	3	0	0	3	50	50	100	3
4.	PCC	MET4003	Kinematics & Dynamics of Machinery	3	0	0	3	50	50	100	3
5.	PCC	MEP4003	Kinematics & Dynamics of Machinery Lab	0	0	2	1	25+25	-	50	-
6.	PCC	MET4004	Fluid Dynamics and HydraulicMachines	3	0	0	3	50	50	100	3
7.	PCC	MEP4004	Fluid Dynamics and HydraulicMachines Lab	0	0	2	1	25+25	-	50	-
8.	PCC	MET4005	Heat Transfer	3	0	0	3	50	50	100	3
9.	PCC	MEP4005	Heat Transfer Lab	0	0	2	1	25+25	-	50	-
10.	OE	MET2990	Open Elective-II OR MOOC Course	3	0	0	3	50	50	100	3
			TOTAL	**16**	**0**	**8**	**20**			**800**	

Open Elective - I I	
Course Code	**Course Name**
MET2990-1	Automobile Engineering
MET2990-2	Project Management
MET2990-3	CAD-CAM

Exit option 2 : Finishing School for a UG Diploma course of Machining Supervisor			
In association with TATA-Technologies Ltd. (Additional 8 Credits)			
	1	A course for Certified Machining Supervisor	Offline certification Course
OR	2	Prescribed Courses for Machining Supervisor	Online certification Course
OR	3	One Month Internship at Industry	As prescribed by Industry

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Engineering)

Semester - V

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	MDM	MAT5001	Numerical Methods	2	0	0	2	50	50	100	2
2.	MDM	MAP5001	Numerical Methods Lab	0	0	2	1	25+25	-	50	-
3.	PCC	MET5001	Robotics and Mechatronics	3	0	0	3	50	50	100	3
4.	PCC	MEP5001	Robotics and Mechatronics Lab	0	0	2	1	25+25	-	50	-
5.	PCC	MET5002	Manufacturing Technology and Processes	3	0	0	3	50	50	100	3
6.	PCC	MEP5002	Manufacturing Technology and Processes Lab	0	0	2	1	25+25	-	50	-
7.	PCC	MET5003	Instrumentation and control	3	0	0	3	50	50	100	3
8.	PCC	MEP5003	Instrumentation and control Lab	0	0	2	1	25+25	-	50	-
9.	PSE	MET5004	Program Specific Elective-I (List Specified)	3	0	0	3	50	50	100	3
10.	OE	MET3980	Open Elective-III OR MOOC Course	3	0	0	3	50	50	100	3
			TOTAL	**17**	**0**	**8**	**21**			**800**	

Program Specific Elective – I			
Course Code	**Course Name**	**Course Code**	**Course Name**
MET5004-1	Mechanical Electrical & Plumbing	MET5004-5	Data Visualization Tools
MET5004-2	Automotive Powertrains	MET5004-6	Digital Twins & Cyber Physical Systems
MET5004-3	Advanced Materials & Composites	MET5004-7	Machine Learning for Mechanical Engineering
MET5004-4	Manufacturing Execution Systems	MET5004-8	Ancient Indian Machines

Open Elective - III	
Code Code	**Course Name**
MET3980-1	Electric Vehicle Technology
MET3980-2	Robotics and Drone Technology
MET3980-3	Heating Ventilation & Air-Conditioning

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Engineering)

Semester - VI

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	MDM	MEP6001	Robotic Process Automation	3	0	0	3	50	50	100	3
2.	PCC	MET6002	Computer Aided Engineering	3	0	0	3	50	50	100	3
3.	PCC	MEP6002	Computer Aided Engineering Lab	0	0	2	1	25+25	-	50	-
4.	PCC	MET6003	Automation in Manufacturing	3	0	0	3	50	50	100	3
5.	PCC	MET6004	Product Innovation and Entrepreneurship **OR** Patent Filing/Appling linked to TBI	2	0	0	2	50	50	100	3
6.	PSE	MET6005	Program Specific Elective-II (List specified)	3	0	0	3	50	50	100	3
7.	PSE	MEP6005	Program Specific Elective-II Lab (List specified)	0	0	2	1	25+25	-	50	-
8.	PSE	MET6006	Program Specific Elective-III (List specified)	3	0	0	3	50	50	100	3
9.	PSE	MEP6006	Program Specific Elective-III Lab (List specified)	0	0	2	1	25+25	-	50	-
10.	VSEC	MEP6007	Object oriented Programming (Skill Based Course) **OR** Industry based Mini Project (working Model) with Seminar	0	0	4	2	50	50	100	2
			TOTAL	**19**	**0**	**6**	**22**			**850**	

Program Specific Elective – II with Lab			
Course Code	**Course Name**	**Course Code**	**Course Name**
MET6005-1	3-D Printing & Additive Manufacturing	MEP6005-1	3-D Printing & Additive Manufacturing Lab
MET6005-2	Renewable Energy Systems	MEP6005-2	Renewable Energy Systems Lab
MET6005-3	Human Machine Interface	MEP6005-3	Human Machine Interface Lab
MET6005-4	Drone & Electric Vehicle Technology	MEP6005-4	Drone & Electric Vehicle Technology ab

Program Specific Elective – III with Lab			
Course Code	**Course Name**	**Course Code**	**Course Name**
MET6006-1	Synthesis of Mechanisms	MEP6006-1	Synthesis of Mechanisms Lab
MET6006-2	Automated System Integration	MEP6006-2	Automated System Integration Lab
MET6006-3	Industrial Internet of Things	MEP6006-3	Industrial Internet of Things Lab
MET6006-4	Hydraulics & Pneumatics	MEP6006-4	Hydraulics & Pneumatics
MET6006-5	Relational DBMS	MEP6006-5	Relational DBMS Lab
MET6006-6	Automotive Mechanics	MEP6006-6	Automotive Mechanics
MET6006-7	Human Factors in Engineering	MEP6006-7	Human Factors in Engineering Lab

Exit option 3 : Finishing school for B. Voc. Degree for a course on A Graduate/Trainee Mechanical Engineer			
In association with TATA-Technologies Ltd (Additional 8 Credits)			
	1	A course for B. Voc. Degree in Mechanical Engineering	Offline certification Course
OR	2	Prescribed Courses for B. Voc. Degree in Mechanical Engineering	Online certification Course
OR	3	One Month Internship at Industry	As prescribed by Industry

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Engineering)

Semester - VII

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	MDM	MET7001	PLC & Industrial Control System	2	0	0	2	50	50	100	2
2.	MDM	MEP7001	PLC & Industrial Control System	0	0	2	1	25+25	-	50	-
3.	PCC	MET7002	Applied Thermal Engineering	3	0	0	3	50	50	100	3
4.	PCC	MEP7002	Applied Thermal Engineering Lab	0	0	2	1	25+25	-	50	-
5.	PSE	MET7003	Program Specific Elective-IV (List specified)	3	0	0	3	50	50	100	3
6.	PSE	MET7004	Program Specific Elective-V (List specified)	3	0	0	3	50	50	100	3
7.	PSE	MEP7004	Program Specific Elective-V Lab (List specified)	0	0	2	1	25+25	-	50	-
8.	PSE	MET7005	Program Specific Elective-VI (List specified)	3	0	0	3	50	50	100	3
9.	PSE	MEP7005	Program Specific Elective-VI Lab (List specified)	0	0	2	1	25+25	-	50	-
10.	PBL	MEP7006	Project Based Learning (Project stage-1)	0	0	8	4	100	100	200	3
			TOTAL	**15**	**0**	**14**	**22**			**900**	

Program Specific Elective – IV			
Course Code	**Course Name**	**Course Code**	**Course Name**
MET7003-1	Artificial Intelligence	MET7003-7	Power Plant Engineering
MET7003-2	Micro Fluidics	MET7003-8	Six Sigma Management
MET7003-3	Micromachining	MET7003-9	Motion Control Systems
MET7003-4	Wealth Creation & Management	MET7003-10	Elements of Marine Engineering
MET7003-5	Armament Technology in Defence	MET7003-11	Space Technology
MET7003-6	Introduction to Corporate Law Practice	MET7003-12	Standards and Certification Processes

Program Specific Elective – V with Lab			
Course Code	**Course Name**	**Course Code**	**Course Name**
MET7004-1	Augmented Reality & Virtual Reality	MEP7004-1	Augmented Reality & Virtual Reality Lab
MET7004-2	Computational Fluid Dynamics	MEP7004-2	Computational Fluid Dynamics Lab
MET7004-3	Supply Chain Management	MEP7004-3	Supply Chain Management Lab
MET7004-4	Industrial Robotics	MEP7004-4	Industrial Robotics Lab
MET7004-5	Operations Research & Optimization	MEP7004-5	Operations Research & Optimization Lab
MET7004-6	Unmanned Aerial Systems (UAS)	MEP7004-6	Unmanned Aerial Systems (UAS) Lab
MET7004-7	Enterprise Resource Planning	MEP7004-7	Enterprise Resource Planning Lab
MET7004-8	National Accreditation Board for Testing and Calibration Laboratories	MEP7004-8	National Accreditation Board for Testing and Calibration Laboratories Course Lab
MET7004-9	Non-Destructive Testing	MEP7004-9	Non-Destructive Testing Lab

Program Specific Elective – VI with Lab			
Course Code	**Course Name**	**Course Code**	**Course Name**
MET7005-1	Product Lifecycle Engineering	MEP7005-1	Product Life Cycle Engineering Lab
MET7005-2	Refrigeration & Air Conditioning	MEP7005-2	Refrigeration & Air Conditioning Lab
MET7005-3	Stress Analysis	MEP7005-3	Stress Analysis Lab
MET7005-4	Field and Service Robots	MEP7005-4	Field and Service Robots Lab
MET7005-5	Noise Vibration & Harshness	MEP7005-5	Noise Vibration & Harshness Lab
MET7005-6	Work System Design	MEP7005-6	Work System Design Lab

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Engineering)

Semester - VIII

Sr. No.	Course Type	Course Code	Course Title	Hours/week			Credits	Maximum marks			ESE Duration (Hrs)
				L	T	P		Continuous Evaluation	End Sem Exam	Total	
1.	PSE	MET8001	Occupational Health & Safety OR MOOC courses	3	0	0	3	50	50	100	3
2.	PSE	MET8002	Multi-criteria Decision Making OR MOOC Courses	3	0	0	3	50	50	100	3
3.	PBL	MEP8003	Field project based on Engineering Strategies for Sustainability	0	0	12	6	100	100	200	3
			TOTAL	**6**	**0**	**12**	**12**			**400**	
			OR								
1.	ELC	MET8004	Research Methodology OR Research Paper Publication in WoS/SCOPUS/SCI Journal	4	0	0	4	50	50	100	3
2.	ELC	MEP8005	Full Semester Research Internship at the Institute	0	0	16	8	100	100	200	-
			TOTAL	**4**	**0**	**16**	**12**			**300**	
			OR								
1.	ELC	MEP8006	TBI Internship	0	0	24	12	100	100	200	-
			OR								
1.	ELC	MEP8007	Full Semester Industry Internship	0	0	24	12	100	100	200	-
			TOTAL			**24**	**12**			**400**	

* For Online MOOC Courses only the SWAYAM portal is allowed

Semester VIII Level 6.0 (B. Tech. in Mechanical Engineering with Multi-disciplinary Minor)

(The Student will take honor courses of additional 18 credits, over and above 160 minimum credits.)

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Engineering)

Honors Courses

Semester	Course Code	Name	L	T	P	Credit
III	METH3100	Geometric Dimensioning and Tolerance	2	0	2	3
IV	METH4100	Mechanical Estimation and Costing	2	0	2	3
V	METH5100	Integrated Advanced Manufacturing	3	1	0	4
VI	METH6100	Advanced Heat and Mass Transfer	3	1	0	4
VII	METH7100	Design of Mechanical Systems	3	0	2	4
			13	**2**	**6**	**18**

Semester VIII Level 6.0 (B. Tech. in Mechanical Engineering Honors with Research & Multi-disciplinary minor)

(The Student will take research project in semester VII & VIII of additional 18 credits, over and above 160 minimum credits.)

Semester	Course Code	Name	L	T	P	Credit
VII	MEPR8001-1	Research Project Phase – I	0	0	12	6
VIII	MEPR8001-2	Research Project Phase – II	0	0	24	12
		TOTAL	**0**	**0**	**36**	**18**

Semester VIII Level 6.0 (B. Tech. in Mechanical Engineering with double minor & multi-disciplinary minor)

(The student will take additional minor courses of 18 credits in another Engineering discipline, over and above 160 minimum credits.)

Teaching Scheme and Examination for Bachelor of Technology (Mechanical Enginnering)

Minors Specialization

Semester	Course Code	Name	L	T	P	Credit
III	METM3100	Elements of Mechanical Engineering	3	0	0	3
IV	METM4100	Additive Manufacturing	3	0	0	3
V	METM5100	CNC Programming & Operations	4	0	0	4
VI	METM6100	Energy Systems	4	0	0	4
VII	METM7100	Product Lifecycle Management (PLM)	4	0	0	4
		TOTAL	**18**	**0**	**0**	**18**

Scheme of Teaching & Examination for Bachelor of Technology List of Multi-Disciplinary Minors (MDM) - Automation (Mechanical Engineering)

Semester	Course Code	Name	L	T	P	Credit
III	MAT3001	Statistics for Mechanical Engineering	2	0	0	2
III	MAP3001	Statistics for Mechanical Engineering Lab	0	0	2	1
IV	MET4001	Material Science & Testing	1	0	0	1
IV	MET4001	Material Science & Testing Lab	0	0	2	1
V	MAT5001	Numerical Methods	2	0	0	2
V	MAP5001	Numerical Methods Lab	0	0	2	1
VI	MET6001	Robotic Process Automation	3	0	0	3
VII	MET7001	PLC & Industrial Control System	2	0	0	2
VII	MEP7001	PLC & Industrial Control System	0	0	2	1
		TOTAL	**10**	**0**	**8**	**14**

Semester I
Department of Mechanical Engineering

Course Code : PHT1005 **Course : Physics for Mechanical Engineering**

L : 2 Hrs., T :1 Hrs., P : 0 Hrs.,Per week **Total Credits : 3**

Course Objectives

1. To train the student to work with oscillatory phenomenon and with optical devices such as lasers, optical fibers.
2. To introduce fundamental concepts of modern physics, nanotechnology, acoustics and ultrasonic.

Course Outcomes

After successful completion of the course students will be able to:

1. Apply oscillatory phenomenon to various oscillating systems.
2. Apply laser light for various applications.
3. Implement theory of quantum physics to nanomaterials, its characterization, to the theory of semiconductors and solar cell.
4. Explain the basic principles of architectural acoustics and ultrasonic.
5. Explain the working of aerodynamic objects placed in fluid stream.

Module 1 : Oscillations (6L)

Damped and forced harmonic oscillations: Differential equation for damped and forced oscillations, LCR circuit (qualitative), electrical resonance, Numerical problems.

Module 2 : Lasers (6L)

Lasers: Laser Characteristics, Spatial and Temporal Coherence, Einstein Coefficient and its significance, Population inversion, Two, three and four level pumping schemes, Threshold gain coefficient, Components of laser, Ruby laser, Gas Laser (CO_2, He-Ne), Nd-YAG, Fiber Laser and Dye laser and their engineering applications. Numerical problems.

Module 3 : Quantum mechanics & Nanosize Effects (8L)

Matter waves, Group velocity and phase velocity, Heisenberg's Uncertainty principle and its application, one dimensional Time Independent Schrodinger's wave equation (TISWE). Its applications to Infinite potential well and Tunneling, Nano size effects. Applications of TISWE to characterization of nanomaterials.

Module 4 : Semiconductors and Solar Cell (7L)

Band theory of solids, Valence band, Conduction band, intrinsic semiconductors, doping, extrinsic semiconductors, PN junction diode, Solar cell: IV characteristics, Conversion efficiency.

Module 5 : Architectural Acoustics and Ultrasonics (8L)

Architectural Acoustics: Absorption, Reverberation and time of reverberation, Sabine's formula (Mention the expression), Factors affecting acoustics of a building and their remedies.

Ultrasonics: Introduction, Principle, Measurement of ultrasonic velocity in liquids and other applications.

Module 6 : Aeronautics Physics (7L)

Real world applications: Smart Skies, Mobile Accelerometers, Parachutes, Helicopters, Numericals on Drag & Lift Forces, Parachute Design.

Text Book(s)

1. The Physics of vibrations and waves by H.J. Pain Sixth edition, John Wiley & Sons.
2. Engineering Physics by M.N. Avadhanulu and Kshirsagar S. Chand Publication

References

1. Applied Physics by S. Jain, G. G. Sahasrabudhe and S. M. Pande, Universities Press 2013.
2. Optics, Ajoy Ghatak, Tata McGraw Hill Education 2005.

Semester I
Department of Mechanical Engineering

Course Code : PHP1005 **Course : Physics for Mechanical Engineering Lab**

L : 0 Hrs., T : 0 Hrs., P : 2 Hrs.,Per week **Total Credits : 1**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions.

Course Outcomes

After successful completion of the course students will be able to

1. Prepare for measurements used in various experiments and analyse errors involved in the measurements.
2. Explore various methods for finding experimental parameters.
3. Acquire the experimental and graph plotting skills.
4. Prepare laboratory reports on the experimental results.
5. Identify principle involved in an experiment.

List of Experiment

1. Error analysis and graph plotting.
2. Study of Ohm's law.
3. Study of Oscillations.
4. To find magnetic field by deflection magnetometer.
5. To find wavelength of laser light by diffraction grating.
6. Study of total internal reflection using Laser source.
7. Determination of velocity of sound in liquid–standing ultrasonic waves.
8. Data analysis using Mathematica.
9. Study of VI characteristics of Diode.
10. Current Voltage (I-V) characteristics of Solar cell.
11. Study of Hall Effect.
12. Demo experiment on Spectroscopy.
13. Optical Flatness of a surface.
14. Study of Aerofoil Shapes.

Suggested References

1. Physics Lab Manual written by the Teaching Faculty of Physics Department, RCOEM.

Semester I
Department of Mechanical Engineering

Course Code : MAT1001 **Course : Name: Applied Mathematics I**

L : 2 Hrs., T : 1 Hrs., P : 0 Hrs., Per week **Total Credits : 03**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equation, statistics, probability and differential calculus.

It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will able to:

1. Recognize first order ordinary differential equations that can be solved by each of the four methods – Linear DE, exact DE, reducible to linear DE and reducible to exact differential equations and use the appropriate method to solve them.
2. Solve higher order ordinary differential equations with constant and variable coefficients.
3. Find best fit curve by method of least square method and calculate correlation, regressions.
4. Recognize and understand discrete, continuous probability distributions and apply Binomial distribution, Poisson distribution and Normal distribution to appropriate problems.
5. Internalize multivariable calculus and apply it find Jacobians, maxima and minima of function / Solve numerical integrations by Newton coat formulas and Gauss-Legendre Quadrature.

Syllabus

Module 1 : First order ordinary differential equations (7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type, Applications of First order Differential Equations.

Module 2 : Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation. Applications of Higher order Differential Equations.

Module 3 : Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation and its application in Engineering.

Module 4 : Differential Calculus (10 hours)

Taylor's and Maclaurin's series expansions, radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Euler's Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module 5 : Probability: (8 hours) (For All Branches except Mechanical Branch)

Probability spaces, conditional probability, independence, Bay's Theorem, Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

OR

Module 5 : Numerical Integration (8 hours)

(Only for Mechanical Branch) Simpson's 1/3rd rule, 3/8th rule, Trapezoidal rule, Gauss-Legendre Quadrature.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory and Problems of probability and statistics: 2nd Ed: J. R. Spiegal, Schaum series.
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Semester I
Department of Mechanical Engineering

Course Code : MAP1001 **Course : Computational Mathematics Lab**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objectives

The computational Mathematics Lab course will consist of experiments demonstrating the principles of Mathematics relevant to the study of Science and Engineering. Students will show that they have learnt Laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. On successful completion of the course students shall be able to:

Proposed Course Outcomes

By using open-source software Sage Math Students will be able to

CO1: Download Sage Math and use it as an advance calculator.

CO2: Sketch and analyze function graphs.

CO3: Apply the concepts of differential calculus to find extreme value of continuous functions and analyze solutions of differential equations

CO4: Evaluate improper integrals and its applications to find length, area, volume, centre of gravity and mass.

CO5: Analyze and calculate Eigen values, Eigen vectors, rank nullity, and solve system of linear equations of a matrix / linear map.

CO6: Analyze the data to find best fit curve.

Mapping of Course outcomes (COs) with Experiments

Exp. No.	Name of Experiments	Mapped COs
1	To use SageMath as advanced calculator	CO1
2	2D Plotting with SageMath	CO2
3	3D Plotting with SageMath	CO2
4	Differential Calculus with SageMath	CO3
5	Solution of differential equations in SageMath	CO3
6	Basics of Linear Algebra	CO5
7	Curve Fitting by using SageMath	CO6
8	Integral Calculus with SageMath	CO4

Semester I
Department of Mechanical Engineering

Course Code : MET1001 **Course : Mechanical Marvels**

L : 1 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 1**

Course Objective

1. To create awareness about the past and recent developments in Mechanical Engineering.
2. To sensitize about the applications of Mechanical Engineering in various fields.

Course Outcomes

1. To know about the evolution of Mechanical Engineering as a discipline.
2. To develop awareness about latest trends in Mechanical Engineering.

Syllabus

Progression in Mechanical Engineering from Ancient to Modern, Mechanical Engineering in day to day life, Technical Disruptions, Cutting edge technologies in Mechanical Engineering Like Drone, Robots, Electric vehicles, UAS, Space Technology, Defence Technology, Marine Technology, Future Fuels, Advanced Materials , green manufacturing, modern machines and infrastructure etc.

Semester I
Department of Mechanical Engineering

Course Code : MET1002 **Course : Engineering Mechanics**

L : 3 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 3**

Course Objectives

The primary objective of the study of engineering mechanics is to develop the capacity to predict the effects of force and motion while carrying out the creative design functions of engineering.

Course Outcomes

After Completion of the syllabus, the students should be able to:

1. Understand the system of forces and their effects on machine element.
2. Analyze the trusses and understand the importance of friction concept.
3. Understand the physical significance of Center of Gravity, Centroid and Moments of Inertia
4. Apply the knowledge of Kinematics and Kinetics of a Particle
5. Evaluate the system by Work and Energy principle as well as Impulse and Momentum principle
6. Understand and apply the concepts of Kinematics of a Rigid Body in real life Unit 1: Basic concepts of Engineering Mechanics

Introduction and need of Engineering Mechanics, Units of Measurement, Force Vectors, Vector Addition of Forces, Equilibrium of a Particle, Rigid Body equilibrium; System of Forces, Coplanar Concurrent Forces, Components in Space – Resultant- Moment of Forces and its Application; Couples and Resultant of Force System, Equilibrium of System of Forces, Free body diagrams (FBD), Equations of Equilibrium of Coplanar Systems and Spatial Systems; Static Indeterminacy.

Unit 2 : Trusses and Friction

Structural Analysis of Simple Trusses by joint and section method. Introduction to space trusses, frames.

Friction: Types of friction, Limiting friction, Laws of Friction, Static and Dynamic Friction; Motion of Bodies, wedge friction, Problems Involving Dry Friction in various applications, Rolling friction.

Unit 3 : Center of Gravity, Centroid and Moments of Inertia

Centroid and Centre of Gravity covering, Centroid of simple figures from first principle, centroid of composite sections; Centre of Gravity and its implications; Area moment of inertia- Definition, Moment of inertia of plane sections from first principles, Theorems of moment of inertia, Moment of inertia of standard sections and composite sections; Mass moment inertia.

Unit 4 : Kinematics and Kinetics of a Particle

Rectilinear Kinematics, General Curvilinear Motion, Motion of a Projectile, Newton's Second Law of Motion and its application, Force and Acceleration

Unit 5 : Kinetics of particle by Work and Energy principle and Impulse and Momentum

The Work of a Force, Principle of Work and Energy, Power and Efficiency, Principle of Linear Impulse and Momentum, Angular Momentum, Relation Between Moment of a Force and Angular Momentum, Principle of Angular Impulse and Momentum.

Unit 6 : Kinematics of a Rigid Body

Introduction to Kinetics of Rigid bodies; Kinetics of rigid body rotation, Circular motion of rigid bodies, Kinetics of rolling bodies.

Text Books

1. Bansal R.K. (10030), A Text Book of Engineering Mechanics, Laxmi Publications
2. S.S. Bhavikatti (10037), Engineering Mechanics, New Age Publications
3. A.K. Sharma, Fundamental of Engineering Mechanics, Sai Publications

Reference Books

1. Irving H. Shames, Engineering Mechanics – Statics and Dynamics, Pearson Educations, Forth edition, 2003.
2. Beer and Johnston, Vector Mechanics for Engineers, Vol.1 "Statics" and Vol.2 "Dynamics, McGraw Hill International Edition, 1995.
3. SuhasNitsure, Engineering Mechanics, Technical Publications, Pune, 2007.
4. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
5. S.S. Deo, (10037), Engineering Mechanics, Nirali Publications.

Semester I
Department of Mechanical Engineering

Course Code : MET1003 **Course : Engineering Graphics**

L : 2 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 2**

Course Outcomes

The expected learning outcome is that, the students shall be able to:

1. Draw and interpret technical drawings
2. Convert 2-D to 3-D drawing and vice versa.
3. Represent the various positions of planes and solids in different orientations.
4. Develop the solid surface for sheet metal working

UNIT 1 : Introduction to Engineering Drawing and Engineering Curves : Principles of Engineering Graphics and their significance, usage of drawing instruments, Lettering and dimensioning, Engineering Curves - Conic sections, Cycloid and Involute etc.

UNIT 2 : Orthographic Projections : Theory of Projections, Concept of Projection, First & Third angle projection methods. Orthographic Projections: Conversion of given 3-dimensional view to 2-dimensional representation.

UNIT 3 : Projections of Lines and Planes : Projections of lines (line inclined to both planes), Projections of planes (inclined to both the planes), Concept of auxiliary plane method for projections of the plane.

UNIT 4 : Projections of Solids : Projections of regular solids inclined to both the Planes (including Auxiliary Views) – Prism, Pyramid, Cylinder, Cone.

UNIT 5 : Sections of Solids and Development of Surfaces : Sections of Solids - Prism, Pyramid, Cylinder, Cone and Development of lateral surfaces of solids.

UNIT 6 : Isometric Projections : Principles of Isometric projection - Isometric Scale, Isometric View, and Conversion of Orthographic views to Isometric Views / Projection.

Text Books

1. Engineering Drawing by N.D. Bhatt, Charotar Publishing House Pvt. Ltd.
2. Engineering Drawing with an Introduction to AutoCAD" by D. A. Jolhe Tata McGraw Hill Publications
3. Engineering Drawing by R.K. Dhawan, S. Chand Publications
4. Engineering Drawing by K.L. Narayana & P. Kannaiah, SciTech Publication

Reference Books

1. AutoCAD 14 for Engineering Drawing by P. Nageshwara Rao, Tata McGraw Hill Publications.
2. A text book of Engineering Drawing by P.S. Gill, S.K. Kataria & sons, Delhi.
3. Engineering Drawing and Computer Graphics by M. B. Shah & B.C. Rana, Pearson Education.

Semester I
Department of Mechanical Engineering

Course Code : MET1003 **Course : Engineering Graphics Lab**

L : 0 Hrs, T : 0 Hr., P : 4 Hrs Per Week **Total Credits : 2**

Course Outcomes

Students are prepared for actual work situations through practical training in a new state of the art computer designed CAD laboratory using engineering software. The student shall be able to:

1. Draw and interpret technical drawings.
2. Plan the sheet layout for the given drawing.
3. Convert 2-D to 3-D drawing and vice versa
4. Represent the various positions of planes and solids in different orientations.
5. Develop the solid surface for sheet metal working
6. Use & demonstrate drafting package.

Introduction to Computer Aided Drawing

Introduction, Drawing Instruments and their uses, relevant BIS conventions and standards. Lettering, line conventions, dimensioning, material conventions, and free hand practicing.

Computer screen, layout of the software, standard tool bar / menu and description of most commonly used tool bars, and navigational tools.

Co-ordinate system and reference planes HP, VP, RPP & LPP of 2D/3D environment. Selection of drawing sheet size and scale.

Commands and creation of Lines, coordinate points, axes, poly-lines, square, rectangle, Polygon, splines, circles, ellipse, text, move, copy, off-set, mirror, rotate, trim, extend, break, chamfer, fillet, curves, constraints viz., tangency, parallelism, inclination and perpendicularity.

Practical's to be performed from the list as below

Sr. No.	List of sheets
1	Engineering Curves
2	Orthographic Projection
3	Projection of Straight Lines
4	Projection of Planes
5	Projections of Solids
6	Section of solids and Development of surfaces
7	Isometric projection

Suggested Text/ Reference Books

i. Bhatt N.D. Panchal V.M. & Ingle P.R., Engineering drawing, Charotar Publiishing house.
ii. Jolhe D.A., Engineering drawing with an Introduction to Auto CAD", Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
iii. Shah M.B. & Rana B.C., Engineering drawing and Computer Graphic, Pearson Education.
iv. Agarwal B & Agarwal C.M. Engineering Graphics, TMH PUBLICATION.
v. Narayana K.L & P Kannaiah, Text Book on Engineering Drawing, Scitech Publishers.
vi. (Corresponding set of) CAD Software Theory and USER Manuals.

Semester I
Department of Mechanical Engineering

Course Code : HUT1002 **Course : English for Professional Communication**

L : 2 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 2**

Course Objectives

The main objective of this course is to enhance the employability skills of students as well as prepare them for effective work place communication.

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

CO1 : Demonstrate effective use of word power in written as well as oral communication.

CO2 : Understand the techniques of listening and apply the techniques of reading comprehension used in professional communication.

CO3 : Apply the principles of functional grammar in everyday as well as professional communication.

CO4 : Effectively implement the comprehensive principles of written communication by applying various writing styles.

CO5 : Create precise and accurate written communication products.

Unit - 1 : Vocabulary Building

1.1 Importance of using appropriate vocabulary.

1.2 Techniques of vocabulary development.

1.3 Commonly used power verbs, power adjectives and power adverbs.

1.4 Synonyms, antonyms, phrases & idioms, one-word substitutions and standard abbreviations.

Unit - 2 : Listening and Reading Comprehension

2.1 Listening Comprehension: active listening, reasons for poor listening, traits of a good listener, and barriers to effective listening.

2.2 Reading Comprehension: types and strategies.

Unit -3: Functional Grammar and Usage

3.1 Identifying Common Errors in use of: articles, prepositions, modifiers, modal auxiliaries, redundancies, and clichés.

3.2 Tenses

3.3 Subject-verb agreement, noun-pronoun agreement

3.4 Voice

Unit - 4 : Writing Skills

4.1 Sentence Structures

4.2 Sentence Types

4.3 Paragraph Writing: Principles, Techniques, and Styles

Unit - 5 : Writing Practices

5.1 Art of Condensation: Précis, Summary, and Note Making

5.2 Correspondence writing techniques and etiquettes – academic writing

5.3 Essay Writing

Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 10031.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press.

Semester I
Department of Mechanical Engineering

Course Code : HUP1002 **Course : English for Professional Communication Lab**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

To enhance competency of communication in English among learners

Course Outcomes

On completion of English Lab course, students will be able to achieve the following:

CO1 : Apply effective listening and speaking skills in professional and everyday conversations.

CO2 : Demonstrate the techniques of effective Presentation Skills

CO3 : Evaluate and apply the effective strategies for Group Discussions

CO4 : Analyse and apply the effective strategies for Personal Interviews

CO5 : Implement essential language skills- listening, speaking, reading, and writing

Syllabus

List of Practical

1. Computer Assisted + Activity Based Language Learning

Practical 1: Everyday Situations: Conversations and Dialogues – Speaking Skills

Practical 2: Pronunciation, Intonation, Stress, and Rhythm

Practical 3: Everyday Situations: Conversations and Dialogues – Listening Skills

2. Activity Based Language Learning

Practical 4: Presentation Skills: Orientation & Mock Session

Practical 5: Presentation Skills: Practice

Practical 6: Group Discussions: Orientation & Mock Session

Practical 7: Group Discussions: Practice

Practical 8: Personal Interviews: Orientation & Mock Session

Practical 9: Personal Interviews: Practice

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-1 **Course : Fundamentals of Indian Classical Dance : Bharatnatyam**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

The course aims to introduce the students to Bharatnatayam, an important element of Indian traditional knowledge system. The course will not only provide the learning and skill to perform this art but would also enhance many mental and physical aspects of the students such as strength, flexibility, discipline, self- confidence, creativity, focus, coordination, etc.

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Bharatnataym as an Indian dance form

CO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give Pratham (1st level formal exam of Bharatnatayam).

Syllabus

Practical -1: Orientation in Bharatnatayam

Practical-2: Tattu Adavu till 8, Naatta Adavu 4 Steps, Pakka Adavu 1 step, Metta Adavu 1 Step, Kuditta Metta Adavu 4 Steps,

Practical -3: Practice sessions

Practical-4: Tatta Kuditta Adavu (Metta), Tatta Kuditta Adavu (Metta) 2 Steps, Tirmanam Adavu 3 Steps, Kattu Adav - 3 Steps, Kattu Adav - 3 Steps

Practical-5: Practice sessions

Practical-6: Tiramanam (front) 3 Steps, Repeat of Tiramanam (Overhead) 3 Steps,

Practical-7: practice sessions

Practical - 8: final practice sessions and performances.

Recommended reading

1. Introduction to Bharata's Natyasastra, Adya Rangacharya, 2011
2. The Natyasastra and the Body in Performance: Essays on the Ancient Text, edited by Sreenath Nair, 2015
3. Bharatanatyam How to ...: A Step-by-step Approach to Learn the Classical Form, Eshwar Jayalakshmi, 2011

Semester I

Department of Mechanical Engineering

Course Code : HUP1003-2 **Course : Fundamentals of Indian Classical Dance : Kathak**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

The course aims to introduce the students to Kathak, an important element of Indian traditional knowledge system. The course will not only provide the learning and skill to perform this art but would also enhance many mental and physical aspects of the students such as strength, flexibility, discipline, self-confidence, creativity, focus, coordination, etc.

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand the importance of dance and Kathak as an Indian dance form

CO2: Develop skills to perform the dance form at its basic level.

CO3: Evaluate their strengths and interest to take bridge course to give Prarambhik (1st level formal exam of Kathak).

Syllabus

Practical -1: Orientation in Kathak. Correct posture of kathak, Basic Movements and exercise Stepping, Chakkar of 5 counts (Bhramari),

Practical -2: practice sessions of practical 1

Practical -3: Hastaks, Hastaks and Steppings, Reciting asamyukta Mudra shloka, Hastak and steppings

Practical -4: practice sessions of practical 3

Practical -5: Todas and Asamyukta hasta mudra shlok, Vandana of Shlok, 2 Todas and Vandana, Ghante Ki Tihai,

Practical -6: practice sessions of practical 5

Practical -7: 2 1 Chakkardar Toda and Ginnti Ki Tihai, 2 Todas and 1 Chakkardar Toda, practice sessions

Practical -8: Final performances.

Recommended reading

1. Kathak Volume1 A "Theoretical & Practical Guide" (Kathak Dance Book), Marami Medhi & Debasish Talukdar, 2022, Anshika Publication (13 September 2022)

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-3 **Course : Introduction to Digital Photography**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

The course aims to develop basic skills of students in digital photography to lay a foundation for them as a hobby and/or a profession.

Course Outcome

At the end of the course the students will be able to achieve the following:

CO1: Develop an understanding of the technical aspects and aesthetics of Photography.

CO2: Apply the rules of digital photography for creating photographs.

CO3: Develop skills to enhance photographs through post processing.

CO4: Create a portfolio of their photographs in selected genre.

Syllabus

Practical 1: Orientation in digital photography: Genres, camera handling and settings

Practical 2: Rules of Composition

Practical 3: Rules of Composition: practice sessions

Practical 4: Understanding Exposure and Art of Pre-Visualization

Practical 5: Rules of Composition and Art of Pre-Visualization: practice sessions

Practical 6: Post Processing Photographs and Portfolio creation

Practical 7: Post Processing Photographs: practice sessions

Practical 8: Portfolio finalization and presentation in selected genre.

Reference Material

1. Scott Kelby (2020) The Digital Photography Book: The Step-by-Step Secrets for how to Make Your Photos Look Like the Pros, Rocky Nook, USA
2. Larry Hall (2014) Digital Photography Guide: From Beginner to Intermediate: A Compilation of Important Information in Digital Photography, Speedy Publishing LLC, Newark
3. J Miotke (2010) Better Photo Basics: The Absolute Beginner's Guide to Taking Photos Like a Pro, AMPHOTO Books, Crown Publishing Group, USA

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-4 **Course : Introduction to Japanese Language and Culture**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

The course aims to develop basic communication skills in Japanese Language and help develop a basic understanding of Japanese culture in cross-cultural communication.

Course Outcome

CO1: Gain a brief understanding about Japan as a country and Japanese culture.

CO2: Develop ability to use vocabulary required for basic level communication in Japanese language.

CO3: Able to write and read the first script in Japanese language.

CO4: Able to frame simple sentences in Japanese in order to handle everyday conversations

CO5: Able to write in basic Japanese about the topics closely related to the learner.

Syllabus

Practical - 1 : Orientation about Japan, its language, and its culture

Practical - 2 : Communication Skills 1: Vocabulary for basic Japanese language

Practical - 3 : Practice sessions

Practical - 4 : Writing Skills 1: Reading and writing first script in Japanese

Practical - 5 : Practice sessions

Practical - 6 : Communication Skills 2: framing sentences

Practical - 7 : Practice sessions

Practical - 8 : Writing Skills 2: Write basic Japanese and practice

Recommended Reading

1. Marugoto Starter (A1) Rikai - Course Book for Communicative Language Competences, by the Japan Foundation, Goyal Publishers & Distributors Pvt. Ltd (ISBN: 9788183078047)
2. Japanese Kana Script Practice Book – Vol. 1 Hiragana, by Ameya Patki, Daiichi Japanese Language Solutions (ISBN: 9788194562900)

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-5 **Course : Art of Theatre**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objectives

The course aims to develop in the students, an actor's craft through physical and mental training.

Course Outcomes

On completion of the course, students will be able to achieve the following:

CO1: Understand and synthesize the working of the prominent genres of theatre across the world.

CO2: Apply the skill of voice and speech in theatre and public speaking

CO3: Apply the art of acting and also develop generic skills such as confidence, communication skills, self- responsibility, motivation, commitment, interpersonal skills, problem solving, and self-discipline.

CO4: Apply skills acquired related to technical/production aspects of theatre and also develop problem solving and interpersonal skills.

Syllabus

Practical 1: Orientation in theatre

Practical 2: Voice and Speech training

Practical 3: Voice and Speech training: practice sessions

Practical 4: Art of acting

Practical 5: Art of acting: practice sessions Practical 6: Art of script writing

Practical 7: Art of script writing: practice sessions Practical 8: Final performances

Reference Books

1. Boleslavsky, R. (2022). Acting: The First Six Lessons (1st ed., pp. 1-92). Delhi Open Books.
2. Shakthi, C. (2017). No Drama Just Theatre (1st ed., pp. 1-171). Partridge.
3. Bruder, M., Cohn, L. M., Olnek, M., Pollack, N., Previto, R., & Zigler, S. (1986). A Practical Handbook for the Actor (1st ed.). Vinatge Books New York.

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-6 **Course : Introduction to French Language**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

To help build a foundation and interest in French language so that the students can pursue the proficiency levels of the language in higher semesters.

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

CO1 : Demonstrate basic knowledge about France, the culture and similarities/differences between India and France

CO2 : Learn to use simple language structures in everyday communication.

CO3 : Develop ability to write in basic French about themselves and others.

CO4 : Develop ability to understand beginner level texts in French

Syllabus

List of Practicals

Practical-1: Orientation about France, the language, and culture

Practical-2: Communication Skills 1: Vocabulary building for everyday conversations

Practical -3: Practice sessions

Practical-4: Reading and writing Skills : Reading and writing simple text in French

Practical-5: Practice sessions

Practical-6: Communication Skills 2: listening comprehension

Practical-7: Practice sessions

Practical-8: Writing Skills: Write basic French and practice

Recommended Reading

1. 15-minute French by Caroline Lemoine
2. Cours de Langue et de Civilisation Françaises by G. Mauger Vol. 1.1
3. Cosmopolite I by Natalie Hirschsprung, Tony Tricot

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-7 **Course : Introduction to Spanish Language**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

To help build a foundation and interest in Spanish language so that the students can pursue the proficiency levels of the language in higher semesters.

Course Outcomes

On successful completion of the course the students will be able to achieve the following:

CO1 : Demonstrate basic knowledge about Spain, the culture and similarities/differences between India and France

CO2 : Learn to use simple language structures in everyday communication.

CO3 : Develop ability to write in basic Spanish about themselves and others.

CO4 : Develop ability to read and understand beginner level texts in Spanish

Syllabus

List of Practicals

Practical-1: Orientation about Spain, the language, and culture

Practical-2: Communication Skills 1: Vocabulary building for everyday conversations

Practical -3: Practice sessions

Practical-4: Reading and writing Skills: Reading and writing simple text in Spanish

Practical-5: Practice sessions

Practical-6: Communication Skills 2: listening comprehension

Practical-7: Practice sessions

Practical-8: Writing Skills: Write basic Spanish and practice

Recommended Reading

1. 15-Minute Spanish by Ana Bremon
2. Aula Internacional 1 by Jaime Corpas ,Eva Garcia, Agustin Garmendia.
3. Chicos Chicas Libro del Alumno by María Ángeles Palomino

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-8 **Course : Art of Painting**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

Painting is fundamentally about learning to see, and to transport that vision onto paper through a variety of mark making techniques. This course aims to develop basic skills of students in painting to lay a foundation for them as a hobby and/or a profession.

Course Outcome

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of painting.

CO2: Train the eye and hand to develop sense of balance, proportion and rhythm.

CO3: Develop the ability to observe and render simple natural forms.

CO4: Enjoy the challenging and nuanced process of painting.

Syllabus

Practical 1: Orientation in Painting tools & basics of lines, shapes, light, shadows and textures

Practical 2: The art of observation how to see shapes in drawing

Practical 3: Introduction Water color how to handle water paints

Practical 4: Introduction to acrylic colors how to handle acrylic paints

Practical 5: Explore layering paint and capturing the quality of light with paint.

Practical 6: Create landscape painting

Practical 7: Create Abstract painting

Practical 8: Paint on Canvas (try to recreate any famous painting)

Reference Material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Alla Prima II Everything I Know about Painting--And More by Richard Schmid with Katie Swatland
3. Daily Painting: Paint Small and Often To Become a More Creative, Productive, and Successful Artist by Carol Marine

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-9 **Course : Art of Drawing**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

Drawing is fundamentally about learning to see, and to transport that vision onto paper through a variety of mark making techniques. This course aims to develop basic skills of students in drawing to lay a foundation for them as a hobby and/or a profession.

Course Outcome

At the end of the course the students will be able to achieve the following:

CO1: Become familiar with the basic methods, techniques & tools of drawing.

CO2: Train the eye and hand to develop sense of balance, proportion and rhythm.

CO3: Develop the ability to observe and render simple natural forms.

CO4: Enjoy the challenging and nuanced process of drawing.

Syllabus

Practical 1: Orientation in Drawing tools & basics of lines, shapes, light, shadows and textures

Practical 2: The art of observation how to see shapes in drawing

Practical 3: One/two-point basic linear perspective

Practical 4: Nature drawing and landscapes Practical 5: Gestalt principles of visual composition

Practical 6: Figure drawing: structure and proportions of human body

Practical 7: Gesture drawing: expression and compositions of human figures

Practical 8: Memory drawing: an exercise to combine the techniques learnt

Reference material

1. Drawing made easy by Navneet Gala; 2015th edition
2. Perspective Made Easy (Dover Art Instruction) by Ernest R. Norling

Semester I
Department of Mechanical Engineering

Course Code : HUP1003-10 **Course : Nature Camp**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objective

To create an opportunity for the students to develop affinity with nature and thus subsequently impact their ability to contribute towards sustainability of nature.

Course Outcome

After the completion of the course the students will be able to do the following:

CO1: Develop an affinity with nature by observing and understanding it marvels with guidance from experts

CO2: Develop an understanding of the challenges and solutions associated with nature and its conservation.

Course content

In collaboration with the Forest Department and/or a local NGO working in the field of environment conservation, this course would be conducted in 24 hours. Students will be taken to a tiger reserve in Vidrabha region or Forest fringe villages or work with an NGO from Vidarbha region working on natural resource management. The camps (for 2 days) will cover any one of the following topics as decided by the course coordinator:

1. Awareness about each element of biodiversity (camps on moths, butterflies, birds, other wildlife etc.)
2. Environment management (water, forest, wildlife) – practices of Forest Department in managing a tiger reserve, and other aspects of water and forest conservation.
3. Sustainable natural resource management - initiatives by rural communities and local NGOs 4. Man- animal conflict and solutions (socio-economic and technical) – role of local communities and Forest Department
5. Traditional practices in environment conservation – role of local communities and local NGOs

Semester I
Department of Mechanical Engineering

Course Code : PEP0001-21 **Course : Disaster Management through Adventure Sports**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objectives

To enable the student:

1. To inculcate rational thinking and scientific temper among the students.
2. To develop critical awareness about the social realities among the students.
3. To build up confidence, courage and character through adventure sports.

Course Outcomes

On completion of the course, students will be able to:

1. Understand the meaning and importance of Adventure sports.
2. Learn the various types of adventure sports, the equipment and resources required to practice disaster Management activities.
3. Learn the safety measures about different risk and their management.
4. To apply Disaster management theory to institutional & societal problems and situations.

Course Content

1. Basic adventure
2. First AID
3. Various types of knots
4. Shelter making
5. Disaster management
6. Team building and goal setting
7. Realization of fear, risk and their roles and analyzing safety Management Plan.

Semester I
Department of Mechanical Engineering

Course Code : PEP0001-22 **Course : Self-defence Essentials and Basics Knowledge of Defence Forces**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

On completion of the Course the student will be able to:

1. Understand the meaning, need and fitness requirements to implement self-defence.
2. Learn the basic techniques of selected combative sports.
3. Learn to prepare basic Physical Training for Defence forces.
4. Implement survival techniques during emergencies.

Course Content

1. General conditioning and self-defence specific conditioning.
2. Applications of techniques of combative sports for self-defence.
3. Self-defence techniques for specific situations: chain snatching, knife or stick attack, holding from back or front etc.
4. Basic Military Knowledge and exposure making students Confident, bold, disciplined and trains them to join Armed Forces.

Semester I
Department of Mechanical Engineering

Course Code : CHP0001-31 **Course : Art of Indian Traditional cuisine**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Outcome

At the end of the course the students will be able to achieve the following:

CO1: Understand the factors that affect regional eating habits and the unique ingredients found in various states of India

CO2: Get insight to prepare popular dishes from various regions of India.

Module 1: Indian Regional foods and snacks - factors effecting eating habits.

Module 2: Indian gravies – ingredients, their importance

Module 3: Indian Sweets - ingredients, their importance

Module 4: Presentation of Indian Meals, Menu Planning, Food Costing Module 5: Food Preservatives and Safety

List of Experiments

1) Introduction to cookery : does and don'ts
2) Introduction to Indian cuisine, philosophy and classification.
3) Regional influence on Indian Food- factors affecting eating habits
4) Preparation of Garam masala and or Chat masala with ingredients and their importance
5) Preparation of different gravies such as white, yellow or brown gravies with ingredients and theirimportance
6) Preparation of Indian sweets like Besan ke laddu with ingredients and their importance
7) Presentation of meal, Menu planning and Food costing
8) Common chemical food preservatives and their safety standards.

Reference Books

1. Arora, K.,; Theory of cookery; First Edition, Frank Brothers Company (Pub) Pvt. Ltd., 2008 ISBN:9788184095036, 8184095031
2. Philip, Thangam . E.,; Modern Cookery: Vol. 1; Sixth Edition, Orient BlackSwan., 2008 ISBN:9788125040446, 8125040447ali
3. Parvinder S;Quantity Food Production Operations and Indian Cuisine (Oxford Higher Education); FirstEdition; Oxford University Press, 2011 ISBN 10: 0198068492 ISBN 13: 9780198068495
4. Singh, Yogesh; A Culinary Tour of India; First Edition I.K. International Publishing House Pvt. Ltd. ISBN 978-93-84588-48-9
5. Singh Shakesh; Simplifying Indian Cuisine; First Edition, Aman Publications, ISBN81- 8204-054-X
6. Dubey Krishna Gopal; The Indian Cuisine;PHI Learning Pvt. Ltd.ISBN978-81 203- 4170-8

Semester I
Department of Mechanical Engineering

Course Code : CHP0001-32 **Course : Introduction to Remedies by Ayurveda**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Outcome

At the end of the course the students will be able to achieve the following

CO1: Know basic principle of Ayurvedic formulations.

CO2: Different types of Natural Remedies.

CO3: Basic idea about their Characterization

Module 1- Introduction to Ayurveda

Module 2- Different types of Ayurvedic formulations: Churn, Bhasma, Vati, Tailum

Module 3- Introduction to Methods of preparation

Module 4 - Characterization, applications

Practicals based on above Syllabus

1) Preparations of some medicinal oils like Bramhi tel, Bramhi Awala, Vatnashak Tel, Bhurngraj Tel etc.
2) Preparation of Churn, like Trifala Churn, Hingastak Churn, Trikut Churn etc.
3) Preparation of some Bhasmas and vati

Books

1) Chemistry and Pharmacology of Ayurvedic Medicinal Plants by Mukund Sabnis, Chaukhambha Amarbharati Prakashan.
2) Everyday Ayurveda by Shailesh Rathod
3) A text Book of Rasashastra by Vikas Dhole and Prakash Paranjpe
4) A text Book of Bha ajya Kalpana Vij¯nana

Books

1) Chemistry and Pharmacology of Ayurvedic Medicinal Plants by Mukund Sabnis, Chaukhambha Amarbharati Prakashan.
2) Everyday Ayurveda by Shailesh Rathod
3) A text Book of Rasashastra by Vikas Dhole and Prakash Paranjpe
4) A text Book of Bhaiajya Kalpana Vij¯nana

Semester I
Department of Mechanical Engineering

Course Code : HUT1004 **Course : Universal Human Values**

L : 1 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 1**

Course Objectives

- To help the student see the need for developing a holistic perspective of life
- To sensitize the student about the scope of life – individual, family (inter-personal relationship), society and nature/existence.
- To strengthen self-reflection.
- To develop more confidence and commitment to understand, learn and act accordingly.

Course Outcome

On completion of course, students will be able to achieve the following:

CO1: Develop a holistic perspective of life

CO2: Better understanding of inter-personal relationships and relationship with society and nature.

CO3: An ability to strengthen self-reflection

Syllabus

Unit 1: Aspirations and concerns

Need for Value Education: Guidelines and content of value education. Exploring our aspirations and concerns: Knowing yourself, Basic human aspirations Need for a holistic perspective, Role of UHV; Self-Management: harmony in human being

Unit 2 : Health

Harmony of the self and Body, Mental and physical health; Health for family, friends and society.

Unit 3 : Relationships and Society

Harmony in relationships, Foundational values: Trust, Respect, Reverence for excellence, Gratitude and love; harmony in society; harmony with nature.

Reference Material

The primary resource material for teaching this course consists of.

Text Book

1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and professional Ethics, Excel books, New Delhi, 10030, ISBN 978-8-174- 46781-2

Reference Books

1. B L Bajpai, 2004, Indian Ethos and Modern Management, New Royal Book Co., Lucknow. Reprinted 2008.
2. PL Dhar, RR Gaur, 1990, Science and Humanism, Commonwealth Purblishers.
3. Sussan George, 1976, How the Other Half Dies, Penguin Press. Reprinted 1986, 1991
4. Ivan Illich, 1974, Energy & Equity, The Trinity Press, Worcester, and HarperCollins, USA
5. Donella H. Meadows, Dennis L. Meadows, Jorgen Randers, William W. Behrens III, 1972, limits to Growth, Club of Rome's Report, and Universe Books.
6. Subhas Palekar, 2000, How to practice Natural Farming, Pracheen (Vaidik) Krishi Tantra Shodh, Amravati.
7. A Nagraj, 1998, Jeevan Vidya ek Parichay, Divya Path Sansthan, Amarkantak.
8. E.F. Schumacher, 1973, Small is Beautiful: a study of economics as if people mattered, Blond & Briggs, Britain.
9. A.N. Tripathy, 2003, Human Values, New Age International Publishers.

Semester II
Department of Mechanical Engineering

Course Code : CHT2004 **Course : Chemistry for Mechanical Engineers**

L : 2 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 2**

Course Outcomes

After completing the course, the students will be able to:

1. Apply the knowledge of chemistry in water and wastewater technology and suggest the method of its treatment.
2. Explain the recent trans-formative technique for harnessing the energies and its applicability.
3. Identify techniques for the analysis of the materials and apply their knowledge for their qualitative and quantitative analysis.
4. Explain the principles of nanomaterials and polymers and their applications in various fields including the non-renewable and sustainable energy sources as well as deterioration of steel dues to atmospheric reactions.

Unit - I : Water Technology

Introduction, sources and impurities, Hardness of water, Alkalinity of Water, Process for Potable water, Membrane technology: Desalination of seawater by reverse osmosis using Polysulfone membrane, Softening of Water for Boiler Feed Water using Ion-Exchange Resins.

Unit - II : Energy Storage

Batteries: Classification of batteries, components, constructions and working of Li-ion battery (Li-CoO2).

Fuel Cell: Introduction, construction and working of Hydrogen-Air and Methanol-Oxygen Fuel Cell.

Green Fuel: Hydrogen production (Photocatalytic water splitting), storage and its applications.

Solar Energy: Introduction, photovoltaic cells, construction and working of dye sensitized solar cell.

Fuels: Knocking in IC engines, octane and cetane number, flash and fire point.

Unit - III : Characterization of Materials using Analytical Techniques Fundamentals of spectroscopy, Electromagnetic spectrum Spectroscopic methods: UV-visible spectroscopy- Beer's law, Double Beam spectrophotometer, Instrumentation,

NMR Spectroscopy: Principle, Chemical Shift, Splitting of signals and applications of NMR. Electron microscopy: Scanning electron microscopy (SEM), Tunneling electron microscope, Instrumentation, applications.

Unit - IV : Engineering Materials and Corrosion Science

Nanomaterials: Introduction, Size-dependent properties (Surface area to volume ratio, optical and catalytic properties), classification of nanomaterials, Synthesis of nanomaterials, Top Down and Bottom-up approach, application of nanomaterial in energy and hydrogen storage.

Polymers: Classification, properties and various important polymers for solar panels, etc.

Corrosion of Steel: Introduction, Types of Corrosion, Prevention of Corrosion.

Text Books

1. Text Book of Engineering Chemistry, S. S. Dara, S. Chand and Company Ltd., New Delhi.
2. Textbook of Engineering Chemistry, P. C. Jain and Monica Jain, Dhanpat Rai and Sons, New Delhi.
3. Text Book of Environmental Chemistry and Pollution Control, S. S. Dara; S. Chand and Company Ltd., New Delhi.
4. Textbook of Engineering Chemistry, S. N. Narkhede, R. T. Jadhav, A. B. Bhake, A.U. Zadgaonkar, Das Ganu Prakashan, Nagpur.
5. Applied Chemistry, A. V. Bharati and Walekar, Tech Max Publications, Pune.
6. Shikha Agrawal , Engineering Chemistry : Fundamentals and Applications, Cambridge University Press.
7. Dr. Rajshree Khare, A Textbook of Engineering Chemistry(AICTE), S.K. Kataria & Sons

Reference Books

1. Engineering Chemistry by Gyngell, McGraw Hill Publishing Company, New Delhi.
2. Engineering Chemistry (Vol I), Rajaram and Curiacose, Tata McGraw Hill Publishing Company, New Delhi.
3. Engineering Chemistry (Vol II), Rajaram and Curiacose, Tata McGraw Hill Publishing Company, New Delhi.
4. Engineering Chemistry, Saraswat and Thakur, Vikas Publication, New Delhi.
5. Engineering Chemistry, B. S. Sivasankar, Tata Mcgraw Hill Publishing Company, New Delhi.
6. Engineering Chemistry, O. G. Palanna, Tata Mcgraw Hill Publishing Company, New Delhi.
7. Engineering Chemistry, R. Shivakumar, Tata Mcgraw Hill Publishing Company, New Delhi.
8. C. N. R. Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH, 2004.

Semester II
Department of Mechanical Engineering

Course Code : CHP2004 **Course : Chemistry Lab for Mechanical Engineers**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

After completing the course, the students will be able to

CO1: Identify the various impurities present in water and waste water samples and quantitatively estimate their amount.

CO2: Apply the knowledge of chemical principles for safe handling and uses of hazardous chemicals, and liquids fuels on the basis of their physical and chemical properties.

CO3: Demonstrate various analytical/spectroscopic tools for qualitative and quantitative analysis.

List of Experiments

1. Handing of various glassware, apparatus and Materials safety data sheets (MSDS) of hazardous materials.
2. To determine the types and extent of alkalinity in water/wastewater samples.
3. To estimate temporary, permanent, and total hardness in the water sample.
4. Estimation of copper in brass (Cu metal alloy) sample by using iodometry principles.
5. Determination of viscosity of lubricating oil using Redwood-Viscometer.
6. Determination of pH, turbidity and suspended solids in water/wastewater samples.
7. Determination of flash point of liquid fuel using Open Flash Point apparatus.
8. Determination of flash point of liquid fuel using closed Flash Point apparatus.
9. Quantitative analysis using Lambert-Beer's law using electronic spectroscopy.
10. Estimation of Ferrous and Ferric ions.
11. Prediction of H-NMR using open-online software tools.
12. Determination of the Acid value of an oil.
13. Determination of the Saponification value of an oil.
14. Determination of Chemical Oxygen Demand (COD) of water/wastewater sample.

Text Books

1) A Textbook on Experiments and Calculations in Engineering Chemistry by S. S. Dara, S. Chand Publications.

2) Advanced Practical Physical Chemistry by J. B. Yadav, Krishna's Prakashan Media (P) Limited.

Reference Books

1) Collection of Interesting General Chemistry Experiments, A by A. J. Elias, Universities Press Publications.

Semester II
Department of Mechanical Engineering

Course Code : MAT2001 **Course : Applied Mathematics - II**

L : 2 Hrs, T : 1 Hr., P : 0 Hrs Per Week **Total Credits : 3**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will able to:

1. Interpret the solutions of system of linear equations and use the concepts of Eigen values, Eigen vectors to find diagonalization of matrices, reduction of quadratic form to canonical form.
2. Evaluate definite and improper integrals using Beta, Gamma functions. Also trace Cartesian curves.
3. Solve multiple integration by change of order, change of variable methods and apply it to find area, volume, mass and center of gravity.
4. Understand geometric meaning of gradient, curl, divergence
5. Perform line, surface and volume integrals of vector-valued functions. Analyze and compare different sets of data and classify the data by means of diagrams and graph.

Syllabus

Module 1: Matrices (8 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms, Introduction to n-dimensional space.

Module 2: Integral Calculus: (8hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

Module 3: Multiple Integrals (10 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module 4: Vector Calculus (Differentiation) (7hours)

Scalar point function, Vector point function, vector differentiation, gradient, divergence and curl, directional derivatives with their physical interpretations, solenoidal and irrotational motions, Scalar potential function.

Module 5: Vector Calculus (Integration) (7 hours) (All Branches except Biomedical Engineering)

Vector integration: Line integrals, work done, conservative fields, surface integrals and volume integrals, Stoke's theorem, Gauss divergence theorem, Green's theorem and their simple applications.

OR

Module 5: Descriptive Statistics (7- Lectures)(Only for Bio-Medical Engineering)

Types of statistical data: categorical, ranked, discrete, and continuous. Distinction between univariate, bi- variate, and multivariate statistics, Visualization techniques such as joint contingency tables, scatter plots, 2D histograms and line graphs, Measures of central tendency and Dispersion.

Topics for self-learning

Rolle's theorem, Mean value theorems, Indeterminate forms, Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 10030.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
6. Biomedical Statistics -Shantikumar Yadav, Sompal Singh, Ruchika Gupta
7. Theory and Problems of Probability and Statistics - M.R. Spiegal (Mc Graw Hill) Schaum Series.

Semester II
Department of Mechanical Engineering

Course Code : MET2001 **Course : Thermal and Fluid Sciences**

L : 3 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 3**

Course Objectives

The objective of the course is to learn the fundamentals of Engineering Thermodynamics and fluid mechanics.

Course Outcomes

The students will be able to

1. Demonstrate an understanding of the fundamental laws and key terminology in thermodynamics.
2. Apply knowledge of thermodynamics to estimate heat and work transfer using steam as the working medium.
3. Evaluate the air standard cycles and vapor cycles, demonstrating the ability to analyze their performance and characteristics.
4. Understand the different types and properties of fluids, and apply various methods to measure pressure.
5. Analyze the principles of buoyancy and flotation to assess the stability of floating bodies and apply hydrostatic laws to submerged surfaces.
6. Comprehend the types of fluid flows and assess fluid flow kinematics

Syllabus

Unit - I : Introduction to Thermodynamics

Basic concepts and laws of Thermodynamics and their applications. Ideal Gas equation of state, Internal energy and specific heats of gases, Universal Gas Constant.

Unit - II : Properties of Steam

Formation of Steam, Application of Steam Table, Dryness fraction, Internal energy of steam, T-S diagram, Mollier chart. Work and Heat transfer during various Thermo dynamics processes with steam as working fluid. Determination of dryness fraction using various calorimeters, Properties of gases and gas mixtures.

Unit - III : Air Standard Cycles

Otto and Diesel cycle, Vapour Cycles: Simple and Modified Rankine cycle with reheat & regeneration, Binary cycle. Refrigeration cycles.

Unit - IV : Introduction to Fluid Mechanics

Properties & Types of fluids. Concept and measurement of Fluid pressure.

Unit - V : Hydrostatics

Pascal's Law, Forces on submerged plane, inclined, curved surfaces. Relating Buoyancy & Flotation to Stability of floating and submerged bodies.

Unit - VI : Kinematics of Fluid Flow

Types of flow. Continuity equation in Cartesian Coordinates, Velocity and Acceleration at a point. Stream function & Velocity potential function, Stream line, equipotential lines, Path line, Streak line, Stream tube.

Text Books

1. Engineering Thermodynamics: P. K. Nag, Tata McGraw Hill Education; 6thedition, 10037.
2. Thermodynamics-An Engineering approach: Yunus A. Cengel, Michael A. Boles, McGraw Hill Education; 8th edition, 10037
3. Fluid Mechanics: Fundamentals and Applications, Yunus A. Çengel, John M. Cimbala, McGraw-Hill Education, 10038 4th Edition
4. Fluid Mechanics: Som & Biswas - McGraw Hill Education, 3rd edition, 10037

Reference Books

1. Fundamentals of Engineering Thermodynamics: Michael J. Moran, Howard N. Shapiro, Wiley, 8th edition, 10034
2. Basic Engineering Thermodynamics: Rayner Joel, Longman; 5th edition, 1996
3. Fluid Mechanics, F. M. White, Henry Xue, McGraw Hill; 9thEdition, 2021

Semester II
Department of Mechanical Engineering

Course Code : MET2002 **Course : Theory of Mechanisms & Elasticity**

L : 3 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 3**

Course Objective

To impart the basic knowledge the machines and mechanisms as well as mechanics of material

Course Outcome

1. Describe the functioning of a machine, the relationship between the number of links and joints and to determine its mobility.
2. Explain the inversions of mechanism and their applications.
3. Classify and synthesize the cams for different follower motions.
4. Understand basic concept of stress, strain and their relations based on linear elasticity, material behavior due to different types of loading.
5. Learn analytical and graphical analysis of compound stresses and analysis of strain energy.
6. Develop shear force – bending moment diagram of beams under different loading conditions & support conditions and analyze bending & shear stresses in beams.

Unit - I : Basics of Mechanisms and Machines

Basics of Mechanisms and Machines: Basic concept of mechanism, link, kinematics pairs, kinematics chain, mechanism, machine, simple & compound chain, Degree of freedom, Kutzbach's theory, Grubber's criterion. Harding's notations, Class-I & Class-II mechanisms (8)

Unit - II : Applications of Inversion of Mechanisms

Inversions and applications of a four bar chain, single slider crank chain and double slider chain. Limiting positions, Mechanical advantage, Transmission angle, various types of mechanism such as Geneva wheel, Pawl and ratchet mechanism, and mechanism used in various toys, Introduction to Belt drive, Chain drive and gear drives (7)

Unit - III : Cams and Followers

Classification of cams and followers- Terminology and definitions- Displacement diagrams-uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions, and pressure angle and its significance, radial follower and offset followers (7)

Unit - IV : Concept of simple stresses and strains

Concept of Elasticity, types of stresses, Hooke's law, stress and strain diagram; statically indeterminate systems, elastic constants and their relations; Factor of safety Thermal stresses and strain.

Unit - V : Compound stresses and strain

Normal and shear stress on inclined plane, principal stresses and principal planes, maximum shear stresses, Mohr's circle.

Strain energy: Strain energy stored in a body subjected to axial loading, & impact loading.

Unit - VI : Shear force and bending moment

Relation between load, shear force and bending moment, Shear force and bending moment diagrams for different types of beams subjected to different types of loads.

Text Books

1. Theory of Machines: S.S. Rattan, Tata McGraw Hill Publishers, 3rd edition onwards
2. Strength of Materials by S.S. Rattan, McGraw-Hills Education (India) Publication, India.
3. Strength of Materials by S.S. Bhavikatti, Vikas Publishing house, Noida, India.

Reference Books

1. Kinematics & Dynamics of Machinery: R. L. Norton Tata McGraw Hill Publishers
2. Mechanism and Machine Theory: J. S. Rao & Rao V. Dukkipati, New Age International
3. Strength of Materials by F. L. Singer, Harper and row Publication.
4. Engineering Mechanics of Solid by Egor P. Popov, Prentice Hall of India Publication.

Semester II
Department of Mechanical Engineering

Course Code : EET2001 **Course : Basics of Electrical and Electronics Systems**

L : 3 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 3**

Course Objectives

The objective of this course is to provide mechanical engineering students with a comprehensive understanding of electrical and electronics principles and their application in electromechanical systems.

Additionally, the course will explore various case studies to demonstrate the real-world applications of these concepts in industries such as automation, electric vehicles, and medical devices.

Course Outcomes

After the completion of the course, students will be able to:

CO1: Explain the basics of Electrical systems and various components.

CO2: Identify the various components in Electro-mechanical systems.

CO3: Classify the types of power converters as per the applications.

CO4: Select the battery for specific application.

Syllabus

Introduction to Electrical System

DC Circuits : Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with DC excitation.

AC Circuits : Representation of sinusoidal waveforms, peak and RMS values. Concept of Impedance, Power, Energy.

Electromechanical Systems

Introduction to electromechanical systems : Basics of electric motors, actuators, and sensors, Design considerations for integrating electrical and mechanical components, Applications of power electronics in mechanical systems. Selection and sizing of motors for mechanical systems, Motor control techniques and applications, introduction to microcontrollers and microprocessors.

Introduction to Power Converters

Basic schematic introduction to power converters, Types of Power converter, AC-DC, DC-DC, DC-AC converters, applications

Energy Storage Systems

Types of Batteries, working principle, Important Characteristics for Batteries, design and selection of battery pack for given application, battery charging, and BMS introduction.

Text Books

1. D. P. Kothariand I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 10030
2. Electrical Technology: B. L. Thereja, S. Chand Publications.
3. Electrical & Electronic Instruments & Measurement by A. K. Sawhney, Dhanpat Rai and Co. 19th Edition, 10035.
4. Mechatronics: Principles, Concepts and Applications, Mahalik N.P., Tata McGraw Hill

Reference Books

1. D. C. Kulshreshtha, "Basic Electrical Engineering", Mc Graw Hill, 2009.
2. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 10031.
3. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.
4. Electronic Instrumentation & Measurement Technique by W.D. Cooper & A.D. Helfrick,
5. Prentice Hall, 3rd revised Edition, 1985.

Semester II
Department of Mechanical Engineering

Course Code : MET2003 **Course : Programming for Problem Solving**

L : 1 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 1**

Course Objective

Course Outcomes

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays to solve various matrix operation, searching, sorting and pointers, Structures for the formulation of algorithms and programs.
4. To understand basics of file operation and to apply various I / O operations for file handling programming.

UNIT - I : Introduction to Programming Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart/ Pseudocode with examples. Arithmetic expressions and precedence

UNIT - II : C Programming Language Introduction to C language : Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if- else statement, Switch case, Loops.

UNIT - III : Arrays and Basic Algorithms Arrays : 1-D, 2-D, Character arrays and Strings. Searching, Basic Sorting Algorithms, Finding roots of equations, example programs (no formal definition required). File handling Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading, writing and closing the file.

Text Books

1. Programming in ANSI C: E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books

1. Programming with C: Byron Gottfried, Schaums Outline Series.
2. Let Us C: Yashwant Kanetkar, BPB Publication

Semester II
Department of Mechanical Engineering

Course Code : MEP2003 **Course : Programming for Problem Solving Lab**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Outcomes

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision-making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C- programming.
3. Understand pointers, structures, unions and apply them to develop programs. Implement file
4. Operations in C programming for a given application

Semester II
Department of Mechanical Engineering

Course Code : HUT2001 **Course : Foundational Literature of Indian Civilization**

L : 2 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 2**

Course Outcome

At the end of the course the students will be able to achieve the following:

CO1: Understand the Indian knowledge system and its scientific approach

CO2: Get introduced to the Vedic corpus and recognize the multi-faceted nature of the knowledge contained in the Vedic corpus

CO3: Understand the salient features of the philosophical systems of the Vedic and non-Vedic schools

CO4: Develop a basic understanding of the ancient wisdom recorded in various Indian literary work

Syllabus

Unit 1: Overview of Indian Knowledge System

Importance of ancient knowledge, defining IKS, IKS classification framework, Historicity of IKS, Some unique aspects of IKS.

Unit 2: The Vedic corpus

Introduction of Vedas, four Vedas, divisions of four Vedas, six Vedangas, Distinct features of Vedic life.

Unit 3 : Indian Philosophical systems

Development and unique features, Vedic schools of philosophy, Samkhya and Yoga School of philosophy, Nayay and Vaisesika school of philosophy, Purva-mimamsa and Vedanta schools of Philosophy, Non-vedic philosophies: Jainism, Buddhism, and other approaches

Unit 4: Indian wisdom through ages

Panchtantras, Purans: contents and issues of interests, Itihasa: uniqueness of the two epics (Ramayan and Mahabharata), Key issues and messages from Ramayana, Mahabharata – a source of worldly wisdom; Indian ancient Sanskrit literature: Kalidas, Vishakadutta, Bhavbhuti, Shudraka**any one text as decided by the course teacher

Reference Material

1. B. Mahadevan, Vinayak Rajat Bhar, Nagendra Pavana R. N., "Introduction to Indian Knowledge System: Concepts and Applications" PHI, 2022
2. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984

Semester II
Department of Mechanical Engineering

Course Code : MET2004 **Course : Fab Lab - I**

L : 1 Hrs, T : 0 Hr., P : 0 Hrs Per Week **Total Credits : 1**

Course Objectives

The Objective of the course is:

1. Identify the different manufacturing process for various workshop trades including fitting, carpentry, smithy/foundry and welding, etc.
2. To get acquainted with the knowledge of various machine tools and equipments.

Course Outcomes

The expected learning outcome is that the students will be able to:

1. Understand casting technique for the production of casted components.
2. Identify an appropriate molding pattern and various carpentry joints.
3. Understand the machining parameters and cutting tool for various machining operations.
4. Distinguish with hot and cold working method for the manufacturing of metal components.
5. Understand various fitting joints and sheet metal operations.
6. Apply the knowledge of suitable joining processes to carry out fabrication work.

Syllabus

Unit - I

Introduction to foundries, metal casting, types of sand, introduction to moulding tools & different casting process.

Unit - II

Introduction to pattern making for metal casting, different types of carpentry tools, holding devices, different types of carpentry joints.

Unit - III

Fundamentals of metal cutting, Lathe machine specification and operations, metal cutting parameters, single point cutting tool.

Unit - IV

Smithy and forging, hot working and cold working of metals, forging tools like chisels, hammers, types of furnaces.

Unit - V

Fitting operations and associated measuring and marking tools, sheet metal operations.

Unit - VI

Metal joining Process, types of welding, mechanics of welding, soldering and brazing.

Text Books

1. Workshop Technology, Volume - I & II - By Hajra Choudhary, Media Promoters & Publishers Pvt. Ltd.
2. Manufacturing Technology, Volume - I & II - P.N. Rao, Tata McGraw Hill Pub. Company, New Delhi.
3. Manufacturing Science - A. Ghosh & A. K. Malik - East West Press Pvt. Ltd. New Delhi.

Reference Books

1. Kalpakjian and Schimd, Manufacturing processes for engineering materials, 5th Edition - Pearson India, 10034.
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and System.
3. Production Engineering - P. C. Sharma, S. Chand and Company Ltd., New Delhi.

Semester II
Department of Mechanical Engineering

Course Code : MEP2004 **Course : Fab Lab - I**

L : 0 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 1**

Course Objectives

The Objective of the course is:

1. To familiarize with major manufacturing process and required Machine Tools.
2. To get acquainted with and hands on experience on machine tools and equipments.

Course Outcomes

The expected learning outcome is that the students will be able to:

1. Prepare a sand mould for casting and perform pattern making.
2. Perform different machining operations on lathe machine and parts fitting job.
3. Apply the knowledge of joining processes to carry out fabrication work.

List of Experiments

Introduction of tools, equipments, material & process along with demonstration and preparation of simple job using various workshop trades such as:

1) Metal casting and molding practice
2) Pattern making practice
3) Machining practices
4) Smithy and forging practice
5) Fitting job practice
6) Welding practice

*Case study: To prepare simple model/ project using various workshop facility (Group Activity)

Text Books

1. Workshop Technology, Volume - I & II - By Hajra Choudhary, Media Promoters & Publishers Pvt. Ltd.
2. Manufacturing Technology, Volume - I & II - P.N. Rao, Tata McGraw Hill Pub. Company, New Delhi.
3. Manufacturing Science - A. Ghosh & A. K. Malik - East West Press Pvt. Ltd. New Delhi.

Reference Books

1. Kalpak Jain and Schimd, Manufacturing processes for engineering materials, 5th Edition - Pearson India, 10034.
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and System.
3. Production Engineering - P. C. Sharma, S. Chand and Company Ltd., New Delhi.

Semester II
Department of Mechanical Engineering

Course Code : PET2001 & PEP2001 **Course : Sports-Yoga-Recreation**

L : 1 Hrs, T : 0 Hr., P : 2 Hrs Per Week **Total Credits : 2**

Aim of the Course

The course aims at creating awareness about the fundamentals of Physical Education, Sports, Yoga, Recreation and its effectiveness to promote Health and wellness through Healthy Lifestyle.

Course Objectives

1. To impart the students with basic concepts of Sports, Yoga and Recreational activities for health and wellness.
2. To familiarize the students with health-related Exercise and evaluate their Health- related Fitness.
3. To make Overall growth & development with team spirit, social values and leadership qualities among students through various sports, games and Yogic activities.
4. To create Environment for better interaction and recreation among students as neutralizer for stress through various minor and recreational games.

Course Outcomes

On completion of the course, students will be able to:

1. Understand fundamental skills, basic principle and practices of sports and Yoga.
2. Practically learn the principles of implementing general and specific conditioning of physical exercises and yoga.
3. Develop Health-related fitness and Body-mind co-ordination through various fitness activities, sports, recreational games and yoga.
4. Practice Healthy & active living with reducing Sedentary Life style.

Course Content

Unit 1: - Theory: Introduction

- Meaning, Definition and Importance of Health & Wellness
- Dimensions of Health and Wellness
- Factors influencing Health and Wellness
- Physical Fitness, Nutrition, Habits, Age, Gender, Lifestyle, Body Types
- Health & Wellness through Physical Activities, Sports, Games, Yoga and Recreation activities
- Causes of Stress & Stress relief through Exercise and Yoga
- Safety in Sports

Unit 2 : Practical- Exercises for Health and Wellness

- Warm-Up and Cool Down - General & Specific Exercises
- Physical Fitness Activities
- Stretching Exercises
- General & Specific Exercises for Strength, Speed, Agility, Flexibility, coordinative abilities
- Cardiovascular Exercises
- Assessment of BMI
- Relaxation techniques
- Physical Efficiency Tests

Unit 3 : Yoga

- Shukshma Vyayam
- Suryanamaskar
- Basic Set of Yogasanas – Sitting, standing, supine and prone position
- Basic Set of Pranayama & Meditation

References

1. Russell, R.P. (1994). Health and Fitness Through Physical Education. USA: Human Kinetics. 2. Uppal, A.K. (1992). Physical Fitness. New Delhi: Friends Publication.
2. AAPHERD "Health related Physical Fitness Test Manual."1980 Published by Association drive Reston Virginia
3. Kumar, Ajith. (1984) Yoga Pravesha. Bengaluru: Rashtrothanna Prakashana.
4. Dr. Devinder K. Kansal, A Textbook of Test Evaluation, Accreditation, Measurements and Standards (TEAMS 'Science)

Bridge Courses : Finishing School Certificate for a UG certificate course on Industry 4.0 Technologies			
In association with TATA-Technologies Ltd (Additional 8 Credits)			
	1	Certificate courses in association with TATA - Technologies Ltd on	Offline certification Course offered by RCOEM-TATA-CIIIT
	RTC01	Basics of Solid Modeling	13 Hrs. - 1 Credit each (any 8 to be selected)
	RTC02	3-D Printing	
	RTC03	Reverse Engineering	
	RTC04	Multi Body Dynamics (MBD)	
	RTC05	Internet of Things	
	RTC06	CNC Operations and Programming	
	RTC07	Finite Element Analysis	
	RTC08	Manufacturing Execution System	
	RTC09	Robotic Welding	
	RTC10	AutoCAD Drafting	
	RTC11	Profile engraving and Laser cutting (SIL)	
	RTC12	Electro Discharge Machining (P 20)	
	RTC13	Solar Technician	
	RTC14	Computer proficiency	
OR	2	One Month Internship at Industry	As prescribed by Industry
OR	3	Project Work (one month)	As prescribed by Industry/Institute

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC01 **Course : Basics of Solid Modeling**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

Course Contents

- Introduction to Design Tools - CAD (CATIAv6/Delmia V5)
- Concept Creation and 3D Modelling
- Detail Design & Engineering
- Introduction to GUI & Getting Started with CATIA
- Sketcher, Workbench Pad, Shaft, pocket & RP
- Drawing Shapes, Modifying sketch and constraints
- Part Design Workbench Practice example
- Sketch based and dress-up features, Holes & Fillet
- Transformation features, Practice example
- Design for Assembly and Design for Manufacturing.

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC02 **Course : 3-D Painting**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

Course Contents

- Intro to Product Design Development
- Introduction to 3D Printing Technology
- Geometric/solid modeling
- Facet generation and File types Obj, Stl, Prt etc
- Slicing softwares, Cura
- Part orientations and Slicing considerations
- Slicing parameter settings
- 3-D Printing materials PLA, ABS, TPU, Wood

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC03 **Course : Reverse Engineering**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Introduction to Reverse Engineering
- Geometry acquisition Hardware and software
- 3D Scanner and Data Processing
- Inspection Software
- Hands-on on Reverse Engineering Software
- live Scan technology EinScan- 3D Scanner
- real-time data capture with 3D scanner
- Scanning / Inspection software. EinScan- 3D
- 3D Scanning (Laser and White / Blue Light)
- Scanned Data to 3D Model, clean up tools
- Convert raw 3D scan data into high quality models
- 3D Inspection & Drag and drop Report generation

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC04 **Course : Multi Body Dynamics (MBD)**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Introduction to MSC Adams
- Starting a New Modelling Session
- Setting up the Model/ Session Parameters
- Setting up Coordinate Systems & amp,
- Define and Connect the Moving parts with Joints
- Run the Simulation & review the results
- Simulating a Four Bar Mechanism
- Simulating a Five Bar Mechanism
- Simulating a Single slider Crank Mechanism

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC05 **Course : Internet of Things**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Distinguish the IoT from other related technologies.
- Different types of sensors and actuators
- Explain the IoT architectures.
- Apply the IoT architecture concepts for specific IoT applications.
- Understand the implementation aspect of IoT architecture.
- IoT Applications using Arduino IDE (Home Automation/Agriculture etc.).

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC06 **Course : CNC Operations and Programming**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Introduction to Various Manufacturing Processes
- Introduction to Advance Manufacturing Processes
- Fanuc interface and operating panel
- CNC Programming and Milling operations
- CNC Programming and Turning operations
- G-Codes & M-Codes for Milling & Turning
- CNC Programming for Drilling operations

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC07 **Course : Finite Element Analysis**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Basics of Strength of Material
- Introduction to Geometric Model & FE Model
- Introduction to Finite Element Analysis (FEA)
- Introduction to MSC NASTRAN and PATRAN
- Linear static structural analysis
- Modal Analysis (Free-Free Run)
- Linear Static Analysis

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC08 **Course : Manufacturing Execution System**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Introduction to MES, Objective MES, Benefits
- Discrete, Continuous & Batch Manufacturing
- Manufacturing Organization Structure
- MES functionality, Integration of Business Layer
- Integration of Shop floor system
- MES Components and Systems Introduction
- Automation & Process Control, Automation Purpose
- Sensors and Actuators - Limit Switch, Prox. Sensor
- Integration of PLC, Conveyor Belt, Sensors.

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC09 **Course : Robotic Welding**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

Course Objective

The aim of the course is to help the student to attain the industry identified competency through various teaching learning experiences.

- Basics of Industrial Robotics
- Various applications in industries
- Introduction to Yasakawa Arc welding Robot
- Product Description and Specifications: ROBOTS
- Robot Transport and Installation
- Operation of ROBOT: ROBOT Programming
- Basic & logical command used in program

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC010 **Course : AutoCAD Drafting**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

The objective of this course id to provide a foundational understanding of AutoCAD's key features. Each segment introduces the basics of AutoCAD setting of units, managing layers. The basic drawing tools are followed by precision tools and the subsequent tools and techniques, building upon the previous knowledge. Ultimately, this course equips students with practical skills and knowledge that are directly applicable in professional settings, enabling them to create accurate, efficient, and standardized technical drawings while preparing them for future advancements in CAD technology and applications.

- **Introduction to AutoCAD**
  Overview of AutoCAD interface
  Basic navigation: Zoom, Pan, Orbit
  Setting up units and drawing limits
  Creating and managing layers
- **Basic Drawing Tools**
  Using line, circle, arc, and polyline tools
  Exploring editing commands: Move, Copy, Rotate, Scale
- **Precision Drawing Techniques**
  Understanding snaps and grid settings
  Applying polar and object snap tracking
- **Working with Text and Annotations**
  Adding and formatting text
  Introduction to dimensioning tools
- **Advanced Editing**
  Exploring trim, extend, fillet, and chamfer commands
  Using grips for editing efficiency
- **Blocks and External References**
  Creating and managing blocks
  Understanding and utilizing external references (Xrefs)
- **Introduction to 3D Modelling**
  Basics of 3D workspace
  Creating simple 3D shapes: extrude, revolve.

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC011 **Course : Profile engraving and Laser cutting**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

The objectives of laser cutting and engraving involve precise material processing through the use of focused laser beams. These techniques aim to achieve high-precision cutting of various materials, including metals, plastics, glass and wood to produce intricate designs.

- Lasers in Manufacturing:
- Fundamentals of Laser Technology
- Laser System: Construction and Types
- Types of Lasers in Material Removal, Process and Performance Parameters
- A Case-study on cutting a Circular Part using CO2 Laser Machine
- Importance and Applications

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC012 **Course : Electro Discharge Machining**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

The objective of course is to covers the details of the advanced machining theory processes. To understand material removal by using plasma ionised column energy for machining of super alloy materials and complex parts with high accuracy by using Electrical Discharge Machining.

- Electrical Discharge Machining (EDM): Working principle, process description.
- Mechanism of material removal, selection of tool electrode and dielectric fluid.
- Process capabilities, limitations, and applications.
- Wirecut electro discharge machining.

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC013 **Course : Solar Technician**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

The course aims to furnish participants with detailed knowledge solar photovoltaic systems. Participants will acquire a solid foundation in the fundamentals solar photovoltaic plants covering component selection based on specific requirements, system installation procedures, and maintenance guidelines

Course Contents

- Introduction to Solar Energy : Basic Terminologies and measuring instruments
- Solar Photovoltaic Technology :
- Construction and working of solar cells and Modules
- Different PV technologies
- Types of Solar PV plants
- Site survey for PV plant
- System Design and Sizing
- Installation Practices
- Maintenance Procedures

13 Hrs/ 1 Credit Courses offered by RCOEM-TATA-CIIIT (RTC)

Course Code : RTC014 **Course : Computer Proficiency**

L: 1 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 01**

The objective of this course is to equip students with a comprehensive and practical understanding of fundamental computer skills, including proficiency in operating systems, office productivity software, internet and email usage, basic troubleshooting, file management, and ethical considerations, empowering them to confidently navigate the digital landscape, efficiently utilize computer resources, and adapt to evolving technologies while promoting responsible and ethical computing practices.

- Introduction to fundamental computer skills.
- Introduction to office productivity software such as MS Word Excel, advanced excel tools etc.
- Data entry and data processing tasks using software like Microsoft Excel or other data management tools.
- Maintaining records, logs, and documentation.
- Develop compelling presentations using software such as Microsoft PowerPoint or Google Slides.
- Collaborate with others through various online tools and platforms, including video conferencing, file sharing, and project management tools.
- Learn about computer ethics, copyright laws, and intellectual property rights related to digital content.

Bridge Courses after First Year B Tech
(For the students of Mechanical Engineering)

The course for a Certified Mechanical Draftsman

Expected Job Roles

Mechanical Draftsman, Technical Assistant, Certified Apprentice

Module 1 – Machine Drawing and Solid Modeling (45 Hrs, 4 Credits)

Contents

UNIT 1 : Conventional representations of standard machine elements like : Bolts, Nuts, Washers, Rivets, and Keys & Couplings. Thread terminology, Types of Threads & their representations. Machining Symbols.

UNIT 2: Limits : Terminology Fits: Types & Applications of fits. Dimensional Tolerance, Geometrical Tolerance.

UNIT 3: Assembly and Dismantling Principles: Study of some Standard Assemblies. Subassembly Drawing, Full Assembly Drawing, Exploded Views. Preparation of Bill of material. Production drawing preparation.

UNIT 4 : Detailing of Drawings, Introduction to drawings, creating new drawings and views, Adding details to drawings, Adding notes to drawings, Adding tolerance and symbols

Module 2 – Technical and Soft Skills (45 Hrs. 4 Credits)

Contents

UNIT1: Overview of Mechanical Engineering – Basic awareness of a Manufacturing Industry, Different types of Materials, Storekeeping, Basics of Safety – Safety at workplace

UNIT2: Tools used in Mechanical Workshop and Machines shops

UNIT2: Technical Communication-Preparing Reports, Minutes of Meeting, Comparative Statements, Quotations, etc.

UNIT3: IT Awareness - Word, Excel, Power Point, Database Management etc.

UNIT4: Soft Skills – Professional work ethics, Discipline,

Other Modules

- Fundamentals of Engineering Mechanics.
- English for Professional Communication
- Universal Human Values
- Fundamentals of Thermal and Fluid Sciences
- Introduction to Theory of Mechanisms and Elasticity
- Basics of Electrical and Electronics Systems
- Basics of Programming for Problem Solving

Text Books

1. Machine Drawing by N. D. Bhat, Charotar Publications
2. Machine Drawing by K. L. Narayan, R. Kannaiah, and K. V. Reddy, New Age Int. Publishers.

OR

Any 8 courses of 1 credit (13 hrs) with support from the External Auditing Agencies

1. Industrial Safety and Risk Assessment Studies
2. Safety Audits
3. Emergency Preparedness and Response Plan
4. Disaster Management Plan
5. Hazard Studies and Fire Load Evaluation
6. Energy Audits, Environmental and Green Audits
7. Six Sigma, Lean Engineering, 7 QC Tools
8. 5-S and Kaizen
9. Design Of Experimentation