Study & Evaluation Scheme

of

Bachelor of Technology
in
Mechanical Engineering

[Applicable for 2022-26]
Version 2022

[As per CBCS guidelines given by UGC]

Approved in BOS	Approved in BOF	Approved in Academic council
14.05.2022	08/08/2022.	10/20/2022. Vide Agenda No. 8.4.1

Quantum University, Roorkee
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Quantum University, Roorkee

Study & Evaluation Scheme Study Summary

Name of the Faculty	Faculty of Mechanical Engineering
Name of the School	Quantum School of Technology
Name of the Department	Department of Mechanical Engineering
Program Name	Bachelor of Technology in Mechanical Engineering
Duration	4 Years
Medium	English

Evaluation Scheme

Type of Papers	**Internal Evaluation (%)**	**End Semester Evaluation (%)**	**Total (%)**
Theory	40	60	100
Practical/ Dissertations/Project Report/ Viva-Voce	40	60	100
Internal Evaluation Components (Theory Papers)			
Mid Semester Examination	60Marks		
Assignment–I	30Marks		
Assignment-II	30Marks		
Attendance	30Marks		
Internal Evaluation Components (Practical Papers)			
Quiz One	30Marks		
Quiz Two	30Marks		
Quiz Three	30Marks		
Lab Records/ Mini Project	30Marks		
Attendance	30Marks		
End Semester Evaluation (Practical Papers)			
ESE Quiz	40Marks		
ESE Practical Examination (write-up)	20Marks		
Viva-Voce	20Marks		
Practical performance	20Marks		

Structure of Question Paper (ESE Theory Paper)

The question paper will consist of 5 questions, one from each unit. Student has to Attempt all questions. All questions carry 20 marks each. Parts a) and b) of question Q1 to Q5 will be compulsory and each part carries 2 marks. Parts c), d) and e) of Q1 to Q5 Carry 8 marks each and the student may attempt any 2 parts.

Important Note:

1. *The purpose of examination should be to assess the Course Outcomes (CO) that will ultimately lead to attainment of Programme Specific Outcomes (PSOs). A question paper must assess the following aspects of learning: Remember, Understand, Apply, Analyze, Evaluate & Create (reference to Bloom's Taxonomy). The standard of question paper will be based on mapped BL level complexity of the unit of the syllabus, which is the basis of CO attainment model adopted in the university.*

2. *Case Study is essential in every question paper (wherever it is being taught as a part of pedagogy) for evaluating higher-order learning. Not all the courses might have case teaching method used as pedagogy.*

3. *There shall be continuous evaluation of the student and there will be a provision of real time reporting on QUMS. All the assignments will evaluated through module available on ERP for time and access management of the class.*

Program Structure – Bachelor of Technology in Mechanical Engineering

Introduction

Bachelor of Technology in Mechanical Engineering syllabus covers all broad areas design, thermal production industrial and the latest technological advancements. It ensures to provide students with an effective learning experience with thought-provoking teaching pedagogy. The curriculum is highly demanding and thoughtfully designed to incorporate all the latest development in the field. The curriculum of Mechanical engineering aims at creating the right mindset which ensures the creation of innovative, thoughtful, and socially aware engineers. We believe in the practical nature of the domain and focus on learning by doing it practically. Students will gain an ability to specify, fabricate, test, operate, validate and complete documentation of any basic mechanical systems or processes. Students will gain an ability to apply the acquired software's skills to design and analysis of advanced mechanical systems or processes.

Towards enhancing employability and entrepreneurial ability of the graduates the Quantum University increase the practical content in the courses wherever necessary. The total number of credits in 8 semesters programme will range from 175 to 187 for all the programmes.

In order to harness regional specialties and to meet region-specific needs the Quantum University modify the content of syllabus as per the regional demands.

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Quantum School of Technology
Department of Mechanical Engineering
Bachelor of Technology in Mechanical Engineering – PC: 01-3-05

CURRICULUM (Batch: 2022-26)

BREAKUP OFCOURSES

Sr. No	CATEGORY	CREDITS
1	Foundation Core (FC)	42
2	Program Core (PC)	73
3	Program Electives (PE)	15 (+ 12Honor)
4	Open Electives (OE)	9
5	Project	14
6	Internship	5
7	Value Added Programs (VAP)	15
8	General Proficiency	7
9	Disaster Preparedness and Management *	2*
TOTAL NO. OF CREDITS		180
TOTAL NO. OF CREDITS (Honors)		192

*Non-CGPA Audit Course

DOMAIN-WISE BREAKUP OF CATEGORY

Domain	Foundation core	Program core	Program elective	Sub total	%age
Sciences	15	-	-	15	8.28
Humanities	4	-	-	4	2.21
Engineering	23	92	15	130	72.37
Open elective				9	4.97
VAP				15	8.28
GP				7	3.86
Disaster Preparedness and Management *				2*	0.0
Grand Total	**42**	**92#**	**15**	**180**	**100**

#Credits of projects and internships included

*Non-CGPA Audit Course

SEMESTER-WISE BREAKUP OF CREDITS

Sr. No	CATEGORY	SEM 1	SEM 2	SEM 3	SEM 4	SEM 5	SEM 6	SEM 7	SEM 8	TOTAL
1	Foundation Core	19	22	1	-	-	-	-	-	42
2	Program Core	-	-	20	17	15	12	9	-	73
3	Program Electives	-	-	(+3H)	(+3H)	(+3H)	3 (+3H)	6	6	15 (+12H)
4	Open Electives	-	-	-	3	3	3	-	-	9
5	Projects	-	-	2	2	2	2	2	4	14
6	Internships	-	-	1	-	2	-	2	-	5
7	VAPs	1	2	2	2	2	4	2	-	15
8	GP	1	1	1	1	1	1	1	-	7
9	Disaster Preparedness and Management *		2*							2*
	TOTAL	**21**	**25**	**27**	**25**	**25**	**25**	**22**	**10**	**180**

H- Honors program

*Non-CGPA Audit Course

Minimum Credit Requirements:

B.Tech. : = 180 Credits
With Honors : 180 +12 = 192 credits

Group B

SEMESTER 1

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
MA3102	FC	Mathematics I	3	2	0	4	1.0	Nil
PS3101	FC	Human Values and Ethics	2	0	0	2	1.0	Nil
CS3103	FC	Basics of Computer and C Programming	4	0	0	4	1.1	Nil
EC3101	FC	Basic Electrical and Electronics Engineering	3	1	0	4	1.1	Nil
CS3140	FC	Basics of Computer and C Programming Lab	0	0	2	1	1.0	Nil
EC3140	FC	Basic Electrical and Electronics Engineering Lab	0	0	3	2	1.0	Nil
ME3145	FC	Engineering Graphics and Design	0	0	4	2	1.0	Nil
VP3101	VP	Communication and Soft Skills-I	0	0	2	1	1.0	Nil
GP3101	GP	General Proficiency	0	0	0	1		Nil
		TOTAL	**12**	**3**	**11**	**21**		

Contact Hrs:26

SEMESTER 2

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
MA3202	FC	Mathematics II	3	2	0	4	1.0	Nil
PH3101	FC	Engineering Physics	3	1	0	4	1.0	Nil
CY3205	FC	Environmental Studies	2	0	0	2	1.0	Nil
ME3103	FC	Fundamentals of Mechanical& Mechatronics Engineering	3	1	0	4	1.0	Nil
CS3207	FC	Advance Computer Programming & Software	3	0	0	3	1.0	Nil
PH3140	FC	Engineering Physics Lab	0	0	2	1	1.0	Nil
CS3245	FC	Advance Computer Programming & Software Lab	0	0	2	1	1.0	Nil
ME3140	FC	Workshop Practice	0	0	3	2	1.0	Nil
VP3201	VP	Communication and Professional Skills-II	1	0	2	2	1.0	Nil
CE3102	FC	Disaster Preparedness and Management *	2	0	0	2*	1.0	Nil
HU3201	FC	Indian Knowledge System	1	0	0	1		
GP3201	GP	General Proficiency	0	0	0	1		Nil
		TOTAL	**19**	**4**	**9**	**25**		

*Non-CGPA Audit Course

Contact Hrs:31

SEMESTER 3

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3308	PC	Strength of Materials	2	2	0	3	1.0	Nil
ME3302	PC	Materials Science	2	0	0	2	1.0	Nil
ME3306	PC	Thermal Engineering	3	2	0	4	1.0	Nil
ME3304	PC	Fluid Mechanics and Machines	3	2	0	4	1.0	Nil
ME3307	PC	Computer aided Machine Drawing	1	0	3	3	1.0	Nil
ME3344	PC	Strength of Material Lab	0	0	2	1	1.0	Nil
ME3341	PC	Material Science Lab	0	0	2	1	1.0	Nil
ME3342	PC	Fluid Mechanics and Machines Lab	0	0	2	1	1.0	Nil
ME3343 / ME3440	PC	Thermal Engineering Lab	0	0	2	1	1.0	Nil
ME3345	P	Project Lab I	0	0	4	2	--	--
VP3301	VP	Communication and Soft Skills-III	1	0	2	2	--	--
ME3371	FW	Internship Presentation I	1	0	0	1	--	--
HU3202	FC	United Nations Development Programme	1	0	0	1		
GP3301	GP	General Proficiency	0	0	0	1	--	--
		TOTAL	**14**	**6**	**17**	**27**		

Contact Hrs: 37

SEMESTER 4

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3404	PC	Heat Transfer	2	2	0	3	1.0	ME3306
ME3402	PC	Theory of Machines	3	2	0	4	1.0	Nil
ME3410	PC	Manufacturing Science I	3	0	0	3	1.0	Nil
ME3603	PC	Measurement and Metrology	3	0	0	3	1.0	Nil
--	OE	Open Elective I	3	0	0	3	--	--
ME3641	PC	Measurement and Metrology Lab	0	0	2	1	1.0	Nil
ME3443	PC	Heat Transfer Lab	0	0	2	1	1.0	Nil
ME3441	PC	Theory of Machines Lab	0	0	2	1	1.0	Nil
ME3447	PC	Manufacturing Science I Lab	0	0	2	1	1.0	Nil
ME3445	P	Project Lab II	0	0	4	2	--	--
VP3401	VP	Employability Skills I(Numerical Ability)	2	0	0	2	--	--
GP3401	GP	General Proficiency	0	0	0	1	--	--
		TOTAL	**16**	**4**	**12**	**25**		

All students are required to attend 04 to 06 weeks Industrial Training after 4th semester. Performance of this training will be evaluated and awarded in 5th semester

Contact Hrs: 32

Open Elective I

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3011	OE	Carbon Emission & Control	3	0	0	3	1.0	Nil
CS3021	OE	Mining and Analysis of Big data	3	0	0	3	1.0	Nil
AG3011	OE	Ornamental Horticulture	3	0	0	3	1.0	Nil
BB3011	OE	Entrepreneurial Environment in India	3	0	0	3	1.0	Nil
JM3011	OE	Media Concept and Process (Print and Electronic)	3	0	0	3	1.0	Nil
HM3011	OE	Indian Cuisine	3	0	0	3	1.0	Nil
MB3011	OE	SAP 1	3	0	0	3	1.0	Nil
EG3011	OE	French Beginner A1	3	0	0	3	1.0	Nil
MT3011	OE	Elementary Robotics	0	0	5	3	1.0	Nil

SEMESTER 5

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3501	PC	Machine Design I	3	2	0	4	1.0	ME3308
ME3510	PC	Manufacturing Science II	2	2	0	3	1.0	Nil
ME3515/ME3715	PC	Industrial Engineering and Management	2	2	0	3	1.0	Nil
ME3504	PC	Vehicle Technology	2	2	0	3	1.0	Nil
--	OE	Open Elective II	3	0	0	3	--	--
ME3547	PC	Manufacturing Science II Lab	0	0	2	1	1.0	Nil
ME3541	PC	Vehicle Technology Lab	0	0	2	1	1.0	Nil
ME3545	P	Project Lab III	0	0	4	2	--	--
VP3501	VP	Employability Skills II (Aptitude and Reasoning)	2	0	0	2	--	--
ME3571	FW	Internship Presentation II	2	0	0	2	--	--
GP3501	GP	General Proficiency	0	0	0	1	--	--
		TOTAL	**16**	**8**	**8**	**25**		

Contact Hrs: 32

Open Elective II

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3013	OE	Environment Pollution and Waste Management	3	0	0	3	1.0	Nil
CS3023	OE	Big Data Analytics: HDOOP Framework	3	0	0	3	1.0	Nil
AG3013	OE	Organic farming	3	0	0	3	1.0	Nil
BB3013	OE	Establishing a New Business	3	0	0	3	1.0	Nil
JM3013	OE	Photo Journalism	3	0	0	3	1.0	Nil
HM3013	OE	Chinese Cuisine	3	0	0	3	1.0	Nil
MB3013	OE	SAP 3	3	0	0	3	1.0	Nil
EG3013	OE	French Intermediate B1	3	0	0	3	1.0	Nil
EG3002	OE	Report Writing	3	0	0	3	1.0	Nil
MT3013	OE	Introduction to Automation	3	0	0	3	1.0	Nil

SEMESTER 6

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3601	PC	Machine Design II	3	2	0	4	1.0	ME3501
ME3610	PC	Entrepreneurship and startup	3	0	0	3	1.0	Nil
MT3607	PC	Mechatronics and Automation	3	0	0	3	1.0	Nil
--	PE	Program Elective I	3	0	0	3	--	--
--	OE	Open Elective III	3	0	0	3	--	--
MT3643	PC	Industrial Automation Lab	0	0	2	1	1.0	Nil
MT3641	PC	Mechatronics Lab	0	0	2	1	1.0	Nil
ME3645	FW	Project Lab IV	0	0	4	2	--	--
VP3601	VP	Employability Skills III(GDPI)	2	0	0	2	--	--
ME3646	VP	Technical VAP I	2	0	0	2	--	--
GP3601	GP	General Proficiency	0	0	0	1	--	--
		TOTAL	**19**	**2**	**8**	**25**		
All students are required to attend 04 to 06 weeks Industrial Training after 6th semester. Performance of this training will be evaluated and awarded in 7th semester								

Contact Hrs: 29

Open Elective III

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
CE3015	OE	Hydrology	3	0	0	3	1.0	Nil
CS3025	OE	Data Science Models : Regression, Classification and Clustering	3	0	0	3	1.0	Nil
AG3015	OE	Mushroom Cultivation	3	0	0	3	1.0	Nil
BB3015	OE	E-commerce	3	0	0	3	1.0	Nil
JM3015	OE	Media industry and Management	3	0	0	3	1.0	Nil
HM3015	OE	Italian Cuisine	3	0	0	3	1.0	Nil
MB3015	OE	SAP 5	3	0	0	3	1.0	Nil
EG3015	OE	French Advance C1	3	0	0	3	1.0	Nil
MT3015	OE	Robotic Industry 4.0	3	0	0	3	1.0	Nil

SEMESTER 7

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3701	PC	CAD/CAM	3	2	0	4	1.0	Nil
ME3716	PC	Engineering Economics and Project Management	3	0	0	3	1.0	Nil
	PE	Program Elective II	3	0	0	3	1.0	--
	PE	Program Elective III	3	0	0	3	1.0	--
ME3740	PC	CAD/CAM Lab	0	0	2	1	1.0	Nil
ME3748	PC	Quality Engineering Lab	0	0	2	1	1.0	Nil
ME3745	PT	Project Lab V	0	0	4	2	--	--
ME3746	VP	Technical VAP II	2	0	0	2	--	--
ME3771	FW	Internship Presentation II	2	0	0	2	--	--
GP3701	GP	General Proficiency	0	0	0	1	--	--
		TOTAL	**16**	**2**	**8**	**22**		

Contact Hrs: 26

SEMESTER 8

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
	PE	Program Elective IV	3	0	0	3	1.0	--
	PE	Program Elective V	3	0	0	3	1.0	--
ME3870	FW	Project	0	0	8	4	--	--
		TOTAL	**6**	**0**	**8**	**10**		

Contact Hrs: 14

OR

It is the prerogative of the university to allow the student to opt for this option only after completing the process of approval before proceed on full semester internship on an industrial project. The evaluation of internal components will be done jointly by industrial supervisor and university supervisor. End semester evaluation will be done by a committee comprise of atleast one expert from industry/corporate.

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3871	FW	Major Industrial Project	0	0	0	10	--	--
		TOTAL	**0**	**0**	**0**	**10**		

List of Program Electives

Elective	Course Code	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
I	ME3602	Refrigeration and Airconditioning	3	0	0	3	1.0	ME3401
	ME3708	Mechanical Vibrations	3	0	0	3	1.0	ME3304
	ME3612	Industrial Inspection and Quality Control	3	0	0	3	1.0	--
	ME3611	Power Plant Engineering	3	0	0	3	1.0	
II	ME3703	Alternative Fuels and Energy Systems	3	0	0	3	1.0	--
	ME3707	Finite Element Method	3	0	0	3	1.0	--
	ME3503	Operation Research	3	0	0	3	1.0	--
	MT3803	Robotics and Automation	3	0	0	3	1.0	--
III	MT3819	Microprocessors in Automation	3	0	0	3	1.0	--
	ME3713	Unconventional Manufacturing Processes	3	0	0	3	1.0	--
	ME3714	Plastic Processing and Techniques	3	0	0	3	1.0	--
	ME3806	Rapid Prototyping	3	0	0	3	1.0	--
IV	ME3815	Non-Conventional Energy Resources	3	0	0	3	1.0	--
	ME3803	Supply Chain Management	3	0	0	3	1.0	--
	ME3817	Industrial Hazards and Safety	3	0	0	3	1.0	--
	ME3808	Energy Storage Systems	3	0	0	3	1.0	--
V	ME3807	Energy Conservation and Audit	3	0	0	3	1.0	--
	ME3810	Lean Manufacturing	3	0	0	3	1.0	--
	ME3818	Hybrid Vehicle Propulsion	3	0	0	3	1.0	--
	ME3816	Facility Planning and Design	3	0	0	3	1.0	--

B. Choice Based Credit System (CBCS)

Choice Based Credit System (CBCS) is a versatile and flexible option for each student to achieve his target number of credits as specified by the UGC and adopted by our university.

The following is the course module designed for the B.Tech (Mechanical Engineering) program:

Core competency: Students will acquire core competency in Mechanical Engineering and in allied subject areas.

Program/Discipline Specific Elective Course (DSEC):

Skilled communicator: The course curriculum incorporates basics and advanced training in order to make a graduate student capable of expressing the subject through technical writing as well as through oral presentation.

Critical thinker and problem solver: The course curriculum also includes components that can be helpful to graduate students to develop critical thinking ability by way of solving problems/numerical using basic & advance knowledge and concepts of Mechanical Engineering.

Sense of inquiry: It is expected that the course curriculum will develop an inquisitive characteristic among the students through appropriate questions, planning and reporting experimental investigation.

Skilled project manager: The course curriculum has been designed in such a manner as to enabling a graduate student to become a skilled project manager by acquiring knowledge about mathematical project management, writing, planning, study of ethical standards and rules and regulations pertaining to scientific project operation.

Ethical awareness/reasoning: A graduate student requires understanding and developing ethical awareness/reasoning which the course curriculums adequately provide.

Lifelong learner: The course curriculum is designed to inculcate a habit of learning continuously through use of advanced ICT technique and other available techniques/books/journals for personal academic growth as well as for increasing employability opportunity.

Value Added Program (VAP): A value added program course is a credit course which is basically meant to enhance general ability of students in areas like soft skills, quantitative aptitude and reasoning ability - required for the overall development of a student and at the same time crucial for industry/corporate demands and requirements. The student possessing these skills will definitely develop acumen to perform well during the recruitment process of any premier organization and will have the desired confidence to face the interview. Moreover, these skills are also essential in day-to-day life of the corporate world. The aim is to nurture every student for making effective communication, developing aptitude and a general reasoning ability for a better performance, as desired in corporate world.

Skill Enhancement Course: This course may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

Generic/Open Elective Course (OE): Open Elective is an interdisciplinary additional subject that is compulsory in a program. The score of Open Elective is counted in the overall aggregate marks under Choice Based Credit System (CBCS). Each Open Elective paper will be of 3 Credits in III, IV and VI semesters. Each student has to take Open/Generic Electives from department other than the parent department. Core / Discipline Specific Electives will

not be offered as Open Electives.

Non CGPA Audit Course (NCAC): This is a compulsory course but audit that does not have any choice and will be of 3 credits. Each student of B.Tech program has to compulsorily pass the Environmental Studies and Human values & professional Ethics.

C. Program Outcomes of B.Tech Mechanical Engineering.

PO-01	Engineering knowledge	Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex civil engineering problems.
PO-02	Problem analysis	Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO-03	Design/development of solutions	Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO-04	Conduct investigations of complex problems	Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO-05	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.
PO-06	The engineer and society	Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO-07	Environment and sustainability	Understand the impact of the professional scientific solutions on societal and environmental issues, and impart knowledge and need for sustainable development.
PO-08	Ethics	Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO-09	Individual and Team work	Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO-10	Communication	Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO-11	Project Management and Finance	Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO-12	Life-long learning	Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological Change

D. Program Specific Outcomes:

PSO1: Apply their engineering knowledge in the domain of manufacturing, thermal and design to develop solution for engineering problems.

PSO2: To develop the ability to provide solutions using cutting edge technologies and modern tools.

E. Program Educational Objectives (PEO's)

PEO1: Able to apply concepts of mathematics, science and computing to Electronics and Communication Engineering

PEO2: Able to design and develop interdisciplinary and innovative systems.

PEO3: Able to inculcate effective communication skills, team work, ethics, leadership in preparation for a successful career in industry and R&D organizations

F. Pedagogy & Unique practices adopted:

""Pedagogy is the method and practice of teaching, especially for teaching an academic subject or theoretical concept". In addition to conventional time-tested lecture method, the institute will emphasize on experiential learning:

Mini projects: students are asked to do or given mini projects for developing an aptitude to critically think and find solutions for real world problems, learn working with other people, under deadlines and guidance.

Flip Presentations: Students are required to present on latest technology trends in mechanical engineering to enhance their ability to self learn and presentation skill along with developing their confidence level to face an audience.

Field/Live Projects: The students, who take up experiential projects in companies, where senior executives with a stake in teaching guide them, drive the learning. All students are encouraged to do some live project other their regular classes.
Project Lab: This course is spread across the semesters, from 3rd semester till seventh semester where student is required to do a design project or field work or design, fabrication and testing of materials/machines

Industrial Visits: Industrial visit are essential to give students hand-on exposure and experience of how things and processes work in industries. Our institute organizes such visits to enhance students' exposure to practical learning and work out for a report of such a visit relating to their specific topic, course or even domain.

MOOCs: Students may earn credits by passing MOOCs as decided by the college. Graduate level programs may award Honors degree provided students earn pre-requisite credits through MOOCs. University allows students to undertake additional subjects/course(s) (In-house offered by the university through collaborative efforts or courses in the open domain by various internationally recognized universities) and to earn additional credits on successful completion of the same. Each course will be approved in advance by the University following the standard procedure of approval and will be granted credits as per the approval. Keeping this in mind, University proposed and allowed a maximum of two credits to be allocated for each MOOC courses. In the pilot phase it is proposed that a student undertaking and successfully completing a MOOC course through only NPTEL could be given 2 credits for each MOOC course.

For smooth functioning and monitoring of the scheme the following shall be the guidelines for MOOC courses, Add-on courses carried out by the College from time to time.

a) It will necessary for every student to take at least one MOOC Course throughout the programme.

b) There shall be a MOOC co-ordination committee in the College with a faculty at the level of Professor heading the committee and all Heads of the Department being members of the Committee.

c) The Committee will list out courses to be offered during the semester, which could be requested by the department or the students and after deliberating on all courses finalize a list of courses to be offered with 2 credits defined for each course and the mode of credit consideration of the student. The complete process shall be obtained by the College before end of June and end of December for Odd and Even semester respectively of the year in which the course is being offered. In case of MOOC course, the approval will be valid only for the semester on offer.

d) Students will register for the course and the details of the students enrolling under the course along with the approval of the Vice Chancellor will be forwarded to the Examination department within fifteen days of start of the

semester by the Coordinator MOOC through the Principal of the College.

e) After completion of MOOC course, Student will submit the photo copy of Completion certificate of MOOC Course to the Examination cell as proof.

f) Marks will be considered which is mentioned on Completion certificate of MOOC Course.

g) College will consider the credits only in case a student fails to secure minimum required credits then the additional subject(s) shall be counted for calculating the minimum credits required for the award of degree.

Special Guest Lectures (SGL) & Extra Mural Lectures (EML): Some topics/concepts need extra attention and efforts as they either may be high in difficulty level or requires experts from specific industry/domain to make things/concepts clear for a better understanding from the perspective of the industry. Hence, to cater to the present needs of industry we organize such lectures, as part of lecture-series and invite prominent personalities from academia and industry from time to time to deliver their vital inputs and insights.

Student Development Programs (SDP): Harnessing and developing the right talent for the right industry an overall development of a student is required. Apart from the curriculum teaching various student development programs (training programs) relating to soft skills, interview skills, SAP, Advanced excel training etc. that may be required as per the need of the student and industry trends, are conducted across the whole program. Participation in such programs is solicited through volunteering and consensus.

Industry Focusedprogrammes: Establishing collaborations with various industry partners to deliver the programme on sharing basis. The specific courses are to be delivered by industry experts to provide practice-based insight to the students.

Special assistance program for slow learners & fast learners: write the note how would you identify slow learners, develop the mechanism to correcting knowledge gap. Terms of advance topics what learning challenging it will be provided to the fast learners.

Induction program: Every year 3 weeks induction program is organized for 1st year students and senior students to make them familiarize with the entire academic environment of university including Curriculum, Classrooms, Labs, Faculty/ Staff members, Academic calendar and various activities.

Mentoring scheme: There is Mentor-Mentee system. One mentor lecture is provided per week in a class. Students can discuss their problems with mentor who is necessarily a teaching faculty. In this way, student's problems or issues can be identified and resolved.

Competitive exam preparation: Students are provided with one class in every week for GATE/ Competitive exams preparation.

Extra-curricular Activities: organizing & participation in extracurricular activities will be mandatory to help students develop confidence & face audience boldly. It brings out their leadership qualities along with planning & organizing skills. Students undertake various cultural, sports and other competitive activities within and outside then campus. This helps them build their wholesome personality.

Career & Personal Counseling: - Identifies the problem of student as early as possible and gives time to discuss their problems individually as well as with the parents. Counseling enables the students to focus on behavior and feelings with a goal to facilitate positive change. Its major role lies in giving: Advice, Help, Support, Tips, Assistance, and Guidance.

Participation in Flip Classes, Project based Learning(A2 Assignment), Workshops, Seminars & writing & Presenting Papers: Departments plan to organize the Flip Classes, Project based Learning(A2 Assignment), workshops, Seminars & Guest lecturers time to time on their respective topics as per academic calendar. Students must have to attend these programs. This participation would be count in the marks of general Discipline & General Proficiency which is the part of course scheme as non-credit course.

Formation of Student Clubs, Membership & Organizing & Participating events: Every department has the departmental clubs with the specific club's name. The entire student's activity would be performed by the club. One faculty would be the coordinator of the student clubs & students would be the members with different responsibility.

Capability Enhancement & Development Schemes: The Institute has these schemes to enhance the capability and holistic development of the students. Following measures/ initiatives are taken up from time to time for the same: Career Counseling, Soft skill development, Remedial Coaching, Bridge Course, Language Lab, Yoga and Meditation, Personal Counseling

Library Visit & Utilization of QLRC: Students may visit the library from morning 10 AM to evening 8 PM. Library created its resources Database and provided Online Public Access Catalogue (OPAC) through which users can be accessed from any of the computer connected in the LAN can know the status of the book. Now we are in process to move from OPAC to KOHA.

Semester I First Year

MA3102	**Title: Mathematics I**	**L T P C** **3 2 0 4**
Version No.	**2.0**	
Course Prerequisites	Nil	
Objectives	To provide the requisite and relevant background necessary to understand engineering courses.	
Expected Outcome	Students will be able to solve applied problems using calculus and also learn to demonstrate matrix facility.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Matrix Algebra**	8
Rank, Solution of linear simultaneous equations. Eigen-values and Eigenvectors of a matrix: Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Orthogonal & Unitary matrices and their properties; Cayley- Hamilton theorem, Diagonalization of a matrix.		
Unit II	**Multivariable Calculus**	6
Functions of two variables, limits and continuity, Partial derivatives, Aproximation of Error,EulersTheorem,Total differential, Taylor's expansion for two variables, Maxima and Minima, Constrained maxima and minima, Lagrange's multiplier method, Jacobians.		
Unit III	**Multiple Integral**	8
Review of curve tracing and quadric surfaces, Double and Triple integrals, Change of order of integration. Change of variables.Application of Double intergartion and triple integarion, Gamma and Beta functions. Dirichlet's integral.		
Unit IV	**Ordinary Differential Equation**	8
Review of Ordinary differential equation of first order and first degree, Exact differential Equation, Solution of second and higher order differential equations with constant coefficients (operation method).		
Unit V	**Vector Calculus**	6
Differentiation of vectors, Scalar and vector point function.Normal and Directional derivative gradient, divergence, curl and their physical meaning. Line and surface integrals. Green's, Gauss and Stroke's theorem and their applications.		
Text Books	1. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, Narosa Publishing House.	
Reference Books	1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Inc., U.K. 2. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, PearsonEducation.	
Mode of Evaluation	Internal and External	
Recommendation by Board of Studies on	28-05-2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome For MA3102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to learn the basic principles of multi-variable calculus with their proofs. They should be able to classify partial differential equations and transform them into canonical form. They will also understand how to extract information from partial derivative models in orderto interpret reality.	2	Em
CO2	Students should be able to understand and learn how to find the area and volume of any region and solid body resectively by integral and also find the moments of inertiafor a thin plate in plane.	2	S
CO3	Students should be able to understand theorems related to directional derivative of gradient and reproduce its proof. They should be able to Explain the concept of a vectorintegration in a plane and in space.	3	S
CO4	Students should be able to know basic application problems described by second order linear differential equations with constant coefficients. They should be also able to understand and solve the applications associatedwithLaplace Transform.	3	En
CO5	Students should be able to solve the linear equations using matrix properties and Determine characteristic equation,eigen values, eigenvectors and diagonalizable of a matrix.	3	None

CO-PO Mapping for MA3102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	1	1	1	3	2	1	2	3	1	2	1	2	2
CO 2	3	3	2	3	3	3	2	3	1	3	3	1	1	3
CO 3	2	3	2	2	1	1	3	1	1	2	2	3	2	3
CO 4	2	3	3	3	3	3	3	2	2	2	2	3	1	1
CO 5	3	2	2	2	3	2	1	2	2	2	2	2	1	3
Avg.	2.6	2.4	2	2.2	2.6	2.2	2	2	1.8	2	2.2	2	1.4	2.4

PS3101	**Title: Human Values and Ethics**	**L T P C** **2 0 0 2**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To facilitate the development of a holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of the human reality and the rest of existence	
Expected Outcome	This course will make the students aware and sensitive to value systems in real life situations. It will help them to discriminate between ephemeral and eternal value and to discriminate between essence and form	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Introduction of Value Education**	5
1. Understanding the need, basic guidelines, content and process of Value Education 2. A look at basic Human Aspirations: Self Exploration–its content and process		
Unit II	**Understanding Harmony - Harmony in Myself!**	5
1. Thoughtful human being in harmony; as a co-existence of the sentient, attitude and its importance in relationship. 2. Understanding the needs, characteristics and activities of Self ('I')		
Unit III	**Understanding Harmony in the Family and Society**	5
1. Harmony in the family; values in human relationships; meaning of Nyaya , Trust (Vishwas) and Respect (Samman) as the foundation values of relationships.2. Harmony in society:Samadhan, Samridhi, Abhay, Sah-astitva as comprehensive Human Goals.		
Unit IV	**Understanding Harmony in the Nature and Existence**	4
1. Understanding the harmony in Nature: Interconnectedness among the four orders of nature- recyclability and self-regulation in nature 2. Natural perception of harmony at all levels of existence		
Unit V	**Understanding Professional Ethics**	5
1. Competencies in professional ethics: a) Ability to utilize the professional competence for augmenting universal human order b) Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems, c) Ability to identify and develop appropriate technologies and management patterns for above production systems.		
Text Books	1. R.R Gaur, R Sangal, G P Bagaria, A foundation course in Human Values and Professional Ethics, Excel books, New Delhi	
Reference Books	1. A.N. Tripathy, Human Values, New Age International Publishers 2. B L Bajpai, Indian Ethos and Modern Management, New Royal Book Co., Lucknow 2. B P Banerjee, Foundations of Ethics and Management, Excel Books	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome For PS 3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the significance of value inputs in a classroom, distinguish between values and skills, understand the need, basic guidelines, content and process of value education, explore the meaning of happiness and prosperity and do a correct appraisal of the current scenario in the society.	2	Em
CO2	Students should be able to distinguish between the Self and the Body, understand the meaning of Harmony in the Self the Co-existence of Self and Body.	2	S
CO3	Students should be able to understand the value of harmonious relationship based on trust, respect and other naturally acceptable feelings in human-human relationships and explore their role in ensuring a harmonious society.	2	S
CO4	Students should be able to understand the harmony in nature and existence, and work out their mutually fulfilling participation in the nature.	2	En
CO5	Students should be able to distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.	3	None

CO-PO Mapping for PS 3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	3	2	2	3	2	1	1	3	3	1	3
CO 2	2	2	3	2	3	3	1	2	1	1	1	3	3	2
CO 3	2	2	1	1	1	2	2	2	2	1	1	2	3	2
CO 4	1	1	3	2	2	2	2	3	2	3	2	2	2	1
CO 5	2	1	2	2	2	1	2	2	1	3	3	2	3	1
Avg.	1.8	1.6	2.4	2	2	2	2	2.2	1.4	1.8	2	2.4	2.4	1.8

CS3103	Title: Basics of Computer and C Programming	L T P C 4 0 0 4
Version No.	**2.0**	
Course Prerequisites	Nil	
Objective	This subjects aims to make student handy with the computers basics and programming.	
Expected Outcome	On completion of subject the students will be able to apply fundamental of Computers, Architecture of Computer, Arithmetic of Computer, Basics of Computer Programming	
Unit No.	**Unit Title**	**No. of Hrs (Per Unit)**
Unit I	**Architecture and Arithmetic of Computer**	**10**
Design of Computer Hardware Design, Number System [Decimal, Binary, Octal, Hexadecimal], Conversions, Binary Arithmetic [Addition, Subtraction, Multiplication, Division, 1s Compliment, 2s Compliment], Floating Point Arithmetic [IEEE 754 Concept, Storage of Floating Point Numbers]		
Unit II	**Basics of C Programming**	**10**
Algorithms, Flow Chart,Types of Computer Languages:-Machine Language, Assembly Language and High Level Language, Concept of Compiler, Assembler, Linker and Loader. Fundamental Data Type: int, float, char and void. Qualifier for int (long and short), singed and unsigned numbers., Storage Classes: auto, static, extern and register, Operators: Arithmetic, Relational, Conditional and Logical.. Precedence vs. Associativity.Fundamentals of C programming: Writing and executing the first C program, conditional execution, Iterations [Loops], switch-case idea [switch, case, break, default], continue statements.		
Unit III	**Programming Elements**	**9**
Iteration (Loop): for, while and do-while, nested of loops, break and continue. Function: What is a Function? , Passing Values between Functions, Stack Handling of function. Recursion: Introduction, Stack Handling of recursion, Practice Programs. Pointer: Introduction, Pointer [Declaration, Initialization and Access], Call by [Value; Reference].		
Unit IV	**Arrays, Preprocessors and Strings**	**9**
Arrays: Array, Declaration & Initialization Array, Passing an Array to a Function. 2-D Arrays: Declaration; Initializing. Passing 2-D array to a Function, Array of Pointers, 3-D Array. Preprocessor: C Preprocessor: Features, Macro Expansion, Macros with Arguments, File Inclusion, #if, #else, #endif, #define, #undef, #ifdef, #ifndef, #elif, #undef, #error, #pragma.String: Concept of char vs. int, Concept of Strings, String Handling Functions Introduction and Implementation [strlen(), strcpy(), strcat(), strcmp(), strlwr(), strupr()], Some more Functions [strncpy(), strncat(), strncmp(), gets(), puts()]		
Unit V	**Structure, Enums and File Handling**	**10**
Structures: Structures (What & Why?), Declaring & Accessing Structure, Logical Storage vs. Actual Storage, Passing Structure to a Function, Structure and Pointer, Application of Structure.Operator, Union & Enum: Operations On Bits, One's Complement Operator, Bitwise Operators (<<, >>, ~, &, |, ^), Union, Union Vs. Structure, Enumerated Data Type & Its Use.File Handling: Concept of File, Types of File, Meaning of File Handling, FILE macro & its respective header file, File Handling Functions [fopen(), fclose(), fgetc(), fputc(), fgets(), fputs(), fscanf(), fprintf(), fread(), fwrite(),fseek() [Macro Explanation : SEEK_SET, SEEK_CUR, SEEK_END], ftell(), rewind(), getw(), putw()].		
Text Books	1. "Mastering C" by KR Venugopal 2. "Let us C" by Y. kanetkar 3. "Programming in ANSI C" by E. Balagurusamy.	
Reference Books	1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Pearson Education 2. 2. Byron S Gottfried, " Programming with C", Schaum's Outlines Tata McGraw-Hill	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	14.05.2022	
Date of Approval by the Academic Council on	20th October 2022	

Course Outcome For CS3103

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand Computer and its Components, will be able to understand Number Systems and their conversion and carry out operations associated with them.	2	Em
CO2	Students should be able to use the C programming language to implement various algorithms, and acquire the basic concepts and terminology of programming in C.	2	S
CO3	Students should be able to understand arrays, their functions that will help them to design new problem solving approach in 'C'.	2	S
CO4	Students should be able to understand pointers, recursion, and macros for solving complex problems in 'C'.	2	En
CO5	Students should be able to gain a broad perspective about the uses of computers in engineering industry.	2	None

CO-PO Mapping for CS3103

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	2	3	3	3	1	1	3	3	2	1	2
CO 2	3	2	1	2	3	2	1	1	1	1	1	2	2	3
CO 3	3	1	1	2	1	2	2	2	2	1	1	3	2	2
CO 4	2	1	2	3	3	3	3	1	3	1	2	3	2	1
CO 5	1	3	2	3	1	1	2	1	2	1	1	2	2	1
Avg.	2.2	1.8	1.8	2.4	2.2	2.2	2.2	1.2	1.8	1.4	1.6	2.4	1.8	1.8

EC3101	**Title: Basic Electrical and Electronics Engineering**	**L T P C** **3 1 0 4**
Version No.	**1.1**	
Course Prerequisites	Nil	
Objectives	To provide an overview of electrical and electronics fundamentals.	
Expected Outcome	The student would acquire the knowledge of basics fundamentamentals of electrical and electronics.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Basic Concepts of Electrical Engineering**	7
Electric Current, Electromotive force, Electric Power, Ohm's Law, Basic Circuit Components, Faraday's Law of Electromagnetic Induction, Lenz's Law, Kirchhoff's laws, Network Sources, Resistive Networks, Series-Parallel Circuits, Node Voltage Method, Mesh Current Method. Superposition, Thevenin's, Norton's and Maximum Power Transfer Theorems.		
Unit II	**Alternating Quantities**	7
Alternating Quantities: Introduction, Generation of AC Voltages, Root Mean Square and Average Value of Alternating Currents and Voltages, Form Factor and Peak Factor, Phasor Representation of Alternating Quantities, Single Phase RLC Circuits, Introduction to 3-Phase AC System.		
Unit III	**Transformers**	8
Transformers: Construction, EMF equation, ratings, phasor diagram on no load and full load, equivalent circuit, regulation and efficiency calculations, open and short circuit tests, auto-transformers.		
Unit IV	**Basic Electronics**	7
Conduction in Semiconductors, Conduction Properties of Semiconductor Diodes, Behavior of PN Junction, PN Junction Diode, Zener Diode, Photovoltaic Cell, Rectifiers, Bipolar Junction Transistor, Field Effect Transistor, Transistor as an Amplifier.		
Unit V	**Digital Electronics and Electrical Measuring Instruments**	7
Digital Electronics:Boolean algebra, Binary System, Logic Gates and Their Truth Tables.Kaurnugh Map, Electrical Measuring Instruments: Basic OP-AMP, Differential amplifier, PMMC instruments, shunt and series multipliers, multimeters, Moving iron ammeters and voltmeters, dynamometer, wattmeter, AC watthour meter, extension of instrument ranges.		
Text Books	1. V. Jagathesan, K. Vinod Kumar & R. SaravanKumar,Basic Electrical & Electronics Engineering Wiley India. 2. Sukhija and Nagsarkar,Basic Electrical and Electronics Engineering Oxford Publication	
Reference Books	1. Kothari, Nagrath,Basic Electrical & Electronics Engineering TMH 2. Prasad Sivanagraju,Basic Electrical & Electronics Engineering Cengage learning Indian Edition 3. Muthusubrmaniam,Basic Electrical and Electronics Engineering by TMH	
Mode of Evaluation	Internal and External Examinations.	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for EC 3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the basic theorms used in simplifying the electrical circuits.	3	Em
CO2	Students should be able to Know about the generation and utilization of three phase alternating quantities.	3	S
CO3	Students should be able to Know about single phase transformer and its various parameters.	2	S
CO4	Students should be able to understand the various components used in electronics like P-N junction and Zener dioide.	2	En
CO5	Students should be able to understand basics of digital electronics and various electrical measurement devices.	3	None

CO-PO Mapping for EC3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	1	1	3	2	1	2	1	1	3	1	2	1
CO 2	3	3	2	3	3	2	3	2	1	1	3	3	2	1
CO 3	2	2	2	2	2	3	2	2	2	2	1	2	2	1
CO 4	1	1	1	2	2	1	3	2	2	3	2	2	3	3
CO 5	2	2	3	3	2	3	1	3	1	2	3	3	1	3
Avg.	2.2	2	1.8	2.2	2.4	2.2	2	2.2	1.4	1.8	2.4	2.2	2	1.8

CS3140	Title:Basics of Computer and C Programming Lab	L T P C 0 0 2 1
Version No.	1.1	
Course Prerequisites	Nil	
Objectives	Learning objectives is to improve confidence in technology use and increased awareness of opportunities afforded to individuals with computer application skills.	
Expected Outcome	Recognize basic computer hardware architecture constructs such as instructions sets, memory, CPU, external devices, and data representation	

List of Experiments

1. Programs using I/O statements and expressions.
2. Programs using decision-making constructs.
3. Write a program to find whether the given year is leap year or Not? (Hint: not every centurion year is a leap. For example 1700, 1800 and 1900 is not a leap year)
4. Design a calculator to perform the operations, namely, addition, subtraction, multiplication, division and square of a number.
5. Check whether a given number is Armstrong number or not?
6. Populate an array with height of persons and find how many persons are above the average height.
7. Populate a two dimensional array with height and weight of persons and compute the Body Mass Index of the individuals.
8. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
9. From a given paragraph perform the following using built-in functions:

a. Find the total number of words.
b. Capitalize the first word of each sentence.
c. Replace a given word with another word.

10. Solve towers of Hanoi using recursion.
11. Sort the list of numbers using pass by reference.
12. Generate salary slip of employees using structures and pointers.
13. Compute internal marks of students for five different subjects using structures and functions.
14. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

Course Outcome For CS 3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to approach the programming tasks using techniques learned in Theory and write pseudo-codes based on the requirements of the problem.	3	Em
CO2	Students should be able to use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.	3	S
CO3	Students should be able to write the program based on numerical techniques learned and able to edit, compile, debug, correct, recompile and run it.	3	S

CO-PO Mapping for CS 3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	2	1	3	1	1	3	3	3	1	1	3	3	1
CO 2	2	1	1	1	3	3	3	1	1	2	3	3	1	1
CO 3	2	3	1	2	1	2	3	3	3	2	2	2	3	2
Avg.	2.3	2	1	2	1.6	2	3	2.3	2.3	1.67	2	2.6	2.33	1.3

EC3140	Title: Basic Electrical and Electronics Engineering Lab	L T P C 0 0 3 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make students familiar with the fundamental laws featuring in the field of Electrical and Electronics Engineering.	
Expected Outcome	Students shall conceptualize and firmly grasp the basic electrical and electronics engineering laws along with the knowledge of fundamental circuits governing the functioning of important devices.	

List of Experiments

1. To verify the Kirchhoff's current and voltage laws.
2. To verify the Superposition theorem.
3. To verify the Thevenin's theorem.
4. To verify the Norton's theorem.
5. To verify the maximum power transfer theorem.
6. To study the V-I characteristics of p-n junction diode.
7. To study the diode as clipper and clamper.
8. To study the half-wave and full-wave rectifier using silicon diode.
9. To study transistor in Common Base configuration and plot its input/output characteristics.
10. To study various logic gates and verify their truth tables.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	24-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome For EC3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to know about the basic concepts of the Kirchhoff's current and voltage laws and perform Thevenin's, Norton's, superposition and maximum power transfer theorems.	3	Em
CO2	Students should be able to analyze and understand the characteristics of transistors and semiconductor diodes and analyze the half-wave and full-wave rectifier using silicon diode.	4	S
CO3	Students should be able to Learn the basic concepts of various logic gates.	2	S

CO-PO Mapping for EC3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	2	1	2	1	1	2	2	3	2	2	1
CO 2	2	1	1	1	2	2	2	1	3	1	1	1	1	2
CO 3	2	3	3	2	2	2	2	1	2	2	2	2	2	2
Avg.	2	2	1.67	1.67	1.67	2	1.67	1	2.3	1.67	2	1.67	1.67	1.67

ME3145	Title: Engineering Graphics and Design	L T P C 0 0 4 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To enable students to acquire and use engineering drawing skills as a means of accurately and clearly communicating ideas, information and instructions through drafting exercises.	
Expected Outcome	To know and understand the conventions and the methods of engineering drawing. To improve their visualization skills so that they can apply these skills in developing new products. Able to draw projection of lines,planes, solids in different positions.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction, Projection of Points, Projection of Straight Lines	12
Introduction to Engineering Equipments, Elements of Engineering Drawing, dimensioning, Types of Lines, Various types of projections, First and third angle systems of orthographic projections. Projections of points in different quadrants.Projection of Lines.		
Unit II	Projection of Planes	8
Introduction, types of planes, Projection of planes by change of position method only, projection of plane perpendicular to a plane, with axis parallel to both planes, with axis parallel to one plane and inclined to the other plane.		
Unit III	Projection and section of Solids	12
Types of solids, Projections of solid in different axis orientations. Introduction - section planes - apparent section - true section - sectional view - need for sectional view - cutting plane - cutting plane line. Sectional view of simple solids. Section plane perpendicular to one plane and parallel to the other, section plane perpendicular to one plane and inclined to the other.		
Unit IV	Development of Surfaces, Orthographic views (First Angle Projection Only)	8
Development of surface of various solids in simple positions, Three orthographic views of solids.		
Unit V	Computer aided Drafting	8
Demonstration knowledge of the theory of CAD software [such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Set up of the drawing page and the printer, including scale settings, Setting up of units and drawing limits; ISO and ANSI standards for coordinate dimensioning and tolerancing; knowing and use of various commands to draw 2D objects.		
Text Books	1 N.D. Bhatt and V.M.Panchal, Engineering Drawing: Plane and Solid Geometry, Charotar Publishing House	
Reference Books	1. Amar Pathak, Engineering Drawing, Dreamtech Press, New Delhi 2. T. Jeyapoovan, Engineering Graphics using AUTOCAD 2000, Vikas Publishing House 3. Thomas E.French, Charles J.Vierck, Robert J.Foster, Engineering Drawing and Graphic Technology, McGraw Hill International Editions 4. P.S. Gill, Engineering Graphics and Drafting, S.K. Kataria and Sons	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome For ME3145

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to know about the basic concepts of the Kirchhoff's current and voltage laws and perform Thevenin's, Norton's, superposition and maximum power transfer theorems.	3	Em
CO2	Students should be able to analyze and understand the characteristics of transistors and semiconductor diodes and analyze the half-wave and full-wave rectifier using silicon diode.	4	S
CO3	Students should be able to Learn the basic concepts of various logic gates.	2	S

CO-PO Mapping for ME3145

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	1	2	1	2	1	1	2	2	3	2	2	1
CO 2	2	1	1	1	2	2	2	1	3	1	1	1	1	2
CO 3	2	3	3	2	2	2	2	1	2	2	2	2	2	2
Avg.	2	2	1.67	1.67	1.67	2	1.67	1	2.3	1.67	2	1.67	1.67	1.67

MA3202	**Title:Mathematics II**	**L T P C** **3 2 0 4**
Version No.	**1.0**	
Course Prerequisites	**MA3102**	
Objectives	This course is designed to give a comprehensive coverage at an introductory level to the subject of Partial Differential Equations,Numerical and Statistical Techniques.	
Expected Outcome	Students will be familiar with various methods that lead to solve ODEs and PDEs; and will als be able to analyze and interpret statistical data.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Partial Differential Equations**	8
Introduction to Partial differential equations, Linear partial differential equations with constant coefficients of second order. Method of separation of Variables for solving PDE, One dimensional wave equation, Laplace equation in two-dimensions, Heat conduction equations of one dimension.		
Unit II	**Fourier series**	6
Trigonometric Fourier series and its convergence. Fourier series of even and odd functions. Fourier half-range series.		
Unit III	**Numerical Methods**	6
Solution of transcendental and algebraic equations: Bisection method, Regula False method, Newton-Raphson method; Solution of system of linear equations: LU-decomposition method, Jaccobi method, Gauss-Seidel method.		
Unit IV	**Interpolation**	7
Interpolation: difference tables, Newton formulae, Lagrange interpolation and Newton's divided difference interpolation. Numerical integration: Trapezoidal, Simpsons 1/3rd and 3/8th rules,Solution of first and second order ordinary differential equations: Euler, Modified Euler, Runge-KuttaMethodof fourth order.		
Unit V	**Complex Variable, Probability and Distributions**	9
Analytic functions; Cauchy-Riemann equations; Cauchy's integral theorem and integral formula; Taylor and Laurent series. Probability and Statistics: Definitions of probability, conditional probability; mean, median, mode and standard deviation; Random variables, Binomial, Poisson and Normal distributions.		
Text Books	1. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, Narosa Publishing House.	
Reference Books	1. E. Kreyszig, Advanced Engineering Mathematics, JohnWiley and Sons, Inc., U.K. 2. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, Pearson Education.	
Mode of Evaluation	Internal and External	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome For MA 3202

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand ordinary differential equations, with their solutions through constant coefficients. They will also learn about Euler-Cauchy equations, Solution of second order differential equations by changing dependent and independent variables.	3	Em
CO2	Students should be able to understand the properties of Fourier series. and the relationship between Fourier series and linear time invariant system.	2	S
CO3	Students should be able to learn the basics of the theory of error and the approximation theory; the fundamental principles of mathematical modeling; the numerical methods for solving problems of algebra; and the methods of numerical integration and differentiation.	2	S
CO4	Students should be able to learn about Interpolation which is a useful mathematical and statistical tool used to estimate values between two points.	2	En
CO5	Students should be able to formulate and solve problems involving random variables and apply statistical methods for analysing experimental data. They will also learn to analyse the complex function with reference to their analyticity, integration using Cauchy's integral and residue theorems. Taylor's and Laurent's series expansions of complex function will be also explored at the end of Unit.	1	None

CO-PO Mapping for MA 3202

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	3	2	2	1	1	1	1	1	1	2	2	1	3	2
CO 2	2	2	2	1	1	2	1	1	2	1	1	1	3	2
CO 3	2	3	2	1	1	1	1	1	1	2	2	1	3	2
CO 4	3	2	1	2	1	1	1	1	1	2	1	1	2	1
CO 5	3	2	1	2	1	1	1	1	1	2	2	1	3	1
Avg	2.4	2.2	1.6	1.4	1	1.2	1	1	1.2	1.8	1.6	1	2.8	1.6

PH3101	Title: Engineering Physics	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Students will be able to understand the basic of classical and modern physics and quantum mechanics and electromagnetic concepts with basic knowledge of optics.	
Expected Outcome	Will have the ability to Analyze the intensity variation of light due to Polarization, interference and diffraction. Will also be able to explain working principle of lasers and Explain fundamentals of quantum mechanics.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Relativistic Mechanics	5
Inertial and Non-inertial Frames, Postulates of Special Theory of Relativity,Galilean and Lorentz Transformation, Length Contraction and Time Dilation, Addition of Velocities, Mass Energy Equivalence and Variation of Mass with Velocity.		
Unit II	Interference and Diffraction	5
Coherent Sources, Conditions of Interference;Young's double slit experiment, Interference in thin films – Wedge Shaped Film, Newton's Rings. Diffraction: Single Slit Diffraction, Diffraction Grating, Raleigh's Criterion of Resolution, Resolving Power of Grating.		
Unit III	Polarization and Laser	5
Phenomenon of Double Refraction, Ordinary and Extra-ordinary Rays, Nicol Prism;Polarisation: Malus law, Brewster's law;Production and Analysis of Plane, Circularly and Elliptically Polarized Light. Laser**:** Principle of Laser Action, Einstein's Coefficients, Construction and Working of He-Ne and Ruby Laser.		
Unit IV	Electromagnetic Properties of Materials	5
Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, Electromagnetic Wave Propagation in Free Space and Conducting Media, Poynting Theorem.		
Unit V	Wave Mechanics	4
Wave Particle Duality, de Broglie Concept of Matter Waves, Heisenberg Uncertainty Principle and its applications, Schrödinger Wave Equation and Its Applications: Particle in a Box (one dimensional only).		
Text Books	1. Beiser, Concepts of Modern Physics, McGraw Hill 2. Dr Amit Dixit, Engineering Physics, Nano Edge Publicatons	
Reference Books	1. Robert Resnick, Introduction to Special theory of Relativity, Wiley 2. AjoyGhatak, Optics, TMH 3. David J. Griffith, Introduction to Electrodynamics, PHI 4. William Hayt, Engineering Electromagnetics, TMH	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	28-05-2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome For PH3101

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand special theory of realtivity (STR), concepts linked with STR and radiationlaws. extract information from partial derivative models in order to interpret reality.	3	Em
CO2	Students should be able to understand interference, diffraction and abletoconnectittoafewengineering applications.	3	S
CO3	Students should be able to explain the phenomena of polarization in electromagnetic waves and their production, Detection and analysis. They will also understand the operation and working principle of laser.	3	S
CO4	Students should be able to understand electromagnetic theory using maxwells equations, and its uses in various engineering application. They will also understand the difference between dia,para and ferromagnetic materials.	3	En
CO5	Students should be able to explain fundamentals of quantum mechanics and apply it to problems on bound states.	3	None

CO-PO Mapping for PH 3101

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	3	3	2	2	3	1	1	1	3	3	1	3
CO 2	2	2	3	2	3	3	1	2	1	1	1	3	3	2
CO 3	3	3	1	1	1	2	2	1	2	1	1	2	3	2
CO 4	1	1	3	2	2	2	2	1	2	3	2	2	2	1
CO 5	2	1	2	2	2	1	2	2	1	3	3	2	3	1
Avg.	2	1.8	2.4	2	2	2	2	1.4	1.4	1.8	2	2.4	2.4	1.8

CY3205	Title: Environmental Studies	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Creating awareness among engineering students about the importance of environment, the effect of technology on the environment and ecological balance is the prime aim of the course.	
Expected Outcome	Students will understand the transnational character of environmental problems and ways of addressing them, including interactions across local to global scales.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Environmental studies and Ecosystems	5
Multidisciplinary nature of environmental studies, Scope and importance,Need for public awareness. Concept,Structure and function of an ecosystem,Energy flow in an ecosystem: food chains, food webs and ecological pyramids.Examples of various ecosystems such as: Forest, Grassland, Desert, Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Producers, consumcrs and decomposers.Hydrological cycle. Water as a universal solvent. Concept of DO, BOD and COD. Sedimentation, coagulation, flocculation, filtration, pH		
Unit II	Natural Resources: Renewable and Non- renewable resources	5
Land as a resource, land degradation, landslides (natural and man-induced), soil erosion and desertification. Forests and forest resources: Use and over-exploitation, deforestation. Impacts of deforestation, mining, dam building on environment and forests. Resettlement and rehabilitation of project affected persons; problems and concerns with examples. Water resources: Use and over-exploitation of surface and ground water, floods, drought, conflicts over water (international and inter-state). Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems with examples. Energy resources: Renewable and non renewable energy sources, use of alternate energy sources, growing energy needs. Aims and objectives of Environmental Impact Assessment (EIA)		
Unit III	Biodiversity and Conservation	5
Levels of biological diversity: genetic, species and ecosystem diversity.Bio-geographic zones of India.Ecosystem and biodiversity services. Biodiversity patterns and global biodiversity hot spots,India as a mega-biodiversity nation; Endangered and endemic species of India. Threats to biodiversity: Habitat loss, poaching of wildlife, man-wildlife conflicts, biological invasions. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.		
Unit IV	Environmental Pollution	4
Environmental pollution and its types.Causes, effects and control measures of :a) Air pollution b) Water pollution – freshwater and marine c) Soil pollution d) Noise pollution e) Thermal pollution Nuclear hazards and human health risks,Solid waste management: Control measures of urban and industrial waste.Indian National Ambient Air Quality Standards. Impact of air pollutants on human health, plants and materials		
Unit V	Environmental Policies and Practices	5
Concept of sustainability and sustainable development.Water conservation and watershed management.Climate change, global warming, acid rain, ozone layer depletion. Disaster management: floods, earthquake, cyclones and landslides.Wasteland reclamation. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of Pollution) Act, Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation. Environment: rights and duties. Population growth.Water conservation, rainwater harvesting, watershed management.Environmental Ethics – Issues and possible solutionField workVisit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of simple ecosystems-pond, river, hill slopes, etc.		
Text Books	1. Bharucha. E,Textbook of Environmental Studies for Undergraduate Courses	
Reference Books	1. Kaushik Anubha, Kaushik C P, Perspectives in Environmental Studies, New Age Publication 2. Rajagopalan , Environmental Studies from Crisis to Cure, Oxford University Press	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	28-05-2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome For CY 3205

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and preventions.	2	Em
CO2	Students should be able to understand the solutions related to environmental problems related with the renewable& non-renewable resources.	2	S
CO3	Students should be able to understand the importance of ecosystem and biodiversity and the method of conservation of biological diversity.	2	S
CO4	Students should be able to understand different components of the environment and their function and the effects pollution on environment and should be able to understand the concept of sustainable development.	3	En
CO5	Students should be able to correlate the human population growth and its trend to the environmental degradation and develop the awareness about his/her role towards environmental protection and preventions.	3	None

CO-PO Mapping for CY3205

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	3	1	1	2	1	2	3	1	3	1	2	1	3	2
CO 2	2	1	1	1	2	1	2	1	3	2	3	2	2	3
CO 3	2	2	3	3	1	3	3	1	2	1	3	2	3	2
CO 4	2	3	1	1	2	3	1	3	3	3	3	3	1	1
CO 5	1	1	3	1	3	1	2	3	3	3	3	2	2	2
Avg.	2	1.6	1.8	1.6	1.8	2	2.2	1.8	2.8	2	2.8	2	2.2	2

ME3103	Title: Fundamentals of Mechanical and Mechatronics Engineering	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic knowledge about various fields of Mechanical Engineering like Thermal Engineering, manufacturing, Mechanics, Strength of Materials and mechatronics.	
Expected Outcome	After learning the course the students will be able to understand basic laws of thermodynamics, basic manufacturing processes ,mechanics,working of IC engines and mechatronics	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Thermodynamics & IC Engines	6
Definition of thermodynamics, Energy and its forms, Enthalpy, Laws of thermodynamics, Heat engines, Heat pump, Refrigerator, Types of refrigerants, Introduction to Air-conditioning. Internal Combustion Engines: Classification and components of I.C. Engines, Working principle and comparison between 2 Stroke and 4 stroke engines, Difference between SI and CI engines.		
Unit II	Mechanics	6
Basic concept: Review of laws of motion, Concept of Free Body Diagrams, Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples -Varignon's theorem - Equilibrium of Rigid bodies in two dimensions, Basic concepts of Friction and Trusses.		
Unit III	Stress and Strain	8
Introduction, Normal &shear stresses, Stress-strain diagrams for ductile and brittle materials, Elastic constants, One dimensional loading of members of varying cross-section		
Unit IV	Introduction to Manufacturing	8
. Introduction and classification of the manufacturing processes, Lathe and basic machining operations in lathe, Cutting tools, Cutting tool materials, Metal Forming: Forging and Sheet Metal operations, Joining Processes: Electric arc welding, Gas welding, Soldering and Brazing. Introduction to CNC machines		
Unit V	Introduction to Mechatronics	8
Evolution, Scope, Advantages and disadvantages of Mechatronics, Industrial applications of Mechatronics, Introduction to autotronics, bionics, and avionics and their applications. Sensors and Transducers: Types of sensors, types of transducers and their characteristics. Actuator and its types.		
Text Books	1. NitaigourMahalik .Mechatronics : Principles, Concepts and Applications, McGraw Hill 2. Onkar Singh, S.S Bhavikatti, Introduction to Mechanical Engineering, New Age International 3. Hajra, Bose, Roy, Workshop Technology Vol 1 and 2, Media Promoters 4. D.S. Kumar, Mechanical Engineering, S.K. Kataria and Sons	
Reference Books	1. Irving H.Shames, Engineering Mechanics , P.H.I 2. Holman, J.P, Thermodynamics, Mc Graw Hill book Co. NY 3. Chapman W.A.J, Workshop Technology Part 1, Elsevier Science	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

CS3207	Title: Advance Computer Programming & Software	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This subject introduces the students with a deeper era of programming in C like Functions, Arrays, Pointer, Structure and Preprocessor Directive etc.	
Expected Outcome	On completion of subject the students will be able to apply learning Advance C, Device Driver Programming, Embedded C, Robotics Programming	
Unit No.	Unit Title	No. of Hrs (Per Unit)
Unit I	Pointers & Beyond Pointers	9
About Pointer [Declaration, Initialization and Access], Concept of memory maps, Concept of Process Control Block, Dangling Pointer, Orphan Objects, Dynamic Memory Allocation [malloc; calloc, realloc, free], Segmentation Fault, Core Dump and Illegal Memory Access, Pointer Arithmetic, Multiple Indirections.		
Unit II	Pointers & Arrays	9
Arrays, Understanding in depth 1-D, 2-D and 3-D array, Converting an array [1-D, 2-D, 3-D, n-D] to its pointer notation, Accessing array[1-D, 2-D, 3-D, n-D]with pointer, Creating Variable length array [1-D, 2-D], Limitation with array, Array of Pointers		
Unit III	Pointers &Functions, Arrays& Function	10
Understanding of function, Pointer pointing to function with different declarations, Accessing function with its pointer, Concept of Function returning function. Variable length arguments, Implementation of myPrintf and myScanf.MixedConcepts:Array containing function(s), Array Containing array(s) [1-D, 2-D], Function returning array [1-D, 2-D].		
Unit IV	Making Header File and C Library	10
Understanding Preprocessor Directives and Compilation Process, Concept of Multiple Inclusion, Guard Macros, Role of Guard macros, Making Sample Header file, Understanding Concept of Linker, Creating Object code of function definition, Storing Object code in library, Setting path for Linker, Running code with user defined Header file and Library.		
Unit V	Tools and Software	10
Understanding Text Editors [vi and NANO], Understanding IDE (Integrated Development Environment) [Eclipse, Netbeans and .Net Framework], VB Code Editor in MS Excel, Introduction AutoCAD, Introduction Matlab, Introduction CATIA, Introduction FreePCB		
Text Books	1. "Mastering C" by KR Venugopal 2. "Let us C" by Y. kanetkar 3. "Programming in ANSI C" by E. Balagurusamy.	
Reference Books	1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Pearson Education, 2. 2. Byron S Gottfried, " Programming with C", Schaum's Outlines Tata McGraw-Hill 3. 3. R.G. Dromey, "How to Solve it by Computer", Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	14.05.2022	
Date of Approval by the Academic Council on	20th October 2022	

Course Outcome For CS3207

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to understand about pointers and their usage in programming	3	Em
CO2	Student will be able to understand the usage of arrays in programming	2	S
CO3	Student will be able to use arrays,function pointer for programming	3	S
CO4	Student will be able to program using various C libraries	3	Em
CO5	Student will be able to know the various software tools	2	Em

CO-PO Mapping for CS3207

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	3	2	2	1	1	1	1	1	1	2	1	1	2	1
CO 2	2	2	2	1	1	2	1	1	2	1	1	1	3	1
CO 3	2	3	2	1	1	1	1	1	1	2	1	2	3	2
CO 4	2	2	1	2	1	1	1	1	1	2	1	2	2	1
CO 5	3	2	1	2	2	1	1	1	1	2	1	2	3	1
Avg	3	2.2	1.6	1	1	1.2	1	1	1.2	1.8	1	1	2.6	1.2

PH3140	Title: Engineering Physics Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The Objective of this course is to make the students gain practical knowledge to co-relate with the theoretical studies. To achieve perfectness in experimental skills and the study of practical applications will bring more confidence and ability to develop and fabricate engineering and technical equipments.	
Expected Outcome	On Completion of this course, students are able to – Develop skills to impart practical knowledge in real time solution. Understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.	

List of Experiments

1. To determine the wavelength of monochromatic light by Newton's ring.
2. To determine the wavelength of monochromatic light with the help of Fresnel's biprism.
3. To determine the focal length of two lenses by nodal slide and locate the position of cardinal points.
4. To determine the specific rotation of cane sugar solution using half shade polarimeter.
5. To determine the wavelength of spectral lines using plane transmission grating.
6. To determine the specific resistance of the material of given wire using Carey Foster's bridge.
7. To determine the variation of magnetic field along the axis of a current carrying coil and then to estimate the radius of the coil.
8. To verify Stefan's Law by electrical method.
9. To calibrate the given ammeter and voltmeter.
10. To study the Hall effects and determine Hall coefficient, carrier density and mobility of a given semiconductor material using Hall-effect set up.
11. To determine energy bank gap of a given semiconductor material.
12. To determine E.C.E. of copper using Tangent or Helmholtz galvanometer.
13. To draw hysteresis curve of a given sample of ferromagnetic material and from this to determine magnetic susceptibility and permeability of the given specimen.
14. To determine the ballistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	31-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome For PH 3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the processof performing the experiments on wavelength andfocal length practically.	3	Em
CO2	Students should be able to verify the theortical calculations with observed results in practical experiments.	3	S
CO3	Students should be able to Enhance the skills of using appratus for verification of different laws.	3	S

CO-PO Mapping for PH3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	1	1	1	2	2	1	2	1	1	2	3	1	2	2
CO 2	2	3	1	2	3	1	3	2	1	3	1	2	1	2
CO 3	3	3	1	3	1	3	1	2	3	1	1	3	3	3
Avg	2	2.33	1	2.33	2	1.67	2	1.67	1.67	2	1.6	2	2	2.33

CS3245	Title: Advance Computer Programming & Software Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Study of basic programming principles introduced in Programming Fundamentals. Advanced concepts of program design, implementation and testing. Study of domain specific Softwares	
Expected Outcome	Know concepts in problem solving, to do programming in C language. To write diversified solutions using C language. Study of domain specific Software	

List of Experiments

1. WAP accessing function definition with the help of pointer.
2. WAP accessing 2-D Array with the help of pointer.
3. WAP declaring an array taking length from the user.
4. WAP declaring 2-D array by using Dynamic memory allocation technique.
5. WAP passing arguments to main function.
6. WAP making function accepting VAR_ARGS.
7. Case Study on VB Script in Excel File.
8. Case Study on Matlab Tool.
9. Case Study on FreePCB Tool.
10. Case Study on AutoCAD.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

ME3140	Title: Workshop Practice	L T P C 0 0 3 2
Version No.	1.1	
Course Prerequisites	Nil	
Objectives	To know about the working methods adopted in various mechanical shops along with tools and equipments for making a product. To understand the working of IC engines, Refrigerator, Air conditioner	
Expected Outcome	Student will be able to develop skill in using machines,tools and knowing the basic operations in each shop along with understanding the working of IC engine,refrigerator and airconditioner.	

List of Experiments

I. Introduction

II. To study layout, safety measures and different engineering materials (mild steel, medium carbon steel, high carbon steel, high speed steel and cast iron etc) used in workshop.

III. To determine the least count of vernier caliper, vernier height gauge, micrometer (Screw gauge) and take different reading over given metallic pieces using these instruments.

2. Carpentry Shop:

I. Study of tools and operations and carpentry joints.

II. To prepare half-lap corner joint / mortise - tenon joint.

3. Fitting (Bench Working) Shop:

I. Study of tools and operations.

II. Step fitting of two metal plates using fitting tools.

III. Drilling and Tapping for generating hole and internal thread on a metal plate.

4. Black Smithy Shop:

I. Introduction of different Forging process.

II. Study of tools and operations such as upsetting, drawing down, punching, bending, fullering and swaging.

III. To forge chisel from MS rod.

5. Welding Shop:

I. Introduction of Welding and its classification.

II. Simple butt and Lap welded joints.

6. Sheet-metal Shop:

I. Introduction of various sheet metal operations.

II. Study of tools and operations.

III. To make geometrical shape like frustum, cone and prisms using GI sheet.

7. Machine Shop:

I. Introduction of Single point cutting tool, various machine tools.

II. Simple operations like Plane turning, Step turning and Taper turning.

8. CNC and 3D Printing Shop

III. Study of main features and working parts of CNC machine and accessories that can be used.

IV. Perform different operations on metal components using any CNC machines

V. Demonstration of preparing a product using 3D printing

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome For ME 3140

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to develop the ability to perform the various operations with the help of lathe machine and its tools	3	Em
CO2	Students will be able to develop the ability to perform the various operations using welding	3	S
CO3	Students will be able to develop the ability to perform the various operations using fitting tools	3	S
CO4	Students will be able to develop the ability to perform the various operations on wood using carpenty tools	3	s
CO5	Students will be able to develop the ability to perform the various operations using Sheet metal and blacksmithy tools	3	s

CO-PO Mapping for ME3140

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	3	2	1	1	2	1	1	1	1	1	1	2	3	1
CO 2	2	2	2	1	2	1	1	1	1	1	1	2	3	2
CO 3	2	2	1	1	1	1	1	1	1	1	1	1	3	1
CO 4	3	2	2	1	1	1	1	1	1	1	1	2	3	2
CO 5	3	2	1	1	2	1	1	1	1	1	1	2	3	1
Avg	2.6	2	1.4	1	1.6	1	1	1	1	1	1	1.8	3	1.4

CE3102	Title: Disaster Preparedness and Management	L T P 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The course is intended to provide a general concept in the dimensions of disasters caused by nature beyond the human control as well as the disasters and environmental hazards induced by human activities with emphasis on disaster preparedness, response and recovery.	
Expected Outcome	● Student should be able understand the concept and type of disaster ● Student should be able to understand classification, causes and impact of disaster ● Student should be able to understand approaches of disaster risk reduction ● Student should be able to understand inter-relationship between disasters and development: ● Student should be able to understand disaster risk management in India	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction to Disasters:	5
Concepts, and definitions (Disaster, Hazard, Vulnerability, Resilience, Risks)		
Unit II	Disasters: Classification, Causes, Impacts	4
(including social, economic, political, environmental, health, psychosocial, etc.) Differential impacts- in terms of caste, class, gender, age, location, disability Global trends in disasteis!urban disasters, pandemics, complex emergencies, Climate change		
Unit III	Approaches to Disaster Risk reduction	5
Disaster cycle - its analysis, Phases, Culture of safety, prevention, mitigation and preparedness community based DRR, Structural-nonstructural nesures, roles and responsibilities of- community, Panchayati Raj Institutions/Urban Local Bodies (PRIs/ULBs), states, Centre, and other stake-holders..		
Unit IV	Inter-relationship between Disasters and Development:	5
Factors affecting Vulnerabilities, differential impacts, impact of Development projects such as dams, embankments, changes in Land-use etc. Climate Change Adaptation. Relevance of indigenous knowledge, appropriate technology and local resources		
Unit V	Disaster Risk Management in India	5
Hazard and Vulnerability profile of India Components of Disaster Relief: Water, Food, Sanitation, Shelter, Health, Waste Management Institutional arrangements (Mitigation, Response and Preparedness, DM Act and Policy, Other related policies, plans, programmes and legislation)		
Text Books	1. Bhattacharya, Disaster Science and Management, McGraw Hill Education Pvt. Ltd.	
Reference Books	1. Dr. Mrinalini Pandey, Disaster Management, Wiley India Pvt. Ltd. 2. Jagbir Singh, Disaster Management: Future Challenges and Opportunities, K W Publishers Pvt. Ltd.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	31/05/2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for CE3102

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to develop the ability to perform the various operations with the help of lathe machine and its tools	3	Em
CO2	Students will be able to develop the ability to perform the various operations using welding	3	S
CO3	Students will be able to develop the ability to perform the various operations using fitting tools	3	S
CO4	Students will be able to develop the ability to perform the various operations on wood using carpenty tools	3	s
CO5	Students will be able to develop the ability to perform the various operations using Sheet metal and blacksmithy tools	3	s

CO-PO Mapping for CE3102

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	3	2	1	1	2	1	1	1	1	1	1	2	3	1
CO 2	2	2	2	1	2	1	1	1	1	1	1	2	3	2
CO 3	2	2	1	1	1	1	1	1	1	1	1	1	3	1
CO 4	3	2	2	1	1	1	1	1	1	1	1	2	3	2
CO 5	3	2	1	1	2	1	1	1	1	1	1	2	3	1
Avg	2.6	2	1.4	1	1.6	1	1	1	1	1	1	1.8	3	1.4

SEMESTER 3

ME3308	Title: Strength of Materials	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know conceptual applications of principles of mechanics on rigid and deformable bodies	
Expected Outcome	● Students should be able to understand the resisting behavior of materials under loads in different loading condition like tension, compression etc. and applying the learnings though numerical problems. ● Students should be able to understand the behavior of beams under the action of shear force and bending moment and applying the learnings though numerical problems ● Students should be able to understand the behavior of different machine elements such as shafts and springs under twisting load and applying the learnings though numerical problems. ● Students should be able to understand the behavior of beams under deflection and applying the learnings though numerical problems. ● Students should be able to understand the behavior of building elements such as columns and struts under different loading condition and applying the learnings though numerical problems	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Stress and Strain	6
Simple Stresses and Strains – Tension, Compression and Shear Stresses - Hooke's Law - Compound Stresses - Thermal Stresses – Compound Bars. Two-Dimensional System, Stress at a Point on a Plane, Principal Stresses and Principal Planes, Mohr's Circle.		
Unit II	Shear Force and Bending Moment	5
Shear Force and Bending Moment Diagrams for Beams and Simple Frames - Theory of Simple Bending, Bending Stress Distribution at Sections.		
Unit III	Torsion	6
Theory of Simple Torsion – Torsional Rigidity – Composite Shafts in Series and Parallel. Thin Cylinders and Shells – Thick Cylinders, Helical and Leaf Springs.		
Unit IV	Deflection of Beams	5
Derivation of Differential Equation of Moment Curvature Relation, Deflection of Simple Beams by Double Integration Method		
Unit V	Columns and Struts	4
Buckling of Column, Slenderness Ratio, Euler's Buckling Load for Slender Column, Effective Length for Different End Condition. Introduction to Strain Energy, Stresses due to Impact and Concept of Virtual Work.		
Text Books	1 R K Bansal, Strength of Material, Kindle Edition. 2 R.K.Rajput, Strength of Materials, S.Chand.	
Reference Books	1. G.H.Ryder, Strength of Materials, Macmillan 2. P.K. Nag, Fundamentals of Strength of Materials, Wiley India 3. E. P. Popov, Engineering Mechanics of Solids, Prentice Hall. 4. P.Boresi , Advanced Mechanics of Materials, Wiley	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3308

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to know and understand various mechanical properties of materials for real time applications.	2	Em
CO2	Students should be able to understand the behaviour of trusses under loads and beams under the application of shear force and bending moment.	3	S
CO3	Students should be able to understand the behaviour of shafts under torsion and behavior of cylinder and springs under various loads.	3	S
CO4	Students should be able to understand the behaviour of beams under stresses and apply the knowledge through numerical problems.	3	En
CO5	Students should be able to understand the behaviour of columns and struts and estimate effective length under different conditions.	3	None

CO-PO Mapping for ME 3308

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2
CO 1	3	2	2	2	1	1	1	1	1	2	1	2	3	2
CO 2	3	3	2	2	1	1	1	1	2	1	1	2	3	2
CO 3	2	3	2	3	1	1	1	1	1	2	1	2	2	2
CO 4	3	2	2	3	1	2	1	1	1	2	1	2	3	2
CO 5	3	2	2	2	1	1	1	1	1	2	1	2	3	2
Avg	2.8	2.4	2	2.4	1	1.2	1	1	1.2	1.8	1	2	2.8	2

ME3302	Title:Materials Science	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the various properties of materials	
Expected Outcome	● Student should be able to understand the fundamental knowledge about engineering materials, its modern and atomic concepts, properties, imperfections and applications. ● Student should be able to learn about the magnetic and electric properties and diffusion of solids. ● Student should be able to learn the fundamental knowledge about Iron-Carbon Equilibrium Phase Diagram and alloys. ● Student should be able to learn the different heat treatment processes and corrosion, its causes, effects and prevention. ● Student should be able to learn the fundamental knowledge about powder metallurgy, composites, ceramics and plastics..	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Material Science	5
Introduction: Importance of Materials. Historical Perspective, Brief Review of Modern and Atomic Concepts in Physics and Chemistry. Atomic Models, Periodic Table, Chemical Bonding. Crystallography and Imperfections: Concept of Unit Cell Space Lattice, Bravais Lattices, Common Crystal Structures, Atomic Packing Factor and Density. Miller Indices. X-Ray Crystallography Techniques. Imperfections, Defects and Dislocations in Solids.		
Unit II	Magnetic Properties, Electric Properties and Diffusion of Solid	5
Concept of Magnetism - Di, Para, Ferro Hysteresis. Soft and Hard Magnetic Materials, Magnetic Storages. Energy Band Concept of Conductors, Insulators and Semi-Conductors. Intrinsic and Extrinsic Semi-Conductors. P-N Junction and Transistors. Basic Devices and Their Applications. Diffusion Mechanism, Steady-State and Non-Steady-State Diffusion, Factors Influencing Diffusion.		
Unit III	Phase Diagram and Equilibrium Diagram, Metals and Alloys	5
Phase and Equilibrium Diagrams, Phase Rules, Iron-Carbon Equilibrium Diagram, Various Types of Carbon Steels, Alloy Steels and Cast Irons, its Properties and Uses. Non-Ferrous Metals, Brass, Bronze, Bearing Materials, Their Properties and Uses. Aluminum Alloys.		
Unit IV	Heat Treatment and Corrosion	5
Various Types af Heat Treatment such as Annealing, Normalizing, Quenching, Tempering and Case Hardening. Time Temperature Transformation (TTT) Diagrams. Corrosion and Its Effects. Preventive Methods.		
Unit V	Powder Metallurgy, Ceramics and Plastics	4
Introduction, Process Detail, Sintering, Secondary and Finishing Operations. Ceramics: Structure Types and Properties and Applications of Ceramics. Mechanical/Electrical Behavior and Processing of Ceramics. Various Types of Plastics and Their Applications, Mechanical Behavior and Processing of Plastics.		
Text Books	1. V. Raghavan ,Materials Science and Engineering, Prentice Hall India 2. R. Srinivasan ,Engineering Materials and Metallurgy, Tata McGraw Hill	
Reference Books	1. E. P. Degarmo ,Materials and Processes in Manufacturing, Wiley India 2. Budinski and Budinski ,Engineering Materials: properties and selection, Prentice Hall India 3.William D. Callister, Material Science and Engineering an Introduction, John Wiley and Sons	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3302

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the fundamental knowledge about engineering materials, its modern and atomic concepts, properties, imperfections and applications.	2	Em
CO2	Student should be able to learn about the magnetic and electric properties and diffusion of solids.	2	S
CO3	Student should be able to learn the fundamental knowledge about Iron-Carbon Equilibrium Phase Diagram and alloys.	2	S
CO4	Student should be able to learn the different heat treatment processes and corrosion, its causes, effects and prevention.	2	En
CO5	Student should be able to learn the fundamental knowledge about powder metallurgy, composites, ceramics and plastics.	2	None

CO-PO Mapping for ME 3302

CourseOutcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2,Low-1,Notrelated-0)												ProgramSpecific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	1	1	1	2	1	1	1	1	1	2	3	2
CO2	3	3	2	2	1	2	2	1	2	2	1	2	3	2
CO3	3	2	2	1	1	2	1	1	1	1	2	2	2	2
CO4	2	3	2	2	1	2	1	1	1	1	2	2	3	2
CO5	3	3	2	1	1	1	1	1	1	1	1	2	3	2
Avg	2.8	2.8	1.8	2.4	1	1.8	1.2	1	1.2	1.2	1.2	2	2..8	2

ME3306	Title:Thermal Engineering	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make the students aware of thermal concepts and their application	
Expected Outcome	● Student should be able to understand the basic concepts of thermodynamics and know the thermodynamic relations ● Student should be able to understand the formation of steam and calculate the efficiency of different power cycles. ● Student should be able to understand the functioning of steam power plant, gas power plant and their components. ● Student should be able to analyze the performance of boilers and flow through nozzles used in existing thermal system. ● Student should be able to apply thermodynamics concepts in the compressor and Evaluate the efficiency of compressor.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Basic Thermodynamics	8
Basic Concepts, Laws of Thermodynamics, Steady Flow Energy Equation and Its Application, Carnot Cycle, Reversed Carnot Cycle, Performance. Clausius Inequality. Concept of Entropy, T-S Diagram, T-DS Equations - Entropy Change for Different Processes, Principle of Increase in Entropy, Availability and Irreversibility Analysis for Open and Closed Systems. Maxwell Relations, Heat Capacities Relations, Energy Equation, Joule-Thomson Experiment, Clausius-Clapeyron Equation.		
Unit II	Pure Substances and Power Cycle	8
Formation of Steam and Its Thermodynamic Properties, Determination of Dryness Fraction, Steam Table and Mollier Chart, Ideal and Actual Rankine, Reheat and Regenerative Cycle. Air Standard Cycles - Otto, Diesel, Dual, Brayton, Stirling and Ericsson Cycle.		
Unit III	Gas Turbine and Steam Turbine	8
Gas Turbine: Open and Closed Cycle. Performance and Its Improvement, Regenerative, Intercooled and Reheat Cycle. Steam Turbine: Types, Impulse and Reaction Principles, Velocity Diagrams, Work Done and Efficiency, Multi-Staging, Compounding and Governing.		
Unit IV	Steam Nozzle and Boilers	6
Steam Nozzle: Types and Shapes of Nozzles Flow of Steam Through Nozzles, Critical Pressure Ratio, Variation of Mass Flow Rate with Pressure Ratio, Effect of Friction, Meta-Stable Flow. Boilers: Types, Comparison. Mountings and Accessories, Performance Calculations, Draught, Boiler Trial.		
Unit V	Compressors	6
Classification and Comparison, Reciprocating Compressors-Working Principle, Work of Compression - With and Without Clearance, Volumetric Efficiency, Isothermal Efficiency and Isentropic Efficiency. Multistage Air Compressor with Intercooling, Centrifugal Compressors- Working Principle, Work of Compression.		
Text Books	1. R.K.Rajput ,Thermal Engineering, Laxmi Publication 2. Mahesh. M. Rathore ,Thermal Engineering, Tata McGraw Hill,	
Reference Books	1. Y. Cengel and M. Boles ,Thermodynamics - An Engineering Approach, TMH 2. P.L.Ballaney ,Thermal Engineering, Khanna Publishers 3. J.P. Holman, Thermodynamics, Tata McGraw Hill 4. P.K Nag ,Engineering Thermodynamics, Tata McGraw Hill New Delhi	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3306

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the basic concepts of thermodynamics and know the thermodynamic relations	2	Em
CO2	Student should be able to understand the formation of steam and calculate the efficiency of different power cycles.	3	S
CO3	Student should be able to understand the functioning of steam power plant, gas power plant and their major components.	3	S
CO4	Student should be able to analyze the performance of boilers and flow through nozzles used in existing thermal system.	3	S
CO5	Student should be able to know concepts of compressor and its working	3	S

CO-PO Mapping for ME 3306

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	1	1	2	1	2	2
CO 2	2	3	2	1	2	1	1	1	1	1	1	1	3	2
CO 3	3	3	2	1	1	2	1	1	1	1	1	1	3	2
CO 4	3	3	2	1	2	1	1	1	1	1	1	2	3	2
CO 5	3	3	2	1	1	1	1	1	1	1	2	1	3	2
Avg	2.8	2.8	2	1	1.4	1.2	1	1	1	1	1.4	1.2	2.8	2

ME3304	Title:Fluid Mechanics and Machines	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the mechanics of fluid and to study and their applications in flow through pipes and hydraulic machines	
Expected Outcome	● Students should be able to understand about basics of fluid mechanics and concepts related to fluid statics. ● Students should be able to clear concepts related to fluid kinematics and fluid dynamics and clear concepts related to basic equations used in fluid dynamics also student able to solve application problems of fluid dynamics. ● Students should be able to understand the mechanics of fluid and to study and their applications in flow through pipes and External Flows. ● Students should be able to understand the properties and characteristics of basics of turbomachinery and Hydraulic turbines. Also able to solve application problems.	
Unit No.	Unit Title	No. of hours(per Unit)
Unit I	Fluid Properties and Statics	7
Introduction: Dimensions and Units, Physical Properties of Fluids- Specific Gravity, Viscosity, Surface Tension, Vapor Pressure and Their Influence on Fluid Motion, Atmospheric Gauge and Vacuum Pressure, Measurement of Pressure - Piezometer, U Tube and Differential Manometers.Fluid Statics: Pressure-Density-Height Relationship, Pressure on Plane and Curved Surfaces, Centre of Pressure, Buoyancy, Stability of Immersed and Floating Bodies, Fluid Masses Subjected to Linear Acceleration and Uniform Rotation about an Axis.		
Unit II	Fluid Kinematic and Dynamics	7
Fluid Kinematics: Stream Line, Path Line and Streak Lines and Stream Tube, Classification of Flows, Equation of Continuity for One Dimensional and 3D Dimensional Flow, Circulation, Stream Function and Velocity Potential, Source, Sink and Doublet.Fluid Dynamics: Surface and Body Forces – Euler's and Bernoulli's Equations for Flow Along a Stream Line, Measurement of Flow, Momentum Equation and Its Application on Force on Pipe Bend.		
Unit III	Internal and External Flows	6
Flow Through Tubes and Plates -Shear Stress and Velocity Distributions, Navier-Stokes Equations of Fluid Motion, Reynolds Transport Theorem, Reynolds Experiment - Darcy-Weisbach Equation, Minor Losses in Pipes - Pipes in Series and Pipes in Parallel, Total Energy Line, Hydraulic Gradient Line.		
Unit IV	Turbo Machinery and Hydraulic Turbines	8
Basics of Turbo Machinery: Hydrodynamic Force of Jets on Stationary and Moving -Flat, Inclined, and Curved Vanes, Velocity Diagrams, Work Done and Efficiency, Flow Over Radial Vanes.Hydraulic Turbines: Classification of Turbines, Impulse and Reaction Turbines, Pelton Wheel, Francis Turbine and Kaplan Turbine - Working Proportions, Work Done, Efficiencies, Draft Tube – Theory, Functions and Efficiency.		
Unit V	Pumps and Compressors	8
Centrifugal Pumps: Classification, Working, Work Done, Manometric Head, Losses and Efficiencies, Specific Speed, Performance Characteristic Curves, NPSH. Reciprocating Pumps: Components and Principles, Classification, Discharge, Work Done, Power Requirement.Compressors: Classification and Types, Rotary and Centrifugal - Single Stage and Multistage, Construction Details and Performance Characteristics		
Text Books	1. P.N. Modi and S.M. Seth ,Hydraulics and Fluid Mechanics, Standard Book House 2. R K Bansal ,Fluid Mechanics and Hydraulic Machines, Laxmi publications.	
Reference Books	1. Robert .Fox, Alan T. McDonald, Philip J.Pritchard, Introduction to Fluid Mechanics, John Wiley 2. C.S.P. Ojha, R.Berndtsson and P.N. Chandramouli , Fluid Mechanics and Machinery, Oxford University Press 3. S.K. and Biswas ,Introduction of Fluid Mechanics and Fluid Machines, TMH,	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome For ME 3304

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand about basics of fluid mechanics and concepts related to fluid statics.	2	Em
CO2	Students should be able to clear concepts related to fluid kinematics and fluid dynamics and clear concepts related to basic equations used in fluid dynamics also student able to solve application problems of fluid dynamics.	2	S
CO3	Students should be able to understand the mechanics of fluid and to study and their applications in flow through pipes and External Flows.	2	S
CO4	Students should be able to understand the properties and characteristics of basics of turbomachinery and Hydraulic turbines. Also able to solve application problems.	2	En
CO5	Students should be able to understand the properties and characteristics of a fluid and also analyze the performance of pumps and Compressors.	2	None

CO-PO Mapping for ME 3304

CourseOutcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2,Low-1,Notrelated-0)												ProgramSpecific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	1	1	1	1	1	1	1	1	1	1	1	3	1
CO2	3	2	1	1	1	1	1	1	2	2	1	1	3	1
CO3	3	3	3	1	1	1	1	1	1	1	1	2	3	3
CO4	3	3	3	1	1	1	1	1	1	1	1	2	3	3
CO5	3	2	1	1	1	1	1	1	1	1	1	1	3	3
Avg	3	2.2	1.8	1	1	1	1	1	1.2	1.2	1	1.4	3	2.2

ME3307	**Title: Computer Aided Machine Drawing**	**L T P C** **1 0 3 3**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To read and interpret the drawings correctly for production of components accurately and development of sketching ability which strengthens effective engineering communication.	
Expected Outcome	● Student should be able to know about various Conventions and symbols and study limits, fits and Tolerances he should be able to Draw different types of screw threads, threaded fasteners, riveted joints and welded joints. ● Student should be able to understand and draw the part and assembly drawing of Machine Components. ● Student should be able to understand the basic commands of AutoCAD software and draw 2D and 3D drawing on this software.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Introduction**	10
Introduction to Machine Drawing, Conventions and Symbols, Limits, Fits and Tolerances, Drawing Different Types of Screw Threads and Threaded Fasteners. Drawing of Different Types of Riveted Joints and Welded Joints		
Unit II	**Assembly Drawings**	20
Free Hand Sketching of Machine Component like Socket Spigot Joint, Connecting Rod, Piston Drawing Machine Component- Plummer Block, Knuckle Joint, Shaft Coupling. Drawing Machine Components like V Belt Pulley, Machine Vice, Screw Jack.		
Unit III	**Drawing Using Computer Software**	18
Starting Autocad, Command Window, Status Bar, Coordinate System, Creating Basic Object Using Different 2D Commands. Creating Drawings With Dimensions. Rules of Isometric Drawing, Working in Isometric Drawing, Setting the Isometric Grid and Snap. Working in 3D, 3D Coordinate Modifying Visuals Styles of Solid. Creating 3D Designs: Working with Predefined Solid Primitive, Manipulating, Modifying 3D Profile and Models, Filleting and Chamfering Solid Models. Prepare Production Drawing of a Machine Part in Autocad.		
Text Books	1. P.S. Gill, Machine Drawing ,Kataria and Sons, Ludhiana. 2. Er. R. K. Dhawan ,A Textbook of Machine Drawing , S Chand publication	
Reference Books	1. GR Nagpal , Machine Drawing, Khanna Publishers, New Delhi. 2. ND Bhatt, Machine Drawing, Charotar Book Depot. 3. Sadhu Singh and P.L. Shah ,Fundamentals of Machine Drawing, PHI	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3307

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to know about various Conventions and symbols and study limits, fits and Tolerances he should be able to Draw different types of screw threads, threaded fasteners, riveted joints and welded joints.	3	Em
CO2	Student should be able to understand and draw the part and assembly drawing of Machine Components.	4	S
CO3	Student should be able to understand the basic commands of AutoCAD software and draw 2D and 3D drawing on this software.	4	S,Em

CO-PO Mapping for ME 3307

CourseOutcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2,Low-1,Notrelated-0)												ProgramSpecific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	2	1	1	1	1	1	1	2	2	1
CO2	3	3	3	2	2	1	1	1	2	2	1	2	2	2
CO3	3	2	3	2	3	1	1	1	1	1	1	3	2	2
Avg	3	2.3	3	2	2.3	1	1	1	1.3	1.3	1	2.3	2	1.6

ME3344	Title: Strength of Materials Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the methods to determine various properties of material.	
Expected Outcome	● students should be able to calculate the hardness of different materials used in mechanical enginnering ● students should be able to perform different tests like impact test, torsion test, tensile and compressive tests to check the mechanical properties of materials ● students should be able to check the deflection in beams and perform different tests like creep test and buckling of column	

List of Experiments

1. Verification of principle of moment: Bell crank lever.
2. Determination of hardness of metals: Brinell / Vicker / Rockwell hardness test
3. Determination of impact strength of metals: Izod / Charpy impact test
4. Determination of tensile strength and percentage elongation of the given metal specimen
5. Determination of compressive strength of the given specimen.
6. Determination of torsional strength and modulus of rigidity for metals
7. Determination of spring index of the given helical coil spring
8. Experiment on deflection of beam
9. Performing creep test of the given specimen
10. To perform the buckling of column under different end conditions.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

Course Outcome for ME 3344

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to calculate the hardness of different materials used in mechanical engineering	3	Em
CO2	Students should be able to perform different tests like impact test, torsion test, tensile and compressive tests to check the mechanical properties of materials	3	S
CO3	Students should be able to check the deflection in beams and perform different tests like creep test and buckling of column	3	S

CO-PO Mapping for ME 3344

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2,Low-1,Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	2	2	1	1	1	1	1	1	1	2	3	2
CO2	2	3	2	3	1	1	1	1	1	1	1	2	3	2
CO3	3	3	2	3	1	1	1	1	1	1	1	2	3	2
Avg	2.3	3	2	2.6	1	1	1	1	1	1	1	2	3	2

ME3343	Title: Thermal Engineering Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the working of boilers and engines	
Expected Outcome	● Student should understand the working and determine the performance parameters of IC engines. ● Student should understand the construction and working of different boilers ● Student should able to analyse the performance parameters of receprocating compressor.	
List of Experiments		
1. Study and sketch of Lancashire boiler model (Fire tube boiler). 2. Study and sketch of Babcock and Wilcox boiler model (Water tube boiler). 3. Study and compare the working of two stroke petrol engine & two stroke diesel engine model. 4. Study the working of steam engine. 5. Study and compare the working of four stroke SI engine & CI engine. 6. To determine the brake horse power, volumetric efficiency of a single cylinder, four stroke water cooled, Vertical diesel engine. 7. To determine the IHP of IC engine by Morse Test. 8. To prepare the heat balance sheet for IC engine Test rig 9. To determine the free air delivered and volumetric efficiency of reciprocating multi stage air compressor. 10. To Study the working and function of various boiler mountings and accessories.		
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME3343

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should understand the working and determine the performance parameters of IC engines.	3	Em
CO2	Student should understand the construction and working of different boilers	2	S
CO3	Student should able to analyse the performance parameters of reciprocating compressor.	3	S

CO-PO Mapping for ME3343

CourseOutcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2,Low-1,Notrelated-0)												Program SpecificOutcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	1	1	1	2	1	2	2	2	2
CO2	2	2	2	2	2	1	1	1	2	1	1	2	2	2
CO3	3	2	2	2	2	2	1	1	1	1	2	2	3	2
Avg	2.67	2	2	2	2	1.33	1	1	1.67	1	1.67	2	2.33	2

ME3341	Title:Material Science Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand structure-property correlation, phase diagrams and properties of the solid based on the phase diagram.	
Expected Outcome	● Student should be able to learn and identify the different properties possessed by the engineering materials. ● Student should be able to learn and perform the microscopic examination using metallurgical microscope and specimen polishing machine. ● Student should be able to learn and perform the different heat treatment processes and calculate the difference in hardness before and after heat treatment.	

List of Experiments

1. Making a plastic pattern using injection moulding.
2. Specimen preparation for micro structural examination using cutting, grinding, polishing, etching.
3. Grain size determination of a given specimen.
4. Comparative study of microstructures of different given specimens (mild steel, gray cast iron, brass, copper etc.)
5. Annealing and normalizing of the given specimen and comparison of hardness before and after treatment.
6. Hardening and tempering of the given specimen and comparison of hardness before and after the treatment.
7. Case hardening of the given specimen using gas flame and comparison of hardness before and after treatment.
8. To determine the energy band gap of a given semiconductor material
9. To measure and compare the variation of resistance/resistivity of metal and semiconductor with temperature
10. Study of microstructure of welded component and identification of HAZ.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

Course Outcome for ME 3341

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to learn and identify the different properties possessed by the engineering materials.	3	Em
CO2	Student should be able to learn and perform the microscopic examination using metallurgical microscope and specimen polishing machine.	3	S
CO3	Student should be able to learn and perform the different heat treatment processes and calculate the	3	S
	difference in hardness before and after heat treatment.		

CO-PO Mapping for ME 3341

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2,Low-1, Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	2	1	1	1	1	1	1	1	3	3	2
CO2	3	2	2	3	1	1	1	1	1	1	1	2	3	2
CO3	2	2	2	3	1	1	1	1	1	1	1	2	3	2
Avg	2.3	2	2	2.6	1	1	1	1	1	1	1	2.3	3	2

ME 3342	Title: Fluid Mechanics and Machines Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To learn methods to measure the discharge and head losses. To learn the working and performance characteristics of hydraulic turbines	
Expected Outcome	● Students should be able to learn practical espects of fluid Mechanics like pressure measurement, losses in fluid flow or due to shape change and apply them in designing and problem solving ● Students should be able to know the practical aspects of various turbines such as kaplan, francis and apply in designing process ● Students should be able to know the practical aspects of various pumps such as reciprocating pump and apply in designing process	

List of Experiments

1. To determine the coefficient of discharge of venturi meter and orifice meter
2. To measure the frictional losses in pipes of different sizes.
3. To determine the coefficient of loss of head due to sudden contraction.
4. To verify the Bernoulli's equation.
5. To find the coefficient of impact of jet on a flat circular and hemispherical vane.
6. To find out the efficiency of the Pelton wheel turbine on different loads.
7. To find out the efficiency of the Francis turbine on different loads.
8. To conduct a test at various heads of given single stage centrifugal pump and to find its efficiency.
9. To conduct a test at various heads of given reciprocating pump and calculate its efficiency.
10. To determine the coefficient of discharge of an orifice of a given shape.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

Course Outcome for ME 3342

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to learn practical espects of fluid Mechanics like pressure measurement, losses in fluid flow or due to shape change and apply them in designing and problem solving	3	Em
CO2	Students should be able to know the practical aspects of various turbines such as kaplan, francis and apply in designing process	3	S
CO3	Students should be able to know the practical aspects of various pumps such as reciprocating pump and apply in designing process	3	S

CO-PO Mapping for ME 3342

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2,Low-1,Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	2	1	1	2	1	1	1	1	2	2	3	3
CO2	3	3	2	1	1	2	1	1	1	1	2	2	3	2
CO3	3	3	2	1	1	2	1	1	1	1	2	2	2	3
Avg	2.67	2.67	2	1	1	2	1	1	1	1	2	2	2.67	2.67

SEMESTER 4

ME3404	Title:Heat Transfer	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	ME3306	
Objectives	To understand the mechanisms of heat transfer under steady and transient conditions and to know about various modes of heat transfer	
Expected Outcome	● Student should be able to Understand the modes of heat transfer and its governing laws and also acquire skills to calculate heat transfer in steady state conditions ● Student should be able to calculate the heat transfer in transient conditions and understand the importance of extended surface. ● Student should be able to understand convective heat transfer and find the heat transfer coefficient in varying conditions. ● Student should be able to analyse heat exchangers and understand the phase change heat transfer. ● Student should be able to understand the various principles involved in the radiation heat transfer and find the heat transfer rate	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Conduction Heat Transfer	5
Introduction to Heat Transfer, Different Modes of Heat Transfer, Effect of Temperature on Thermal Conductivity of Materials, Introduction to Combined Heat Transfer Mechanism. Conduction: General Equation in Different Coordinates, One Dimensional Steady State Heat Conduction (Plane and Composite Systems), Introduction to Conduction with Internal Heat Generation.		
Unit II	Fins and Transient Heat Conduction	4
Extended Surfaces, Transient Heat Conduction (Lumped Analysis and Use Of Heisler's Charts).		
Unit III	Convection Heat Transfer	5
Boundary Layer Concept, Forced Convection: External Flow (Flow Over Plates, Cylinders and Spheres). Internal Flow (Entrance Effects). Free Convection: Flow Over Vertical Plate, Horizontal Plate, Inclined Plate, Cylinders and Spheres.		
Unit IV	Phase Change Heat Transfer and Heat Exchangers	5
Nusselt's Theory of Condensation, Regimes of Pool Boiling, Correlations in Boiling and Condensation. Heat Exchanger Types - Overall Heat Transfer Coefficient – Fouling Factors. LMTD and NTU Methods		
Unit V	Thermal Radiation	5
Basic Radiation Concepts; Radiation Properties of Surfaces; Black Body Radiation Laws; Shape Factor; Black-Body Radiation Exchange; Radiation Exchange Between Non-Black Bodies in an Enclosure; Infinite Parallel Planes, Radiation Shields.		
Text Books	1. Heat Transfer, P.K. Nag, Tata McGraw Hill, New Delhi. 2. R. C. Sachdeva , Fundamentals of Engineering Heat and Mass transfer, New Age International Publishers.	
Reference Books	1. Frank P. Incropera and David P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley and Sons. 2. S.P. Venkateshan , Heat Transfer, , Ane Books, New Delhi. 3. C.P. Kothandaraman, Fundamentals of Heat and Mass Transfer, New Age International, New Delhi. 4. R. Yadav , Heat and Mass Transfer, Central Publishing House. 5. J.P. Holman , Heat and Mass Transfer, Tata McGraw Hill.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome ForME3404

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to Understand the modes of heat transfer and its governing laws and also acquire skills to calculate heat transfer in steady state conditions	2	Em
CO2	Student should be able to calculate the heat transfer in transient conditions and understand the importance of extended surface.	2	S
CO3	Student should be able to understand convective heat transfer and find the heat transfer coefficient in varying conditions.	2	S
CO4	Student should be able to analyse heat exchangers and understand the phase change heat transfer.	2	S
CO5	Student should be able to understand the various principles involved in the radiation heat transfer and find the heat transfer rate	2	S

Mapping for ME3404

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	3	2	3	1	1	1	1	1	1	2	3	3
CO 2	3	3	2	2	2	1	1	1	1	1	1	2	3	1
CO 3	3	2	2	2	2	2	1	1	2	1	2	2	3	1
CO 4	3	3	3	2	2	1	2	1	1	2	1	2	3	1
CO 5	3	2	3	2	3	2	1	1	2	1	2	2	3	2
Avg	3	2.4	2.6	2	2.4	1.4	1.2	1	1.4	1.2	1.4	2	3	1.6

ME3402	Title: Theory of Machines	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the motion, transmission of the motion and the forces responsible for the motion.	
Expected Outcome	● Student should be able to understand the basic components used in the making of machines and mechanism along with the exploration of their interrelation to give them motion ● Student should be able to understand the use of clutches, brakes and dynamometers in vehicles and applying the knowledge gained through numerical problems ● Student should be able to understand the application of flywheel in machines and applying the knowledge gained through numerical problems ● Student should be able to understand the application of governors in machines and applying the knowledge gained through numerical problems ● Student should be able to understand the concept of gyroscope and cams in machines & aircrafts and applying the knowledge gained through numerical problems	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Kinematics	8
Links Types, Kinematics Pairs Classification, Constraints Types, Degree of Freedom, Grubler's Equation, Linkage Mechanisms, Inversions of Four Bar Linkage, Slider Crank Chain and Double Slider Crank Chain. Velocity in Mechanisms: Velocity of Point in Mechanism, Relative Velocity Method Instantaneous Point in Mechanism, Kennedy's Theorem, Instantaneous Center Method		
Unit II	Friction Devices: Clutches, Brakes and Dynamometers	7
Classification of Clutches, Torque Transmission Capacity, Considerations for Uniform Wear and Uniform Pressure Theory, Single Plate and Multi-Plate Clutch, Centrifugal Clutch, Classification of Brakes, Braking Effect, Analysis of Brakes, Classification of Dynamometers.		
Unit III	Flywheel	7
Significance of Flywheel, Turning Moment and Crank Effort Diagrams for Reciprocating Machines, Coefficient of Fluctuation of Speed and Energy, Limiting Velocity of Flywheel, Design of Flywheels for Engines and Punching Machines		
Unit IV	Governors	7
Necessity of Governor, Classification of Governors, Working Principle of Centrifugal Governors, Concept of Control Force, Control Force Diagram, Stability of Governor, Condition for Stability, Concept of Isochronism, Sensitivity of Governor, Characteristics of Governors, Hunting of Governors.		
Unit V	Gyroscope and Cams	7
Principle of Gyroscope, Definition of Axes, Active and Reactive Couples; Roll, Yaw and Pitch Motions; Gyroscopic Effect in a Rotor, Two Wheelers, Four Wheelers, Ship and Airplane. Introduction to Cams and Follower.		
Text Books	1. S S Rattan, Theory of Machines, Tata McGraw-Hill. 2. J.Uicker , Gordon R Penstock and J.E. Shigley ,Theory of Machines and Mechanisms, Oxford publication.	
Reference Books	1. R L Norton ,Kinematics and Dynamics of Machinery, Tata McGraw-Hill. 2. Kenneth J Waldron , Gary L Kinzel, Kinematics, Dynamics and Design of Machinery, Wiley publication. 3. A G Ambekar ,Mechanism and Machine Theory, PHI 4. Martin, Kinematics and Dynamics of Machines, McGraw Hill.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome For ME 3402

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the basic components used in the making of machines and mechanism along with the exploration of their interrelation to give them motion	2	Em
CO2	Student should be able to understand the use of clutches, brakes and dynamometers in vehicles and applying the knowledge gained through numerical problems	3	S
CO3	Student should be able to understand the application of flywheel in machines and applying the knowledge gained through numerical problems	3	S
CO4	Student should be able to understand the application of governors in machines and applying the knowledge gained through numerical problems	3	S
CO5	Student should be able to understand the concept of gyroscope and cams in machines & aircrafts and applying the knowledge gained through numerical problems	3	S

CO-PO Mapping for ME 3402

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2,Low-1,Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	1	1	1	1	1	1	2	3	3
CO2	3	3	1	1	1	1	1	1	1	1	1	1	2	2
CO3	3	3	2	1	1	1	1	1	1	1	1	2	3	2
CO4	3	3	1	2	1	1	1	1	1	1	1	2	2	3
CO5	3	3	2	1	1	1	1	1	1	1	1	1	3	3
Avg	3	3	1.6	1.2	1	1	1	1	1	1	1	1.6	2.6	2.6

ME3410	Title: Manufacturing Science I	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To acquire knowledge about the casting & welding for manufacturing industries.	
Expected Outcomes	1. Student will be able to gain the knowledge in material casting processes and develop an understanding of the dependent and independent variables which control materials casting in a production setting. 2. Student will be able to introduce to good foundry practices and product designconsiderations. 3. Student will be able to get overview of joining processes; different welding processes weld testing and advanced processes to be able to appreciate the practical applications of welding.	
Unit No.	Unit Title	No. of hours(per Unit)
Unit I	Patterns and Pattern making &Mould	7
Introduction to Foundry - Steps involved in casting, advantages, limitations and applications of casting process. Pattern types, allowances for pattern, pattern materials, color coding and storing of patterns.Moulding methods and processes-materials, equipment, Moulding sand ingredients, essential requirements, sand preparation and control, testing, cores and core making. Design considerations in casting, gating and Riser - directional solidification in castings, Metallurgical aspects of Casting.		
Unit II	Casting Processes, Melting, Pouring and Testing	8
Sand castings, pressure die casting, permanent mould casting, centrifugal casting, precision investment casting, shell Moulding, Co2 Moulding, continuous casting-squeeze casting, electro slag casting, Fettling and finishing, defects in Castings, Casting of non-ferrous materials.Melting furnaces- -crucibles oil fired furnaces-electric furnaces-cupola, selection of furnace, calculation of cupola charges-Degasification, inoculation, pouring techniques casting defects and Inspection of castings.		
Unit III	Basic Joining Processes	7
Types of welding-gas welding, -arc welding,-shielded metal arc welding, GTAW, GMAW, SAW, ESW-Resistance welding (spot, seam, projection, percussion, flash types)-atomic hydrogen arc welding-thermit welding, Flame cutting - Use of Oxyacetylene, modern cutting processes, arc cutting,		
Unit IV	Special WeldingProcesses	7
Soldering, brazing and braze welding and their application., welding of special materials – Stainless steel, Aluminium etc. weldability of cast iron, steel, stainless steel, aluminium alloys. Introduction to Electron beam and Laser welding.		
Unit V	Design and Testing of Weldments	7
Welding symbols-Positions of welding-joint and groove design-weld stress-calculations-design of weld size, estimation of weld dilution, heat input, effect of welding parameters preheating, and post heating temperature: Selection of electrodes, flux etc.Inspection of welds – destructive and non-destructive testing methods, Defects in welding-causes and remedies, -effect of gases in welding-fatigue failure in Weldments.		
Text Books	1.Lindberg,"Processes and Materials of Manufacture", Prentice hall India (p) Ltd. 2.P.N.Rao, "Manufacturing Technology", TMH Ltd 1998(Revised edition). 3.Richard L.Little, "Welding& Welding Technology", Tata Mc Graw Hill, 1992.	
Reference Books	1.Heine, Loper and Rosenthal, "Principles of Metal Casting", Tata Mc Graw Hill Publishing Co, Ltd; New Delhi, 1995. 2.Doehler.E.H, "Die Casting", McGraw Hill Book Co. New York.1991. 3.Banga T.R; and Agrawal R.L, "Foundry Engineering", Khanna Publishers, 1992. 4.Serope Kalpakjian, Steven R.Schmid, "Manufacturing Engineering and Technology". (4th Edition), Prentice Hall 2000-06-15 ISBN:0201361310 5.E.PaulDeGarmo, J.T.Black, Ronald A.Khoser, "Materials and Processes in Manufacturing" Wiley; 9 edition (December6, 2002) ISBN:0471033065.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	

Date of approval by the Academic Council	20.10.2022

Course Outcome For ME 3410

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand the various considerations in Pattern making &Moulds preparation	2	s
CO2	Student will be able to understand about the Casting Processes and melting furnaces	2	S
CO3	Student will be able to know about the welding process	2	S
CO4	Student will be able to know about the special welding processes	2	S
CO5	Student will know about the weldments design and its testing methods	2	S

CO-PO Mapping for ME 3410

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2,Low-1,Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	1	1	1	1	1	1	1	1	2	3	3
CO2	3	3	1	1	1	1	1	1	1	1	1	1	2	2
CO3	3	2	2	1	1	1	1	1	1	1	1	2	3	2
CO4	3	3	1	2	1	1	1	1	1	1	1	2	2	3
CO5	3	2	2	1	1	1	1	1	1	1	1	1	3	2
Avg	3	2.6	1.6	1.2	1	1	1	1	1	1	1	1.6	2.6	2.4

ME3603	Title: Measurement and Metrology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To acquire knowledge on different mechanical measurement instruments.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Errors in measurements, measuring instruments sensitivity, stability, range, accuracy and precision-static and dynamic response- repeatability, systematic, source of error, statistical analysis of data, regression analysis, correction, calibration. Estimation of uncertainty, introduction to limits, fits, tolerances and is standards, tolerance analysis in manufacturing and assembly. Standards of linear measurement, line and end standards. Interchange ability and standardization. Measurement system analysis.		
Unit II	Linear and Angular Measurements	8
Linear measuring instruments: evolution, types, classification, limit gauges, gauge design, terminology, procedure, concepts of interchange ability and selective assembly, angular measuring instruments, types, bevel protractor clinometers angle gauges, spirit levels sine bar, angle alignment telescope, autocollimator, applications. Measurement of pressure: gravitational, directing acting, elastic and indirect type pressure transducers. Measurement of very low pressures (high vacuum). Strain measurement: types of strain gauges and their working, strain gauge circuits, temperature compensation. Strain rosettes, calibration.		
Unit III	Power Flow and Temperature Measurement	7
Flow measurement: pitot tube, venturimeter, hot wire anemometry, laser doppler velocimetry, rotameter Temperature measurement: thermometers, bimetallic thermocouples, thermistors and pyrometers. Measurements of force, torque: different types of load cells, elastic transducers, pneumatic & hydraulic systems. Seismic instruments. Measurements of acceleration, and vibration: accelerometers vibration pickups and decibel meters, vibrometers.		
Unit IV	Metrology	7
Comparators: sigma, Johansson's Microkrator. Limit gauges classification, Taylor's principle of gauge design Basic concept of lasers, advantages of lasers, laser interferometers – types, DC and AC lasers interferometer, applications, straightness, alignment. Basic concept of CMM, types of CMM, constructional features, probes, accessories, software, applications, basic concepts of machine vision system, element, applications.		
Unit V	Form Measurement	7
Principles and methods of straightness, flatness measurement, thread measurement, gear measurement, surface finish measurement, roundness measurement, applications.		
Text Books	1. Jain, RK ,Engineering Metrology, Khanna Publishers 2. Jain, R.K., Mechanical Measurement, Khanna Publishers	
Reference Books	1. Gupta SC , Engineering Metrology, Dhanpat Rai Publications 2. Beckwith ,Mechanical Measurements, Pearson 3. Bentley, Principles of Measurement Systems, Pearson. 4. Bewoor and Kulkarni ,Metrology of Measurements, McGraw Hill.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome For ME 3603

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to develop the inspection of engineering parts with various precision instruments.	2	Em
CO2	Students should be able to the basic use Principles of measuring instruments and gauges and their uses.	2	S
CO3	Students should be able to the significance of measurement system, errors, transducers, intermediate modifying and terminating devices.	2	S
CO4	Students should be able to the advances in Metrology such as use of CMM, Laser, Machine Vision System for Metrology etc.	2	S
CO5	Students should be able to the Inspection of spur gear, thread elements and Evaluation and inspection of surface roughness.	2	S

CO-PO Mapping for ME 3603

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	3	1	1	1	1	1	1	2	2	2
CO 2	3	3	2	3	3	1	1	1	1	1	1	2	2	2
CO 3	3	2	3	2	3	2	1	1	2	1	1	2	3	3
CO 4	3	2	2	2	3	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	2	1	1	2	1	1	3	2	3
Avg	2.6	2.2	2.6	2.2	3	1.4	1	1	1.4	1	1	2.2	2.,2	2.4

ME3445	Title:Manufacturing Science I Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To acquire practical knowledge about the casting & welding for manufacturing industries.	
	List of Experiments	

1.Design of pattern & pattern making
- At least one wooden pattern with proper calculations

2.Making a green sand mould
- One mould each on pit Moulding& split pattern
- At least two for different type of components with core and without core to be made

3.Sand testing experiments to determine:
- Grain Fineness Number
- Green Strength
- Permeability Test
- Moisture content test

4.Study, understanding and working of simple destructive & non-destructive testing procedures used for castings

5. Melting of metal in furnace

6. Preparation of simple shapes of metal sheets by gas cutting

7.Preparation of specimen & welding of:

Angle joint / T joint

Lap joint / Butt joint

(By use of both Arc & Gas welding)

8.Study, understanding and working of simple destructive & non-destructive testing procedures used for welding.

9.Study on influence of welding parameters in Arc & Gas welding with demonstration

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome For ME3445

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to gain the practical knowledge in material casting processes	3	s
CO2	Student will be able to gain practical knowledge of arc and gas welding and cutting processes	3	S
CO3	Student will be able to understand about weld and casting defects	3	S

PO Mapping for ME3445

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	2	1	1	1	1	1	2	1	1	3	3	2
CO 2	3	2	2	1	1	1	1	1	2	1	1	2	2	2
CO 3	3	3	2	1	2	1	1	1	2	2	2	2	3	2
Avg	3	2.3	2	1	1.33	1	1	1	2	1	1.6	2.33	2.67	2

ME3443	Title: Heat Transfer lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	NIL	
Objectives	To understand the methods to determine the thermal conductivity and heat transfer rate in different conditions.	
Expected Outcome	● Student should be able to understand the conduction heat transfer in steady conditions. ● Student should be able to understand and analysis of heat exchanger ● Student should be able to analyze the convection heat transfer	
List of Experiments		
1. To determine the effectiveness of a heat exchanger in parallel flow condition and draw the graph between temperature and length. 2. To determine the effectiveness of a heat exchanger in counter flow condition and draw the graph between temperature and length. 3. To determine the thermal conductivity of given specimen by using guarded hot plate apparatus 4. To find out the nature of the temperature distribution in case of a heat pipe and also comparing its heat transfer rate with a stainless steel and copper pipe. 5. To determine the boiling heat transfer coefficient in two phase heat transfer system. 6. To determine the value of emissivity of a given surface experimentally. 7. To experimentally determine the heat transfer coefficient from the outer side of an electrically heated vertical tube in air during natural convection. 8. To measure the heat transfer rate through the given composite wall. 9. To measure the critical radius of insulation of the given specimen.		
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME3443

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the conduction heat transfer in steady conditions	2	Em
CO2	Student should be able to understand and analysis of heat exchanger	3	S
CO3	Student should be able to analyze the convection heat transfer	3	S

PO Mapping for ME3443

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	0	1	1	2	0	0	0	1	1	3	3	2
CO 2	3	2	2	3	1	2	2	0	3	1	1	2	2	0
CO 3	3	3	2	3	2	2	1	3	2	2	2	2	3	2
Avg	3	2.3	1.3	2.3	1.33	2	1	1	1.6	1	1.6	2.33	2.67	1.3

ME3441	Title: Theory of Machines lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the various mechanism and toanalyse governors, gyroscope and brakes	
Expected Outcome	Student should be able to understand the principles of working of various links, mechanisms and dynamometers. Student should be able to determine performance parameters of gyroscope,governors. Student should be know the concept of balancing of masses and determine the critical speed of shafts in loading conditions	

List of Experiments

1. To study various types of kinematic links, pairs, chains and mechanisms
2. Performance of spring controlled governors
3. Analysis of gyroscopic effect using gyroscope
4. To study various types of gear trains- simple, compound reverted, epicyclic and differential
5. To study dynamic force analysis of 4-bar mechanism and slider crank mechanism (Analytical Methods)
6. Design of flywheel for IC engine and punch press.
7. Measurement of critical speed of a rotating shaft of given diameter.
8. To study the various types of dynamometers
9. To perform the experiment of balancing of rotating parts and find the unbalanced couple and forces
10. To study various types of cam and follower arrangement
11. To find out critical speed experimentally and to compare the whirling speed of a shaft with theoretical values.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

Course Outcome for ME 3441

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the principles of working of various links, mechanisms and dynamometers.	2	Em
CO2	Student should be able to determine performance parameters of gyroscope,governors.	4	S
CO3	Student should be know the concept of balancing of masses and determine the critical speed of shafts in loading conditions	3	S

CO-PO Mapping for ME 3441

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	1	1	1	1	1	1	1	3	3	2
CO 2	3	2	1	2	2	1	1	1	1	1	1	2	3	2
CO 3	2	3	1	2	2	1	1	1	1	1	1	3	2	2
Avg	2.67	2.67	1	1.67	1.67	1	1	1	1	1	1	2.67	2.67	2

ME3641	Title: Measurement and Metrology Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide students with the necessary skills for measuring, calibration and testing of different gauges and instruments.	
Expected Outcome	● Students should be able to develop the theoretical concepts taught in Mechanical Measurements & Metrology through experiments. ● Students should be able to describe the basic use of various measuring tools measuring techniques. ● Students should be able to the calibration techniques of various measuring devices.	
	List of Experiments	
1. Measurement of effective diameter of a screw thread using 3 wire methods. 2. Measurement of angle using sine bar & slip gauges. 3. Study of limit gauges and Adjustment of spark plug gap using feeler gauges. 4. Study & angular measurement using level protector and Study of dial indicator & its constructional details. 5. Use of dial indicator and V Block to check the circularity and plot the polar Graph. 6. Experiment on measurement of pressure, temperature by measuring equipment and Measurement using Strain gauge. 7. Measurement of speed using stroboscope and measurement of flow. 8. Measurement of displacement using LVDT. 9. To analyze, assess, measure and document all Measuring attributes of a selected component by using appropriate methods and devices		
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME3641

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/Entrepreneurship(En)/None(*Use,formorethan One*)
CO1	Students should be able to develop the theoreticalconcepts taught inMechanicalMeasurements& Metrologythrough experiments.	3	Em
CO2	Studentsshouldbe abletodescribe the basic useof Variousmeasuring toolsmeasuring techniques.	3	S
CO3	Studentsshouldbe abletothecalibrationtechniques Ofvariousmeasuringdevices.	3	S

CO-PO Mapping for ME3641

Course Outcome s	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	1	1	2	1	1	1	1	1	1	1	3	1
CO 2	2	2	2	1	2	1	1	1	1	1	1	1	2	2
CO 3	2	3	2	2	3	1	1	1	1	1	1	1	2	2
Avg	2	2.3	1.67	1.3	2.3	1	1	1	1	1	1	1	2.33	1.67

ME3501	Title: Machine Design I	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	ME3308	
Objectives	To understand procedure of designing a machine component and develop an ability to apply the theories of failure for design of different mechanical components.	
Expected Outcome	● Student should be able to gain basic concept of machine design and find out the machine component life under the application of various types of load conditions. ● Student should be able to design the Shaft, key and coupling under different type of Stress conditions. ● Student should be able to know the basics of Lever and different types of joints used in mechanical engineering and study how to design them for practical application. ● Student should be able to Understand the various parts and types of screw jack and design their components according to load value given. ● Student should be able to understand about different types of spring used in machines and the design procedure adopted for different types of spring.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Design Principles	6
Design process, design considerations, standards and codes, use of preferred series, factor of safety, service factor, stress concentration - causes and remedies, theories of failure. Fluctuating stresses, fatigue failures, s-n curve, endurance limit, notch sensitivity, endurance strength modifying factors, design for finite and infinite life, cumulative damage in fatigue failure, Soderberg, Gerber, Goodman, modified Goodman diagrams, fatigue design of components under combined stresses.		
Unit II	Design of Shaft, Key and Couplings	8
Design of shafts based on strength, torsional rigidity and lateral rigidity, A.S.M.E. Code for shaft design, design of Keys and splines, design of flange coupling and flexible bushed pin coupling.		
Unit III	Design of Joints	7
Design of cotter joint, knuckle joint, welding symbols, strength of butt, parallel and transverse fillet welds, design of welded joints: axially loaded unsymmetrical welded joints, eccentric load in plane of welds, welded joints subjected to bending and torsional moments.		
Unit IV	Design of Screw Jack	8
Forms of threads, multiple start screws, torque analysis and design of power screws with square and trapezoidal threads, self-locking screw, collar friction torque, stresses in power screws, design of a c-clamp, design of screw jack.		
Unit V	Design of Springs	7
Types, applications and materials for springs, stress and deflection equations for helical compression springs, style of ends, design of helical compression and tension springs, springs in series and parallel, concentric helical springs. Helical torsion spring, surge in springs. Multi-leaf springs.		
Text Books	1. V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publication Co. Ltd. 2. R. S. Khurmi, A Text Book of Machine Design, S Chand Publishers.	
Reference Books	1. P. H. Black and O. Eugene Adams, Machine Design, McGraw Hill Book Co. Inc. 2. Willium C. Orthwein, Machine Components Design, West Publishing Co. and Jaico Publications House. 3. A. S. Hall, A. R. Holowenko and H.G. Laughlin, Theory and Problems of Machine Design, Schaum's Outline Series 4. J.E. Shigley and C.R. Mischke, Mechanical Engineering Design, McGraw Hill Publication Co. Ltd	
Mode of Evaluation	Internal and External Examinations (Use of design data book is allowed during the examination)	
Recommendation by Board of Studies on	14.05.2022	

Date of approval by the Academic Council	20th October 2022

Course Outcome For ME 3501

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to gain basic concept of machine design and find out the machine component life under the application of various types of load conditions.	3	Em
CO2	Student should be able to design the Shaft, key and coupling under different type of Stress conditions.	2	S
CO3	Student should be able to know the basics of Lever and different types of joints used in mechanical engineering and study how to design them for practical application.	2	S
CO4	Student should be able to Understand the various parts and types of screw jack and design their components according to load value given.	2	S
CO5	Student should be able to understand about different types of spring used in machines and the design procedure adopted for different types of spring.	3	S

CO PO Mapping for ME 3501

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)											Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	3	3	3	2	1	1	1	1	1	1	3	3	3
CO 2	3	2	3	2	2	1	1	1	1	1	1	2	3	2
CO 3	2	3	3	3	2	1	1	1	1	1	1	2	3	3
CO 4	3	2	2	2	2	1	1	1	1	1	1	2	2	2
CO 5	3	2	3	3	1	1	1	1	1	1	1	2	3	3
Avg	2.6	2.6	2.8	2.6	1.8	1	1	1	1	1	1	2.2	2.8	2.6

ME3510	Title: Manufacturing Science-2	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To acquire knowledge on different mechanical manufacturing processes.	
Expected Outcomes	1. Students will be able to acquire a fundamental knowledge on metal forming technology which is necessary for an understanding of industrial processes. 2. Students will be able to introduce the wide range of materials and processes, which are currently used in manufacturing industry. 3. Students will be able to get methods of analysis allowing a mathematical/physical description of forming processes.	
Unit No.	Unit Title	No. of hours(per Unit)
Unit I	Theory of Metal Forming	7
Introduction to cold/hot forming processes: Metallurgical aspects of metal forming –slip-twining-mechanics of plastic deformation- effects of temperature, strain rate, microstructure and friction in metal forming, yield criteria and their significance, classification of metal forming processes: slip line field theory.		
Unit II	Forging and rolling processes.	8
Forging principle, classification, equipment, tooling-processes, parameters and calculation of forces and power requirements during forging post forging heat treatment - defects (cause and remedy) & application; Principles of rolling processes, classification, types of rolling mills, ring comparison tests calculation of forces and geometrical relationship in rolling, analysis of rolling load, torque and power, rolling mill control, , effects of friction. Form rolling, rolling defects, causes and remedies.		
Unit III	Extrusion and Drawing Processes.	7
Classification of extrusion processes-tool, equipment, and principle of these processes, influence on friction-Extrusion force calculation-defects and analysis-rod/wire drawing-tool, equipment and principle of processes defects-Tube drawing and sinking processes-Mannessmann processes of seamless pipe manufacturing.		
Unit IV	Sheet metal forming processes	7
Classification - conventional and HERF processes-presses-types and selection of presses-formability of sheet metals-principle, process parameters, equipment and application of the following processes: deep drawing, spinning, stretch forming. Plate bending, spring back, press brake forming, Introduction to forming, electro hydraulic forming, magnetic pulse forming. Introduction to press work – coining, embossing etc., Design of sheet metal dies.		
Unit V	Powder Metallurgy	7
Introduction to Powder Metallurgy process, preparation of powders, types & function of binders, green compaction, sintering process and its effect on the product, application of powder metallurgy products, advantages of powder metallurgy products. Sintering equipment.		
Text Books	1.Serope Kalpakjian, Steven R. Schmid “Manufacturing Engineering and Technology” (4th Edition) Prentice Hall 2000-06-15 ISBN: 0201361310 2. P.N.Rao “Manufacturing Technology”, TMH Ltd 1998(Revised edition). 3. Dieter “Mechanical Metallurgy”, Revised edition 1992, Mcgraw.	
Reference Books	1. E. Paul DeGarmo, J. T. Black, Ronald A. Kohser, “Materials and Processes in Manufacturing”, Wiley; 9 edition (December 6, 2002) ISBN: 0471033065 2 Lindberg, “Processes and Materials of Manufacture ", Prentice Hall of India (p) Ltd 3 George.E. Dieter, “Engineering design (A materials and processing approach)”, McGraw Hill –EditionII 1991 4 William F.Hosford& Robert M.Caddel “Metal forming” 5 Amitabha Ghosh and Mallik, “Manufacturing Science”, East west press pvt ltd 6 Narayanaswamy. R, “Metal Working Technology”, PHI (1997) 7 Nagpal. G.R., ”Metal Forming Processes” Khanna publishers, Delhi 1998.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the	20.10.2022	

Academic Council	

Course Outcome For ME 3510

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students will be able to acquire a fundamental knowledge on metal forming technology	2	s
CO2	Students will be able to understand the rolling and forging metal forming processes used in manufacturing industry.	2	S
CO3	Students will be able to understand the extrusion and drawing metal forming processes used in manufacturing industry.	2	S
CO4	Students will be able to understand the sheet metal forming processes used in manufacturing industry.	2	S
CO5	Students will be able to understand the powder metallurgy techniques adopted in manufacturing	2	S

CO PO Mapping for ME 3510

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	1	1	1	1	1	1	1	1	1	3	3	3
CO 2	3	2	2	1	1	1	1	1	1	1	1	2	3	2
CO 3	2	2	1	1	1	1	1	1	1	1	1	2	3	3
CO 4	3	2	1	1	1	1	1	1	1	1	1	2	2	2
CO 5	3	2	1	1	2	1	1	1	1	1	1	2	3	3
Avg	2.6	2	1.2	1	1.2	1	1	1	1	1	1	2.2	2.8	2.6

ME3715	Title: Industrial Engineering and Management	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide knowledge on different concepts regarding organization and productivity in industries and to know methods to plan and control production systems for effective management.	
Expected Outcome	● Student should be able to understand the management principles. ● Student should be able to know the organizational structure and approaches for decision making process. ● Student should be able to understand the layout of a manufacturing plant. ● Student should be able to apply the method study and perform work measurement techniques for productivity. ● Student should be able to understand methods to improve productivity and importance of value engineering.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction and Concepts of Management	10
Definition and scope of industrial engineering, functions of industrial engineering department and its organization, qualities of an industrial engineer, concept of production and productivity. Functions of management, evolution of management thought: Taylor's scientific management, Fayol's principles of management, Douglas Mc-Gregor's theory x and theory y, mayo's Hawthorne experiments, Hertzberg's two factor theory of motivation, Maslow's hierarchy of human needs – systems approach to management.		
Unit II	Designing Organizational Structures and Management Planning	8
Concept, importance and characteristics of organization, types of organization - project, matrix and informal organization. Span of control, delegation of authority. Steps, hierarchy, principles and dimensions of planning function, approaches to decision making, decision support systems, basic control process, control parameters, principles of control.		
Unit III	Plant Location and Layout	8
Plant location: definition, factors affecting the plant location, comparison of rural and urban sites-methods for selection. Plant layout: needs for a good layout, different types viz. product, process and combination layouts, introduction to layouts based on the gt, jit and cellular manufacturing systems, development of plant layout.		
Unit IV	Work Analysis	9
Definition, need and scope of work analysis. Method-study: definition, objectives, step-by-step procedure, questioning techniques, charts and diagrams for recording data. Principles of motion economy; development and installation of new method. Work–measurement: definition, various techniques of work-measurement such as work-sampling, stopwatch time study & its procedure, job selection, equipment and forms used for work measurement, need for rating operator, methods of rating, allowances and their types, standard time. Standard data techniques.		
Unit V	Productivity and Value Engineering	5
Definition, reasons for low productivity, methods to improve productivity, relation between work-study and productivity. Value engineering- definition, types of values, concept, phases and application of value engineering Uttarakhand Labour laws and National Labour policy		
Text Books	1. Industrial Engineering & Management, Philip E Hick, Tata McGraw Hill 2.Techniques of Value Analysis and Engineering, Lawrence D. Miles McGraw Hill.	

Reference Books	1. Management of Systems, Rajnish Parkash, R.N. Nauhria, Wheeler Publishers 2. Modern Production Management, S. Buffa, Wiley Eastern 3. Work Study and Ergonomics, H.S. Shan, Dhanpat Rai and Co. (P) Ltd.
Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome For ME 3715

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the management principles.	2	Em
CO2	Student should be able to know the organizational structure and approaches for decision making process.	3	S
CO3	Student should be able to understand the layout of a manufacturing plan	3	S
CO4	Student should be able to apply the method study and perform work measurement techniques for productivity.	2	S
CO5	Student should be able to understand methods to improve productivity and importance of value engineering.	2	S

CO-PO Mapping for ME 3715

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
		PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	1	1	1	1	1	1	1	1	1	1	3	2
CO 2	3	2	2	2	1	1	1	1	2	2	1	1	3	2
CO 3	2	2	1	1	1	1	1	1	1	1	1	1	2	2
CO 4	3	2	1	2	1	1	1	1	1	1	1	1	3	2
CO 5	3	2	2	1	1	1	1	1	1	1	1	1	3	2
Avg	2.8	2	1.4	1.4	1	1	1	1	1.2	1.2	1	1	2.8	2

ME3504	Title: Vehicle Technology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	ME3401	
Objectives	This course is designed to give the students an understanding of all the parts of the vehicle and its various power systems (IC Engine, Electric, Hybrid)	
Expected Outcome	● Student should be able to understand the Vehicle's Fundamentals. ● Student should be able to learn about the applications of various IC Engine Power System. ● Student should be able to understand the working principles of Transmission and understanding of Control System. ● Student should be able to know about the various concept of Suspension and Electrical System. ● Student should be able to get understanding of various Electric Vehicle	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Vehicle Fundamentals	7
Types of vehicle, description of a vehicle, classification of chassis and frame, vehicle movement description, vehicle Resistance, tractive effort, vehicle power plant and transmission characteristics, vehicle performance.		
Unit II	IC Engine Power Systems	8
IC engine classification and parts, valve timing diagram, rotary engines, stratified charge engine. Fuels, dopes, additives, ignition delay, knocking, detonation and its control.Fuel supply systems in S.I. Engine and C.I engine., introduction and working of carburetor, fuel pump and fuel injector, types of nozzles and fuel spray patterns, MPFI system, CRDI.Necessity and types of cooling and lubrication systems.		
Unit III	Transmission and Control System	7
Steering system: introduction, general arrangements of steering systems, steering gears, steering ratio, reversibility, steering geometry, steering arms, drag link, and power steering. Clutches. Torque converters. Over drive and free wheel, universal joint.Differential gear mechanism of rear axle. Automatic transmission, steering and front axle. Front axle: introduction, construction, types of front axles, stub axles.Braking system: classification of brakes, mechanical brakes, hydraulics brakes, power brakes and brake effectiveness. Anti-lock braking system(abs).		
Unit IV	Suspension and Electrical Systems	7
Requirement and types of suspension system and wheels. Requirement and types of tyres, tread patterns, factors affecting tyre life, wheel balancing, wheel alignments.Brief description of battery and starting motor, dynamo and alternators,Ignition system: introduction, coil ignition system, spark plugs, firing order, ignition timing. DTSI. Charging and lighting systems in vehicles.		
Unit V	Electric Vehicle	7
Configuration of electric vehicles, electric propulsion systems (permanent magnet bldc motor, srm motor performance of electric vehicles-traction motor characteristics, tractive effort and transmission requirement, vehicle performance, tractive effort in normal driving, energy consumption. Concept of hybrid electric drive trains. National Vehicle Scrappage policy 2021, India Electric Vehicle Policy 2030		
Text Books	1. Kripal Singh, Automobile Engineering, Standard Publisher 2. V. Ganeshan, I.C Engine, TMH 3. MehradEhsani, Yimin Gao, Sebastien Gay, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals Theory and Design, CRC Press.	
Reference Books	1. Crouse, Automotive Mechanics, TMH 2. Ferguson, I C Engines, Wiley India 3. Hietner, Automotive Engineering, CBS Publisher 4. R. Yadav, I.C Engine, Central Publishing House, Allahabad	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	

Date of approval by the Academic Council	20th October 2022

Course Outcome for ME 3504

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the Vehicle's Fundamentals	2	Em
CO2	Student should be able to learn about the applications of various IC Engine Power System	2	S
CO3	Student should be able to understand the working principles of Transmission and understanding of Control System	2	S
CO4	Student should be able to know about the various concept of Suspension and Electrical System	2	S
CO5	Student should be able to get understanding of various Electric Vehicle	2	S

CO-PO Mapping for ME 3504

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	2	3	1	2	1	1	0	1	1	1	3	3	2
CO 2	2	2	3	1	1	3	1	0	1	2	1	3	2	1
CO 3	2	1	2	1	2	2	2	0	2	1	1	2	2	1
CO 4	3	2	2	1	3	1	1	0	1	1	1	2	2	1
CO 5	3	3	3	2	1	2	2	1	2	1	1	3	3	2
Avg	2.6	2	2.6	1.2	1.8	1.8	1.4	1	1.4	1.2	1	2.6	2.4	1.6

ME3541	Title: Vehicle Technology Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the various systems in vehicle	
Expected Outcome	● Student should be able to understand the working of various systems in a vehicle. ● Student should be able to Know about the types of tyres and tread patterns. ● Student should be able Learn about the fuel standards and emission norms	

List of Experiments

1. To study the working of fuel supply system and ignition systems of an engine-based automobile.
2. To study the constructional details, working principles and operation of clutch and gear box of an automobile.
3. To study the constructional details, working principles and operation of suspension and steering system of an automobile.
4. To study the latest fuel standards and emission norms applied for vehicles in India.
5. To study the constructional details, working principles and operation of engine cooling and lubricating system of an automobile.
6. To study the constructional details, working principles and operation of braking system of an automobile.
7. To study tyre types and its tread pattern.
8. To study the lighting and charging systems in a vehicle
9. To study the constructional details, working principles and operation of automotive emission/pollution control system.
10. To understand the procedure of wheel balancing and wheel alignment.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome for ME 3541

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the working of various systems in a vehicle	2	Em
CO2	Student should be able to Know about the types of tyres and tread patterns	3	S
CO3	Student should be able Learn about the fuel standards and emission norms	2	S

CO-PO Mapping for ME 3541

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	3	3	1	1	1	2	1	1	1	1	1	2	2	2
CO 2	3	2	1	3	1	2	1	1	1	1	1	2	1	1
CO 3	2	2	2	2	1	1	2	1	1	1	1	1	1	2
Avg	2.6	2.3	1.3	2	1	1.6	1.3	1	1	1	1	1.6	1.3	1.3

ME 3544	Title:Manufacturing Science II Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide students with the necessary skills for understanding different manufacturing processes.	
Expected Outcome	Students will be able to acquire a fundamental knowledge on metal forming technology which is necessary for an understanding of industrial processes. Students will be able to introduce the wide range of materials and processes, which are currently used in manufacturing industry. Students will be able to get methods of analysis allowing a mathematical/physical description of forming processes.	
	List of Experiments	

1.Use of rolling mill, measurement of friction, power consumption
2 Basic experiment on forging – preparation of at least two models in smithy shop
3 Experiment on sheet metal development:
Preparation of models – tray, funnel, truncated cone, pyramid, transition piece
Soldering and brazing exercises on above models
4 Formability test on sheet metals
5 Simple exercise on wire drawing
6 Study of power hammer
7 Study of the extrusion and drawing process – visit to industry with report presentation
8 Preparation of layouts of various metal forming units for specific products with material handling equipments
9 Experiment on strain hardening
10 Experiment on Powder metallurgy
• Making green compact

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome for ME 3544

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand and perform the rolling, forging and sheet metal operations used in forming process	2	s
CO2	Student will be able to understand the methods to perform extrusion, wire drawing process	2	S
CO3	Student will be able to understand about powder metallurgy techniques	2	S

CO PO Mapping for ME 3544

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	1	1	1	1	1	1	1	1	1	2	3	3
CO 2	3	2	2	1	1	1	1	1	1	1	1	2	3	2
CO 3	3	2	1	2	1	1	1	1	1	1	1	2	2	2
Avg	3	2	1.2	1.2	1	1	1	1	1	1	1	2	2.6	2.3

ME3601	**Title: Machine Design II**	**L T P C** **3 2 0 4**
Version No.	**1.0**	
Course Prerequisites	ME3501	
Objectives	To understand the design process and modes of failure of mechanical components like gears, bearings and engine parts.	
Expected Outcome	● Student should be able to understand about spur gear and design procedure adopted for spur gear under various load conditions. ● Student should be able to understand about Helical and Bevel gear and design the helical and bevel gear under various load conditions. ● Student should be able to know about Rolling contact bearing and design various types of rolling contact bearing for industrial applications. ● Student should be able to understand about sliding contact bearing and design various types of sliding contact bearing for industrial applications. ● Student should be able to know about the general design considerations and selection of Type of IC Engine and Design IC engine Components.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Spur Gears**	7
Tooth forms, system of gear teeth, contact ratio, standard proportions of gear systems, interference in involute gears, backlash, selection of gear materials, gear manufacturing methods, design considerations, beam strength of gear tooth, dynamic tooth load, wear strength of gear tooth, failure of gear tooth, design of spur gears, agma and Indian standards.		
Unit II	**Helical and Bevel Gears**	7
Helical and bevel gears: types of helical and bevel gears, terminology, virtual number of teeth, and force analysis of helical and straight bevel gear. Design of helical SND straight bevel gear based on beam strength, wear strength and estimation of effective load based on velocity factor (Barth factor) and Buckingham's equation. Mountings of bevel gear. Worm and worm gear terminology and proportions of worm and worm gears, force analysis of worm gear drives, friction in worm gears, efficiency of worm gears, design of worm gearing system.		
Unit III	**Rolling Contact Bearing**	7
Types of rolling contact bearings, static and dynamic load carrying capacities, Stribeck's equation, equivalent bearing load, load- life relationship, selection of bearing life selection of rolling contact bearings from manufacturer's catalog, design for cyclic loads and speed, bearing with probability of survival other than 90% taper roller bearing: force analysis and selection criteria. (theoretical treatment only)		
Unit IV	**Sliding Contact Bearing**	7
Types, selection of bearing, plain journal bearing, hydrodynamic lubrication, properties and materials, lubricants and lubrication, hydrodynamic journal bearing, heat generation, design of journal bearing, thrust bearing-pivot and collar bearing, hydrodynamic thrust bearing,		
Unit V	**IC Engine Parts**	8
Selection of type of IC engine, general design considerations, design of cylinder and cylinder head; design of piston, piston ring and gudgeon pin; design of connecting rod; design of crankshaft.		
Text Books	1. V.B. Bhandari, Design of Machine Elements, Tata McGraw Hill Publication Co. Ltd. 2. R. S. Khurmi, A Text Book of Machine Design, S Chand Publishers.	
Reference Books	1. P. H. Black and O. Eugene Adams, Machine Design, McGraw Hill Book Co. Inc. 2. Willium C. Orthwein, Machine Components Design, West Publishing Co. and Jaico Publications House. 3. A. S. Hall, A. R. Holowenko and H.G. Laughlin, Theory and Problems of Machine Design, Schaum's Outline Series 4. J.E. Shigley and C.R. Mischke, Mechanical Engineering Design, McGraw Hill Publication Co. Ltd	
Mode of Evaluation	Internal and External Examinations (Use of design data book is allowed during the examination)	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3601

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand about spur gear and design procedure adopted for spur gear under various load conditions.	2	Em
CO2	Student should be able to understand about Helical and Bevel gear and design the helical and bevel gear under various load conditions.	2	S
CO3	Student should be able to know about Rolling contact bearing and design various types of rolling contact bearing for industrial applications.	2	S
CO4	Student should be able to understand about sliding contact bearing and design various types of sliding contact bearing for industrial applications.	2	S
CO5	Student should be able to know about the general design considerations and selection of Type of IC Engine and Design IC engine Components.	3	S

CO-PO Mapping for ME 3601

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	3	2	1	1	1	1	1	1	1	2	3	2
CO 2	3	2	3	2	1	1	1	1	1	1	1	2	2	2
CO 3	3	3	3	3	2	2	1	1	2	1	2	2	3	2
CO 4	2	2	3	3	1	1	1	1	1	2	1	2	3	2
CO 5	2	2	2	2	2	2	1	1	2	1	2	2	3	2
Avg	2.6	2.2	2.8	2.4	1.4	1.4	1	1	1.4	1.2	1.4	2	2.8	2

ME3610	Title: Entrepreneurship and Startup	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	--	
Objectives	To orient the student towards entrepreneurship as a career and creative thinking. To gain the knowledge about the components and role of business houses. To identify the sources of new ideas, know the regulatory framework for successful operations	
Expected Outcome	On completion of the course, student will be able to: Understand the nature of entrepreneurship. Describe the role of agencies in entrepreneurship promotion Build an entrepreneurial business idea Assess opportunities and constraints for new business ideas Identify funding opportunities Design strategies for successful implementation of ideas	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Entrepreneurship - meaning, elements, determinants and importance of entrepreneurship and creative behavior- Dimensions of entrepreneurship- Qualities of an Entrepreneur, factors influencing entrepreneurship. role of small scale industries in the national economy; characteristics and types of small scale industries; Government policy for small scale industry; stages in starting a small scale industry. Startup India Policy, Uttarakhand state initiatives for startup ecosystem development		
Unit II	Project indentification	7
Project identification- assessment of viability, formulation, evaluation, financing, field-study and collection of information, preparation of project report, demand analysis, material balance and output methods, benefit cost analysis, discounted cash flow, internal rate of return and net present value methods. Agencies - commercial banks –district industries center- national small industries corporation –Small industries development organization –small industries service institutions –All India institutions – IDBI-IFCIICIIC-IRCBI.		
Unit III	Funding	7
Funding new venture - requirement –availability and access to finance –marketing – technology and industrial accommodation- Role of industries/entrepreneur's associations and self-help groups concept-business incubators-angel investors- venture capital and private equity fund.		
Unit IV	Project planning	7
Significance of writing the business plan/ project proposal - Contents of business plan/ project proposal - Designing business processes — location - layout — operation - planning & control - preparation of project report - Project submission/ presentation and appraisal by external agencies - financial/non-financial institutions.		
Unit V	Regulatory Framework	8
Laws concerning entrepreneur viz, partnership laws, business ownership, sales and income taxes and workman compensation act. Role of various national and state agencies which render assistance to small scale industries. Mobilizing resources to start –up Accommodation and utilities – preliminary contracts with the vendors suppliers-bankers-principal customers-contract management.		
Text Books	1 Forbat, John, "Entrepreneurship" New Age International. 2. Havinal, Veerbhadrappa, "Management and Entrepreneurship" New Age International 3. Joseph, L. Massod, "Essential of Management", Prentice Hall of India	
Reference Books	1 Kuratko and Rao, Entrepreneurship: A South Asian Perspective, Cengage Learning, 1st Edition, 2012. 2. Robert Hisrich, Michael Peters, Dean Shepherd, Entrepreneurship, Mc Graw Hill Education, 10th Edition, 2016. 3. Sangeeta Sharma, Entrepreneurship Development, PHI Learning Pvt. Ltd, 2017. 4. Holt David H, Entrepreneurship: New Venture Creation, Pearson, 2016.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME 3610

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand the nature and basics of entrepreneurship.	2	Ent
CO2	Student will be able to understand the identification of project and describe the role of agencies in entrepreneurship promotion	4	Ent
CO3	Student will be able to understand and Build an entrepreneurial business idea and identify funding oppurtunies	3	Ent
CO4	Student will be able to understand assess opportunities and constraints for new business ideas	2	Ent
CO5	Student will be able to understand design strategies for successful implementation of ideas by knowing regulatory frameworks	2	Ent

CO-PO Mapping for ME 3610

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	1	2	1	1	1	1	1	1	1	1	2	2
CO 2	2	2	1	1	1	2	1	1	1	1	1	1	1	2
CO 3	2	2	1	2	1	2	1	1	2	2	1	2	2	2
CO 4	2	2	2	2	1	1	1	1	1	2	2	1	2	2
CO 5	1	2	2	1	1	2	2	1	2	2	2	1	2	2
Avg	1.8	2	1.4	1.6	1	1.6	1.2	1	1.4	1.6	1.4	1.2	1.8	2

MT3607	Title: Mechatronics and Automation	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This course aims at providing fundamental understanding about the elements of a mechatronics system, interfacing, and its practical applications.	
Expected Outcome	1. The students will learn the process behind the transformation of mechanical systems to mechatronics system. 2. The students will learn the use of various types of sensors and transducers in automated systems. 3. The students will learn the use of various types of drives and actuators in automated systems. 4. The students will learn the use of PLC in automated systems. 5. The students will learn about the micro mechatronic systems and their applications.	
Unit No.	Unit Title	No. of hours (Per Unit)
Unit I	Introduction	08
Definition of Mechanical Systems, Philosophy and approach; Systems and Design: Mechatronic approach, Integrated Product Design, Modelling, Analysis and Simulation, Man-Machine Interface		
Unit II	Sensors and Transducers	09
Classification, Development in Transducer technology, Opto-Electronics-Shaft encoders, CD Sensors, Vision System, etc.		
Unit III	Drives and Actuators	08
Hydraulic and Pneumatic drives, Electrical Actuators such as servo motor and Stepper motor, Drive circuits, open and closed loop control; Embedded Systems: Hardware Structure, Software Design and Communication, Programmable Logic Devices, Automatic Control and Real Time Control Systems		
Unit IV	Programmable Logic Controllers	07
Basic Structure, Types and Working Principle, Concept of Scan Cycle and Scan Time, IO's and its Types, Selection Criteria and Applications. Programming Techniques: Ladder diagram –Concept of Contacts and Coil, Latching/ Holding Circuit, Memory Bits, Timers and Counter.		
Unit V	Micro mechatronic systems	08
Microsensors, Micro actuators; Micro-fabrication techniques LIGA Process: Lithography, etching, Micro-joining etc. Application examples; Case studies Examples of Mechatronic Systems from Robotics Manufacturing, Machine Diagnostics, Road vehicles and Medical Technology.		
Text Books	1. Devdas Shetty & Richard A. Kolk, "Mechatronics System Design", PWS Publishing Company (Thomson Learning Inc.). 2. William Bolton, "Mechatronics: A Multidisciplinary Approach", Pearson Education	
Reference Books	1. R. K. Rajput, "A Textbook of Mechatronics", S. Chand & Company Private Limited. 2. William Bolton, "Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering", Macmillon	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for MT 3607

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand basic fundamentals of automation in terms of mechatronics as an interdisciplinary system	2	Em
CO2	Students should be able to understand the fundamentals of sensors and transducers used in automating the industrial environment	2	S
CO3	Students should be able to understand the fundamentals of actuators and drives used in automating the industrial environment	2	S
CO4	Students should be able to understand the fundamentals of PLC used for automating the systems	2	Em
CO5	Students should be able to understand the fundamentals of micro mechatronic systems used in automating the process	2	Em

CO-PO Mapping for MT3607

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	3	2	2	1	1	1	1	1	1	1	2	3	2
CO 2	2	3	2	1	1	1	1	1	1	1	1	2	3	2
CO 3	2	2	1	1	1	1	1	1	1	1	1	2	2	2
CO 4	2	3	2	2	1	1	1	1	1	1	1	2	2	2
CO 5	2	2	2	1	1	1	1	1	1	1	1	2	3	2
Avg	2	2.6	1.8	1.4	1	1	1	1	1	1	1	2	2.6	2

MT3643	Title: Industrial Automation Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The objective of teaching this subject to the students is to make them understand the engineering aspects of Industrial Automation	
Expected Outcome	This lab imparts skill and knowledge on Industrial automation.	

List of Experiments

1. To Study the working of different types of Directional control valve with valve symbol.
2. To Study the working of a double acting cylinder using 5/3 Hand lever valve.
3. To Study the working of a double acting cylinder using 5/2 Two way Solenoid valve
4. To Study the working of the cylinder using timer operated valve.
5. To Study the working of the double acting cylinder using 5/2 Solenoid and spring return valve.
6. Study hardware and software used in PLC. Implementation of logic gates in PLC.
7. To Simulate analog and digital function blocks of Distributed Control System (DCS)
8. Logic implementation for bottle filling application.
9. To simulate and implementation of the On-Delay Timer, Off-Delay Timer.
10. To simulate and implementation of the PLC Arithmetic Instructions.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome For MT 3643

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand the various valves used for control operations in automating systems	2	Em
CO2	Student will be able to understand the operation of PLC and implementation of logic in PLC	2	S
CO3	Student will be able to implement the instructions in PLC	2	S

CO-PO Mapping for MT 3643

Course Outcome	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO 1	PSO 2
CO 1	2	2	1	1	2	1	1	1	1	1	1	2	3	1
CO 2	2	2	2	2	2	1	1	1	1	1	1	2	2	2
CO 3	2	3	2	2	2	1	1	1	1	1	1	2	2	2
Avg	2	2.3	1.67	1.67	2	1	1	1	1	1	1	2	2.33	1.67

MT3641	Title: Mechatronics Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The objective of teaching this Lab to the students is to make student know about various devices used to develop automated systems.	
Expected Outcome	● Students should be able to get knowledge about the different types of sensors and their use in automating the machines. ● Students should be able to get knowledge about the working of microprocessors in automating the machines. ● Students should be able to get knowledge about the working of various automated systems such as pick & place robot, windscreen wiper motion.	
List of Experiments		
1. Study of displacement and position sensors 2. Study of temperature and pressure sensors 3. Study of velocity and motion sensors 4. Study of microprocessor using 8085 instructions 5. Study of timed switch 6. Study of windscreen wiper motion 7. Study of pick and place robot 8. Study of car park barriers 9. Study of bar code and bar reader 10. Study of car engine management system		
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for MT 3641

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to get knowledge about the different types of sensors and their use in automating the machines	2	Em
CO2	Students should be able to get knowledge about the working of microprocessors in automating the machines	2	S
CO3	Students should be able to get knowledge about the working of various automated systems such as pick & place robot, windscreen wiper motion etc.	2	S

CO-PO Mapping for MT 3641

Course Outcome s	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	1	1	2	1	1	1	1	1	1	1	3	1
CO 2	2	2	2	1	2	1	1	1	1	1	1	1	2	2
CO 3	2	3	2	2	3	1	1	1	1	1	1	1	2	2
Avg	2	2.3	1.67	1.3	2.3	1	1	1	1	1	1	1	2.33	1.67

ME3646	Title: Technical VAP I	L 2	T 0	P 0	C 2
Version No.	**1.0**				
Course Prerequisites	Nil				
Objective	The course aims brush-up the topics important in terms of placement activity.				
Expected Outcome	● Student should be able to apply the engineering knowledge to attain the problem solving skills required during the placement drives. ● Student should be able to develop ability to face technical interviews. ● Student should be able to know the types of technical questions asked by the companies in the placement drives.				
Unit No.	**Unit Title**	**No. of Hrs (Per Unit)**			
Unit I	**Thermal Concepts**	5			
Overview of thermal concepts, interview questions with solutions set 1(50 questions) set 2 for exercise, previous year placement paper discussion and solution					
Unit II	**Manufacturing Concepts**	5			
Overview of manufacturing concepts, interview questions with solutions set 1(50 questions) set 2 for exercise, previous year placement paper discussion and solution					
Unit III	**Industrial and Quality Techniques**	4			
Overview and implementation details with interview questions, previous year placement paper, discussion and solution.					
Unit IV	**Design Concepts**	5			
Overview of design concepts, interview questions with solutions set 1(50 questions) set 2 for exercise, previous year placement paper discussion and solution					
Unit V	**Software**	5			
Revision of design software, revision of c and C++ and its importance in industry, practice exercises on different software					
Text Books	1. Practice Material				
Reference Books	1. Practice Material				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studies on	14.05.2022				
Date of Approval by the Academic Council on	20th October 2022				

Course Outcome for ME 3646

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to apply the engineering knowledge to attain the problem solving skills required during the placement drives.	3	Em
CO2	Student should be able to develop ability to face technical interviews.	3	Em
CO3	Student should be able to know the types of technical questions asked by the companies in the placement drives.	2	Em

CO-PO Mapping for ME 3646

Course Outcome s	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	1	2	1	1	1	1	1	1	1	3	2	2
CO 2	2	2	1	2	1	1	1	1	2	2	1	3	3	3
CO 3	2	2	1	1	1	1	1	1	2	2	1	2	2	2
Avg	2	2	1	2.67	1	1	1	1	1.67	1.67	1	2.6	2.6	2.6

ME 3701	Title: CAD/CAM	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide knowledge on different CAD modeling and CAM techniques.	
Expected Outcome	● Students should be able to develop an understanding of the basics of CAD/CAM, exchange formats, transformation techniques, Basic of FEM and wireframe modeling. ● Students should be able to attain a theoretical understanding of surface modeling and solid modeling. ● Students should be able to understand about NC machine, Part programming by using G and M Code, CNC and DNC machine. ● Students should be able to attain a theoretical understanding of System devices and method to control NC system. ● Students should be able to theoretically analyze about advance tool which is used in CAM system such as GT, CAPP, FMS, CIM, Computer aided inspection and QC.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction and Wire Frame Modelling	6
Introduction to CAD/CAM, product cycle, CAD/CAM system evaluation criteria, input and output devices, graphic standards and exchange formats (IGES, STEP, STL). Transformations (both 2D and 3D)Introduction of FEM, wire frame modeling: wire frame entities and their definition, properties of curves, parametric representation of synthetic curves Hermite cubic spline, Bezier curves, B-spline curves.		
Unit II	Surface and Solid Modeling	8
Surface modeling: surface representation analytic surfaces: definition of plane surface, ruled surface, surface of revolution, tabulated cylinder, synthetic surfaces- hermit bicubic surface, Bezier surface, b- spline surface, coons' surface, blending surface, sculptured surface.Solid modeling: solid models and representation scheme B-REP & CSG, sweep representation, cell decomposition, spatial occupancy enumeration		
Unit III	Numerical Control of Machine Tools	8
Features and elements of NC, types of NC systems: PTP, straight cut and contouring, MCU & other components, co-ordinate system, NC manual part programming, formats for writing part program, G & M codes, and part program for drilling and milling of simple parts. Apt programmingCNC: introduction to CNC, typical configurations, machining centers, introduction to FANUC, SIEMENS ControllersDNC: typical configurations, comparison between CNC vs DNC vs NC vs ordinary machine tools		
Unit IV	System Devices and Control of NC Systems	6
Introduction to DC motors, stepping motors, feedback devices such as encoder, counting devices, digital to analog converter and vice versa.Open and closed loops. Automatic control of closed loops with encoder & tachometers. Speed variation of DC motor. Adaptive control systems: ACO and ACC		
Unit V	Advancements	8
GT: part families, layout, part classification and coding system- OPITZ, MICLASS.CAPP: variant and generative process planning.FMS and CIM: FMS equipment, FMS layouts, benefits of FMS, elements of CIM.Computer aided inspection and QC: automated inspection- off-line, on-line, contact (co-ordinate measuring machine), non-contact inspection (machine vision, scanning laser beam, photogrammetry)		
Text Books	1. A Zimmers and P. Groover, CAD/CAM, PHI 2. Ibrahim Zeid CAD/CAM Theory and Practice, TMH 3. P.N. Rao, CAD/CAM, TMH	
Reference Books	1. Vikram Sharma, Fundamental of CAD/CAM, Ketson books 2. Sareen & Grewal, CAD/CAM theory and Concepts, S.Chand 3. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the	20.10.2022	

Course Outcome For ME 3701

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to develop an understanding of the basics of CAD/CAM, exchange formats, transformation techniques, Basic of FEM and wireframe modeling.	2	Em
CO2	Students should be able to attain a theoretical understanding of surface modeling and solid modeling.	4	S
CO3	Students should be able to understand about NC machine, Part programming by using G and M Code, CNC and DNC machine.	3	S
CO4	Students should be able to attain a theoretical understanding of System devices and method to control NC system.	2	S
CO5	Students should be able to theoretically analyze about advance tool which is used in CAM systems.	2	S

CO-PO Mapping for ME 3701

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	3	1	1	1	1	1	1	2	2	2
CO 2	3	3	2	3	3	1	1	1	1	1	1	2	2	2
CO 3	3	2	3	2	3	2	1	1	2	1	1	2	3	3
CO 4	3	2	2	2	3	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	2	1	1	2	1	1	3	2	3
Avg	2.6	2.2	2.6	2.4	3	1.4	1	1	1.4	1	1	2.2	2.2	2.4

ME3716	Title: Engineering Economics and Project Management	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide a comprehensive analysis of the subject so that students can perform and evaluate present worth, future worth and annual worth analyses on one of more economic alternatives.	
Expected Outcome	The students will have an idea of Economics in general, Economics of India particularly for public sector agencies and private sector businesses and able to carry out and evaluate benefit/cost, life cycle and breakeven analyses on one or more economic alternatives.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Engineering Economics	8
Basic Principles and Methodology of Economics. Demand/Supply – elasticity – Government Policies and Application. Theory of the Firm and Market Structure. Basic Macro- economic Concepts (including GDP/GNP/NI/Disposable Income) and Identities for both closed and open economies. Aggregate demand and Supply (IS/LM). Price Indices (WPI/CPI), Interest rates, Direct and Indirect Taxes		
Unit II	Concepts of Engineering Economics	6
Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics – Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis – V ratio, Elementary economic Analysis – Material selection for product Design selection for a product, Process planning		
Unit III	Concepts of Project Management	8
Introduction of Project: Definitions & Characteristics of Project, Types of Projects, Project Life Cycle, Project Management Process: Introduction, Tools & Techniques of Project Management. Project Team and Scope of Project Management: Characteristics of a Project Team & Project Leader, Project Organization, and Importance of Project Management, project planning and graphic presentation; work breakdown structure, Establishing the project and goals, Project feasibility Analysis: Technical feasibility, commercial and financial visibility, Environment Analysis		
Unit IV	Project Monitoring and Control	8
Dimensions of Project Monitoring & Control, Project Management Information System, Earned Value Analysis: Planned Value (PV), Earned Value (EV), Cost Variance (CV), Schedule Variance (SV), Cost performance Index (CPI), Schedule performance Index (SPI), Project Termination: Types of Terminations, Project Termination Process, Challenges in implementation of engineering projects in Uttarakhand.		
Unit V	Project Appraisal and Cost Estimation	8
Introduction, technical appraisal, Financial Appraisal, Institutional Appraisal , commercial appraisal, Environmental Appraisal, economic appraisal, Legal Appraisal , Methodology of Project Appraisal PROJECT APPRAISAL TECHNIQUES: Non-Discounting Techniques- Urgency, Payback Period, Accounting Rate of Return, Debt Service Coverage Ratio. Discounting Criteria Techniques- Net Present Value(NPV), Benefit Cost Ratio(BCR) , Internal Rate of Return(IRR), Annual Capital Charge		
Text Books	1. Mankiw Gregory N. (2002), Principles of Economics, Thompson Asia	
Reference Books	1. M Chakravarty, Estimating, Costing Specifications & Valuation 2. Misra, S.K. and Puri (2009), Indian Economy, Himalaya	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME 3716

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand the fundamentals of economics in operation of an engineering industry	2	Em
CO2	Student will be able to know about break even analysis for economic efficiency of the industry	3	S
CO3	Student will be able to understand the basics of managing a project with feasibility analysis	3	S
CO4	Student will be able to know the methods to monitor the project progress	2	Em
CO5	Student will be able to know the techniques of project appraisal and estimating the project.	3	Em

CO-PO Mapping for ME 3716

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)											Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	1	3	2	3	1	1	1	1	1	3	2	2	2
CO 2	2	2	2	3	3	1	1	1	1	1	3	2	2	2
CO 3	2	2	3	2	3	2	1	1	2	1	3	2	3	3
CO 4	2	2	2	2	3	1	1	1	1	1	3	2	2	2
CO 5	2	2	3	3	3	2	1	1	2	1	3	3	2	3
Avg	2	1.8	2.6	2.4	3	1.4	1	1	1.4	1	3	2.2	2.2	2.4

ME3740	Title: CAD/CAM Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To study design and manufacturing techniques using computer.	
Expected Outcome	● Students should be able to develop an understanding about CAD package and working in sketch mode and understand part features and draw Part modeling of various machine components. ● Students should be able to know about CNC Lathe Machine (MTab FANUC controller: standard feature & machine specification). ● Students should be able to write a part program and simulate the tool part for the given model using FANUC controller for facing, step turning, taper turning and thread cutting.	
	List of Experiments	
1. To study about CAD package and working in sketch mode and understand part features and draw Part modeling of various machine components 2. To draw the components of screw jack and to assemble them using CAD software. 3. To draw the components of crosshead and to assemble them using CAD software. 4. To draw the components of universal coupling and to assemble them using CAD software 5. To draw the components of Plummer Block and to assemble them using CAD software. 6. To draw a machine component and indicate tolerances on size and geometrical form, position; indicate surface finish, surface treatments and write process sheet for anyone component. 7. To Study CNC Lathe Machine (MTab FANUC controller – standard feature & machine specification) 8. To write a part program and simulate the tool part for the given model using FANUC controller for facing. 9. To write a part program and simulate the tool part for the given model using FANUC controller for step turning and taper turning. 10. To write a part program and simulate the tool part for the given model using FANUC controller for thread cutting. 11. To design a product and manufacture/generate CNC machining tool path for its components.		
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME 3740

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to develop an understanding about CAD package and working in sketch mode and understand part features and draw Part modeling of various machine components.	4	Em
CO2	Students should be able to know about CNC Lathe Machine (MTab FANUC controller – standard feature & machine specification)	2	S
CO3	Students should be able to write a part program and simulate the tool part for the given model using FANUC controller for facing, step turning, taper turningand thread cutting.	4	S

CO-PO Mapping for ME 3740

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	2	2	3	1	1	1	1	1	1	2	2	1
CO 2	2	2	2	3	3	1	1	1	1	1	1	2	1	1
CO 3	3	3	2	2	3	2	1	1	2	1	1	2	2	3
Avg	2.6	2.3	2	2.3	3	1	1	1	1	1	1	2	1.6	1.6

ME3748	Title: Quality Engineering Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make students familiar with the working of softwares and their applicability in quality analysis	
Expected Outcome	● Student should be able to get knowledge about the working of softwares and their application in quality analysis ● Student should be able to get knowledge about performing various tools and techniques of quality analysis such as measurement charts, cause and effect analysis and control charts ● Student should be able to get knowledge about performing various tools and techniques of quality analysis such as process capability, hypothesis testing and Multi-Vari analysis	

List of Experiments

1. Introduction to different softwares and their application in quality analysis
2. Drawing various types of measurement charts such histogram, bar chart etc.
3. Performing Cause and Effect analysis
4. Conducting measurement system analysis
5. Preparing control charts
6. Performing Multi-Vari Analysis
7. Conducting process capability analysis
8. Conducting hypothesis testing / ANOVA

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Outcome For ME 3748

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to get knowledge about the working of softwares and their application in quality analysis	3	S
CO2	Student should be able to get knowledge about performing various tools and techniques of quality analysis such as measurement charts, cause and effect analysis and control charts	3	S
CO3	Student should be able to get knowledge about performing various tools and techniques of quality analysis such as process capability, hypothesis testing and Multi-Vari analysis	3	S

CO-PO Mapping for ME 3748

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	3	2	2	2	1	1	1	1	1	1	3	2	2
CO 2	2	3	2	2	2	1	1	1	1	1	1	2	2	2
CO 3	2	2	1	2	1	1	1	1	1	1	1	2	1	1
Avg	2	2.6	1.6	2	1.6	1	1	1	1	1	1	2.3	1.6	1.6

ME3746	Title: Technical VAP II	L 2	T 0	P 0	C 2
Version No.	1.0				
Course Prerequisites	Nil				
Objective	The course aims brush-up the topics important in terms of placement activity.				
Course Outcome	● Student should be able to apply the engineering knowledge to attain the problem solving skills required during the placement drives. ● Student should be able to develop ability to face technical interviews. ● Student should be able to know the types of technical questions asked by the companies in the placement drives.				
Unit No.	Unit Title	No. of Hrs (Per Unit)			
Unit I	Thermal Concepts	5			
Overview of thermal concepts, interview questions with solutions set 1(50 questions) set 2 for exercise, previous year placement paper discussion and solution					
Unit II	Manufacturing Concepts	5			
Overview of manufacturing concepts, interview questions with solutions set 1(50 questions) set 2 for exercise, previous year placement paper discussion and solution					
Unit III	Industrial and Quality Techniques	4			
Overview and implementation details with interview questions, previous year placement paper, discussion and solution.					
Unit IV	Design Concepts	5			
Overview of design concepts, interview questions with solutions set 1(50 questions) set 2 for exercise, previous year placement paper discussion and solution					
Unit V	Aptitude and Logical Reasoning	5			
Revision of quantitative aptitude tips, Review of reasoning tips, Discussion of old question papers, practice tests on major placement question papers on reasoning and quantitative aptitude.					
Text Books	1. Practice Material				
Reference Books	1. Practice Material				
Mode of Evaluation	Internal and External Examinations				
Recommended by Board of Studies on	14.05.2022				
Date of Approval by the Academic Council on	20.10.2022				

Outcome For ME 3746

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to apply the engineering knowledge to attain the problem solving skills required during the placement drives.	3	Em
CO2	Student should be able to develop ability to face technical interviews.	3	S
CO3	Student should be able to know the types of technical questions asked by the companies in the placement drives.	2	S

CO-PO Mapping for ME 3746

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	3	1	2	2	1	1	1	1	1	1	3	2	2
CO 2	3	3	3	3	3	1	1	1	1	1	1	3	3	3
CO 3	1	1	1	1	1	1	1	1	2	1	1	2	1	1
Avg	2.3	2.3	1.6	2	2	1	1	1	1.3	1	1	2.6	1.6	1.6

Program Electives

ME3505/ME3602	Title: Refrigeration and Air Conditioning	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	ME3306	
Objectives	The main objective of this course is to provide an insight how thermodynamic principle are applied in the refrigeration and air-conditioning.	
Expected Outcome	● Students should be able to develop understanding about basics of Refrigeration and clear concepts related to ideal parameters of refrigeration. ● Students should be able to clear concepts related to vapor compression refrigeration system. ● Students should be able to understand the basics of vapor absorption system and its application ● Students should be able to understand the properties and characteristics of basics of air conditioning. ● Students should be able to solve cooling load calculations and also able to design of air conditioning system by solving practical problems	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Air Refrigeration System	5
Introduction to refrigeration, basic definition, air refrigeration: air refrigeration cycles-reverse Carnot cycle, bell-Coleman cycle analysis, air refrigeration systems (ARS) types, analysis, merits and demerits, dry air rated temperature (DART) and comparison of various ARS		
Unit II	Vapor Compression Refrigeration System	5
Vapor compression refrigeration system, working and analysis, use of charts, limitations, multistage vapor compression refrigeration systems, flash gas removal, flash intercooling and water intercooling. Cascade system.Refrigeration system equipment: compressors, condensers, expansion devices and evaporators.		
Unit III	Vapor Absorption Systems	4
Vapor absorption refrigeration systems, water-ammonia systems, water-lithium bromide system, rectifier and analyzer. Refrigerants: classification, designation, desirable properties of refrigerants, global warming due to refrigerants and advances in refrigerants.		
Unit IV	Air Conditioning	5
Psychrometry: psychrometric properties, psychrometric chart, representation of psychrometric processes on the chart, heating /cooling with humidification and dehumidification, adiabatic dehumidification, mixing processes. Introduction to air conditioning: requirements of comfort air conditioning, thermodynamics of human body, comfort chart, Effective temperature. Industrial air conditioning.		
Unit V	Design of Air Conditioning Systems	5
Cooling load calculations in air conditioning: concept of bypass factor, sensible heat factor, apparatus dew point, room sensible heat factor (RSHF), gross sensible heat factor (GSHF), different heating and cooling loads, problems. Design of air conditioning systems: all fresh air, re-circulated air with bypassed air, types of air conditioningSystems.		
Text Books	1. C.P. Arora, Refrigeration and Air Conditioning, Tata McGraw Hill, New Delhi. 2. S. C. Arora, and S. Domkundwar, A Course in Refrigeration and Air conditioning, Dhanpat Rai and Sons, New Delhi.	
Reference Books	1. V. K. Jain , Refrigeration and Air ConditioningS Chand and Company, New Delhi. 2. W.S. Stocker, Refrigeration and Air conditioning, McGraw Hill, New Delhi. 3. Roy J Dossat, Principles of Refrigeration, Pearsons. 4. Manohar Prasad, Refrigeration and Air-conditioning, New Age International.	
Mode of Evaluation	Internal and External Examinations (Use of Refrigeration and Air-conditioning Tables and Chart is allowed during the examination)	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME3505/ ME 3602

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to develop understanding about basics of Refrigeration and clear concepts related to ideal parameters of refrigeration.	3	Em
CO2	Students should be able to clear concepts related to vapor compression refrigeration system.	3	S
CO3	Students should be able to understand the basics of vapor absorption system and its application	2	S
CO4	Students should be able to understand the properties and characteristics of basics of air conditioning.	3	S
CO5	Students should be able to solve cooling load calculations and also able to design of air conditioning system by solving practical problems	3	S

CO-PO Mapping for ME3505/ ME 3602

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	2	1	1	1	1	1	1	1	1	2	3	1
CO 2	3	2	2	2	1	1	2	1	1	1	1	2	3	2
CO 3	3	3	3	2	1	3	3	1	2	2	1	3	2	2
CO 4	3	3	3	3	2	2	1	1	1	1	2	3	3	1
CO 5	3	3	3	3	2	2	2	1	1	2	1	3	3	2
Avg	3	2.6	2.6	2.2	1.4	1.4	1.8	1	1.2	1.4	1.2	2.6	2.8	1.6

ME3708	Title: Mechanical Vibrations	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	ME3402	
Objectives	To study the one and multi-degree-of-freedom systems. Natural frequencies and modes of vibrations, resonance, beat phenomenon, effect of damping, applications to practical problems, and methods to avoid excessive vibrations.	
Expected Outcome	● Students should be able to develop an understanding of different types of motions and effect of damping. ● Students should be able to develop an understanding of single degree of freedom and vibration measuring instruments. ● Students should be able to attain a theoretical understanding of Two Degree Freedom System and undamped dynamic. ● Students should be able to develop an understanding of exact analysis undamped free and forced vibrations of multidegree system. ● Students should be able to numerical analyze the Rayleigh's, Dunkerley's, Holzer's and Stodola's methods and Critical speed of shafts.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	6
Periodic motion, harmonic motion, superposition of simple harmonic motions, beats, Fourier analysis. Single degree freedom system: free vibration, natural frequency, equivalent systems, energy method for determining natural frequency, response to an initial disturbance, torsional vibrations, damped vibrations. Damping models – structural, coulomb and viscous damping, vibrations of system with viscous damping, logarithmic decrement, viscous dampers.		
Unit II	Single Degree Freedom	8
Single degree freedom: forced vibration, harmonic excitation with viscous damping, steady state vibrations, forced vibrations with rotating and reciprocating unbalance, support excitation, vibration isolation, transmissibility, vibration measuring instruments- displacement, velocity, acceleration and frequency measuring instrument.		
Unit III	Two Degree Freedom System	8
Two degree freedom system: introduction, principal modes, double pendulum, torsional system with damping, coupled system, undamped dynamic, vibration absorbers, centrifugal pendulum absorber, dry friction damper, untuned viscous damper.		
Unit IV	Multidegree Freedom System	8
Multidegree freedom system: exact analysis undamped free and forced vibrations of multidegree system, influence numbers, reciprocal theorem, torsional vibration of multi rotor system, vibration of geared system, principal coordinates, continuous systems- longitudinal vibration of bars, torsional vibrations of circular shafts, lateral vibration of beams.		
Unit V	Multidegree Freedom System II	10
Multidegree freedom system: numerical analysis Rayleigh's, Dunkerley's, Holzer's and Stodola's methods, Rayleigh – Ritz method. Critical speed of shafts: shafts with one disc with and without damping, multi-disc shafts, secondary critical speed.		
Text Books	1. S.S Rao, Mechanical Vibrations, Pearson 2. V. Rama Murthy, Mechanical Vibration Practice with Basic Theory, Narosa Publishers	
Reference Books	1. W. T. Thomson , Theory of Vibration with Applications, PHI	

	2. M. L. James, G. M. Smith, J. G Wolford, P. W. Whaley, Vibration of Mechanical and Structural Systems, Harper Collins 3. Magreb, Mechanical Vibration, Cengage India, New Delhi 4. Palm, Mechanical Vibration, Wiley India, New Delhi
Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome for ME 3708

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to develop an understanding of different types of motions and effect of damping.	3	Em
CO2	Students should be able to develop an understanding of single degree of freedom and vibration measuring instruments.		S
CO3	Students should be able to attain a theoretical understanding of Two Degree Freedom System and undamped dynamic.	3	S
CO4	Students should be able to develop an understanding of exact analysis undamped free and forced vibrations of multidegree system.	3	S
CO5	Students should be able to numerical analyze the Rayleigh's, Dunkerley's, Holzer's and Stodola's methods and Critical speed of shafts.	3	S

CO-PO Mapping for ME 3708

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	1	1	1	1	1	1	1	2	2	2
CO 2	3	3	2	3	2	1	1	1	1	1	1	2	2	2
CO 3	2	2	3	2	1	1	1	1	2	1	1	2	3	3
CO 4	2	2	2	2	1	1	1	1	1	1	1	2	2	3
CO 5	2	2	3	3	1	2	1	1	2	1	1	2	2	2
Avg	2.2	2.2	2.6	2.4	1.2	1.2	1	1	1.4	1	1	2	2.2	2.4

ME3612	Title: Industrial Inspection and Quality Control	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	--	
Objectives	To understand the quality inspection and control techniques adopted in an industry.	
Expected Outcome	Student will be able to know the measurement techniques- linear, angular, surface topography. Student will be able to know the quality control techniques, prepare control charts and sampling acceptance economics.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Principles of Measurement	8
Principles of Measurement: Limit gauging, various systems of limits, Fits and tolerance, ISI and ISO system. Basic principles of design of gauges, types of gauges and their design. Optical instruments like projector, auto collimeter, use of interferometry for linear measurement		
Unit II	Inspection gauges	7
Angular measurement, angle gauges, sine-bar, clinometers, measurement of straightness, flatness and squareness. Surface topography - primary & secondary texture, measurement of surface roughness. Inspection of screw threads and gears.		
Unit III	Quality Control	7
Place of quality control in industries, quality control organization, difference between inspection and quality control. Application of quality control.		
Unit IV	Control Charts	9
Theory of control charts, sample size and frequency of sampling, out of control criteria. Variable control charts, control charts for X, and R, process capability studies. Control charts for fraction defective and number of defects		
Unit V	Acceptance sampling	9
Acceptance sampling, single sampling plans, double sampling and sequential sampling plans, Sampling plans continuous production. Selection of sampling plans for different situations. Economics of acceptance sampling.		
Text Books	Jain R.K., Engineering Metrology Grant, Statistical Quality Control	
Reference Books	1 Hume, Engineering Metrology. 2. Judge, Engineering Precision Measurement 3 Hanson, Quality Control. 4. Duncon, Quality Control	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome For ME 3612

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand the principles of measurement and instruements used for measurement	3	Em
CO2	Student will be able to understand the principles of measurement and inspection using gauges		S
CO3	Student will be able to understand the fundamentals of quality control	3	S
CO4	Student will be able to understand the quality control techniques adopted in industry	3	S
CO5	Student will be able to understand the fundamentals of sampling techniqus	3	S

CO-PO Mapping for ME 3612

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	1	1	1	1	1	1	1	1	2	2	2
CO 2	3	3	2	1	2	1	1	1	1	1	1	2	2	2
CO 3	2	2	2	2	1	1	1	1	2	1	1	2	3	3
CO 4	2	2	2	2	1	1	1	1	1	1	1	2	2	3
CO 5	2	2	3	1	1	2	1	1	2	1	1	2	2	2
Avg	2.2	2.2	2.4	1.4	1.2	1.2	1	1	1.4	1	1	2	2.2	2.4

ME3611	Title: Power Plant Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites		
Objectives	To provide an overview of power plants and the associated energy conversion issues	
Expected Outcome	Students will be able to compare different types of welding process for effective welding.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Thermal Power Plant	8
Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant, super critical boilers, FBC boilers, turbines, condensers, steam and heating rates, subsystems of thermal power plants, fuel and ash handling, draught system, feed water treatment, binary cycles and cogeneration systems		
Unit II	Gas Power Plant	7
Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.		
Unit III	Nuclear Power Plant	7
Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants		
Unit IV	Hydroelectric Plant	7
Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems		
Unit V	Power Plant Economics	7
Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.		
Text Books	1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.	
Reference Books	Elliot T.C., Chen K and Swanekamp R.C., Power Plant Engineering, 2 nd ed., McGraw Hill, 1998 El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome For ME 3611

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand about coal based power plants and its systems	2	Em
CO2	Student will be able to about gas based power plants and its systems	2	Em
CO3	Student will be able to about nuclear power plants and its systems	2	Em
CO4	Student will be able to about hydel based power plants and its systems	2	Em
CO5	Student will be able to know the economics,environment and safety issues and standards related to power plants	2	Em

CO-PO Mapping for ME 3611

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	1	1	2	1	1	1	1	2	2	2
CO 2	3	3	2	3	2	1	2	1	1	1	1	2	2	2
CO 3	3	2	2	2	2	2	2	1	1	1	1	1	3	3
CO 4	3	2	2	2	2	2	2	1	1	1	1	2	2	2
CO 5	2	2	3	3	1	3	3	2	1	1	2	2	2	3
Avg	2.6	2.2	2.4	2.4	1.6	2.2	2.8	1.2	1	1	1.2	1.8	2.2	2.4

ME3703	Title: Alternative Fuels and Energy Systems	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To introduce students to bio-fuels, hydrogen energy and solar energy and to expose students to future energy systems.	
Expected Outcome	● Students should be able to understand the need of alternative fuels. ● Students should be able to compare different types of alcohols and vegetable oils. ● Students will aware about the production of natural gas, LPG, Hydrogen and Biogas. ● Students should be able to understand the need of electric and solar power. ● Students should be able to understand different emission control techniques.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Introduction: estimation of petroleum reserve , need for alternate fuels, availability and properties of alternate fuels, astm standards, merits and demerits of various alternate fuels.		
Unit II	Alcohols and Vegetable Oils	7
General use of alcohols, properties as engine fuel, alcohols and gasoline blends, performance in si engine, methanol and gasoline blends, combustion characteristics in engines, emission characteristics. Soyabeen oil, jatropha, pongamia, rice bran, mahuaetc as alternate fuel for engines, etherification, esterification, performance in engines.Bio Fuels in India		
Unit III	Natural Gas, LPG, Hydrogen and Biogas	8
Availability of CNG, properties, modification required to use in engines, performance and emission characteristics of CNG using LPG in SI and CI engines, performance and emission of LPG. Hydrogen; Hydrogen production, hydrogen as an alternative fuel, fuel cell, performance and safety aspects. Biogas production, performance and emission characteristics.		
Unit IV	Electric and Solar Powered	7
Layout of an electric vehicle, advantage and limitations, specifications ,system component, electronic control system, high energy and power density batteries, hybrid vehicle, solar powered vehicle.		
Unit V	Emission and Control	7
Need for emission control, classification/ categories of emissions, major pollutants, control of emissions, evaluating vehicle emissions ,Euro I,II,III,IV standards, Indian standards		
Text Books	1. Dr. S. Thipse, Alternate Fuels, Jaico Publications. 2. AyhanDemirbas, Biodiesel A Realistic Fuel Alternative for Diesel Engines, Springer- Verlag London Limited	
Reference Books	1. Richard.L.Bechfold ,Alternative Fuels Guide Book, SAE International 2. Halderman, J. D., & Linder, J, Automotive fuel and emissions control systems, Pearson Higher Ed	
Mode of Evaluation	Internal and external examination	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME 3703

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the need of alternative fuels.	2	Em
CO2	Students should be able to compare different types of alcohols and vegetable oils.	2	S
CO3	Students will aware about the production of natural gas, LPG, Hydrogen and Biogas.	2	S
CO4	Students should be able to understand the need of electric and solar power.	2	S
CO5	Students should be able to understand different emission control techniques.	2	S

CO-PO Mapping for ME 3703

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	1	1	2	2	1	1	1	2	2	2
CO 2	3	3	2	3	2	1	3	1	1	1	1	2	2	2
CO 3	3	2	2	2	2	2	2	1	1	1	1	2	3	3
CO 4	3	2	2	2	2	3	2	1	1	1	1	2	2	2
CO 5	2	2	3	3	1	2	3	1	1	1	1	3	2	3
Avg	2.6	2.2	2.4	2.4	1.6	2.8	2.4	1.2	1	1	1	2.2	2.2	2.4

ME3707	Title: Finite Element Method	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	MA3104	
Objectives	To understand the fundamental concepts of the theory of the finite element method.	
Expected Outcome	● Students should understand the concepts behind formulation methods in FEM. ● Students should be able to Identify the application and characteristics of FEA elements in truss and frames. ● Students should develop element characteristic equation. ● Students should be able to apply the FEM 2D concept on steady state heat transfer analysis. ● Students should be able to understand dynamic analysis in different stepped bar and a beam, time dependent field problems.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Introduction to finite element method for solving field problems, stress and equilibrium, boundary conditions, strain, displacement, stress-strain relations. one dimensional problem: finite element equations, treatment of boundary conditions, galerkin's approach.		
Unit II	Analysis of Trusses and Frames	8
Element stiffness matrix for a truss member, analysis of plane truss with two at each node. Analysis of frames with two translations and a rotational degree of freedom at each node, analysis of beams: element stiffness matrix for two nodes (two degrees of freedom per node).		
Unit III	Finite Element Modeling	7
Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Finite element modeling of axi-symmetric solids subjected to axi-symmetric loading with triangular elements.		
Unit IV	Two Dimensional Analysis	7
Two dimensional four nodded iso-parametric elements and numerical integration. Steady state heat transfer analysis: one dimensional analysis of a fin and two dimensional analysis of thin plate, analysis of circular shaft subjected to torsion.		
Unit V	Dynamic Analysis	7
Formulation of finite element model, element matrices, evaluation of eigen values and eigen vectors for a stepped bar and a beam, time dependent field problems: application to one dimensional heat flow in a rod. Introduction to finite element formulation of three-dimensional problems in stress analysis, convergence requirements. Introduction to finite element analysis software.		
Text Books	1. G. Ramamurthy, Applied Finite Element Analysis, I.K. International Publishing House Pvt. Ltd., New Delhi, 2. Tirupathi R, Chandraputla and Ashok D Belagundu, Introduction to Finite Elements in Engineering, Practice Hall of India, . 3. S S Rao, The Finite Element Method in Engineering, Pergamon Press.	
Reference Books	1. L J Segerlind, Applied Finite Element Analysis, Wiley Eastern. 2. JN Reddy, An Introduction to Finite Element Method, McGraw-Hill.	
Mode of Evaluation	Internal and external examination	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3707

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should understand the concepts behind formulation methods in FEM.	2	Em
CO2	Students should be able to Identify the application and characteristics of FEA elements in truss and frames.	3	S
CO3	Students should develop element characteristic equation.	3	S
CO4	Students should be able to apply the FEM 2D concept on steady state heat transfer analysis.	3	S
CO5	Students should be able to understand dynamic analysis in different stepped bar and a beam, time dependent field problems.	2	S

CO-PO Mapping for ME 3707

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	3	3	3	3	1	1	1	1	1	1	2	2	2
CO 2	2	3	2	2	2	1	1	1	1	1	1	2	2	2
CO 3	3	3	2	3	3	2	1	1	2	1	1	2	3	3
CO 4	3	3	2	3	3	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	2	1	1	2	1	1	3	2	3
Avg	2.4	2.8	2.2	2.8	2.8	1.4	1	1	1.4	1	1	2.2	2.2	2.4

ME3503	Title: Operation Research	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To learn decision making for the real-life problems by appropriate measures and apply scientific techniques in industry.	
Expected Outcome	● Student should be able to understand the principles of decision making through linear programming and applying the learnings though numerical problems. ● Student should be able to understand the principles of decision making through transportation & assignment models and applying the learnings though numerical problems. ● Student should be able to understand the principles of decision making through queuing theory & waiting line models and applying the learnings though numerical problems. ● Student should be able to understand the principles of decision making through network diagrams such as PERT & CPM and applying the learnings though numerical problems. ● Student should be able to understand the principles of decision making through Game Strategy and applying the learnings though numerical problems	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Linear Programming	6
Scope and application of operations research, linear programming problem: introduction, requirement of LP, basic assumptions, formulation of LP, general statement of LP; solution techniques of LP using graphical methods and analytical methods: simplex, big m and two phase, sensitivity analysis, primal and dual problems.		
Unit II	Transportation Model	5
Transportation and assignment model: linear form, solution methods: north west corner method, least cost method, Vogel's approximation method. Degeneracy in transportation, modified distribution method, unbalanced problems and profit maximization problems. Transshipment problems. Assignment problems and travelling sales man problem.		
Unit III	Queuing Theory	5
Queuing theory: basics and elements of queuing theory, classification of queuing models, Kendall's notation, operating characteristics, examples of m/m/1:∞/FCFA		
Unit IV	PERT and CPM	4
Introduction to pert and CPM, critical path calculation, float calculation and its importance, cost reduction by crashing of activity.		
Unit V	Game Theory	4
Game theory: introduction and characteristics, two person zero sum games, pure strategy. Dominance theory, mixed Strategies (2x2, mx2), algebraic and graphical methods.		
Text Books	1. P.K Gupta and D.S Hira, Operation Research, S. Chand Publishers. 2. Hamdy Taha, Operations Research: An Introduction, Pearson	
Reference Books	1. H N Wagner, Operations Research, Prentice hall. 2. Ronald Rardin, Optimization in Operations Research, Pearson Education Inc. 3. R. Paneerselvam, Operations Research, Prentice Hall of India Pvt. Ltd. 4. N D Vohra, Quantitative Techniques in Management, Tata McGraw-Hill 5. S D Sharma , Operations Research-Theory Methods and Applications, Kedar Nath Ram Nath Publishers.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3503

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the principles of decision making through linear programming and applying the learnings though numerical problems	3	S
CO2	Student should be able to understand the principles of decision making through transportation & assignment models and applying the learnings though numerical problems.	2	S
CO3	Student should be able to understand the principles of decision making through queuing theory & waiting line models and applying the learnings though numerical problems.	2	S
CO4	Student should be able to understand the principles of decision making through network diagrams such as PERT & CPM and applying the learnings though numerical problems.	2	S
CO5	Student should be able to understand the principles of decision making through Game Strategy and applying the learnings though numerical problems.	2	S

CO-PO Mapping for ME 3503

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	2	2	1	1	1	1	1	1	2	1	2	2
CO 2	2	3	3	2	1	1	1	1	1	1	2	1	3	2
CO 3	2	2	2	2	2	1	1	1	2	1	2	2	2	2
CO 4	2	2	2	2	1	1	1	1	1	1	2	1	2	2
CO 5	3	3	2	2	2	1	1	1	2	1	2	2	3	2
Avg	2.4	2.4	2.2	2	1.4	1	1	1	1.4	1	2	1.4	2.4	2

MT3803	Title:Robotics and Automation	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the engineering aspects of 3D translation, orientation representation arm, Automation and ROS concept.	
Expected Outcome	● Students should be able to understand the basics of Robotics and Automation concepts . ● Students should be able to describe the basic concept of Trajectories Motion and Automation Integration. ● Students should be able to attain a theoretical and practical understanding of Robot Navigation and Automation. ● Students should be able to classify the theoretical and practical understanding of Robot Arm Kinematics. ● Students should be able to theoretical and practical understanding of the Real Time Operating System and Application of Robotics and Automation.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	5
Definitions, types of robots, application of robots, representing position and orientation, representing pose in 2 dimensions, representing pose in 3 dimensions, representing orientation in 3 dimensions, combining translation and orientation.		
Unit II	Trajectories Motion and Automation	6
Trajectories, smooth one-dimensional trajectory, multi-dimensional case, multi segment trajectories, interpolation of orientation in 3d, cartesian motion, time varying coordinate frames, rotating coordinate frame, incremental motion, inertial navigation systems, mobile robot vehicles, mobility, car like mobile robots, moving to a point, following a line, following a path, moving to a pose.		
Unit III	Robot Navigation and Automation	7
Reactive navigation, Braitenberg vehicles, simple automata, map based planning, distance transform, Veronai roadmap method, probabilistic roadmap method, localization, dead reckoning, modeling the vehicle, estimating pose, using a map, creating a map, localization and mapping, monte Carlo localization.		
Unit IV	Robot Arm Kinematics	7
Describing a robot arm, forward kinematics, a 2 link robot, a 6 axis robot, inverse kinematics, closed form solution, numerical solution, under actuated manipulator, redundant manipulator, joint space motion, cartesian motion, cylindrical motion, spherical motion, SCARA motion, articulated motion, motion through a singularity.		
Unit V	Getting Started with ROS	5
Installing ROS, understanding the ROA file system level, packages, stacks, messages, services, understanding the ROS computation graph level, nodes, topics, services, messages, bags, master, parameter server, creating workspace, creating & building anros package, creating & building the node, visualization of images, working with stereo vision, 3d visualization, visualizing data on a 3d world using rviz.		
Text Books	1. John J. Craig, Introduction to Robotics, Addison Wesley 2. M. P. Grover, Automation, Production Systems and Computer Integrated Manufacturing, Pearson Education. 3. Aaron Martinez & Enrique Fernández, Learning ROS for Robotics Programming, Packt Publishing	
Reference Books	1. Yoram Koren, Robotics for Engineers, McGraw Hill International 2. Groover, Weiss, Nagel, Industrial Robotics, McGraw Hill International 3. Fu, Lee and Gonzalez, Robotics, control vision and intelligence. McGraw Hill International 4. Saeed B. Niku, Introduction to Robotics – Analysis, Systems and Application, John Wiley & Sons Inc.	
Mode of Evaluation	Internal and External Examinations	

Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

Course Outcome For MT3803

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the basic concepts of Definitions,	2	Em
CO2	Student should be able to understand the types of robots	2	S
CO3	Student should be able to understand the Trajectories Motion and Automation, Robot Navigation and Automation	2	S
CO4	Student should be able to analyze Robot Arm Kinematics	2	S
CO5	Student should be able to know and apply concepts of ROS	2	S

CO-PO Mapping for MT 3803

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	2	2	3	1	1	1	1	1	1	2	2	3
CO 2	2	3	2	3	2	1	1	1	1	1	1	3	3	3
CO 3	2	2	2	2	3	1	1	1	2	1	1	2	3	3
CO 4	2	2	2	2	3	1	1	1	1	1	1	3	2	2
CO 5	2	2	2	3	3	1	1	1	2	1	1	3	2	3
Avg	2	2.2	2	2.4	2.8	1	1	1	1.4	1	1	2.6	2.4	2.8

MT3819	Title: Microprocessors in Automation	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To introduce the basic concepts of Digital circuits, Microprocessor system and digital controller	
Expected Outcome		
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	5
Number Systems, codes, digital electronics: Logic Gates, combinational circuits design, Flip-flops, Sequential logic circuits design: Counters, Shift registers. Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals.		
Unit II	Machine Cycle	8
Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.		
Unit III	Assembly Language programming	10
Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controlle Interfacing peripherals: Programmable peripheral interface (8255).		
Unit IV	Converter and Timer	10
Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display syste Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features		
Unit V	Digital Control	8
Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, Z-Transform, Digital Filters, Implementation of Digital Algorithm		
Text Books	Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI Learning Private Limited 2) Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvin Tata McGraw-Hill Publishing Company Ltd.	
Reference Books	Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar, PENRAM International Publishers. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition, 2007). Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Ha	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for MT 3819

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand fundamentals of number systems,logic gates and 8085 microprocessor	2	Em
CO2	Student will be able to understand fundamentals of machine cycles	2	S
CO3	Student will be able to understand fundamentals of Assembly language programming	2	S
CO4	Student will be able to understand fundamentals of convertor and timers	2	S
CO5	Student will be able to understand fundamentals of digital control	2	S

CO-PO Mapping for MT3819

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	1	2	1	1	1	1	1	1	1	2	2	2
CO 2	2	2	2	2	2	1	1	1	1	1	1	2	2	2
CO 3	1	2	1	2	1	1	1	1	1	1	1	2	1	1
CO 4	2	2	1	2	2	1	1	1	1	1	1	2	2	2
CO 5	1	2	1	2	1	1	1	1	1	1	1	2	2	1
Avg	1.6	2	1.2	2	1.4	1	1	1	1	1	1	2	1.8	1.6

ME3713	**Title: Unconventional Manufacturing Processes**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To make students aware of different nontraditional manufacturing processes and their applications.	
Expected Outcome	● Students should be able to understand the need of non traditional machining processes and able to classify various processes. ● Students should be able to recognize the role of mechanical energy in non-traditional machining processes. ● Students should be able to various on machining electrically conductive material through electrical energy in non-traditional machining processes. ● Students should be able to perform process analysis considering the various responses considered in a process. ● Students should be able to the use of controlled explosive and spark energy in deformation process.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Introduction**	7
Limitations of conventional manufacturing processes, need of unconventional manufacturing processes and its classification.		
Unit II	**Unconventional Machining Process - I**	7
Principle and working and applications of unconventional machining process such as Electro-Discharge machining, Electro-chemical machining, ultrasonic machining, Abrasive jet machining etc.		
Unit III	**Unconventional Machining Process – II**	7
Principle and working and application of unconventional machining processes such as laser beam machining, Electron beam machining, Ultrasonic machining etc.		
Unit IV	**Unconventional Welding Process**	7
Explosive welding, Cladding etc. Under water welding, Metallizing, Plasma are welding/cutting etc.		
Unit V	**Unconventional Forming Process**	8
Principle, working and applications of High energy forming processes such as Explosive Forming, Electromagnetic forming, Electro-Discharge forming, water hammer forming, explosive compaction etc.		
Text Books	1. P.C. Pandey, Modern Machining Processes, Tata McGraw Hill 2. Jagadeesha , Non-Traditional Machining Processes, IK Publishers	
Reference Books	1. G.F. Benedict, Non-Traditional Manufacturing Processes, CRC Press 2. V.K. Jain, Advanced Machining Processes, Allied Publisher	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3713

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to understand the need of non traditional machining processes and able to classify various processes.	2	Em
CO2	Students should be able to recognize the role of mechanical energy in non-traditional machining processes.	2	S
CO3	Students should be able to various on machining electrically conductive material through electrical energy in non-traditional machining processes.	2	S
CO4	Students should be able to perform process analysis considering the various responses considered in a process.	2	S
CO5	Students should be able to the use of controlled explosive and spark energy in deformation process.	2	S

CO-PO Mapping for ME 3713

Course Outcom es	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	3	1	1	1	1	1	1	2	2	2
CO 2	2	2	2	2	2	2	1	1	1	1	1	2	2	2
CO 3	3	2	3	2	3	2	1	1	1	1	1	2	3	3
CO 4	3	2	1	2	2	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	2	1	1	1	1	1	2	2	3
Avg	2.4	2	2.4	2.2	2.6	1.6	1	1	1	1	1	2	2.2	2.4

ME3714	Title: Plastic Processing and Techniques	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make students aware of various processing techniques of plastics and understand their applications.	
Expected Outcome	● Students should be able to Understand the various types of PPEs and their usage in Plastic industry and non-conventional blow molding process. ● Students should be able to Co-extrusion blow molding displacement processes, blow molding of irregular shaped parts. ● Students should be able to various screw designs used in extrusion plants, specialized extrusion processes for non-conventional extrusion product. ● Students should be able to the Reaction injection molding (rim)and features of rim process and, characteristic of rim parts. ● Students should be able to the use non-conventional injection molding techniques and injection molding of reinforced thermoplastics.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Advanced Blow Molding Processes-I	7
Stretch blow molding: introduction, single stage & two stage processes and its comparison orientation and stretch ratio, pre-forming, extrusion stretch blow molding, injection orientation blow molding		
Unit II	Advanced Blow Molding Processes-II	7
Co-extrusion blow molding: co-extrusion equipment process, Miscellaneous blow molding processes: neck ring process drape process dip / displacement processes blow molding of irregular shaped parts		
Unit III	Advanced Extrusion Techniques	7
Advanced extruder machine features: twin screw extruder intermeshing and non-intermeshing counter rotating and co-rotating, comparison with single screw, vented screw extruder designs, internal bubble cooling. Co-extrusion: co-extrusion structures barrier materials & adhesives comparison, feed block die and multi manifold die advantages of co-extrusion products, applications of co-extruded products. Specialized processes: reinforced pipes- nylon braided pipes, hose pipe, fishing net, heat shrink film, cling film, corrugated sheets and pipes		
Unit IV	Advanced Injection Molding Processes-I	7
Reaction injection molding (rim): introduction to rim process, materials and additives, features of rim process and variables, machine & auxiliary, flow diagram of rim process, characteristic of rim parts, merits and demerits of rim process		
Unit V	Advanced Injection Molding Processes-II	8
Non-conventional injection molding process: material, process, advantages and disadvantages of the following processes, gas-assisted injection molding, sandwich injection molding, structural foam injection molding, flow molding, metal filled, multicolor molding, injection molding of reinforced thermoplastics		
Text Books	1. W.S.Allen,P N Baker, Handbook of Plastics Technology-Plastic Processing Operations Vol 1., CBS Hb.	
Reference Books	1. Edward Muccio, Plastic Processing Technology, ASM International 2. A Brent strong, Plastics:Materials and Processes, Prentice Hall	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3714

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to Understand the various types of PPEs and their usage in Plastic industry and non-conventional blow molding process.	2	Em
CO2	Students should be able to Co-extrusion blow molding displacement processes, blow molding of irregular shaped parts.	2	S
CO3	Students should be able to various screw designs used in extrusion plants, specialized extrusion processes for non-conventional extrusion product.	2	S
CO4	Students should be able to the Reaction injection molding (rim)and features of rim process and, characteristic of rim parts.	2	S
CO5	Students should be able to the use non-conventional injection molding techniques and injection molding of reinforced thermoplastics.	2	S

CO-PO Mapping for ME 3714

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	3	2	3	2	2	2	2	1	1	1	1	2	2	2
CO 2	3	3	2	3	2	1	1	1	1	1	1	2	2	2
CO 3	3	2	3	2	2	2	1	1	1	1	1	2	3	3
CO 4	3	2	3	2	2	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	1	2	1	1	1	1	1	2	2	3
Avg	2.8	2.2	2.8	2.4	1.8	1.6	1.2	1	1	1	1	2	2.2	2.4

ME3806	Title:Rapid Prototyping	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites		
Objectives	To make students aware of different types of Rapid prototyping processes, materials used in RP systems and reverse engineering.	
Expected Outcome	● Students should be able to know about RP system fundamentals and detail study about rapid manufacturing. ● Students should be able to attain a theoretical understanding of reverse engineering and new technology related to reverse engineering. ● Students should be able to develop an understanding of materials used for rapid prototyping system. ● Students should be able to theoretically analyze the Liquid and Solid Based Rapid Prototyping Systems. ● Students should be able to attain a theoretical understanding Powder Based Rapid Prototyping Systems.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
History, development of RP systems, applications in product development, need for the compression in product development, classification of RP, rapid tooling, rapid manufacturing- principle – fundamental – file format, data files and data formats. Data preparation.		
Unit II	Reverse Engineering and New Technologies	7
Introduction, measuring device- contact type and non-contact type, CAD model creation from point clouds-preprocessing, point clouds to surface model creation, medical data processing – types of medical imaging, software for making medical models, medical materials, other applications – Case study.		
Unit III	Materials for Rapid Prototyping Systems	7
Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder-based materials – case study.		
Unit IV	Liquid and Solid Based Rapid Prototyping Systems	7
Classification – Liquid based system – Stereolithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system – Fused Deposition Modeling, principle, process, products, advantages, applications and uses – Laminated Object Manufacturing.		
Unit V	Powder Based Rapid Prototyping Systems	8
Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three-Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, e-manufacturing – Laser Engineered Net Shaping (LENS).		
Text Books	1. Rafiq I. Noorani, Rapid Prototyping, Principles and Applications, Wiley & Sons, 2. Chua C.K, Leong K.F and Lim C.S, Rapid Prototyping: Principles and Applications, World Scientific,	
Reference Books	1. N. Hopkinson, R.J.M, Hauge, P M, Dickens,Rapid Manufacturing – An Industrial revolution for the digital age, Wiley, 2. Ian Gibson , Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying, Wiley,	
Mode of Evaluation	Internal and External Examinations	

Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20th October 2022

Course Outcome For ME 3806

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand about development of RP systems	2	Em
CO2	Student should be able to understand about Reverse Engineering and New Technologies	2	S
CO3	Student should be able to know about Materials for Rapid Prototyping Systems	2	S
CO4	Student should be able to understand about Liquid and Solid Based Rapid Prototyping Systems	2	S
CO5	Student should be able to know about the Powder Based Rapid Prototyping Systems	2	S

CO-PO Mapping for ME 3806

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate-2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	3	1	1	1	1	1	1	2	2	2
CO 2	3	3	2	3	2	1	1	1	1	1	1	2	2	2
CO 3	3	2	3	2	3	2	1	1	2	1	2	2	3	3
CO 4	3	2	2	2	3	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	2	1	1	2	1	2	3	2	3
Avg	2.6	2.2	2.6	2.4	2.8	1.4	1	1	1.4	1	1.4	2.2	2.2	2.4

ME3815	Title: Non-Conventional Energy Resources	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the basic concepts of the solar & nuclear thermal systems for their utilization as alternate energy source.	
Expected Outcome	● Students should be able to Identify the renewable energy sources and their utilization. ● Students should be able to understand the different type of solar energy. ● Students should be able to understand various concepts related to solar radiation and its measurement. ● Students should be able to understand various concepts related to solar thermal electricity generation. ● Students should be able to Understand the principle of working of nuclear power plants.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Solar Energy	5
Environmental impacts of burning of fossil fuels; sustainable development and role of renewable energy sources. The sun as energy source; solar energy received on the earth; primary and secondary solar energy and utilization of solar energy. Characteristic advantages and disadvantages.		
Unit II	Solar Radiation and Measurement	8
Solar radiation on the earth surface, extraterrestrial radiation characteristics, terrestrial radiation, solar insulation, spectral energy distribution of solar radiation. Depletion of solar radiation, absorption, scattering. Beam radiation, diffuse and global radiation. Measurement of solar radiation, pyranometer, pyrheliometer, sunshine recorder. Solar time - local apparent time (LAT), equation of time (E).		
Unit III	Solar Thermal Photovoltaic Systems	8
Solar concentrators and tracking; dish and parabolic trough concentrating generating systems, central tower solar thermal power plants; solar ponds. Basic principle of power generation in a PV cell: band gap and efficiency of PV cells, manufacturing methods of mono- and poly-crystalline cells, amorphous silicon thin film cells single and multi-junction cells, application of PV, brief outline of solar PV stand-alone system design, storage and balance of system		
Unit IV	Nuclear Energy	9
Nuclear fission. Nuclear reactions and radiations – principles of radioactive decay interactions of an ray with matter – the fission process. Basic principles of controlled fusion. Nuclear reactor principles, criticality condition, basic features of reactor control. Principles of the conversion of nuclear energy to useful power, various types of nuclear power plant Boiling water reactor. Description of reactor system, main components, control and safety features. Nuclear fuels.		
Unit V	Reactor Safety	5
Radiation safety: reactor shielding – radiation dozes – standards of radiation protection,nuclear plant safety-safety systems-changes and consequences of accident-criteria for safety-nuclear waste types of waste and its disposal-radiation hazards and their prevention-weapons proliferation		

Text Books	1. De Vos. A ,Thermodynamics of Solar Energy Conversion, Wiley-VCH 2. Prakash. J, Garg. H. P , Solar Energy Fundamentals and Applications, Tata McGraw-Hill 3. G. Vaidyanathan, Nuclear Reactor Engineering - Principles and Concepts, S. Chand Publishers
Reference Books	1. Kalogirou. S ,Solar Energy Engineering, Processes and Systems, Elsevier 2. Petela. R, Engineering Thermodynamics of Thermal Radiation for Solar Power, McGraw-Hill Co. 3. Yogi Goswami. D, Frank Kreith, Jan F. Kreider,Principles of Solar Engineering, Taylor & Francis 4. John R. Lamarsh and Anthony J. Baratta, Introduction to Nuclear Engineering, Prentice Hall
Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome for ME3803

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should be able to Identify the renewable energy sources,their utilization and types of solar energy	2	Em
CO2	. Students should be able to understand various concepts related to solar radiation and its measurement	2	S
CO3	Students should be able to understand various concepts related to solar thermal electricity generation	2	S
CO4	Students should be able to Understand the principle of working of nuclear power plants	2	S
CO5	Students should be able to Understand the safety features adopted in nuclear reactors	2	S

CO-PO Mapping for ME 3803

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	2	2	2	3	3	1	1	1	1	2	2	2
CO 2	2	1	2	1	2	2	2	1	1	1	1	2	2	2
CO 3	2	1	1	2	1	2	2	1	2	1	1	2	3	2
CO 4	2	2	2	2	1	2	2	1	1	1	1	2	2	3
CO 5	2	2	2	1	1	3	3	1	2	1	1	3	2	3
Avg	2	1.6	1.8	1.6	1.4	2.4	2.4	1	1.4	1	1	2.2	2.2	2.4

ME3803	Title: Supply Chain Management	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide the student with an understanding of the tools and techniques useful in implementing supply chain management in a business.	
Expected Outcome	● Students Should be able to understand the basic concept of supply chain management. ● Students Should be able to understand the planning demand and its related terminology. ● Students Should be able to understand the inventory management in a supply chain. ● Students Should be able to importance of transportation, network design and information technology in supply chain management. ● Students Should be able to define and establish the strategic importance of managing supply chains in business for better efiiciency.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	8
Historical perspective, objective and importance of supply chain, decision phases in supply chain, examples, supply chain performance, supply chain drivers and metrics.		
Unit II	Planning Demand and Supply in a Supply Chain	10
Demand forecasting in supply chain, aggregate planning in supply chain, planning supply and demand; managing predictable variability, economic order quantity models, reorder point models, multi-echelon inventory systems.		
Unit III	Planning and Managing inventories in a Supply Chain	8
Managing economies of supply chain, managing uncertainty in a supply chain, determining optimal levels of product availability.		
Unit IV	Transportation, Network Design and Information Technology	8
Transportation aspects in a supply chain, facility decision, network design in a supply chain, information technology and its use in supply chain, National Logistics policy 2022		
Unit V	Coordination in Supply Chain and effect of E-Business:	6
Role of coordination and e- business in a supply chain; financial evaluation in a supply chain.		
Text Books	1. Chopra and Meindl ,Supply Chain Management, Pearson Education. 2. Janat Shah, Supply Chain Management, Pearson Education.	
Reference Books	1. Bowersox, Closs, Cooper , Supply Chain Logistics Management, McGraw Hill. 2. Mohanty R.P, S.G Deshmuki, Supply Chain Management, Biztantra, New Delhi	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME3803

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to Know about the objective and importance of supply chain	2	Em
CO2	Student should be able to Know about thePlanning Demand and Supply in a Supply Chain	2	S
CO3	Student should be able to Know about the Planning and Managing inventories in a Supply Chain	2	S
CO4	Student should be able to Know about the Transportation, Network Design and Information Technology	2	S
CO5	Student should be able to learn about the Coordination in Supply Chain and effect of E-Business	2	S

CO-PO Mapping for ME 3803

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	2	2	2	1	1	1	1	1	2	2	2	2
CO 2	2	3	2	3	2	1	1	1	1	1	3	2	2	2
CO 3	2	2	3	2	1	2	1	1	2	1	3	2	3	2
CO 4	2	2	2	2	1	2	1	1	1	1	2	2	2	3
CO 5	2	2	2	3	1	2	1	1	2	1	2	3	2	3
Avg	2	2.2	2.2	2.4	1.4	1.6	1	1	1.4	1	2.4	2.2	2.2	2.4

ME3817	Title: Industrial Hazard and Safety	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The course is planned in such a manner that the students can build on the foundation laid in the basic course on Industrial Hazards and Safety. The course will highlight in detail various Industrial Hazards with emphasis on different types of safety measures.	
Expected Outcome	Student should be able to understand the cause of hazards in industry due to physical,biological,ergonomical reasons. Student will also be able to know about occupational hazards and toxicology.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	PHYSICAL HAZARDS	6
Noise, properties of sound, occupational damage, risk factors, sound measuring instruments, noise control programmes. Ionizing radiation, types, effects, monitoring instruments, control programmes, OSHA standard - nonionizing radiations, effects, types, radar hazards, microwaves and radiowaves, lasers, TLV- cold environments, hypothermia, wind chill index, control measures- hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control		
Unit II	CHEMICAL AND NUCLEAR HAZARDS	6
Recognition of chemical hazards- types, and concentration, Exposure vs. dose, TLV - Methods of evaluation, process or operation description, field survey, sampling methodology, Air Sampling instruments, Types, Measurement Procedures, Instruments Procedures, Gas and Vapour monitors, dust sample collection devices, personal sampling. Methods of Control - Engineering Control, Nuclear hazards, Disposal of nuclear wastes, Safety measures In nuclear plants		
Unit III	BIOLOGICAL AND ERGONOMICAL HAZARDS	8
Classification of Biohazardous agents – examples, bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control Programmes, employee health Programmeslaboratory safety programmes-animal care and handling-biological safety cabinets – building design. Work Related Musculoskeletal Disorders –carpal tunnel syndrome (CTS) - Tendon pain-disorders of the neck- back injuries		
Unit IV	OCCUPATIONAL HEALTH AND TOXICOLOGY	8
Concept and spectrum of health - functional units and activities of occupational health services, pre - employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases, their effects and prevention. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems		
Unit V	OCCUPATIONAL PHYSIOLOGY	8
Man as a system component – allocation of functions – efficiency – occupational work capacity – aerobic and anaerobic work – evaluation of physiological requirements of jobs – parameters of measurements – categorization of job heaviness – work organization – stress – strain – fatigue – rest pauses – shift work – personal hygiene.		
Text Books	1. Occupational Safety and Health Management" by Thomas J. Anton, 2nd 1989 E	
Reference Books	1. "Hand book of Occupational Safety and Health", National Safety Council, Chicago. 1982 2. 2 "Encyclopedia of Occupational Health and Safety", Vol. I and II, International Labour Office, Geneva 3. "Occupational Safety Management and Engineering" by Willie Hammer and Dennis Price	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME3817

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand about physical occupational hazards and standards	2	Em
CO2	Student will be able to understand about chemical and nuclear occupational hazards	2	S
CO3	Student will be able to understand about biological and ergonomical occupational hazards	2	S
CO4	Student will be able to understand about occupational health and toxicology	2	S
CO5	Student will be able to understand about occupational physiology	2	S

CO-PO Mapping for ME 3817

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	1	2	1	3	2	2	1	1	1	2	2	2
CO 2	2	1	2	1	2	2	3	1	1	1	1	2	2	2
CO 3	1	2	1	2	1	3	2	1	1	1	1	2	3	3
CO 4	2	2	2	2	1	2	2	1	1	1	1	2	2	2
CO 5	2	2	1	1	2	3	3	2	1	1	1	2	2	3
Avg	1.8	1.8	1.4	1.6	1.4	2.6	2.4	1.4	1	1	1	2	2.2	2.4

ME3808	Title: Energy Storage System	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To enable the student to understand the need for energy storage, devices and technologies available and their applications	
Expected Outcome	● Students should be able to understand the need for energy storage, devices and technologies available and their applications ● Students should be able to analyze the characteristics of energy from various sources and need for storage, classify various types of energy storage ● Students should be able to understand various devices used for the purpose, Identify various real time applications. ● Students should be able to understand various types of NCER. ● Students should be able to Understand some new type of unconventional energy systems.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Electrical Energy Storage Technologies	10
Characteristics of electricity, electricity and the roles of EES, high generation cost during peak-demand periods, need for continuous and flexible supply, long distance between generation and consumption, congestion in power grids, transmission by cable.		
Unit II	Need	8
Emerging needs for ees, more renewable energy, less fossil fuel, smart grid uses, the roles of electrical energy storage technologies, the roles from the viewpoint of a utility, the roles from the viewpoint of consumers, the roles from the viewpoint of generators of renewable energy.		
Unit III	Features	8
Classification of EES systems, mechanical storage systems, pumped hydro storage (PHS), compressed air energy storage (CAES), flywheel energy storage (FES),electrochemical storage systems, secondary batteries, flow batteries, chemical energy storage, hydrogen (H2),synthetic natural gas (SNG)		
Unit IV	Renewable Energy Systems	9
Solar energy, wind energy, pumped hydro energy, fuel cells. Energy storage in microgrid and smart grid. Energy management with storage systems, battery SCADA, increase of energy conversion efficiencies by introducing energy storage.		
Unit V	Other Systems	5
Simulation of energy storage systems and its management, smart park, electric vehicle charging facility, HESS in microgrid and smart grid, microbial fuel cell, hydrogen fuel cell.		
Text Books	1. A. R. Pendse , Energy Storage Science and Technology, SBS Publishers & Distributors Pvt. Ltd., New Delhi	
Reference Books	1. Jim Eyer, Garth Corey , Energy Storage for the Electricity Grid: Benefits and Market Potential Assessment Guide, , Sandia National Laboratories,	

	2. A.G. Ter Gazarian, Energy Storage for Power Systems, The Institution of Engineering and Technology (IET) Publication, UK,
Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	14.05.2022
Date of approval by the Academic Council	20.10.2022

Course Outcome For ME3808

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand the basic concepts of Electrical Energy Storage Technologies	2	Em
CO2	Student should be able to understand the Emerging needs for ees	2	S
CO3	Student should be able to understand the Classification of EES systems	2	S
CO4	Student should be able to analyze the Renewable Energy Systems Simulation of energy storage systems and its management	2	S
CO5	Student should be able to know smart park, electric vehicle charging facility, HESS in microgrid and smart grid, microbial fuel cell, hydrogen fuel cell.	2	S

CO-PO Mapping for ME 3808

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	3	3	2	2	1	1	1	2	2	2
CO 2	2	3	2	3	2	2	3	1	1	1	1	2	2	2
CO 3	3	2	3	2	3	3	2	1	1	1	1	2	3	3
CO 4	2	2	2	2	3	2	2	1	1	1	1	2	2	2
CO 5	2	2	3	3	2	3	3	2	1	1	1	2	2	3
Avg	2.2	2.2	2.6	2.4	2.6	2.6	2.4	1.4	1	1	1	2	2.2	2.4

ME3807	Title: Energy Conservation and Audit	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This course provides the knowledge of energy conservation measures in thermal and electrical energy systems.	
Expected Outcome	● Students should be able to understand about the principle, planning of energy conservation in small and large-scale industries. ● Students should be able to understand the basic concepts of energy audit and energy management. ● Students should be able to understand the concept of demand side management and its strategy, planning, implementation and applications. ● Students should be able to calculate the voltage and reactive power in distribution system. ● Students should be able to calculate and test the efficiency in motors and lighting system.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Energy conservation	6
Principles of energy conservation, energy conservation planning, energy conservation in small scale industries, large scale industries and in electrical generation, transmission and distribution, energy conservation legislation.		
Unit II	Energy Audit	8
Aim of energy audit, strategic of energy audit, energy management team consideration in implementing energy conservation programme, instruments for energy audit, energy audit of electrical systems, HVAC, buildings, economic analysis.		
Unit III	Demand Side Management	6
Concept and scope of demand side management, evolution of demand side management, DSM strategy, planning, implementation and its application, customer acceptance & its implementation issues, national and international experiences with DSM.		
Unit IV	Voltage and Reactive power in Distribution Systems	8
Voltage and reactive power calculations and control, voltage classes and nomenclature, voltage drop calculations, voltage control, VAR requirements and power factor, capacitors unit and bank rating, protection of capacitors and switching, controls for switched capacitors and fields testing.		
Unit V	Efficiency in Motors and Lighting system	8
Load scheduling/shifting, motor drives-motor efficiency testing, energy efficient motors, and motor speed control. Lighting-lighting levels, efficient options, fixtures, day lighting, timers, energy efficient windows, ups selection, installation operation and maintenance. Indian Electricity Act 1956, Distribution Code and Electricity Bill 2003.		
Text Books	1. Tripathy S.C, Electric Energy Utilization and Conservation, , Tata McGraw Hill. 2. I. G. C. Dryden, The Efficient Use of Energy, Butterworths, London	
Reference Books	1. W. C. Turner , Energy Management Handbook, Wiley, New York 2. L. C. Witte, P. S. Schmidt, D. R. Brown Industrial Energy Management and Utilization, HemispherePubl, Washington 3. Recommended Practice for Energy Conservation and cost effective planning in industrial facilities, IEEE Bronze Book, IEEE Press	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome For ME3807

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student should be able to understand about Energy conservation	2	Em
CO2	Student should be able to understand about Energy Audit	2	S
CO3	Student should be able to know about Demand Side Management	2	S
CO4	Student should be able to understand about Voltage and Reactive power in Distribution Systems	2	S
CO5	Student should be able to know about the Efficiency in Motors and Lighting system	2	S

CO-PO Mapping for ME 3807

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped- 3, Moderate- 2, Low-1, Not related-0)												Program Specific Outcomes	
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO 1	PSO 2
CO 1	2	2	3	2	3	2	2	1	1	1	1	2	2	2
CO 2	3	3	2	3	2	2	3	1	1	1	2	2	2	2
CO 3	3	2	3	2	3	2	3	2	1	1	1	2	3	3
CO 4	3	2	2	2	3	3	3	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	3	3	1	1	2	2	3	2	3
Avg	2.6	2.2	2.6	2.4	2.2	2.4	2.8	1.2	1	1.2	1.4	2.2	2.2	2.4

ME3810	Title:Lean Manufacturing	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This course is designed to provide the students the complete insights of various lean tools, techniques and lean implementation strategies.	
Expected Outcome	● Students should be able to develop an understanding of the basic principles, elements, and tools of Lean Manufacturing. ● Students should be able to describe the basic of Cellular Manufacturing, JIT and TPM. ● Students should be able to attain a theoretical understanding of Set up time reduction, TQM, 5S, VSM. ● Students should be able to theoretically analyze Lean Manufacturing Implementation techniques. ● Students should be able to attain a theoretical understanding of Six Sigma and its implementation.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Lean Manufacturing	7
Conventional manufacturing versus lean manufacturing, principles of lean manufacturing, lean manufacturing concepts, basic elements of lean manufacturing, introduction to LM tools.		
Unit II	Cellular Manufacturing, JIT and TPM	7
Cellular manufacturing – types of layout, principles of cell layout, implementation. JIT – principles of JIT and implementation of Kanban. TPM – pillars of TPM, principles and implementation of TPM.		
Unit III	Set up time reduction, TQM, 5S, VSM	7
Set up time reduction – definition, philosophies and reduction approaches, TQM – principles and implementation, 5s principles and implementation, value stream mapping - procedure and principles.		
Unit IV	Lean Manufacturing Implementation	8
Various lean implementation frameworks, steps for lean manufacturing implementation, enablers and barriers of lean implementation, case study-various case studies of implementation of lean manufacturing at industries.		
Unit V	Six Sigma	7
Definition, statistical considerations, variability reduction, design of experiments, six sigma implementations.		
Text Books	1. N. Gopalkrishnan, Simplified Lean Manufacture, PHI Learning Private Limited. New Delhi 2. Hobbs, D.P, Lean Manufacturing implementation, Narosa Publisher	
Reference Books	1. Lonnie Wilson, How to Implement Lean Manufacturing, McGraw Hill. 2. William M. Feld, Lean Manufacturing: Tools, Techniques and How to Use Them, The St Lucie Press. 3. Devadasan S.R, Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities,PHI 4. Michael L. George , Lean Six Sigma, McGraw-Hill.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20th October 2022	

Course Outcome for ME 3810

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand principles about lean manufacturing and importance	2	Em
CO2	Student will be able to know about JIT and TPM principles and implementation technques	2	S
CO3	Student will be able to know about TQM,5S and VSM procedure and principles	2	S
CO4	Student will be able to know implementation technique of Lean manufacturing	2	s
CO5	Student will be able to know about significance of six sigma	2	s

CO-PO Mapping for ME 3810

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped-3,Moderate-2, Low-1, Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2	3	2	3	1	1	1	1	1	1	2	2	2
CO2	1	3	2	3	2	1	1	1	1	1	1	2	2	2
CO3	1	2	3	2	3	2	1	1	2	1	2	2	3	3
CO4	1	2	2	2	3	1	1	1	1	1	1	2	2	2
CO5	1	2	3	3	3	2	1	1	2	1	2	3	2	3
Avg	1	2.2	2.6	2.4	2.2	1.4	1	1	1.4	1	1.2	2.2	2.2	2.4

ME3818	Title: Hybrid Vehicle Propulsion	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the basics of hybrid vehicle and its propulsion systems	
Expected Outcome	Understand the basics of the hybrid electric vehicles and it's types Understand the propulsion units used in Hybrid Vehicles and their efficiency	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	6
History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern drive-trains on energy supplies Conventional Vehicles: Basics of vehicle performance, vehicle power source characterization, transmission characteristics, and mathematical models to describe vehicle performance.		
Unit II	Drive train	5
Basic concept of hybrid traction, introduction to various hybrid drive-train topologies, power flow control in hybrid drive-train topologies, fuel efficiency analysis. Basic concept of electric traction, introduction to various electric drive-train topologies, power flow control in electric drive-train topologies, fuel efficiency analysis		
Unit III	Electric propulsion Unit	5
Introduction to electric components used in hybrid and electric vehicles, Configuration and control of DC Motor drives, Configuration and control of Induction Motor drives, configuration and control of Permanent Magnet Motor drives, Configuration and control of Switch Reluctance Motor drives, drive system efficiency.		
Unit IV	Energy Storage	4
Introduction to Energy Storage Requirements in Hybrid and Electric Vehicles, Battery based energy storage and its analysis, Fuel Cell based energy storage and its analysis, Super Capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis, Hybridization of different energy storage devices.		
Unit V	Energy Management	4
Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies		
Text Books	1. Iqbal Hussein, Electric and Hybrid Vehicles: Design Fundamentals, CRC Press , 2003. 2. MehrdadEhsani, YimiGao, Sebastian E. Gay, Ali Emadi, Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals, Theory and Design, CRC Press , 2004	
Reference Books	1. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley , 2003. 2. Chris Mi, M. Abul Masrur, David Wenzhong Gao, Hybrid Electric Vehicles: Principles and Applications with Practical Perspectives, John Wiley & Sons Ltd., 2011	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	

Date of approval by the Academic Council	20.10.2022

Course Outcome for ME3818

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand about hybrid and electric vehicle fundamentals	2	Em
CO2	Student will be able to understand about drive train used in hybrid vehicles	2	S
CO3	Student will be able to understand about electric propulsion unit used in hybrid vehicles	2	S
CO4	Student will be able to understand about energy storage systems	2	s
CO5	Student will be able to understand about energy management techniques	2	s

CO-PO Mapping for ME 3818

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped-3,Moderate-2, Low-1, Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	2	1	1	1	2	3	1	1	1	1	2	2	2
CO2	2	2	1	1	1	2	2	1	1	1	1	2	2	2
CO3	3	2	1	2	2	2	2	1	2	1	2	2	3	3
CO4	2	2	2	2	1	2	3	1	1	1	1	2	2	2
CO5	2	2	1	1	2	2	3	1	2	1	2	3	2	3
Avg	2.2	2	1.2	1.4	1.4	2	2.6	1	1.4	1	1.2	2.2	2.2	2.4

ME3816	Title: Facility Planning and Design	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Students will be able to understand the plant location and site selection, factors influencing the plant location, the plant layout and plant layout design techniques	
Expected Outcome	Students will be able to 1. use the concepts of plant location and site selection and its layout design. 2. Apply the group technology concept and plan material handling in plant.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Factory Planning	4
Factory Planning: Introduction, factors to be considered Plant Location and Site Selection: Levels of plant location, rural, urban and suburban location of plants, factors influencing the plant location, optimum plant location, location theories.		
Unit II	Plant Layout	5
Plant Layout: Introduction of production system, scope, objectives, importance, and types of plant layout, characteristics of a good plant layout, factoring affecting plant layout, procedure of developing a plant layout, different graphical and computerized plant layout design techniques, installation and evaluation of plant layout, optimum plant layout		
Unit III	Group Technology	5
Group Technology: Definition, objectives, planning, part families and machine cell formation, evaluation of machine cells, types of GT layout, benefits of GT, implementation of GT.		
Unit IV	Line Balancing	4
. Line Balancing: Definitions, heuristic and analytical methods of balancing the assembly and production line, single and mixed model line balancing.		
Unit V	Material handling	6
Materials Handling: Definition, scope, objectives, principles, importance, factors in materials handling problem, analysis of materials handling, types and selection of materials handling equipment's, aids and techniques in materials handling equipment selection. Planning of material flow, advantages of planned material flow, flow planning principles, flow patterns, analysis of material flow.		
Text Books	1. Groover,M.P.,"Automation, Production Systems and ComputerIntegrated Manufacturing", Pearson Education Inc. Delhi 2.Sule,D.R.,"Manufacturing Facilities-Location, Planning, and Design", PWS Publishing Company	
Reference Books	1.Francis, R.L., McGinnis, L.F., and White, J.A., "Facility Layout and Location: An Analytical Approach", Prentice Hall of India 2.Tompkins,J.A., White, J.A.,Bozer,Y.A.,Frazelle, E.H.,Tanchoco, J.M., and Tervino,J.,"Facilities Planning",2nd 1996 Ed., John Willey & Sons	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	14.05.2022	
Date of approval by the Academic Council	20.10.2022	

Course Outcome for ME 3816

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will be able to understand about facilities planning	2	Em
CO2	Student will be able to understand about plant layout	2	S
CO3	Student will be able to understand about group technology	2	S
CO4	Student will be able to understand about line balancing	2	S
CO5	Student will be able to understand about effective material handling	2	S

CO-PO Mapping for ME 3816

Course Outcomes	Program Outcomes (Course Articulation Matrix (Highly Mapped-3,Moderate-2, Low-1, Notrelated-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	2	1	1	1	1	1	1	1	2	2	2
CO2	3	2	2	1	2	1	1	1	1	1	1	2	2	2
CO3	2	2	1	2	1	2	1	1	2	1	2	2	3	3
CO4	2	2	2	2	1	1	1	1	1	1	2	2	2	2
CO5	3	2	1	1	1	2	1	1	2	1	2	3	2	3
Avg	2.4	1.8	1.4	1.6	1.2	1.4	1	1	1.4	1	1.2	2.2	2.2	2.4