Study & Evaluation Scheme

of

Bachelor of Technology
in
Mechanical Engineering

[Applicable for 2018-22]
Version 2018

[As per CBCS guidelines given by UGC]

BOS	BOF	BOM
24.03.2018	05.06.2018	11.06.2018 Approved vide agenda number 1.7.1

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)			
Sessional Examination I	50 Marks		
Sessional Examination II	50 Marks		
Assignment –I	25 Marks		
Assignment-II	25 Marks		
Attendance	50 Marks		
Internal Evaluation Components (Practical Papers)			
Quiz One	25 Marks		
Quiz Two	25 Marks		
Quiz Three	25 Marks		
Lab Records/ Mini Project	75 Marks		
Attendance	50 Marks		
End Semester Evaluation (Practical Papers)			
ESE Quiz	30 Marks		
ESE Practical Examination	50 Marks		
Viva- Voce	20 Marks		

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:

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.

1. *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.*

2. *There shall be continuous evaluation of the student and there will be a provision of real time reporting on QUMS. All the assignments will be 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 and needs.

Curriculum (18-22)

Quantum School of Technology

Department of Mechanical Engineering

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

BREAKUP OF COURSES

Sr. No	CATEGORY	CREDITS
1	Foundation Core (FC)	41
2	Program Core (PC)	76
3	Program Electives (PE)	15
4	Open Electives (OE)	9
5	Project	14
6	Internship	4
7	Value Added Programs (VAP)	10
8	General Proficiency	7
9	Disaster Management*	2*
TOTAL NO. OF CREDITS		176
TOTAL NO. OF CREDITS (Honors)		188

*Non-CGPA Audit Course

DOMAIN-WISE BREAKUP OF CATEGORY

Domain	Foundation core	Program core	Program elective	Sub total	%age
Sciences	17	-	-	17	9.71
Humanities	5	-	-	5	2.86
Management	5	3	-	8	4.57
Engineering	14	91	15	120	66.86
Open elective				9	5.14
VAP				10	6.86
GP				7	4.00
Disaster Management*				2*	0.0
Grand Total	**41**	**94**	**15**	**176**	**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	20	21	-	-	-	-	-	-	41
2	Program Core	-	-	21	17	15	14	9	-	76
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	-	-	-	-	2	-	2	-	4
7	VAPs	1	1	1	1	2	2	2	-	10
8	GP	1	1	1	1	1	1	1	-	7
9	Disaster Management*									2*
	TOTAL	**22**	**23**	**25**	**24**	**25**	**25**	**22**	**10**	**176**

Group B

SEMESTER 1

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
MA3101	FC	Mathematics – I	3	2	0	4	1.0	Nil
PS3101	FC	Human Values and Ethics	2	0	0	2	1.0	Nil
CS3101	FC	Basics of Computer and C Programming	2	0	0	2	1.0	Nil
MB3101	FC	Engineering Economics	2	0	0	2	1.0	Nil
EC3101	FC	Basic Electrical and Electronics Engineering	3	0	0	3	1.0	Nil
EG3102	FC	Professional Communication	2	0	0	2	1.0	Nil
CS3140	FC	Basics of Computer and C Programming lab	0	0	2	1	1.0	Nil
EG3140	FC	Professional Communication lab	0	0	2	1	1.0	Nil
EC3140	FC	Basic Electrical and Electronics Engineering Lab	0	0	2	1	1.0	Nil
ME3141	FC	Engineering Graphics	0	0	4	2	1.0	Nil
VP3101	VP	Communication and Professional Skills - I	0	0	2	1		Nil
GP3101	GP	General Proficiency	0	0	0	1		Nil
CE 3101	AU	Disaster Management*	2	0	0	2*	1.0	
		TOTAL	**16**	**2**	**12**	**22**		

*Non-CGPA Audit Course

Contact Hrs: 30

SEMESTER 2

Course Code	Category	Course Title	L	T	P	C	Version	Course Prerequisite
MA3201	FC	Mathematics – II	3	2	0	4	1.0	Nil
CS3201	FC	Computer Programming	2	0	0	2	1.0	Nil
PH3101	FC	Engineering Physics	2	2	0	3	1.0	Nil
CY3205	FC	Environmental Studies	2	0	0	2	1.0	Nil
ME3101	FC	Basic Mechanical Engineering	3	0	0	3	1.0	Nil
MB3201	FC	Principles of Management	3	0	0	3	1.0	Nil
CS3240	FC	Computer Programming Lab	0	0	2	1	1.0	Nil
PH3140	FC	Engineering Physics 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	0	0	2	1		Nil
GP3201	GP	General Proficiency	0	0	0	1		Nil
		TOTAL	**15**	**4**	**9**	**23**		

Contact Hrs: 28

SEMESTER 3

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3301	PC	Strength of Materials	3	1	0	4	1.0	Nil
ME3302	PC	Materials Science	3	0	0	3	1.0	Nil
ME3303	PC	Industrial Engineering	3	1	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
ME3340	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
ME3345	PT	Project Lab I	0	0	4	2		Nil
VP3301	VP	Communication and Professional Skills - IIII	0	0	2	1	1.0	Nil
GP3301	GP	General Proficiency	0	0	0	1		
		TOTAL	**13**	**4**	**15**	**25**		

Contact Hrs: 32

SEMESTER 4

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3401	PC	Thermal Engineering	3	2	0	4	1.0	Nil
ME3402	PC	Theory of Machines	3	2	0	4	1.0	Nil
ME3403	PC	Production Technology	3	0	0	3	1.0	Nil
MT3401	PC	Electrical Machines and Control	3	0	0	3	1.0	Nil
	OE	Open Elective I	3	0	0	3		Nil
ME3440	PC	Thermal Engineering Lab	0	0	2	1	1.0	Nil
ME3441	PC	Theory of Machines Lab	0	0	2	1	1.0	Nil
ME3442	PC	Production Technology Lab	0	0	2	1	1.0	Nil
ME3445	PT	Project Lab II	0	0	4	2		Nil
VP3401	VP	Employability skills /-I (Numerical Abilities)	0	0	2	1	1.0	Nil
GP3401	GP	General Proficiency	0	0	0	1		
		TOTAL	**15**	**4**	**12**	**24**		
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: 31

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	ME3301
ME3502	PC	Heat Transfer	2	2	0	3	1.0	ME3401
ME3503	PC	Operation Research	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	--	Nil
ME3540	PC	Heat Transfer Lab	0	0	2	1	1.0	Nil
ME3541	PC	Vehicle Technology Lab	0	0	2	1	1.0	Nil
ME3545	PT	Project Lab III	0	0	4	2	--	--
VP3501	VP	Employability skills-II (aptitude and reasoning)	2	0	0	2	--	--
ME3571	IN	Internship Presentation	2	0	0	2	--	--
GP3501	GP	General Proficiency	0	0	0	1	--	--
		TOTAL	**16**	**8**	**8**	**25**		

Contact Hrs: 32

Open Elective II

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
ME3602	PC	Refrigeration and Air Conditioning	2	2	0	3	1.0	ME3401
MT3603	PC	Mechatronics	3	0	0	3	1.0	Nil
	PE	Program Elective I	3	0	0	3	--	--
	OE	Open Elective III	3	0	0	3	--	--
ME3640	PC	Refrigeration and Air Conditioning Lab	0	0	2	1	1.0	Nil
MT3641	PC	Mechatronics Lab	0	0	2	1	1.0	Nil
ME3645	PT	Project Lab IV	0	0	4	2	--	--
VP3601	VP	Employability skills III (GDPI)	2	0	0	2	--	--
ME3646	PC	Technical VAP-I	2	0	0	2	--	--
GP3601	GP	General Proficiency	0	0	0	1	--	--
		TOTAL	**18**	**4**	**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: 30

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

EMESTER 7

Course Code	Category	COURSE TITLE	L	T	P	C	Version	Course Prerequisite
ME3701	PC	CAD/CAM	3	2	0	4	1.0	Nil
ME3702	PC	Measurement and Metrology	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
ME3741	PC	Measurement and Metrology Lab	0	0	2	1	1.0	Nil
ME3745	PT	Project Lab V	0	0	4	2	--	--
ME3746	PC	Technical VP	2	0	0	2	--	--
ME3771	IN	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	PT	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	ME3604	Gas Dynamics and Jet Propulsion	3	0	0	3	1.0	ME3401/M E 3306
	ME3605	Computational Fluid Dynamics	3	0	0	3	1.0	ME3304
	ME3606	Production Planning and Control	3	0	0	3	1.0	--
	ME3607	Plant Layout and Material Handling	3	0	0	3	1.0	--
	ME3608	Advanced Engineering Material	3	0	0	3	1.0	ME3302
	ME3609	Welding Technology	3	0	0	3	1.0	ME3403
II	ME3703	Alternative Fuels and Energy Systems	3	0	0	3	1.0	--
	ME3704	Fuels and Combustion	3	0	0	3	1.0	--
	ME3705	Reliability Engineering	3	0	0	3	1.0	--
	ME3706	Statistical Quality Control	3	0	0	3	1.0	--
	ME3707	Finite Element Method	3	0	0	3	1.0	--
	ME3708	Mechanical Vibrations	3	0	0	3	1.0	ME3402
III	ME3709	Waste Heat Recovery Systems	3	0	0	3	1.0	--
	ME3710	Heating Ventilation and Air-Conditioning	3	0	0	3	1.0	--
	ME3711	Six Sigma and Applications	3	0	0	3	1.0	--
	ME3712	Quality Assurance and Management	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	--
IV	ME3801	Solar and Thermal Power Engineering	3	0	0	3	1.0	--
	ME3802	Nuclear Power Engineering	3	0	0	3	1.0	--
	ME3803	Supply Chain Management	3	0	0	3	1.0	--
	ME3804	Value Engineering	3	0	0	3	1.0	--
	MT3803	Robotics and Automation	3	0	0	3	1.0	--
	ME3806	Rapid Prototyping	3	0	0	3	1.0	--
V	ME3807	Energy Conservation and Audit	3	0	0	3	1.0	--
	ME3808	Energy Storage Systems	3	0	0	3	1.0	--
	ME3809	Product Design and Development	3	0	0	3	1.0	--
	ME3810	Lean Manufacturing	3	0	0	3	1.0	--
	ME3811	Introduction to Tribology	3	0	0	3	1.0	--
	ME3812	Automotive Pollution and Control	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 Bachelor of Technology in 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 Focused programmes: 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.

Detailed Syllabus (Semester wise /course wise)

SEMESTER 1 Year -1

MA3101	**Title: Mathematics-I**	**L T P C** **3 2 0 4**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To provide essential knowledge of basic tools of Differential Calculus, Integral Calculus, Vector Calculus and Matrix Algebra.	
Unit Nos.	**Unit Title**	**Number of hours (per Unit)**
Unit 1	**Matrix Algebra**	8
Elementary operations and their use in getting the Rank, Inverse of a matrix and solution of linear simultaneous equations. Eigen-values and Eigenvectors of a matrix, Symmetric, Skew-symmetric, Hermitian, Skew-Hermitian, Orthogonal and Unitary matrices and their properties, Cayley- Hamilton theorem, Diagonalization of a matrix		
Unit II	**Differential Calculus**	8
Limit, Continuity and differentiability of functions of two variables, Euler's theorem for homogeneous equations,. Change of variables, chain rule, Jacobians, Taylor's Theorem for two variables, Error approximations. Extrema of functions of two or more variables, Lagrange's method of undetermined multipliers		
Unit III	**Integral Calculus**	6
Review of curve tracing and quadric surfaces, Double and Triple integrals, Change of order of integration. Change of variables.		
Unit IV	**Application of Multiple Integration**	6
Gamma and Beta functions. Dirichlet's integral. Applications of Multiple integrals such as surface area, volumes, centre of gravity and moment of inertia.		
Unit V	**Vector Calculus**	8
Differentiation of vectors, gradient, divergence, curl and their physical meaning. Identities involving gradient, divergence and curl. 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 PublishingHouse	
Reference Books	1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons 2. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, Pearson Education	
Mode of Evaluation	Internal and External Examinations	
Recommendation byBoard of Studies on	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for MA3101

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 order to 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 respectively by integral and also find the moments of inertia for 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 vector integration 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 associated with Laplace 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 MA3101

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	
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 lo**Qok**u**a**a**t**n**b**t**a**u**s**m**i**c H**I**u**n**m**i**v**a**e**n**r**A**c**i**s**t**n**v**ir at**S**i**o**v**n**l**s**l**:**a**S**b**e**u**lfs**F**(**2**x**0**p**l**1**o**8**ra **2**ti**2**o)**n–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 productionsystems.		
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 on 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.	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

CS3101	Title: Basics of Computer and C Programming	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objective	This subjects aims to make student handy with the computers basics and programming.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Architecture of Computer	5
What is Computer: Brief History and Evolution Chain, Concept of Hardware, The Inside Computer [Hard Drives (HD), Solid State device(SSD, Concept of CPU, Concept of RAM], The Peripherals [Input Devices: Keyboard, Mouse, Media devices [Floppy, DVD ROM, CD ROM, USB Storage Drive], Scanner], Output Devices [Monitor, Printer, Speaker.		
Unit II	Arithmetic of Computer	4
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 III	Algorithms and Flow Chart	4
Algorithm [What is Algorithm? Algorithm Writing Examples] Flow Chart [What is Flow Chart? Flow Chart Symbols,How to make Flow Chart? Types of Flow Chart, Flow Chart Examples]		
Unit IV	Basics of C Programming –Part 1	6
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. Program vs. Process, Storage Classes: auto, static, extern and register. Operator vs. Operand. Operators: Arithmetic, Relational, Conditional and Logical.		
Unit V	Basics of C Programming – Part 2	5
Functions: Introduction [Function Definition, Declaration and Call], Types of Functions, Basic Programs, RecursiveFunction. Arrays: Introduction, Array Notation and Representation, Basic Programs, Types of Arrays [1-D, 2-D and n-D Array]. Pointer: Introduction, Declaration, Initialization and Access of data using pointer		
Text Books	1. KR Venugopal, Mastering C 2. Y. Kanetkar, Let us C	
Reference Books	1. Kernighan, B.W and Ritchie,D.M, The C Programming language, Pearson Education 2. Byron S Gottfried, Programming with C, Schaum's Outlines, Tata McGraw-Hill 3. R.G. Dromey, How to Solve it by Computer, Pearson Education 4. E. Balagurusamy, Programming in ANSI C	
Mode of Evaluation	Internal and External Examinations	
Recommended by Board of Studied on	24-03- 2018	
Date of Approval by the Academic Council on	11-06-2018	

Course Outcome for CS3101

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.	1	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.	3	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 CS 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	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

MB3101	Title: Engineering Economics	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To enable students to understand the fundamental economic concepts applicable to engineering and to learn the techniques of incorporating Present value factor in economic decision making.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Economics	6
Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Scope of engineering economics – concept of Depreciation and its methods.		
Unit II	Time value of money	7
Simple and compound interest, Time value equivalence, Compound interest factors, Cash flow diagrams, Calculation, Calculation of time –value equivalences. Present worth comparisons, Future worth comparison, payback period.		
Unit III	Project - Cost analysis	3
Analysis of public Projects: Benefit/ Cost analysis, quantification of project, Cost –effectiveness analysis. Rate of return, Internal rate of return, comparison of IRR with other methods, Capital Budgeting and its techniques.		
Unit IV	Markets Structures and Pricing Theory	3
Perfect Competitions Imperfect- Monopolistic, Oligopoly, duopoly- features, price determination in various marketconditions. Inflation andDeflation: Meaning, causes, Measures and Impact on Indian economy.		
Unit V	Demand Forecasting and cost Estimation	3
Theory of Demand , laws related to demand, Meaning of forecasting, Steps to Forecasting, Forecasting Methods, Forecasting Performance Measures, Cost Estimation, Elements of cost, Marginal costing, Break even analysis.		
Text Books	1. Thuesen and Fabrycky, Engineering Economy, Pearson 2. Panneerselvam, Engineering Economics, PHI	
Reference Books	1. E.P. Degarmo, W.G. Sullivan and J.R. Canada, Engineering Economy, MacmillanNew York 2. Zahid A Khan, Engineering Economy, Dorling Kindersley 3. Newnan, Eschenbach and Lavelle, Engineering Economic Analysis, OxfordUniversity Press 4. Blank and Tarquin, Engineering Economy, McGraw-Hill	
Mode of Evaluation	Internal and External Examinations	
Recommendation byBoard of Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

Course Outcome for MB 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 concepts and scope of engineering economics	2	Em
CO2	Students should be able to Evaluate the time value of money.	2	S
CO3	Students should be able to Analyze the public projects through different techniques.	1	S
CO4	Students should be able to understand the features and functioning of different market structures in an economy.	1	En
CO5	Students should be able to understand and apply the concepts of Demand, Supply, Cost and Revenue in business forecasting.	1	None

CO-PO Mapping for MB 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	1	1	2	2	2	1	1	3	1	1	3	3	3	2
CO 2	2	1	1	3	3	2	1	1	3	1	2	2	1	2
CO 3	3	1	2	1	2	2	3	3	2	2	3	3	3	3
CO 4	3	3	1	1	1	2	2	3	2	3	2	2	1	1
CO 5	1	1	1	3	1	3	3	2	2	3	3	1	1	1
Avg.	2	1.4	1.4	2	1.8	2	2	2.4	2	2	2.6	2.2	1.8	1.8

EC3101	Title: Basic Electrical and Electronics Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide an overview of electrical and electronics fundamentals.	
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	Transformers and Alternating Quantities	7
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. 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	Rotating Electrical Machines	8
DC Machines: Principle of Operation of DC Machine, EMF Equation, Applications of DC Machines. AC Machines: Principle of Operation of 3-Phase Induction Motor, 3-Phase Synchronous Motor and 3- Phase Synchronous Generator (Alternator), Applications of AC Machines.		
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 and R. Saravan Kumar, Basic Electrical and Electronics Engineering, Wiley India 2. Sukhija and Nagsarkar, Basic Electrical and Electronics Engineering, Oxford Publication	
Reference Books	1. Kothari, Nagrath, Basic Electrical and Electronics Engineering, TMH 2. Prasad/Sivanagraju, Basic Electrical and Electronics Engineering, Cengage learning Indian Edition 3. Muthusubrmaniam, Basic Electrical and Electronics Engineering, TMH	
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 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

EG3102	Title: Professional Communication	L T P C 2 0 0 2
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Fundamentals of Communication**	5
Introduction–Communication Process, Distinction between General and Technical Communication.Language as a Tool of Communication; Interpersonal, Organizational, Mass Communication. Formal Communication: Downward, Upward, Lateral/ Horizontal, Diagonal; Informal Communication (Grapevine).Barriers to Communication		
Unit II	**Components of Technical Written Communication**	5
Vocabulary building: Synonyms and Antonyms, Homophones, Conversions. Common Grammatical Errors, Paragraph Development, Précis writing.Technical Papers: Project, Dissertation andThesis.		
Unit III	**Forms of Business Communication**	5
Business Correspondence- Types:, Memorandum; Official letters.Job Application, Resume/CV/Bio-data; Notice, Agenda, Minutes of Meetings.Technical Proposal: Types, Significance, Format and Style of Writing Proposals.Technical Report: Types, Significance, Format and Style of Writing Reports.		
Unit IV	**Presentation Techniques and Soft Skills**	5
Presentation: Defining Purpose, Audience and Location; Organizing Contents; Preparing Outline; Audio-Visual Aids in Presentations.Non-Verbal Aspects of Presentation: Kinesics, Proxemics, Chronemics, Paralanguage. Listening Skills: Importance, Active and Passive listening. Speaking Skills: Common Errors in Pronunciation; Vowels, Consonants and Syllables; Accent, Rhythm and Intonation.		
Unit V	**Value-based Text Readings**	4
Thematic and value-based critical reading of the following essays with emphasis on the mechanics of writing and speaking:1.The Language Of Literature And Science by Aldous Huxley 2.Of Discourse by Francis Bacon		
Suggested Reference Books	1. Barun K. Mitra, Effective Technical Communication, Oxford Univ. Press 2. Meenakshi Raman and Sangeeta Sharma, Technical Communication-Principles andPractices, Oxford Univ.Press 3. Prof.R.C.Sharma and Krishna Mohan, Business Correspondence and ReportWriting,Tata McGraw Hill and Co.Ltd. New Delhi 4. V.N.Arora and Laxmi Chandra, Improve Your Writing, Oxford Univ. Press, NewDelhi 5. Ruby Gupta, Basic Technical Communication	
Mode of Evaluation	Internal and External Examinations	
Recommendation byBoard of Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

Course Outcome for EG3102

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 fundamentals of communication process used within the organization.	2	Em
CO2	Students should be able to learn about the components of Technical Written Communication.	2	S
CO3	Students should be able to learn about the different forms of Business Communication.	2	S
CO4	Students should be able to learn presentation techniques and soft skills.	2	En
CO5	Students should be able to understand Value-based Text Readings.	2	None

CO-PO Mapping for EG 3102

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	1	1	1	2	1	3	1	2	2	2	2	2	2
CO 2	1	1	2	2	3	3	3	1	3	3	2	3	2	1
CO 3	2	1	1	2	1	2	3	1	2	3	2	2	1	2
CO 4	2	2	1	1	1	2	1	3	3	3	1	2	1	2
CO 5	2	2	2	2	3	3	1	2	3	3	2	2	1	2
Avg.	1.8	1.4	1.4	1.6	2	2.2	2.2	1.6	2.6	2.8	1.8	2.2	1.4	1.8

CS3140	Title: Basics of Computer and C Programming Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Learning objectives is to improve confidence in technology use andincreased awareness of opportunities afforded to individuals with computer application skills.	

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. Given a string — a$bcd./fg‖ find its reverse without changing the position of special characters. (Example input: a@gh%;j and output: j@hg%;a)
9. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
10. 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.

11. Solve towers of Hanoi using recursion.
12. Sort the list of numbers using pass by reference.
13. Generate salary slip of employees using structures and pointers.
14. Compute internal marks of students for five different subjects using structures and functions.
15. 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 byBoard of Studies on	24-3-2018
Date of approval by theAcademic Council	11-06-2018

Course Outcome for CS3140

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 CS3140

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	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

EG3140	Title: Professional Communication Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide practice to students in an interactive manner to apply thefundamentals and tools of English communication to life situations	

List of Experiments

1. Common conversation skills
2. Introductions
3. Making requests
4. Asking for permission
5. Asking questions
6. Describing events, people, places
7. Learning correct pronunciation, syllable, stress, intonation
8. Extempore speaking
9. Role play
10. Grammar-tense practice
11. Mother tongue influence- correction
12. Speech making / public speaking
13. Listening effectively
14. E-mail Etiquettes

Mode of Evaluation	Internal and External Examinations
Recommendation byBoard of Studies on	31.03.2018
Date of approval by theAcademic Council	11-06-2018

Course Outcome for EG 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 improve communication skills (Reading, Writing, Speaking & Listening).	3	Em
CO2	Students should be able to achieve grammatical competency in drafting documents.	3	S
CO3	Students should be able to identify different situations & react accordingly using appropriate communication skills.	3	S

CO-PO Mapping for EG3140

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	1	3	2	1	2	2	2	1	2
CO 2	2	1	1	2	2	2	1	2	1	2	1	2	3	2
CO 3	2	2	2	3	3	2	1	1	3	3	3	2	1	3
Avg	2	1.6	1.3	2.3	2	1.67	1.67	1.67	1.67	2.3	2	2	1.67	2.3

EC3140	Title: Basic Electrical and Electronics Engineering lab	L T P C 0 0 2 1
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.	

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. 10.To study various logic gates and verify their truth tables.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	24-3-2018
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

ME3141	Title: Engineering Graphics	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.	
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 of Solids	12
Types of solids, Projections of solid in different axis orientations.		
Unit IV	Section of Solids	8
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 V	Development of Surfaces, Orthographic views (First Angle Projection Only)	8
Development of surface of various solids in simple positions, Three orthographic views of solids.		
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	24-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3141

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 know about basic concepts of projection and To Draw the projection of points and lines located in different quadrants	3	Em
CO2	Students will be able to Draw the projection of plane surfaces in various positions	3	S
CO3	Students will be able to Draw the projection of solids in various positions	3	S
CO4	Students will be able to Draw sectional views of a given object	3	En
CO5	Students will be able to develop surfaces and draw orthographic view of given object	3	None

CO-PO Mapping for ME3141

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	3	2	1	2	1	1	1	1	2	1	1	3	1
CO 2	3	3	2	2	1	2	1	1	2	1	1	1	3	2
CO 3	2	2	3	1	2	1	2	1	2	2	1	2	2	1
CO 4	3	2	2	1	2	1	1	1	1	2	1	2	3	2
CO 5	3	3	2	2	2	1	1	1	1	2	1	1	3	1
Avg	2.8	2.6	2.2	1.4	1.8	1.2	1.2	1	1.4	1.8	1	1.4	2.8	1.4

CE3101	Title: Disaster Management	L T P C 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.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit: 1	Introduction on Disaster	5
Different Types of Disaster : A) Natural Disaster: such as Flood, Cyclone, Earthquakes, Landslides etc B) Man-made Disaster: such as Fire, Industrial Pollution, Nuclear Disaster, Biological Disasters, Accidents (Air, Sea, Rail and Road), Structural failures(Building and Bridge), War and Terrorism etc. Causes, effects and practical examples for all disasters.		
Unit II	Risk and Vulnerability Analysis	4
Risk: Its concept and analysis 2. Risk Reduction 3. Vulnerability: Its concept and analysis 4. Strategic Development for Vulnerability Reduction		
Unit III	Disaster Preparedness	5
Disaster Preparedness: Concept and Nature . Disaster Preparedness Plan Prediction, Early Warnings and Safety Measures of Disaster. Role of Information, Education, Communication, and Training, . Role of Government, International and NGO Bodies. . Role of IT in Disaster Preparedness. Role of Engineers on Disaster Management.		
Unit IV	Disaster Response	5
Introduction Disaster Response Plan Communication, Participation, and Activation of Emergency Preparedness Plan Search, Rescue, Evacuation and Logistic Management Role of Government, International and NGO Bodies Psychological Response and Management (Trauma, Stress, Rumor and Panic). Relief and Recovery Medical Health Response to Different Disasters		
Unit V	Rehabilitation, Reconstruction and Recovery	5
Reconstruction and Rehabilitation as a Means of Development. Damage Assessment Post Disaster effects and Remedial Measures. Creation of Long-term Job Opportunities and Livelihood Options, Disaster Resistant House Construction Sanitation and Hygiene Education and Awareness, Dealing with Victims' Psychology, Long-term Counter Disaster Planning Role of Educational Institute.		
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 Publication Pvt. Ltd.	
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 CE3101

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 concepts of disasters and its relationships with development.	1	Em
CO2	Students should be able to understand the approaches of Disaster Risk Reduction (DRR) and the relationship between vulnerability, disasters, disaster prevention and risk reduction.	1	S
CO3	Students should be able to understand the Medical and Psycho-Social Response to Disasters.	1	S
CO4	Students should be able to prevent and control Public Health consequences of Disasters.	2	En
CO5	Students should have awareness of Disaster Risk Management institutional processes in India.	2	None

CO-PO Mapping for CE3101

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	2	1	1	2	1	2	2	1	2	1	1	1	1	2
CO 2	1	2	2	1	2	2	2	1	2	1	1	2	1	2
CO 3	2	2	1	2	1	2	2	1	2	1	1	2	1	2
CO 4	1	2	1	1	1	2	2	1	2	1	1	2	1	2
CO 5	2	1	1	1	1	3	1	1	2	1	1	2	1	2
Avg	1.6	1.6	1.2	1.4	1.2	2.2	1.8	1	2	1	1	1.8	1	2

SEMESTER 2

MA3201	Title: Mathematics-II	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide knowledge of essential mathematical tools applied insolving ordinary and partial differential equations, initial and boundary value problems	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Ordinary Differential Equations	8
Ordinary differential equation of first order and first degree, Solution of linear differential equations with constant coefficients. Euler-Cauchy equations, Solution of second order differential equations by changing dependent and independent variables. Method of variation of parameters.		
Unit II	Laplace Transform	8
Laplace and inverse Laplace transform of some standard functions, Shifting theorems, Laplace transform of derivatives and integrals. Convolution theorem, Initial and final value theorem. Laplace transform of periodic functions, Heavisideunit step function and Dirac delta function. Applications of Laplace transform for solving ODE.		
Unit III	Partial Differential Equations	8
Introduction to Partial differential equations, Linear partial differential equations with constant Coefficients of secondorder and their Classification. Method of separation of Variables for solving PDE, One dimensional wave equation , Laplace equation in two-dimensions, Heat conduction equations of one dimension and two dimension.		
Unit IV	Infinite Series	6
Infinite Series, Convergence and Divergence of an infinite series, Cauchy's General Principle, Comparison Tests, D'Alember's Ratio Test, Cauchy's Root test, Cauchy's Integral Test, Alternating series, Leibnitz test, Absolute convergence, Conditional Convergence		
Unit V	Fourier series	6
Trigonometric Fourier series and its convergence. Fourier series of even and odd functions. Fourier half-range series.		

Text Books	1. R.K. Jain and Publishing House
Reference Books	1. E. Kreyszig, Advanced Engineering Mathematics, John Wiley and Sons, Inc. 2. R.K. Jain and S.R.K. Iyenger, Advanced Engineering Mathematics, NarosaPublishing House 3. M.D. Weir, J. Hass, F.R. Giordano, Thomas' Calculus, Pearson Education
Mode of Evaluation	Internal and External Examinations
Recommendation byBoard of Studies on	31-03-2018
Date of approval by theAcademic Council	11-06-2018

Course Outcome for MA3201

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	3	Em
	differential equations by changing dependent and independent variables.		
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 MA3201

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

CS3201	Title: Computer Programming	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	CS 3101	
Objective	This subject introduces the students with a deeper era of programming in C like Functions, Arrays, Pointer, Structure and Preprocessor Directive etc.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Basics of C Programming	5
C Programming Languages: Introduction of C Language, Why C Language? Setting up and Installation: Prerequisite in C Language, Installation of C Compiler Data Type, Constants and Variables, Data Types, Integers [Long andShort], Integers [Signed and Unsigned], chars [Signed and Unsigned], floats and doubles, Constants, Variables		
Unit II	Programming Elements	5
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. Pointer: An Introduction to Pointers, PointerNotation [Declaration, Initialization and Access], Call by Value, Call by Reference. Recursion: Introduction, Stack Handling of recursion, Practice Programs.		
Unit III	Arrays and Preprocessors	5
Arrays: What is Array?, Declaration of Array, Initialization Array, Passing Array Elements to a Function, Passing anEntire Array to a Function. Two Dimensional Arrays, Declaration of 2-D Array, Initializing a 2-Dimensional Array. Passing 2-D array to a Function, Array of Pointers, 3-D Array. Preprocessor: C Preprocessor		
Unit IV	Strings and Structures	5
String: Concept of char vs. int, Concept of Strings, Conceptual Practice Programs, String Handling FunctionsIntroduction [strlen(), strcpy(), strcat(), strcmp(), strlwr(), strupr()], String Handling Functions Implementations [strlen(), strcpy(), strcat(), strcmp(), strlwr(), strupr()], Some more String Handling Functions [strncpy(), strncat(),strncmp(), gets(), puts()].		
Unit V	File Handling and Bitwise Operator	4
File Handling: Concept of File, Types of File, Meaning of File Handling, FILE macro and 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()]. Operator and Enum:		

Text Books	1. Y. Kanetkar, Let us C 2. Programming in ANSI C" by E. Balagurusamy.
Reference Books	1. Kernighan, B.W and Ritchie, D.M, The C Programming language, PearsonEducation 2. Byron S Gottfried, Programming with C, Schaum's Outlines, Tata McGraw-Hill 3. KR Venugopal, Mastering C
Mode of Evaluation	Internal and External Examinations
Recommended by Boardof Studied on	24-03-2018
Date of Approval by the Academic Council on	11-06-2018

Course Outcome for CS3201

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 basic Understanding of computers the concept of algorithm, C programming and algorithmic/Programming thinking.	2	Em
CO2	Students should be able to use the C programming language to implement various algorithms, and develops the basic concepts and terminology of programming in general.	2	S
CO3	Students should be able to understand pointers, arrays, functions and macros that will be able to help them to design new problem solving approach in 'C'.	3	S
CO4	Students should be able to acquire the knowledge of different softwares on different Operating System Platform such as Linux/Windows (Open Source and Licensed) with understanding of different IDE.	3	En
CO5	Students should be able to gain a broad perspective about the uses of computers in engineering industry.	3	None

CO-PO Mapping for CS3201

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	2	3	3	2	2	1	3	2	2	1	2
CO 2	1	2	3	2	1	2	1	3	3	1	3	2	1	1
CO 3	2	1	1	1	1	1	3	3	2	1	1	3	1	2
CO 4	2	3	2	2	1	2	1	3	1	3	3	2	1	1
CO 5	1	3	2	1	1	1	2	2	3	2	3	3	3	2
Avg.	1.8	2.2	1.8	1.6	1.4	1.8	1.8	2.6	2	2	2.4	2.4	1.4	1.6

PH3101	Title: Engineering Physics	L T P C 2 2 0 3
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.	
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. Radiation: Kirchhoff's Law, Stefan's law (only statement), Energy spectrum of Blackbody Radiation, Compton Effect.		
Unit II	Interference and Diffraction	5
Coherent Sources, Conditions of Interference, Fresnel's Bi-prism Experiment, Displacement of Fringes, 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, 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 and Magnetic Properties of Materials	5
Ampere's Law and Displacement Current, Maxwell's Equations in Integral and Differential Forms, ElectromagneticWave Propagation in Free Space and Conducting Media, Poynting Theorem. Basic Concept of Para, Dia and Ferro-Magnetism.		
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, Mc-Graw Hill 2. Dr Amit Dixit, Engineering Physics, Nano Edge Publicatons	
Reference Books	1. Robert Resnick, Introduction to Special theory of Relativity, Wiley 2. Ajoy Ghatak, Optics, TMH 3. David J. Griffith, Introduction to Electrodynamics, PHI 4. William Hayt, Engineering Electromagnetics, TMH	
Mode of Evaluation	Internal and External Examinations	
Recommendation byBoard of Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

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 radiation laws. Extract information from partial derivative models in order to interpret reality.	3	Em
CO2	Students should be able to understand interference, diffraction and able to connect it to a few engineering 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.	
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, lake river oceans, estuaries)		
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.		
Unit III	Biodiversity and Conservation	5
Levels of biological diversity: genetic, species and ecosystem diversity. Biogeographic 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.		
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. Field work Visit 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	31-03-2018
Date of approval by the Academic Council	11-06-2018

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	3	En
	components of the environment and their function and the effects pollution on environment and should be able to understand the concept of sustainable development.		
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	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
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

ME3101	Title: Basic Mechanical Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart basic knowledge about various fields of MechanicalEngineering like Thermal Engineering, manufacturing, Mechanics and Materials.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Thermodynamics and IC engines	8
Definition of thermodynamics, Energy and its forms, Enthalpy. Laws of thermodynamics, Processes - flow and non-flow, Steady flow energy equation, Heat engines, Efficiency; Heat pump, refrigerator, Coefficient of Performance. Internal Combustion Engines: Classification of I.C. Engines and their parts, working principle and comparison between2 Stroke and 4 stroke engine, difference between SI and CI engines.		
Unit II	Mechanics	8
Basic concept: Review of laws of motion, transfer of force to parallel position, resultant of planer force system, FreeBody Diagrams, Types of supports and their reactions - requirements of stable equilibrium - Moments and Couples - Varignon's theorem - Equilibrium of Rigid bodies in two dimensions, 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, Strain energy.		
Unit IV	Introduction to Manufacturing	7
Introduction to manufacturing processes, Classification of the manufacturing processes, Cutting tools, Cutting tool materials, tool signature, Lathe and basic machining operations in lathe, Introduction to multi-point machining processes, Introduction to computerized numerical control (CNC) machines. Metal Forming: Forging and Sheet Metal operations. Joining Process, Electric Arc, Gas Welding, Soldering and Brazing.		
Unit V	Engineering Materials	5
Importance of engineering materials, classification, mechanical properties and applications of Ferrous, Nonferrous and composite materials. Introduction to Smart materials.		
Text Books	1. Hajra, Bose, Roy, Workshop Technology, Media Promotors 2. D.S. Kumar, Mechanical Engineering, S.K. Kataria and Sons	
Reference Books	1. Irving H. Shames I.H, 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 4. Basant Agarwal, Basic Mechanical Engineering, Wiley India 5. Onkar Singh, Introduction to Mechanical Engineering, S.S. Bhavikatti	
Mode of Evaluation	Internal and External Examinations	
Recommendation byBoard of Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

Course Outcome for ME3101

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 application of the laws of thermodynamics to wide range of systems and aware about the basics of thermal engineering applications in IC engines and its working.	3	Em
CO2	Students should be able to know and apply the types of forces and concepts used to analyse force mechanisms	2	S
CO3	Students should be able to analyze and understand the Stress-strain diagrams and use of material.	2	S
CO4	Students should be able to understand the various machining processess	2	En
CO5	Students should be able to gain knowledge on the various engineering materials and their properties.	1	None

CO-PO Mapping for ME3101

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	2	2	3	3	1	1	1	3	1	3	3
CO 2	3	2	2	2	2	2	1	2	1	1	1	2	2	2
CO 3	3	2	2	1	1	1	1	3	3	3	2	1	2	2
CO 4	3	3	1	1	2	2	2	2	2	3	3	1	2	1
CO 5	3	2	3	1	1	2	1	1	3	2	3	3	2	2
Avg.	3	2.2	2	1.4	1.6	2	1.6	1.8	2	2	2.4	1.6	2.2	2

MB3201	Title: Principles of Management	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	The purpose of this paper is to impart to the student an understanding of state of the art of the management with the developments in the concept, theories and practices in the field of commerce.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction of management and Planning	9
Introduction: Concept, Nature, Functions and Significance of Management. Levels of Management. Development of management thought: Classical, Neo Classical , Contingency and contemporary approach to management. Contributions of F.W. Taylor and Henri Fayol to Modern Management Thoughts. Conceptual Framework of Planning, Decision-making and Management by Objectives. Planning Corporate strategy –environmental analysis, formulation of strategic plan, growth strategies		
Unit II	Organising and Organisation Structure	5
Organising: Concept, Process and Significance of Organisation. Types of Organisation Structure. Delegation of Authority. Centralisation and Decentralisation of Authority. Span of Management. Accountability, Delegation, Formal and informal organization Group, Formation and Role of Groups in organization. Role of Positive Thinking in Organisations.		
Unit III	Staffing	5
Staffing : Concept, Scope and Process of Staffing. Recruitment – Meaning and Sources. Selection – Process of Selection. Types of Interviews and Essentials of Successful Interview. Training – Concept, Significance and Methods.		
Unit IV	Directing and Coordination	7
Directing and Coordination: Meaning, Elements and Significance of Directing. Principles of Directing. Leadership : Concept, Significance and Types of Leaders. Style of Leadership. Coordination – Concept and Techniques. Communication – Concept, Process and Barriers to Communication		
Unit V	Controlling and Motivation	7
Controlling: Meaning and Process of Controlling. Techniques of Controlling. Management of Change: Adaptability to Change, Resistance to Change. Emerging Challenges for the Managers. Theories of Motivation – Abraham Maslow, Fredric Herzberg, Douglas McGregor and William Ouchi.		
Text Books	1. Chhabra, T.N. Principles and Practice of Management. Dhanpat Rai and Co., Delhi 2. Prasad, Lallan and S.S. Gulshan, Management Priciples and Practoice. S. Chand and Co. Ltd, New Delhi	
Reference Books	1. LM Prasad, Principles and Practices of Management, Himalaya Publishing, New Delhi. 2. Basu, Business Organisation and Management, Tata McGraw Hill, New Delhi. 3. C.B. Gupta, Modern Business Organisation, Mayur Paper Backs, New Delhi. 4. B.P. Singh, and T.N. Chabara, Business Organisation and Management, Dhanpat Rai and Company. Delhi 5. N. Mishra, Modern Business Organisation and Management, Dhanpat Rai and Co., Delhi.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	05-04-2018	
Date of approval by the Academic Council	11.06.2018	

Course Outcome for MB3201

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 have a clear understanding of managerial functions like planning, organizing, staffing, Directing, Controlling, Budgeting and have some basic knowledge of an international aspect of management.	2	Em
CO2	Students should be able to understand the planning process in the organization.	2	S
CO3	Students should be able to understand the concept of organization.	2	S
CO4	Students should be able to demonstrate the ability to directing, leadership and communicate effectively.	2	En
CO5	Students should be able to analyse isolated issues and formulate best control methods.	2	None

CO-PO Mapping for MB 3201

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	2	1	1	1	2	2	3	3	3	2	2	1	3
CO 2	2	1	3	3	3	3	1	1	2	1	2	1	2	3
CO 3	3	1	2	2	1	3	3	1	2	1	3	1	1	1
CO 4	2	1	3	3	3	2	2	3	1	2	2	3	3	1
CO 5	3	3	3	2	2	3	3	2	1	1	2	2	2	2
Avg.	2.2	1.6	2.4	2.2	2	2.6	2.2	2	1.8	1.6	2.2	1.8	1.8	2

CS3240	Title: Computer Programming Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	Students will learn the concept of C character set identifiers and keywords, data type and sizes, variable names, declaration, statements ,concept of Arithmetic operators, relational and logical operators, type, conversion, Standard input and output, formatted output and input	

List of Experiments

1. WAP adding 2 numbers without using arithmetic operators. (Excluding +,-,*,/,%, ++, --).
2. Convert the given decimal number into binary, octal and hexadecimal numbers using user defined functions.
3. Sort the list of numbers using pass by reference.
4. Generate salary slip of employees using structures and pointers.
5. Compute internal marks of students for five different subjects using structures and functions.
6. Insert, update, delete and append telephone details of an individual or a company into a telephone directory using random access file.
7. WAP subtracting 2 numbers without using arithmetic operators.
8. WAP divide 2 numbers without using arithmetic operators.
9. WAP multiply 2 numbers without using arithmetic operators.
10. WAP comparing 2 numbers for greater or lesser by using bitwise operators.

Mode of Evaluation	Internal and External Examinations
Recommendation by Board of Studies on	24-3-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome for CS3240

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 Pointer, recursion, functions and array based programs in C.	3	Em
CO2	Students should be able to develop Dynamic memory allocation technique based programs and execute Command line Arguments in C.	3	S
CO3	Students should be able to execute C programs and Shell Commands in Unix Environment.	3	S

CO-PO Mapping for CS3240

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	3	3	1	1	1	3	2	3	3	2	3	1	2
CO 2	1	2	2	3	3	1	2	2	1	1	2	1	3	2
CO 3	3	1	2	1	1	1	2	2	2	1	1	1	2	1
Avg	1.67	2	2.3	1.67	1.67	1	2.33	2	2	1.67	1.67	1.67	2	1.67

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 equipment.	

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, carnier density and mobility of a given semi conductor 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 balistic constant of a ballistic galvanometer.
15. To determine the viscosity of a liquid.

Mode of Evaluation	Internal and External Examinations
Recommendation byBoard of Studies	31-03-2018
Date of approval by theAcademic 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 process of performing the experiments on wavelength and focal 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

ME3140	Title: Workshop Practice	L T P C 0 0 3 2
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know about the working methods adopted in various mechanicalshops along with tools and equipments for making a product. To understand the working of IC engines, Refrigerator, Air conditioner	

List of Experiments

1. Carpentry Shop:

I. Study of tools and operations and carpentry joints.
II. To prepare half-lap corner joint / mortise - tenon joint.
III. To make duster from wooden piece using carpentry tools

2. 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.

3. 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.

4. Welding Shop:

I. Introduction of Welding and its classification.
II. Simple butt and Lap welded joints.

5. 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.

6. Machine Shop:

I. Introduction of Single point cutting tool, various machine tools.
II. Simple operations like Plane turning, Step turning and Taper turning.

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

Course Outcome for ME3140

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 blacksmithy tools	3	s

CO-PO Mapping for ME3140

Course Outco mes	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

ME3301	Title: Strength of Materials	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know conceptual applications of principles of mechanics on rigid and deformable bodies	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Properties of Materials	7
Elastic, homogeneous, isotropic materials; Stress –Strain relationships for ductile and brittle materials, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening, proof stress, factor of safety, working stress, load factor, Properties related to axial, bending and torsional and shear loading, Toughness, hardness, Ductility, Brittleness. Destructive and Non-destructive testing (NDT).		
Unit II	Statically Determinate Structures	7
Analysis of support reactions, Internal forces in trusses, beams; Consideration of concentrated loads, moments/couples, Uniformly Distributed Loads (UDL), Uniformly Varying Loads (UVL); Shear Force and Bending Moment Diagrams for Beams, Point of Contraflexures, Point and magnitude of Maximum bending moment and maximum shear force.		
Unit III	Springs	7
Helical and Leaf Springs: Deflection of springs by energy method, helical springs under axial load and under axial twist (respectively for circular and square cross sections) axial load and twisting moment acting simultaneously both for open and closed coiled springs, laminated springs.		
Unit IV	Stresses in Beams	7
Flexural stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular and circular (solid and hollow), I, T, Angle, channel sections Shear stresses – Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections.		
Unit V	Torsion, Principal Stresses and Cylinders	8
Derivation of equation of torsion and applications, Torsional rigidity, Power Transmitted by shaft. Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress. Thin cylinders and spheres - Hoop and axial stresses and strain.- Volumetric strain.- Thick cylinders- Radial, axial and circumferential stresses in thick cylinders subjected to internal or external pressures		
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3301

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 springs under loads in machines and apply the knowledge through numerical problems.	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 shafts under torsion, cylinders and apply the knowledge through numerical problems.	3	None

CO-PO Mapping for ME3301

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 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the various properties of materials	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Material Science	7
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	7
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	7
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	7
Various types of 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	8
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3302

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 ME3302

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	1	1	2	1	1	1	1	1	2	3	2
CO 2	3	3	2	2	1	2	2	1	2	2	1	2	3	2
CO 3	3	2	2	1	1	2	1	1	1	1	2	2	2	2
CO 4	2	3	2	2	1	2	1	1	1	1	2	2	3	2
CO 5	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

ME3303	Title: Industrial Engineering	L T P C 3 1 0 4
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the working environment of industries and to know different methods to study about productivity improvement and inventory control	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	5
Definition, Objective, Need, Scope, Evolution and developments of Industrial Engineering, Principles of Organization, Development of Organizational Charts, , Plant Location, Type of Layout, Principles of Facility Layout		
Unit II	Production and Productivity	5
Definition of Productivity, Productivity of Materials, Land, Building, Machine and Power, Measurement of Productivity, Factors affecting the Productivity, Productivity Improvement Programs. Sales Forecasting – Benefits, Types, Methods		
Unit III	Work Study	5
Meaning and Benefits of Work Study, Job Analysis, Job Description, Job Simplification ,Time and Motion study, Method Study, Micro motion Study, Man Machine Diagram Flow Chart, Motion Economy, Work Measurement, Standard Time, Stop watch time study, Work Sampling, P.M.T.S. Introduction to material handling, principles of material handling.		
Unit IV	Ergonomics	5
Introduction, Areas of Study under Ergonomics, System Approach to Ergonomics Model, Man-Machine System, Components of Man-Machine System and their Functions, Work Capabilities of Industrial Worker, Study of Development of Stress in Human Body and their Consequences, Computer Based Ergonomics.		
Unit V	Inventory Control	4
Inventory, classification, Function, Cost, Deterministic Models, EOQ, safety stock, quantity discounts, depreciation and its calculations, Introduction to MRP and ERP		
Text Books	1. Ravi Shankar ,Industrial Engineering and Management, Galgotia Publications. 2. O.P. Khanna , Industrial Engineering and Management, Dhanpat Rai Publications	
Reference Books	1. Ralph M Barnes ,Motion and Time Study, John Wiley 2. H.S Shan, Work Study and Ergonomics, Dhanpat Rai and Co. 3. Marvin E. Mundel ,Motion and Time study, PHI 4. S.N. Chary ,Production and Operations Management, TMH	
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 ME3303

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 and understand the basic points to keep in mind while locating a plant and planning its organizational structure	2	Em
CO2	Student should be able to know and undertstand the basic concepts of production and productivity in industries	2	S
CO3	Student should be able to know and undertstand the basic concepts of work study to improve the working in industries	2	S
CO4	Student should be able to know and understand the importance of human motion and its impact over the organizational effectiveness	2	En
CO5	Student should be able to know and undertstand the basic concepts of inventory management and its impact on the productivity in industries	3	None

CO-PO Mapping for ME3303

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	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

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	
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 & 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 & 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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3304

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 ME3304

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	1	1	1	1	1	1	1	1	3	1
CO 2	3	2	1	1	1	1	1	1	2	2	1	1	3	1
CO 3	3	3	3	1	1	1	1	1	1	1	1	2	3	3
CO 4	3	3	3	1	1	1	1	1	1	1	1	2	3	3
CO 5	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.	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3307

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

CO-PO Mapping for ME3307

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	3	2	2	1	1	1	1	1	1	2	2	1
CO 2	3	1	3	2	2	1	1	1	2	2	1	2	2	1
CO 3	2	2	3	2	3	1	1	1	1	1	1	3	1	2
Avg	2.6	1.3	3	2	2.3	1	1	1	1.3	1.3	1	2.3	1.6	1.3

ME3340	Title: Strength of Materials Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This lab is based on the study of conceptual applications of principles of mechanics of rigid and deformable bodies in Engineering.	
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 measure elastic constants of a wire using Searle method		
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 ME3340

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 enginnering	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 ME3340

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	3	2	2	1	1	1	1	1	1	1	2	3	2
CO 2	2	3	2	3	1	1	1	1	1	1	1	2	3	2
CO 3	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

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.	

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	31-03-2018
Date of approval by the Academic Council	11-06-2018

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 difference in hardness before and after heat treatment.	3	S

CO-PO Mapping for ME 3341

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	PO4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PS O2
CO 1	2	2	2	2	1	1	1	1	1	1	1	3	3	2
CO 2	3	2	2	3	1	1	1	1	1	1	1	2	3	2
CO 3	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	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

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 aspects 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, Not related-0)												Program Specific Outcomes	
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO 1	2	2	2	1	1	2	1	1	1	1	2	2	3	3
CO 2	3	3	2	1	1	2	1	1	1	1	2	2	3	2
CO 3	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

ME3401	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	
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 Cycles	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. IC Engine performance characteristics and heat balance.		
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome For ME3401

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.	2	S
CO3	Student should be able to understand the functioning of steam power plant, gas power plant and their major components.	2	S
CO4	Student should be able to analyze the performance of boilers and flow through nozzles used in existing thermal system.	2	S
CO5	Student should be able to know and apply thermodynamics concepts of compressor and Evaluate the efficiency of compressor.	2	S

CO-PO Mapping for ME3401

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

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.	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3402

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	2	S
	problems		
CO3	Student should be able to understand the application of flywheel in machines and applying the knowledge gained through numerical problems	2	S
CO4	Student should be able to understand the application of governors in machines and applying the knowledge gained through numerical problems	2	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	2	S

CO-PO Mapping for ME3402

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	2	1	1	1	1	1	1	1	1	2	3	3
CO 2	3	3	1	1	1	1	1	1	1	1	1	1	2	2
CO 3	3	3	2	1	1	1	1	1	1	1	1	2	3	2
CO 4	3	3	1	2	1	1	1	1	1	1	1	2	2	3
CO 5	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

ME3403	Title: Production Technology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide knowledge of various manufacturing processes like casting, joining, forming and metal cutting.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Casting Process	8
Introduction to Casting, Steps involved in casting, advantages, limitations and applications of casting process. Pattern types, allowances for pattern, pattern materials. Moulding methods and processes-materials, equipment, Moulding sand ingredients, essential requirements, sand preparation and control, cores and core making. Gating system. Casting Processes: sand castings die casting, centrifugal casting, investment casting, shell moulding, defects in castings.		
Unit II	Welding	7
Basic joining processes, welding classifications, gas welding and it types, arc welding and its types, resistance welding and its types, thermit welding,. soldering, brazing and their application. welding defects.		
Unit III	Forming Processes I	7
Metal Forming: Elastic and plastic deformation, concept of strain hardening, hot and cold working processes. Forging: Introduction, classification of forging, forging defects, swaging, wire and tube drawing. Rolling: Introduction, classification of rolling , rolling defects.		
Unit IV	Forming Processes II	7
Extrusion: Classification, extrusion equipment, load displacement, characteristics; different extrusion dies, extrusion defects, tube extrusion. Sheet Metal Working : Applications of sheet formed products. Shearing mechanism. Processes - blanking, piercing, punching, trimming etc. Forming processes - bending, cup drawing, coining, embossing etc, punch and die clearances, Progressive, compound and combination dies.		
Unit V	Metal Cutting and Machine Tools	7
Cutting parameters, Cutting tool geometry; Tool signature, Tool materials and cutting fluids, Tool Life, Power required for machining; Types of Machine tools-Lathe, Shaper, Planer, Milling and Drilling Machines		
Text Books	1. P N Rao ,Manufacturing Technology (Vol. I and II),Tata McGraw Hill, New Delhi 2. P.C. Sharma ,A Text Book of Production Technology, S Chand and Company Ltd.	
Reference Books	1. Ghosh and Mallik ,Manufacturing Science ,East West Press Pvt. Ltd., New Delhi 2. S Kalpakjian and S R Schmidt ,Manufacturing Engineering and Technology, Addision Wesley Longman, New Delhi. 3. R K Jain ,Production Technology, Khanna Publishers, New Delhi.	
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 ME3403

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 understanding of casting process	2	Em
CO2	Student should be able to Know about the applications of various types of welding processes.	2	S
CO3	Student should be able to Know about the principles of forming processes,	2	S
CO4	Student should be able to Know about the various concept of sheet metal operation	2	S
CO5	Student should be able to learn about the conventional and modern machine tools, understanding of metal cutting principles and mechanism, and cutting tool geometry of single point and multipoint cutting tool	2	S

CO-PO Mapping for ME3403

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	2	1	1	3	2	2
CO 2	2	2	1	1	2	2	1	1	2	1	1	2	2	2
CO 3	2	2	1	1	1	1	1	1	1	1	2	2	2	3
CO 4	2	3	1	1	1	1	1	1	1	1	2	2	3	3
CO 5	3	3	1	1	2	2	2	1	1	1	2	3	2	2
Avg	2.4	2.6	1	1	1.4	1.4	1.2	1	1.4	1	1.6	2.4	2.2	2.4

MT3401	Title: Electrical Machines and Control	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide basics of power electronic converter topologies, models and control techniques, and electromechanical energy converters	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Electromechanical Conversion- I	5
Single phase Transformer: EMF Equation Efficiency, Voltage regulation, O.C.& S.C Tests. Three Phase Transformer (Introduction) Auto Transformer (Introduction). DC machines: introduction, emf equation and Method speed control of DC motor.		
Unit II	Electromechanical Conversion- II	5
Three phase Induction Motor: Construction, equivalent circuit, torque equation and torque- slip characteristics, Alternator: Construction, emf. equation. Single phase induction motor.		
Unit III	Modeling of Mechanical System	5
Linear mechanical elements, force -voltage and force current analogy, electrical analog of simple mechanical systems; concept of transfer function & its determination for simple systems; concept of various types of system. Signals: Unit step, unit ramp, unit impulse and periodic signals with their mathematical representation and characteristics.		
Unit IV	Time Response Analysis	5
Time response of a standard second order system and response specifications, steady state errors and error constants. Stability: Concept and types of stability, Routh Hurwitz Criterion and its application for determination of stability		
Unit V	Frequency Response Analysis	4
Concept of root locus, construction of root loci, Bode plot, gain margin and phase margin and their determination from Bode and Polar plots.		
Text Books	1 IJ Nagrath & D. P. Kothari, Electrical machines, Tata McGraw Hill. 2. BR Gupta & Vandana Singhal, Fundamentals of Electrical Machines, New Age International. 3. K. Ogata, Modern Control Engineering, Prentice Hall of India. 4. BC Kuo, Automatic Control systems, Wiley India Ltd.	
Reference Books	1. Irvin L. Kosow, Electric Machinery and Transformers, Prentice Hall of India. 2. D. Roy Choudhary, Modern Control Engineering, Prentice Hall of India. 3. M. Gopal, Control Systems: Principles and Design, Tata McGraw Hill.	
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 MT3401

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 constructional features, parts, Working principle of transformer, DC machines.	2	Em
CO2	Student should be able to know about alternator, three phase induction and single phase induction motor.	2	S
CO3	Student should gain knowledge on electrical analog, transfer function and signal characteristics.	2	S
CO4	Student should be able to know about time response analysis of second order systems.	2	
CO5	Student should know about frequency response analysis and draw bode and polar plots.	2	

CO-PO Mapping for MT3401

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	3	2	2	3	1	2	3	2	1	2	2
CO 2	2	1	3	2	1	1	1	2	1	2	2	2	2	1
CO 3	2	1	2	3	2	1	2	1	1	1	1	2	2	2
CO 4	1	2	3	2	1	1	1	2	2	2	2	2	2	2
CO 5	2	2	2	1	2	2	2	2	3	1	2	2	2	2
Avg	1.8	1.6	2.2	2.2	1.6	1.4	1.8	1.6	1.8	1.8	1.8	1.8	2	1.8

ME3440	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	

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	31-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome for ME3440

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 receprocating compressor.	3	S

CO-PO Mapping for ME3440

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	2	2	1	1	1	2	1	2	2	2	2
CO 2	2	2	2	2	2	1	1	1	2	1	1	2	2	2
CO 3	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

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 to analyse governors, gyroscope and brakes	

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	31-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome for ME3441

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 ME3441

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

ME3442	Title: Production Technology Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To perform various manufacturing processes experimentally.	

List of Experiments

1. Thread cutting in lathe machine
2. Drilling and Boring operation in Lathe machine
3. Basic experiment on forging like making a hook/S bend
4. Exercises on wire drawing and rolling
5. Press work experiment such as blanking/piercing, washer, making etc.
6. Tube bending with the use of sand and on tube bending m/c.
7. Pattern making with proper allowance for desired casting.
8. Making a mould and perform casting.
9. Gear cutting on milling machine
10. Slot cutting on shaper machine

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 ME3442

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 acquire skills to make a pattern and perform simple casting process.	3	Em
CO2	Student should be able to learn about the preparation of various jobs in various manufacturing machines such as Milling, Shaper, Wire Drawing and Rolling.	3	S
CO3	The student should be able to perform machining operations in a lathe machine.	3	S

CO-PO Mapping for ME3442

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	2	1	1	1	1	1	2	2	3	2
CO 2	3	2	2	1	2	1	1	1	1	1	1	2	2	2
CO 3	3	3	2	2	2	2	1	1	1	1	2	3	2	2
Avg	3	2.3	2	1.3	2	1.3	1	1	1	1	1.67	2.3	2.3	2

SEMESTER 5

ME3501	Title: Machine Design I	L T P C 3 2 0 4
Version No.	1.0	
Course Prerequisites	ME3301	
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.	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3501

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 ME3501

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	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

ME3502	Title: Heat Transfer	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	ME3401	
Objectives	To understand the mechanisms of heat transfer under steady and transient conditions and to know about various modes of heat transfer	
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. P.K. Nag Heat Transfer, 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, Allahabad 5. J.P. Holman, Heat and Mass Transfer, Tata McGraw Hill.	
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 ME3502

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

CO PO Mapping for ME3502

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

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.	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3503

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	2	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 ME3503

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

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)	
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.		
Text Books	1. Kripal Singh, Automobile Engineering , Standard Publisher Ganeshan, I.C Engine, TMH 2. Mehrad Ehsani, Yimin Gao, Sebastien Gay , Modern Electric, Hybrid Electric and Fuel Cell Vehicles: Fundamentals Theory and design, CRC Press.	
Reference Books	3. Crouse, Automotive Mechanics, TMH 4. Ferguson , I C Engines, Wiley India 5. Hietner, Automotive Engineering, CBS Publisher 6. R. Yadav, I.C Engine, Central Publishing House, Allahabad	
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 ME3504

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 ME3504

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

ME3540	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.	

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 due to 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	31-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome for ME3540

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

CO-PO Mapping for ME3540

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

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	

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	31-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome for ME3541

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 ME3541

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

SEMESTER 6

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	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3601

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 ME3601

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

ME3602	Title: Refrigeration and Air Conditioning	L T P C 2 2 0 3
Version No.	1.0	
Course Prerequisites	ME3401	
Objectives	The main objective of this course is to provide an insight how thermodynamic principles are applied in the refrigeration and air-conditioning.	
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 Conditioning Systems.		
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 Conditioning, S 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 Airconditioning, New Age International.	
Mode of Evaluation	Internal and External Examinations (Use of Refrigeration and Airconditioning Tables and Chart is allowed during the examination)	
Recommendation by Board of Studies on	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for 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	2	Em
	about basics of Refrigeration and clear concepts related to ideal parameters of refrigeration.	2	Em
CO2	Students should be able to clear concepts related to vapor compression refrigeration system.	2	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.	2	S
CO5	Students should be able to solve cooling load calculations and also able to design of air conditioning system by solving practical problems	2	S

CO-PO Mapping for 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

MT3603	Title: Mechatronics	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	EC3101	
Objectives	The objective of teaching this subject to the students is to make them understand the use of electronic devices to implement automation in industries.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	6
Introduction to Mechatronic Systems, Mechatronics in Products, Measurement Systems, Control Systems, Traditional Design and Mechatronics Design. Principles and Strategies of Automation.		
Unit II	Pneumatic and Hydraulic Systems	7
Introduction to Pneumatic and Hydraulic System, Pneumatic and Hydraulic Actuators, Mechanical Actuators, Electrical Actuators. Block Diagram and Circuits of Pneumatic and Hydraulic System, Selection of Pumps and Valves, 3/2 Way Valve, 4/2 Way Valve, 5/2 Way Valve, Electronic Controller/Automatic Controller.		
Unit III	Sensors and Transducers	8
Introduction to Sensors And Transducers, Energy form of Sensors and Transducers, Performance Terminologies, Displacement, Position and Proximity, Velocity and Motion, Fluid Pressure and Temperature Sensors, Light Sensors, Selection of Sensors, Signal Processing, Servo Systems, Digital Transducer Element, Micro Sensor, Smart Sensors.		
Unit IV	Microprocessors and Microcontroller	9
Introduction to Microprocessor, Architecture, Pin Configuration, Instruction Set, Programming of Microprocessor using 8085 Instructions, , Introduction to Microcontroller, Microcontrollers Vs Microprocessors, Architecture of 8051 Microcontrollers, Pin Configuration, Instruction Set, Interfacing D/A Converters, Interfacing A/D Converters, Applications.		
Unit V	PLC and Robotics	6
Introduction of PLC, Block Diagram of PLC, Characteristics Function of PLC, Use of PLC in Mechanical Industry. General Idea of Robot, Application of Robot in Mechanical System like Material Handling, Machine Loading and Unloading.		
Text Books	1. W Bolton ,Mechatronics, Pearson Education 2. K. K. Appuu Kuttan , Introduction to Mechatronics, Oxford Press, London	
Reference Books	1. Mikell P. Groover , Automation, Production Systems and CIM, PHI 2. Robert H. Bishop, The Mechatronics Handbook, CRC Press 3. Annalisa Milella, Donato Di Paola and Grazia Cicirelli, Mechatronic Systems, Applications, In-Tech 3. David G. Alciatore and Michael B. Histand, Introduction to Mechatronics and Measurement Systems, Tata McGraw Hill 4. Brain Morriess, Automated Manufacturing Systems – Actuators, Controls, Sensors and Robotics, McGraw Hill International Edition	
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 MT 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 understand basic fundamentals of automation in terms of mechatronics as an interdisciplinary system	2	Em
CO2	Students should be able to understand the Pneumatics and Hydraulic systems used in automating the industrial environment using principles of mechatronics	2	S
CO3	Students should be able to understand the fundamentals of sensors and transducers used in automating the industrial environment using principles of mechatronics	2	S
CO4	Students should be able to understand the fundamentals of Microprocessors and Microcontrollers used in automating the industrial environment using principles of mechatronics	2	Em
CO5	Students should be able to understand the fundamentals PLC and Robotics used in automating the industrial environment using principles of mechatronics	2	Em

CO-PO Mapping for MT 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	3	3	2	1	1	1	1	1	1	1	1	1	3	2
CO 2	2	3	2	1	1	1	1	1	1	1	1	1	3	2
CO 3	2	2	1	1	1	1	1	1	1	1	1	1	2	2
CO 4	2	2	2	2	1	1	1	1	1	1	1	1	2	2
CO 5	2	3	2	1	1	1	1	1	1	1	1	1	3	2
Avg	2.2	2.6	1.8	1.2	1	1	1	1	1	1	1	1	2.6	2

ME3640	Title: Refrigeration and Air Conditioning 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 them understand how refrigerators, air-conditioner work	
List of Experiments		
1. To Calculate Coefficient of Performance (COP) of Air Conditioning Test Rig. 2. To Study the Evaporators used in Refrigerating System. 3. To Study the Expansion Devices used in Refrigerating System. 4. To Study and Sketch of Refrigeration Test Rig. 5. To Study and Sketch of Window Type Air Conditioner. 6. To Study Basic Components of Air Conditioning System. 7. To Study the Working Principle of Steam Jet Refrigeration System. 8. To Draw the Cooling and Dehumidification Process on Psychometric Chart and to Determine Latent, Sensible and Total Heat Loss. 9. Study of Procedure for Leak Detection, Evaluation and Charging of Refrigerants. 10. To Study the Constructional Details of Hermetically Sealed Compressor Unit.		
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 ME 3640

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 acquire the knowledge about the working of basic components of refrigeration system and study the performance calculations.	2	Em
CO2	Student should be able to acquire the knowledge about the basic components of air conditioning and investigate the effect of psychometric processes on the performance of air conditioners	3	S
CO3	Student should be able to acquire the knowledge of psychometric processes	3	S

CO-PO Mapping for ME 3640

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	2	1	1	1	1	1	1	2	3	1
CO 2	3	2	2	2	1	1	1	1	1	1	1	2	3	2
CO 3	2	3	3	2	1	1	1	1	1	1	1	1	2	2
Avg	2.67	2.3	2.3	1.6	1.3	1	1	1	1	1	1	1.67	2.67	1.67

MT3641	Title: Mechatronics Lab	L T P C 0 0 2 1
Version No.	1.0	
Course Prerequisites	NIL	
Expected Outcome	They would understand the working of devices used to develop automated systems.	

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	31-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome for ME 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 ME 3641

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	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	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims brush-up the topics important in terms of placement activity.	
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 Softwares, Revision of C & 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	31-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

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

Program Electives

ME3604	**Title: Gas Dynamics and Jet Propulsion**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites	**ME3401**	
Objectives	To understand the working of jet engines and principles of gas dynamics	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Gas Dynamics**	7
Wave Motion - Compressible Fluid Flow Through Variable Area Devices ,Stagnation State Mach Number and its Influence and Properties, Isentropic Flow, Rayleigh and Fanno Flow. Deflagration and Detonation, Normal Shock and Oblique Shock Waves.		
Unit II	**Aircraft Engines**	7
Theory of Aircraft Propulsion, Thrust, Various Efficiencies , Different Propulsion Systems ,Turboprop, Ram Jet , Turbojet, Turbojet With After Burner, Turbo Fan and Turbo Shaft. Variable Thrust, Nozzles , Vector Control		
Unit III	**Performance Characteristics of Aircraft Engines**	7
Engine, Aircraft Matching, Design of Inlets and Nozzles, Performance Characteristics of Ramjet, Turbojet, Scramjet and Turbofan Engines.		
Unit IV	**Rocket Propulsion**	7
Theory of Rocket Propulsion , Rocket Equations , Escape and Orbital Velocity ,Multi-Staging of Rockets ,Space Missions, Performance Characteristics , Losses and Efficiencies		
Unit V	**Rocket Thrust Chamber**	8
Classification of propellants, Combustion in Solid and Liquid Propellant, Propellant Injection Systems, Non-Equilibrium Expansion and Supersonic Combustion, Propellant Feed Systems, Reaction Control Systems, Heat Transfer in Surface and Tip of Rocket.		
Text Books	1. S.M. Yahya, Fundamentals of Compressible Flow, New Age International Pvt Ltd.	
Reference Books	1. Philip G. Hill and Carl R. Peterson, Mechanics and Thermodynamics of Propulsion, Wesley Publishing Company, New York. 2. Zucrow N.J , Principles of Jet Propulsion and Gas Turbines, John Wiley and Sons New York. 3. Zucrow N.J, Aircraft and Missile Propulsion, Vol. I and Vol. II,.John Wiley and Sons Inc, New York.	
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 ME 3604

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Student will understand about the gas dynamics and its significance	2	Em
CO2	Student will know about Aircraft engine types and their working	2	Em
CO3	Student will understand the performance characteristics of Aircraft engines	2	None
CO4	Student will understand about propulsion of rocket,charecteristics and about space missions	2	None
CO5	Students will know about thrust chambers and propellants	2	none

CO-PO Mapping for ME 3604

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	1	1	1	1	1	1	1	1	1	3	2
CO 2	2	3	2	2	1	1	1	1	1	1	1	1	2	2
CO 3	2	2	2	2	1	1	1	1	1	1	1	1	3	2
CO 4	2	3	2	2	1	1	1	1	1	1	1	1	3	1
CO 5	2	3	2	1	1	1	1	1	1	1	1	1	2	2
Avg	2	2.8	2	1.6	1	1	1	1	1	1	1	1	2.6	1.8

ME3605	Title: Computational Fluid Dynamics	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	ME3304	
Objectives	To understand the fundamentals of CFD techniques and its application.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Basic Equations of Fluid Dynamics , Incompressible and Inviscid Flow Vortex and Doublet Flow. Mathematical Properties of Fluid Dynamics Equations. Discretization of Partial Dif,ferential Equations.		
Unit II	Grid Generation	7
Structured Grids. Types and Transformations. Generation of Structured Grids. Unstructured Grids. Delany Triangulation.		
Unit III	Discretization	7
Boundary Layer Equations and Methods of Solution , Implicit Time Dependent Methods for in Viscid and Viscous Compressible Flows, Concept of Numerical Dissipation ,Stability Properties of Explicit and Implicit Methods Conservative Upwind Discretization for Hyperbolic Systems , Further Advantages of Upwind Differencing.		
Unit IV	Finite Element Techniques	7
Overview of Finite Element Techniques in Computational Fluid Dynamics. Strong and Weak Formulations of a Boundary Value Problem.		
Unit V	Finite Volume Techniques	8
Cell Centered Formulation , Runge , Kutta Time Stepping , FDM , like Finite Volume Techniques , Central and Up-wind type Discretizations , Treatment of Derivatives.		
Text Books	1. John D Ramshaw, Elements Computational Fluid Dynamics, Imperial college press 2. Gautam Biswas, Computational Fluid Dynamics, Narosa Publishers.	
Reference Books	1. John F Wendt, Computational Fluid Dynamics-An Introduction, Springer 2. Atul Sharma, Computational Fluid Dynamics, Wiley 3. Jens, Dominick and Muller, Essentials of Computational Fluid Dynamics, CRC Press	
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 ME 3605

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 dicretization methods used in fluid dynamics	2	Em
CO2	Student will be able to Interpret the knowledge, capability of analyzing and solving any concept or problem associated with heat energy dynamics and utilization	2	S
CO3	Student will be able to Apply the various discretization methods, solution procedures and turbulence modeling to solve flow and heat transfer problems	2	S
CO4	Student will be able to Illustrate the working concepts of thermal engineering	2	
CO5	Student will be able to Express numerical modeling and its role in the field of fluid flow and heat transfer.	2	

CO-PO Mapping for ME 3605

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	2	2	2	1	1	1	1	1	1	2	3	2
CO 2	2	3	2	3	2	1	1	1	1	1	1	2	3	2
CO 3	3	3	2	2	2	1	1	1	1	1	1	2	3	2
CO 4	2	2	2	3	2	1	1	1	1	1	1	2	2	2
CO 5	3	3	2	3	3	1	1	1	1	1	1	2	3	2
Avg	2.6	2.8	2	2.6	2.2	1	1	1	1	1	1	2	2.8	2

ME3606	Title: Production Planning and Control	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	ME3303	
Objectives	The main objective of this subject is to understand the various tools of planning and control used for the optimal utilisation of various resources used in industry.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	7
Objectives and Benefits of Planning and Control, Functions of Production Control, Types of Production (Job, Batch and Continuous), Product Development and Design, Marketing Aspect, Functional Aspects, Operational Aspect, Durability and Dependability Aspect, Aesthetic Aspect. Profit Consideration, Standardization, Simplification and Specialization, Break Even Analysis, Economics of a New Design		
Unit II	Production Planning	7
Product Planning, Extending the Original Product Information, Value Analysis, Problems in Lack of Product Planning, Process Planning and Routing, Pre Requisite Information Needed for Process Planning, Steps in Process Planning, Quantity Determination in Batch Production, Machine Capacity, Balancing, Analysis of Process Capabilities in a Multi-Product System		
Unit III	Production Control	9
Production Control Systems, Loading and Scheduling, Master Scheduling, Scheduling Rules, Gantt Charts, Perpetual Loading, Basic Scheduling Problems, Line of Balance, Flow Production Scheduling, Batch Production Scheduling, Product Sequencing, Production Control Systems, Periodic Batch Control, Dispatching, Progress Reporting and Expediting, Manufacturing Lead Time, Techniques for Aligning Completion Times and Due Dates.		
Unit IV	Inventory Control	8
Inventory Control, Purpose of Holding Stock, Effect of Demand on Inventories, Ordering Procedures. Two Bin System, Ordering Cycle System, Determination of Economic Order Quantity and Economic Lot Size, ABC Analysis		
Unit V	Quality Control and Production Systems	5
Quality Control Tools (Check Lists, Histogram, Pareto Charts, Fishbone Diagram, Control Chart Flow Charts and Scatter Plots), Fundamentals of MRP and ERP, 5S, 6S, Kaizen, Poka Yoke, Kanban, JIT, Introduction to Computer Integrated Production Planning Systems.		
Text Books	1. Martand Telsang , Industrial Engineering and Production Management, S. Chand and Company. 2. James.B.Dilworth, Operations management – Design, Planning and Control for manufacturing and services, McGraw Hill International.	
Reference Books	1. Melynk, Denzler, Irwin , Operations Management – A value driven approach McGraw Hill. 2. Jain. K.C and L.N. Aggarwal, Production Planning Control and Industrial Management, Khanna Publishers. 3. Chary. S.N , Theory and Problems in Production and Operations Management, Tata McGraw Hill 4. S.K.Mukhopadyay, Production planning and control-Text and cases, PHI	
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 ME 3606

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 importance and benefits of production planning and control along with their various aspects.	2	Em
CO2	Ability to do the planning for production processes	2	S
CO3	Ability to do the production control of production processes	2	S
CO4	Control the inventory in the plant so that right amount of inventory in right time is available for smooth production operation.	2	S
CO5	Ability to do the control of quality and know about the production systems.	2	S

CO-PO Mapping for ME 3606

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	1	1	1	1	1	1	1	1	2	3	3
CO 2	2	3	2	1	1	1	1	1	1	1	2	2	3	2
CO 3	2	2	2	2	1	1	1	1	2	1	2	1	2	2
CO 4	2	3	2	1	2	1	1	1	1	1	1	2	2	3
CO 5	2	3	1	1	1	1	1	1	2	1	2	2	3	2
Avg	2	2.8	1.8	1.2	1.2	1	1	1	1.4	1	1.6	1.8	2.6	2.4

ME3607	Title: Plant Layout and Material Handling	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	--	
Objectives	Student will be able know about plant location, plant layout and materials handling.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Plant Location and Facilities	7
Factors to be Considered for Plant Location and Plant Layout, Consideration in Facilities Planning, Equipments Required for Plant Operation, Selection of Equipments Considering Plant Capacity, Serviceability, Flexibility, Space and Man Power Requirements.		
Unit II	Plant Layout	7
Need for Layout, Types of Layout, Factors Influencing Plant Layout(Product, Process, Fixed and Combination Layout), Tools and Techniques for Developing Layout, Process Chart, Flow Diagram, String Diagram, Template and Scale Models, Machine Specifications. Layout Planning Procedure. Visualization of Layout, Revision and Improving Existing Layout, Balancing of Fabrication and Assembly Lines.		
Unit III	Material Handling	7
Importance, Scope and Principles of Material Handling. Planning, Operating and Costing Principles, Factors Influencing the Selection of Material Handling Systems, Types of Material Handling Systems.		
Unit IV	Analysis of Material Handling	7
Motion Analysis, Flow Analysis, Graphic Analysis, Safety Analysis, Equipment Cost Analysis, Palletization Analysis, Analysis of Operation, Material Handling Surveys.		
Unit V	Industrial Building and Utilities	8
Centralized Electrical, Pneumatic, Water Line Systems, Types of Buildings, Lighting, Heating, Air Conditioning and Ventilation Utilities, Planning and Maintenance, Industrial Waste Handling. Packing and Storage Materials. Importance of Packaging, Layout for Packaging, Packaging Machinery, Wrapping and Packing Materials, Cushion Materials.		
Text Books	1. B. K. Aggarwal, Plant Layout and Material Handling, Jain Brothers. 2. S. C. Sharma, Plant Layout and Material Handling, Khanna Publishers.	
Reference Books	3. James M. Apple, Plant Layout and Material Handling, John Wiley and Sons. 4. Fred E. Meyers, Plant Layout and Material Handling, Prentice Hall.	
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 ME 3607

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 Plant Location and Facilities	2	Em
CO2	Student will be able to know Plant Layout	2	S
CO3	Student will be able to get knowledge about Material Handling	2	S
CO4	Student will be able to understand about Analysis of Material Handling	2	S
CO5	Student will be able to Industrial Building and Utilities	2	S

CO-PO Mapping for ME 3607

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	1	1	1	1	1	1	1	1	2	3	3
CO 2	2	3	2	1	1	1	1	1	1	1	2	2	3	2
CO 3	3	2	2	2	1	1	1	1	2	1	2	1	2	2
CO 4	3	2	2	1	2	1	1	1	1	1	1	2	2	3
CO 5	2	3	1	1	1	1	1	1	2	1	2	2	3	2
Avg	2.4	2.6	1.8	1.2	1.2	1	1	1	1.4	1	1.6	1.8	2.6	2.4

ME3608	Title: Advanced Engineering Materials	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	ME3302	
Objectives	Students be made aware of advances in material for selecting appropriate advanced engineering materials for different engineering applications.	
Unit No.	Unit Title	No. of hours(per Unit)
Unit I	Ferrous Materials	6
Introduction, Fe-C Phase Diagram, Steel, Low Carbon Steel, Dual Phase Steels, Micro Alloying Steels, Weathering Steels, Free Cutting Steels, Medium Carbon Steels, High Strength Structure Steels, Ausformed Steels, Martensitie Stainless Steels, Tool Materials – Classification, Properties, Heat Treatment of High Speed Steel, Tool for Cold and Hot Forming, Tools for High Speed Cutting, Cast Iron, Grey Cast Iron, White Cast Iron, Malleable Cast Iron, Properties and Applications.		
Unit II	Non Ferrous Materials	9
Introduction, Types of Non Ferrous Materials, Cu and Cu Alloys, Properties and Applications, Aluminum, Cast Aluminum Alloys, Wrought Aluminum Alloys, Properties and Applications, Ti and its Alloys, Properties and Applications Mg and its Alloys, Properties and Applications, Super Alloys : Ni, Fe and Co Based Alloys, Properties and Applications, Bio- Materials, Bio Compatibility, Applications and Properties.		
Unit III	Polymeric and Ceramic Materials	7
Introduction to Thermoplastic and Thermosettting Plastics, Industrial Polymerization Method, Processing of Plastic Materials, Processes used for Thermoplastic Materials: Injection Moulding, Extrusion, Blow Moulding and Thermo Forming, Charecteristics and Applications, Processes used for Thermosettting Materials: Compression Moulding, Transfer Moulding and Injection Moulding, Ceramic Materials: Processing of Ceramics, Forming – Pressing, Dry Pressing, Isostatic Pressing, Hot Pressing, Slip Casting , Extrusion, Thermal Treatment, Vitrification, Properties and Applications, Engineering Ceramics – Alumina, Silicon Carbide.		
Unit IV	Composite Materials and Conducting Materials	7
Composite Materials : Classification, MMC's Preparation of Composite Materials, Properties and Applications, FRP Composites,Processing of Composite Materials, Properties and Applications, Semi Conducting Materials, Intrinsic and Extrinsic Semi Conduction, Semi Conductor Devices, Properties and Applications, Super Conducting Materials, Super Conducting Oxide.		
Unit V	Magnetic and Smart Materials	7
Hard Magnetic Materials, Properties and Applications, Smart Materials: Classification, Piezo Electric Materials, RheologicalMaterials, Smart Gels, Chromic Materials, Thermo Responsive Materials Magneto-Strictive Materials, Electro-Stricitve Materials, Nanotechnology Materials Synthesis, Properties, Carbon Nanotechnology Tubes and Applications.		
Text Books	1. Van Vlack, Elements of Material Science and Engineering, Pearson Education India. 2. K.M.Gupta, Engineering Materials-Research, Applications and Advances, CRC Press.	
Reference Books	1. V.D. Kodgire , Material science and Metallurgy, Everest Publishing House. 2. D. R. Askeland and P. P. Phule , The Science and Engineering of Materials, , ThomsonPublication. 3. Ashutosh Tiwari and Arul Murugan, Advanced Engineering Materials and Modelling, Wiley.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Boardof Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

Course Outcome for ME 3608

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 Ferrous Materials	2	Em
CO2	Students should be able to understand the Non Ferrous Materials	2	S
CO3	Students should be able to understand the Polymeric and Ceramic Materials	2	S
CO4	Students should be able to understand the Composite Materials and Conducting Materials	2	S
CO5	Students should be able to understand the Magnetic and Smart Materials	2	S

CO-PO Mapping for ME 3608

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	2	2	1	1	1	1	1	1	1	1	3	2
CO 2	3	3	1	2	1	1	1	1	1	1	1	1	3	2
CO 3	2	2	1	1	1	1	1	1	1	1	1	1	3	2
CO 4	3	2	2	2	2	1	1	1	1	1	1	1	3	2
CO 5	3	2	2	2	2	1	1	1	1	1	1	1	2	2
Avg	2.8	2.4	1.6	1.8	1.2	1	1	1	1	1	1	1	2.8	2

ME3609	Title: Welding Technology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	ME3403	
Objectives	To understand the fundamentals of various welding processes and to learn about their mechanisms, advantages, limitations and application areas.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Gas and Arc Welding Processes	8
Fundamental Principles – Air Acetylene Welding, Oxyacetylene Welding, Carbon Arc Welding, Shielded Metal Arc Welding, Submerged Arc Welding, TIG and MIG Welding, Plasma Arc Welding and Electroslag Welding Processes – Advantages, Limitations and Applications. Heat Affected Zone (HAZ).		
Unit II	Resistance Welding Processes	7
Spot Welding, Seam Welding, Projection Welding, Resistance Butt Welding, Flash Butt Welding, Percussion Welding and High Frequency Resistance Welding Processes – Advantages, Limitations and Applications.		
Unit III	Solid State Welding Processes	7
Cold Welding, Diffusion Bonding, Explosive Welding, Ultrasonic Welding, Friction Welding, Forge Welding, Roll Welding and Hot Pressure Welding Processes – Advantages, Limitations and Applications.		
Unit IV	Other Welding Processes	7
Thermit Welding, Atomic Hydrogen Welding, Electron Beam Welding, Laser Beam Welding, Friction Stir Welding, Under Water Welding, Welding Automation in Aerospace, Nuclear and Surface Transport Vehicles.		
Unit V	Weld Joints, Weldability and Testing of Weldments	7
Various Weld Joint Designs, Weldability of Aluminium, Copper, and Stainless Steels. Destructive and Non-Destructive Testing of Weldments.		
Text Books	1. Parmer R.S., Welding Engineering and Technology, Khanna Publishers, New Delhi. 2. Little R.L., Welding and welding Technology, Tata McGraw Hill Publishing Co., Ltd., New Delhi.	
Reference Books	1. Schwartz M.M , Metals Joining Manual, McGraw Hill Books. 2. Tylecote R.F., The Solid Phase Welding of Metals, Edward Arnold Publishers Ltd. London. 3. AWS- Welding Hand Book.. Vol- 2. Welding Process 4. Nadkarni S.V. , Modern Arc Welding Technology, Oxford IBH Publishers. 5. Davis A.C , The Science and Practice of Welding, Cambridge University Press.	
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 ME 3609

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 Gas and Arc Welding Processes	2	Em
CO2	Students should be able to understand the Resistance Welding Processes	2	S
CO3	Students should be able to understand the Solid State Welding Processes	2	S
CO4	Students should be able to understand the Other Welding Processes	2	
CO5	Students should be able to understand the Weld Joints, Weldability and Testing of Weldments	2	

CO-PO Mapping for ME 3609

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	2	1	1	1	1	1	1	1	1	2	3	2
CO 2	3	3	2	1	1	1	1	1	1	1	1	1	3	2
CO 3	3	3	2	1	1	1	1	1	2	1	1	2	2	2
CO 4	3	2	2	1	1	1	1	1	1	1	1	1	2	2
CO 5	3	3	2	1	1	1	1	1	1	1	1	2	3	2
Avg	3	2.8	2	1	1	1	1	1	1.2	1	1	1.6	2.6	2

SEMESTER 7

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.	
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 programming CNC: introduction to CNC, typical configurations, machining centers, introduction to FANUC, SIEMENS Controllers DNC: 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	4. Vikram Sharma, Fundamental of CAD/CAM, Ketson books 5. Sareen & Grewal, CAD/CAM theory and Concepts, S.Chand 6. Yoram Koren, Computer Control of Manufacturing Systems, McGraw Hill	
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 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 system such as GT, CAPP, FMS, CIM, Computer aided inspection and QC.	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

ME3702	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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME 3702

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 3702

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

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.	
	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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

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.	6	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 turning and thread cutting.	6	S

CO-PO Mapping for ME 3740

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	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

ME3741	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.	
	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	31-03-2018
Date of approval by the Academic Council	11-06-2018

Course Outcome for ME 3741

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 theoretical concepts taught in Mechanical Measurements & Metrology through experiments.	3	Em
CO2	Students should be able to describe the basic use of various measuring tools measuring techniques.	3	S
CO3	Students should be able to the calibration techniques of various measuring devices.	3	S

CO-PO Mapping for ME 3741

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	3	1	1	1	1	1	1	2	2	1
CO 2	2	2	2	2	3	1	1	1	1	1	1	2	2	1
CO 3	3	2	2	2	3	2	1	1	2	1	1	2	2	3
Avg	2.6	2	2	2	3	1	1	1	1	1	1	2	2	1.6

ME3746	Title: Technical VAP II	L T P C 2 0 0 2
Version No.	1.0	
Course Prerequisites	Nil	
Objective	The course aims brush-up the topics important in terms of placement activity.	
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	31-03-2018	
Date of Approval by the Academic Council on	11-06-2018	

Course 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

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.	
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.		
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. Ayhan Demirbas, 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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

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 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	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

ME3704	Title: Fuels and Combustion	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the available fuels and their characteristics along with combustion behavior.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Basics	7
Fuels types and characteristics of fuels, determination of properties of fuels, fuels analysis - proximate and ultimate analysis, moisture determination, calorific value -gross and net calorific values, calorimetry, Dulong's formula for cv estimation, flue gas analysis, Orsat apparatus, fuel and ash storage and handling, spontaneous ignition temperatures.		
Unit II	Solid and Liquid Fuels	7
Solid fuels: wood and wood charcoal, origin of coal, composition of coal, analysis and properties of different grades of coal, preparation and storage of coal-coal washing, briquetting. Liquid coals: origin of petroleum fuels-production, composition, petroleum refining, various grades of petro-products properties and testing, alcohol shale oil gasification of liquid fuels, synthetic fuels, storage and handling of liquid fuels.		
Unit III	Gaseous Fuels	7
Classification, composition and properties, estimation of calorific value, gas calorimeter. Rich and lean gas - Wobbe index, natural gas, dry and wet natural gas, stripped ng, foul and sweet NG, LPG, LNG, CNG, methane, producer gas –gasifiers, water gas, town gas, coal gasification, gasification efficiency, non-thermal route, biogas, digesters – reactions, viability, economics.		
Unit IV	Combustion	8
Stoichiometry - mass basis and volume basis, excess air calculation - fuel and flue gas compositions – calculations, rapid methods, combustion processes, stationary flame, surface or flameless combustion, submerged combustion, pulsating and slow combustion explosive combustion. Mechanism of combustion – ignition and ignition energy - spontaneous combustion -flame propagation - solid - liquid and gaseous fuels combustion, flame temperature, theoretical, adiabatic and actual - ignition limits – limits of inflammability.		
Unit V	Air Pollution	7
Types of pollution - combustion-generated air pollution - effects of air pollution -pollution of fossil fuels and its control - pollution from automobiles and its control.		
Text Books	1. Samir Sarkar ,Fuels and combustion, Orient Black Swan Publication	
Reference Books	1. Sharma S. P., Cahandramohan ,Fuels and combustion, Tata McGraw-Hill. 2. William H Booth, Liquid Fuel and Its Combustion, Forgotten Books	
Mode of Evaluation	Internal and external examination	
Recommendation by Board of Studies on	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME 3704

Unit-wise Course Outcome	Descriptions	BL Level	Employability (Em)/ Skill(S)/ Entrepreneurship (En)/ None (*Use , for more than One*)
CO1	Students should aware about different types of fuel and can estimate their properties.	2	Em
CO2	Students should be able to compare different solid and liquid fuels	2	S
CO3	Students will aware about the production and hermos-physical properties of gaseous fuel.	2	S
CO4	Students should be able to understand the mechanism of combustion.	2	S
CO5	Students should aware about air pollution caused by different fuel combustion	2	S

CO-PO Mapping for ME 3704

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	2	1	1	1	1	1	2	2	2
CO 2	2	2	2	2	2	2	1	1	1	1	1	1	2	1
CO 3	3	2	3	2	1	2	1	1	2	1	1	2	3	2
CO 4	3	2	2	2	1	1	1	1	1	1	1	2	2	2
CO 5	2	2	2	3	1	2	1	1	2	1	1	1	2	2
Avg	2.4	2.2	2.2	2.2	1.2	1.8	1	1	1.4	1	1	1.6	2.2	1.8

ME3705	Title: Reliability Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To impart the knowledge on principles of reliability, failure rate and its relation to reliability.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	8
Reliability: definition; probability concept; addition of probabilities; complimentary events; Kolmogorov axioms. Failure data analysis: introduction, mean failure rate, mean time to failure (MTTF), mean time between failures (MTBF), graphical plots, MTTF in terms of failure density, MTTF in integral form.		
Unit II	Hazards Models and Conditional Probability	9
Hazard models: introduction, constant hazard; linearly increasing hazard, the Weibull model, density function and distribution function, reliability analysis, important distributions and their choice, standard deviation and variance. Conditional probability: introduction, multiplication rule, independent events, Venn diagram, hazard rate as conditional probability, Bayes theorem.		
Unit III	Reliability Improvement	8
System reliability: series. Parallel and mixed configurations, complex systems, logic diagrams, Markova models. Reliability improvement & repairable systems: redundancy, element, unit and standby redundancy, optimization; reliability – cost trade-off		
Unit IV	Fault Tree Analysis	7
Fault-tree analysis and other techniques: fault-tree construction, calculation of reliability, tie- set and minimal tie-set. Introduction to repairable systems, instantaneous repair rate, MTTR, reliability and availability functions, important applications,8D method,5 rule sheet.		
Unit V	Maintainabilty and Avalability	8
Maintainability and availability: introduction, maintenance planning, reliability and maintainability trade – off. Up time, down time, total time, system breakdown maintenance. Various types of maintenance plans		
Text Books	1. L.S. Srinath,, Reliability Engineering, Affiliated East-West Press, New Delhi. 2. A. K. Govil, Reliability Engineering, Tata Mc-Graw Hill, New Delhi.	
Reference Books	1. L. Balagurusamy ,Reliability Engineering, Tata Mc-Graw Hill, New Delhi. 2. S. Rao, Reliability Based Design, Mc-Graw Hill, 3. K.C. Kapur and L.R. Lamberson, Reliability in Engineering Design,Wiley Publications. 4. D.J. Smith ,Reliability Engineering, , E.W. Publications.	
Mode of Evaluation	Internal and external examination	
Recommendation by Board of Studies on	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME 3705

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 concepts of reliability and carry out reliability data analysis.	2	Em
CO2	Students should be able to understand the concept of hazards models and conditional probability.	2	S
CO3	Student should be able to get acquainted with computation of system reliability and reliability improvement methods.	2	S
CO4	Student should be able to understand the concepts of fault tree analysis and techniques related to it.	2	S
CO5	Student should be able to understand the maintainability and availability and relate it with failure rate	2	S

CO-PO Mapping for ME 3705

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	2	1	2	3	2	1	1	1	1	1	1	2	2	2
CO 3	2	2	3	3	2	1	1	1	1	1	1	1	1	1
CO 4	3	3	2	2	3	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	1	1	1	1	1	1	1	2	1
Avg	2.2	2	2.6	2.6	2.6	1	1	1	1	1	1	1.6	1.8	1.6

ME3706	Title: Statistical Quality Control	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand statistical description of quality, control charts for variables and attributes, process capability analysis and techniques.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	10
Concept of quality, quality characteristics, quality standards, quality cost, concept of quality control, quality control methodology, statistical methods of quality control, Statistical Description of Quality: Population and sample, techniques of sampling, simple random sample, analysis of sample data, representation of sample data, practical examples.		
Unit II	Control Charts	10
Basis of control chart, types of control chart, design of control chart, analysis of control chart, control charts for variables and attributes, case studies.		
Unit III	Process Capability	8
Concept of process capability, measures of process capability, potential process capability, actual process capability, process capability analysis, case studies.		
Unit IV	Acceptance Sampling	6
Basis of sampling schemes, types of sampling schemes, acceptance sampling schemes for variables and attributes, operating characteristic curve, producer's risk, consumer's risk, rectifying inspection.		
Unit V	Six Sigma	6
Concept of six sigma, methods of six sigma, DMAIC methodology, DFSS methodology, six sigma control chart, case studies.		
Text Books	1. M. Mahajan, Statistical Quality Control, Dhanpat Rai and Co. 2. D.C. Montgomery,Introduction to statistical quality control, John Wiley & Sons.	
Reference Books	1. Eugene Grant, Richard Leavenworth, Statistical Quality Control, Mc Graw hill 2. K. Krishnaiah Applied Statistical Quality Control and Improvement, PHI	
Mode of Evaluation	Internal and external examination	
Recommendation by Board of Studies on	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME 3706

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 concepts of quality, quality assurance and management.	2	Em
CO2	Student should be able to demonstrate the ability to use the methods of statistical process control and able to use and interpret control charts for variables.	3	S
CO3	Student should be able to use appropriate statistical concepts, processes, tools, and technologies in the solution to various conceptual and real-world problems.	3	S
CO4	Students should be able to understand sampling and its related terminology.	3	S
CO5	Student should be able to understand the concept of six sigma and its case studies.	2	S

CO-PO Mapping for ME 3706

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	2	2	2	2
CO 2	2	3	2	3	2	1	1	1	1	1	2	1	2	2
CO 3	2	2	3	2	3	1	1	1	1	1	2	2	3	3
CO 4	2	2	2	2	3	1	1	1	1	1	1	2	2	2
CO 5	2	2	3	3	3	1	1	1	1	1	2	2	2	3
Avg	2	2.2	2.6	2.4	2.8	1	1	1	1	1	1.8	1.8	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.	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

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 ME3707

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	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

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.	
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	31-03-2018
Date of approval by the Academic Council	11-06-2018

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 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	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

ME3709	Title: Waste Heat Recovery Systems	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This course provides the knowledge about upcoming concept of waste heat recovery systems and cogeneration.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	8
Introduction, principles of thermodynamics and second law, sources of waste heat recovery, diesel engines and power plant.technologies for waste heat recovery and utilization. Need of storage systems for waste heat, utilization of waste heat - continuous and intermittent. Selection criteria for waste heat recovery technologies.		
Unit II	Cogeneration	8
Principles of thermodynamics, combined cycles, topping, bottoming, organic rankin cycles, advantages of cogeneration technology,cogeneration application in various industries like cement, sugar mill, paper mill etc. Sizing of waste heat boilers, concept of tri generation		
Unit III	Applications	8
Recuperators, regenerators, economizers, plate heat exchangers, waste heat boilers-classification, location, service conditions, design considerations		
Unit IV	Application II	10
Unfired combined cycle ,supplementary fired combined cycle, fired combined cycle, applications in industries, fluidised bed heat exchangers, heat pipe exchangers, heat pumps, thermoelectric devices, utilization of low grade reject heat from power plants, calculation of heat losses, case studies.		
Unit V	Economics	10
Investment cost, economic concepts, measures of economic performance, procedure for optimization of system selection and design, load curves, sensitivity analysis. Regulatory and financial framework for cogeneration and waste heat recovery systems. Environmental considerations for cogeneration and waste heat recovery, pollution.		
Text Books	1. S Mukherjee, P Roy, Mechanical Sciences Engineering Thermodynamics and Fluid Mechanics, Prentice Hall, India 2. Srinivasan, Environmental Engineering, PHI	
Reference Books	1. Robert J Goldstick, Albert Thernman , The Waste Heat Recovery Handbook, Fairmont Press 2. Khartchenko N.V. Advanced Energy Systems, Taylor and Francis, Washington DC 3. Harvey D.L. Handbook on Low-Energy Buildings and District-Energy Systems, Earthscan.	
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 ME 3709

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 waste heat recovery systems.	2	Em
CO2	Students should be able to describe the basic thermodynamic principles of cogeneration, the cogeneration technologies based on the steam turbine, gas turbine, and IC engine.	2	S
CO3	Students should be able to attain a theoretical understanding of applications and issues related to waste heat recovery and cogeneration technologies.	2	S
CO4	Students should be able to classify the commercially viable waste heat recovery devices along with their applications and associated saving potential.	2	S
CO5	Students should be able to theoretically analyze the economic and environmental aspects of waste heat recovery systems and cogeneration.	2	S

CO-PO Mapping for ME 3709

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	2	3	3	3	1	1	1	2	2	2
CO 2	2	3	2	3	2	2	2	2	1	1	1	2	2	2
CO 3	2	3	3	2	2	3	3	3	2	1	1	2	3	3
CO 4	3	3	2	2	2	3	3	3	1	1	1	2	2	2
CO 5	2	2	3	3	2	3	3	3	2	1	1	3	2	3
Avg	2.2	2.6	2.6	2.4	2	2.8	2.8	2.8	1.4	1	1	2.2	2.2	2.4

ME3710	Title: Heating Ventilation and Air-conditioning	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To know the process of designing a HVAC system to meet desired needs within realistic constraints.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to HVAC	10
Scope of HVAC industry with overview of consulting & construction industry, concepts of air conditioning systems. Principles of air conditioning, refrigerant cycle, chilling system, cooling, heating, humidification methods, dehumidification methods, filtration, air-conditioning systems, local cooling comfort system, window air conditioning, split air conditioning, VRV- air conditioning, chilled water fan coil unit, central air conditioning system, chilled water system, psychometric chart, properties of air.		
Unit II	Heat Load Estimation	8
Basics of heat transfer in a building envelop, understanding of outdoor & indoor conditions, correction to outdoor temperature & indoor temperature requirements, exposure of wall, latitude of location, yearly range, daily range etc. Factors effecting the loads estimate, sources of heat gain, external- sun gain through glass/window, sungain through roof/wall, partition gain, internal - people, lights, electrical equipment, motors, kitchen appliances, heat gain through infiltration air, heat gain thorough ventilation & by-pass air, heat gain through ducts. Calculating RSH, RLH, OASH,OALH, GTH, ESHF, ADP, dehumidified CFM, heat loss calculations, basics of heat loss in a building envelop, sources of heat loss		
Unit III	Design of Air Distribution System	8
Components of air distribution system, types of ducts, duct fittings, dampers, types of diffusers, return air grill, flexible duct, flexible connector, end cap, sound attenuator etc., duct elbows selections, vanes location & number of vanes required, duct material calculation- gi sheet, total sheet required in kgs. Gauge of duct & thickness of gauge. Hanger spacing, hanger rod diameter and angle support size, duct designing methods, fixed velocity method, equal friction method, static regain method.		
Unit IV	Chilled Water system design	9
Introduction to chilled water system, hot water system, classification of chillers- as per evaporator, as per condenser,As per compressor, chiller arrangements, cooling tower arrangement, types of cooling tower & expansion tank connections, pumps required in chilled water system, production pumps, distribution pumps, pump classifications, chilled water system pipe designing		
Unit V	Equipment Selection	5
AHU & FCU classification and selection, package unit selection dx- chiller selection, condenser selection, cooling tower selection mixed air temperature HRF for open and closed compressor. Expansion tank selection		
Text Books	1. Siddhartha Yadav Sujit Mishra ,Heating, Ventilation and air-conditioning, Notion Press 2. C.P. Arora, Refrigeration and Air-conditioning, McGraw Hill	
Reference Books	1. T. E. Mull, HVAC Principles and Application Manual, McGraw-Hill 2. R, David Skaves Fundamentals of HVAC, , AHRI institute press 3. Byoger Legg ,Air-conditioning System Design, Buttorworth	
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 ME 3710

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 HVAC systems.	2	Em
CO2	Students should be able to describe the various heat load estimation.	2	S
CO3	Students should be able to attain a theoretical and design understanding of air distribution system.	2	S
CO4	Students should be able to understand and design pumps and chillers.	2	S
CO5	Students should be able to select right equipment in HVAC according to the requirement.	2	S

CO-PO Mapping for ME 3710

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	2	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	2	2	2	2	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	2	2	3	3	2	2	1	1	2	1	1	3	2	3
Avg	2.6	2.2	2.4	2.4	2	1.4	1	1	1.2	1	1	2.2	2.2	2.4

ME3711	Title: Six Sigma and Applications	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To familiarize with the role of six sigma and its tools in improving the processes, products or any system in the organization.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	5
Introduction to six sigma, meaning of sigma, relationship between quality and sigma level, success stories, benefits of six sigma, methodology, voice of customer, goal setting and measurements, problem solving and decision making, project charter		
Unit II	Measurement	8
Variability and its causes, sample statistics, graphical representation, basic tools, process mapping, probability, distribution curve, six sigma measurement, control charts, MSA, cause and effect matrix, QFD, FMEA		
Unit III	Process Capability and Analyze	10
Process capability analysis, visualization of data, confidence interval, hypothesis test, ANOVA, correlation and regression analysis		
Unit IV	Improve and Control	10
Design of experiments – classical, Taguchi and Shainin D.O.E, response surface methodology, alternate to control charts, pre-control charts, control plan, poka-yoke, realistic tolerancing, and project completion, reliability testing		
Unit V	Application and Integration	8
DFSS, case studies of six sigma, integration of six sigma with lean, theory of constraints.		
Text Books	1. Forrest W. Breyfogle III ,Implementing Six Sigma: Smarter Solutions using Statistical Method, John Wiley and Sons. 2. Thomas Pyzdek , The Six Sigma Handbook, McGraw Hill	
Reference Books	1. Dean H. Stamatis, Six Sigma Fundamentals: A Complete Guide to the System, Methods and Tools, Productivity Press 2. R.A. Fisher , The Design of Experiments, Oliver and Boyd	
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 ME 3711

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 concepts of six sigma.	2	Em
CO2	Students should be able to understand the measurement related basic tools and methods.	2	S
CO3	Students should be able to understand the terminologies and concepts related to process capability and its analyzation.	2	S
CO4	Students should be able to solve the quality improvement problems in any industry through the various tools of six sigma.	2	S
CO5	Students should be able to understand the applications and cases studies related to six sigma.	2	S

CO-PO Mapping for ME3711

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	2	2	2	2
CO 3	3	3	2	3	3	2	1	1	2	1	1	2	3	3
CO 4	2	2	2	1	3	1	1	1	1	1	2	2	2	2
CO 5	2	2	3	1	3	2	1	1	2	1	2	3	2	3
Avg	2.4	2.4	2.4	2	2.8	1.4	1	1	1.4	1	1.6	2.2	2.2	2.4

ME3712	Title: Quality Assurance and Management	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To make students understand and familiarize with the different quality tools and techniques.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	5
Principles of quality management, quality gurus, quality cost, quality systems, customer orientation, benchmarking, reengineering, concurrent engineering		
Unit II	Practices of Quality Management	5
Leadership, organizational structure, team building, information system and documentation, quality auditing, ISO 9000, QS 9000		
Unit III	Tools and Techniques of Quality Management	8
Single vendor concept, JIT, quality function deployment, quality circles, TQM, 5S, Kaizen, SGA, POKA YOKE, Taguchi methods		
Unit IV	Statistical Quality Control	10
Methods and philosophy of statistical process control, control charts for variables and attributes, cumulative sum and exponentially weighted moving average control charts, other spc techniques, process capability analysis, six sigma accuracy		
Unit V	Acceptance Sampling	10
Acceptance sampling problems, single sampling plans for attributes, double, multiple and sequential sampling, military standards, the dodge-roming sampling plans		
Text Books	1. Mohammd Zairi, Total Quality Management for Engineers, Woodhead Publishing Limited 2. Douglus C. Montgomery, Introduction to Statistical Quality Control, John Wiley and Sons. 3. Dr. Ravi Shankar, Industrial Engineering and Management, Galgotia Publications Pvt. Ltd.	
Reference Books	1. Harvid Noori and Russel , Productions and Operations Management – Total Quality and Responsiveness, McGraw Hill Inc. 2. Suresh Dalela and Sourabh ,ISO 9000: A Manual for Total Quality Management, ,S. Chand 3. John Ban , The Essence of Total Quality Management, PHI	
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 ME 3712

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 principles of quality, quality assurance and management.	2	Em
CO2	Students should be able to understand the practices of quality management.	2	S
CO3	Students should be able to apply the tools and techniques of quality management.	3	S
CO4	Students should be able to demonstrate the ability to use the methods of statistical quality control.	3	S
CO5	Students should be able to understand sampling and its related terminology.	2	S

CO-PO Mapping for ME 3712

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	1	1	1	1	1	2	2	2	2
CO 2	2	3	2	1	2	1	1	1	1	1	2	2	2	2
CO 3	3	2	2	2	1	1	1	1	2	1	3	2	3	3
CO 4	2	2	2	1	2	1	1	1	1	1	2	2	2	2
CO 5	3	2	2	1	2	2	1	1	2	1	2	2	2	3
Avg	2.6	2.2	2.2	1.4	1.8	1.2	1	1	1.4	1	2.2	2	2.2	2.4

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.	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

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 ME3713

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	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.	
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3714

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 ME3714

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

SEMESTER 8

ME3801	**Title: Solar and Thermal Power Engineering**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To understand the basic concepts of the solar radiation and analyze the solar Thermal systems for their utilization as alternate energy source.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Introduction**	5
Energy demand growth and supply: historical perspectives; fossil fuels: consumption and reserve; environmental impacts of burning of fossil fuels; sustainable development and role of renewable energy sources.		
Unit II	**Solar Energy**	8
The sun as energy source and its movement in the sky; solar energy received on the earth; primary and secondary solar energy and utilization of solar energy. Characteristic advantages and disadvantages.		
Unit III	**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 IV	**Solar Thermal Electricity Generation**	9
Solar concentrators and tracking; dish and parabolic trough concentrating generating systems, central tower solar thermal power plants; solar ponds.		
Unit V	**Solar Photovoltaic Systems**	5
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.		
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	
Reference Books	3. Kalogirou. S ,Solar Energy Engineering, Processes and Systems, Elsevier 4. Petela. R, Engineering Thermodynamics of Thermal Radiation for Solar Power, McGraw- Hill Co. 5. Yogi Goswami. D, Frank Kreith, Jan F. Kreider,Principles of Solar Engineering, Taylor & Francis 6. Andrews J., Jelley N , Energy Science, Oxford University Press	
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 ME 3702

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 demand growth and supply	2	Em
CO2	Student should be able to understand about Solar Energy	2	S
CO3	Student should be able to know about Solar Radiation and Measurement	2	S
CO4	Student should be able to understand about Solar Thermal Electricity Generation	2	S
CO5	Student should be able to know about the Solar Photovoltaic Systems	2	S

CO-PO Mapping for ME 3801

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	3	2	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	1	1	1	2	3	3
CO 4	3	2	2	2	2	1	1	1	1	1	1	2	2	2
CO 5	2	2	2	2	2	2	1	1	1	1	1	3	2	3
Avg	2.6	2.2	2.4	2.2	2.4	1.8	1.4	1.2	1	1	1	2.2	2.2	2.4

ME3802	Title: Nuclear Power Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To understand the systems, components and process adopted in generation of nuclear power along with safety and economic aspects.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction	8
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.		
Unit II	Nuclear Reactors	8
Boiling water reactor. Description of reactor system, main components, control and safety features. Materials of reactor construction – fuel, moderator, coolant, problems involving core hydrodynamics of boiling-water reactors, pressurized water reactor components, gas- cooled reactor cycles and components.		
Unit III	Nuclear Fuels	8
Structural materials, cladding, radiation damage, nuclear fuels: metallurgy of uranium, general principles of solvent extraction, reprocessing of irradiated fuel, separation process fuel enrichment.		
Unit IV	Heat removal and Economics aspects	8
Reactor heat removal/equations of heat transfer as applied to reactor cooling– reactor heat transfer systems – heat removed in fast reactors. Economics of nuclear power plants. Accounting for capital costs, fuel costs and O&M (operations and maintenance) costs, as well as environmental aspects - sustainability, proliferation, safety, relative merits of different types of power plants.		
Unit V	Nuclear Radiation Safety	4
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. G. Vaidyanathan, Nuclear Reactor Engineering - Principles and Concepts, S. Chand Publishers 2. M. M. El-Wakil , Nuclear Power Engineering, Mc Graw Hill	
Reference Books	1. John R. Lamarsh and Anthony J. Baratta, Introduction to Nuclear Engineering, Prentice Hall. 2. John Lee, Nuclear Reactor Physics and Engineering, Wiley	
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 ME 3802

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 Nuclear fission, reactor control	2	Em
CO2	Student should be able to Know about the Nuclear Reactors	2	S
CO3	Student should be able to Know about the Nuclear Fuels	2	S
CO4	Student should be able to Know about the Heat removal and Economics aspects	2	S
CO5	Student should be able to learn about the Nuclear Radiation Safety	2	S

CO-PO Mapping for ME 3802

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	3	2	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	1	1	1	2	3	3
CO 4	3	2	2	2	2	1	1	1	1	1	1	2	2	2
CO 5	2	2	2	2	2	2	1	1	1	1	1	3	2	3
Avg	2.6	2.2	2.4	2.2	2.4	1.8	1.4	1.2	1	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.	
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		
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	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

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 ME3803

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

ME3804	Title: Value Engineering	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	This course provides the knowledge about the value analysis, its techniques and applications.	
Unit No.	Unit Title	No. of hours (per Unit)
Unit I	Introduction to Value Analysis	6
Definition of value, value analysis, value engineering, value management, value analysis versus value engineering, value analysis versus traditional cost reduction techniques, uses, applications, advantages and limitations of value analysis. Symptoms to apply value analysis, coaching of champion concept. Types of values: reasons for unnecessary cost of product, peeling cost onion concept, unsuspected areas responsible for higher cost, value analysis zone, attractive features of value analysis. Meaning of value, types of value & their effect in cost reduction. Value analysis procedure by simulation. Detailed case studies of simple products.		
Unit II	Functional Cost and its Evaluation	6
Meaning of function and functional cost, rules for functional definition, types of functions, primary and secondary functions using verb and noun, function evaluation process, methods of function evaluation. Evaluation of function by comparison, evaluation of interacting functions, evaluation of function from available data, matrix technique, miss technique, numerical evaluation of functional relationships and case studies.		
Unit III	Value Engineering Job Plan and Techniques	8
Meaning and importance of value engineering job plan. Phases of job plan proposed by different value engineering experts, information phase, analysis phase, creative phase, judgement phase, development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, value analysis change proposal. Result accelerators or new value engineering techniques, listing, role of techniques in value engineering, details with case examples for each of the techniques.		
Unit IV	Advanced Value Analysis Techniques	8
Functional analysis system technique and case studies, value analysis of management practice (VAMP), steps involved in vamp, application of VAMP to government, university, college, hospitals, school problems etc., (service type problems).		
Unit V	Total Value Engineering and Applications	8
Total value engineering: concepts, need, methodology and benefits. Application of value analysis: application of value analysis in the field of accounting, appearance design, cost reduction, engineering, manufacturing, management, purchasing, quality control, sales, marketing, material management etc.,		
Text Books	1. Lawrence D. Miles, Techniques of Value Analysis and Engineering, McGraw Hill Book Company 2. Anil Kumar Mukhopadhyaya, Value Engineering: Concepts Techniques and applications, SAGE Publications	
Reference Books	1. Warren J Ridge, Value Analysis for Better Management, American Management Association 2. G.Jagannathan, Getting More at Less Cost (The Value Engineering Way), Tata Mcgraw Hill Pub. Comp 3. Arther E Mudge, Value Engineering, McGraw Hill Book Comp	
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 ME3804

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 Introduction to Value Analysis	2	Em
CO2	Student should be able to understand about Functional Cost and its Evaluation	2	S
CO3	Student should be able to know about Value Engineering Job Plan and Techniques	2	S
CO4	Student should be able to understand about Advanced Value Analysis Techniques	2	S
CO5	Student should be able to know about the Total Value Engineering and Applications	2	S

CO-PO Mapping for ME 3804

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	2	2	1	1	2	2	3
CO 2	2	3	2	3	2	1	1	3	2	1	1	2	3	2
CO 3	2	2	3	2	3	2	1	2	2	1	1	2	2	2
CO 4	2	2	2	2	3	1	1	3	3	1	1	2	2	2
CO 5	2	2	3	3	3	2	1	3	2	1	1	3	2	2
Avg	2	2.2	2.6	2.4	2.2	1.4	1	2.6	2.2	1	1	2.2	2.2	2.2

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.	
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 an ros 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.	
Recommendation by Board of Studies on	28.07.2021	
Date of approval by the Academic Council		
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 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

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 RPsystems and reverse engineering.	
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, WorldScientific,	
Reference Books	1. N. Hopkinson, R.J.M, Hauge, P M, Dickens,Rapid Manufacturing – An Industrial revolution forthe digital age, Wiley, 2. Ian Gibson , Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying, Wiley, 3. Paul F. Jacobs, Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography, McGraw Hill 4. Pham. D.T., and Dimov. S. S, Rapid Manufacturing, Springer Verlog.	
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 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

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.	
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 itsapplication, 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 capacitorsand 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-lightinglevels, 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, Hemisphere Publ, Washington 3. Recommended Practice for Energy Conservation and cost effective planning in industrialfacilities, IEEE Bronze Book, IEEE Press	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Board of Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

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

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 andtheir applications	
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 continuousand 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 withstorage 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 andsmart 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 PotentialAssessment Guide, , Sandia National Laboratories, 2. A.G. Ter Gazarian, Energy Storage for Power Systems, The Institution of Engineering andTechnology (IET) Publication, UK,	
Mode of Evaluation	Internal and External Examinations	
Recommendation byBoard of Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

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

ME3809	**Title: Product Design and Development**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites		
Objectives	To provide students with a set of tools and methods for product design and development and make students aware of the role of multiple functions in creating a new product.	
Unit No.	**Unit Title**	**No. of hours(per Unit)**
Unit I	**Design Fundamentals**	7
The importance of engineering design, types of design, the design process, relevance of product lifecycle issues in design, designingto codes and standards- societal considerations in engineering design, generic product development process, various phases of product development, planning for products, establishing markets, market segments, relevance of market research		
Unit II	**Customer oriented design & Societal Considerations**	7
Identification of customer needs, customer requirements, quality Function Deployment Product Design Specifications- Human Factors in Design, Ergonomics and Aesthetics. Societal consideration, Contracts, Product liability, Protecting intellectual property, Legal and ethical domains, Codes of ethics, Ethical conflicts, Environment responsible design, future trends in interaction of engineering with society.		
Unit III	**Material selection processing and Design**	7
Material Selection Process, Economics, Cost Vs Performance, Weighted property Index, Value Analysis, Role of Processing inDesign, Classification of Manufacturing Process, Design for Manufacture, Design for Assembly, Designing for castings, Forging, Metal Forming, Machining and Welding, Residual Stresses, Fatigue, Fracture and Failure.		
Unit IV	**Design Methods**	7
Creativity and problem solving- creative thinking methods- generating design concepts, systematic methods for designing, functionaldecomposition, physical decomposition, functional representation, morphological methods, TRIZ, axiomatic design. decision making theory- utility theory, decision trees, concept evaluation methods.		
Unit V	**Industrial Design concepts**	8
Human factors design, user friendly design, design for serviceability, design for environment, prototyping and testing, cost evaluation, categories of cost, overhead costs, activity based costing, methods of developing cost estimates, manufacturing cost,value analysis in costing.		
Text Books	1. Kari T. Ulrich and Steven D. Eppinger, Product Design and Development, McGraw Hill International Edns.	
Reference Books	1. Kemnneth Crow, Concurrent Engg. Integrated Product Development, DRM Associates,Workshop Book. 2. Stephen Rosenthal, Effective Product Design and Development, Business One Orwin, Homewood 3. Staurt Pugh , Tool Design Integrated Methods for Successful Product Engineering, AddisonWesley Publishing, New York, NY.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Boardof Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

Course Outcome for ME3809

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 Design Fundamentals Customer oriented design & Societal Considerations	2	Em
CO2	Student should be able to understand about Material selection processing and Design	2	S
CO3	Student should be able to know about Design Methods Industrial Design concepts	2	S
CO4	Student should be able to understand about Design Methods	2	S
CO5	Student should be able to know about the Industrial Design concepts	2	S

CO-PO Mapping for ME 3809

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	3	1	1	1	1	1	2	2	2
CO 2	3	3	1	1	1	2	1	1	1	1	1	2	2	2
CO 3	3	2	1	1	1	3	2	1	2	1	2	2	3	3
CO 4	3	2	1	1	1	2	1	1	1	1	1	2	2	2
CO 5	2	2	1	1	1	3	2	1	2	1	2	2	2	3
Avg	2.6	2.2	1	1	1	2.6	1.4	1	1.4	1	1.4	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.	
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	3. Lonnie Wilson, How to Implement Lean Manufacturing, McGraw Hill. 4. William M. Feld, Lean Manufacturing: Tools, Techniques and How to Use Them, The St LuciePress. 5. Devadasan S.R, Lean and Agile Manufacturing: Theoretical, Practical and Research Futurities,PHI 6. Michael L. George , Lean Six Sigma, McGraw-Hill.	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Boardof Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

Course Outcome for ME3810

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 understanding of casting process	2	Em
CO2	Student should be able to Know about the applications of various types of welding processes.	2	S
CO3	Student should be able to Know about the principles of forming processes,	2	S
CO4	Student should be able to Know about the various concept of sheet metal operation	2	S
CO5	Student should be able to learn about the conventional and modern machine tools, understanding of metal cutting principles and mechanism, and cutting tool geometry of single point and multipoint cutting tool	2	S

CO-PO Mapping for ME 3810

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	1	2	3	2	3	1	1	1	1	1	1	2	2	2
CO 2	1	3	2	3	2	1	1	1	1	1	1	2	2	2
CO 3	1	2	3	2	3	2	1	1	2	1	2	2	3	3
CO 4	1	2	2	2	3	1	1	1	1	1	1	2	2	2
CO 5	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

ME3811	Title: Introduction to Tribology	L T P C 3 0 0 3
Version No.	1.0	
Course Prerequisites	Nil	
Objectives	To provide the knowledge and importance of tribology in design, friction, wear and lubricationaspects of machine components	
Unit No.	Unit Title	No. of hours(per Unit)
Unit I	Surfaces and Friction	7
Introduction to the concept of tribology, tribological problems, nature of engineering surfaces, surface topography. Surface profilometer, measurement of surface topography. Contact between surfaces, sources of sliding friction, friction due to ploughing, friction due to adhesion friction characteristics of metals and non-metals, sources of rolling friction, stick slip motion. Friction of ceramic materials and polymers, measurement of friction.		
Unit II	Wear	7
Wear and types of wear, simple theory of sliding wear mechanism, abrasive wear, adhesive wear, corrosive wear, and surface fatiguewears situations, wear of ceramics, wear of polymers, wear measurements.		
Unit III	Film Lubrication Theory	8
Coefficient of viscosity, fluid film in simple shear, viscous flow between very close parallel plate, lubricant supply, lubricant flow rate, cold jacking, Couette flow, cavitations, film rupture, oil whirl, shear stress variation within the film, lubrication theory byOsborne Reynolds, pressure fields for full Sommerfeld, half Sommerfeld, Reynolds boundary conditions.		
Unit IV	Lubricants and Lubrication Types	7
Types of lubricants, properties of lubricants, testing methods, hydrodynamic lubrication, elasto-hydrodynamic lubrication,hydrostatic lubrication.		
Unit V	Surface Engineering and Materials for Bearings	7
Classification of surface modifications and surface coatings, surface modifications, transformation hardening, surface modifications, surface fusion, thermo chemical processes, surface coatings, materials for rolling element bearings, materials for fluid film bearings, materials for marginally lubricated and dry bearings.		
Text Books	1. Hutchings. I. M, Edward, Tribology, Friction and Wear of Engineering Material, Arnold,London, 2. Williams. J. A., Engineering Tribology, Oxford University Press,	
Reference Books	1. Stolarski T.A , Tribology in Machine Design,., Industrial Press Inc. 2. Cameron A, Basic Lubrication Theory, Longman, U.K. 3. Neale M. J., Newnes, Tribology Handbook, Butter worth, Heinemann, 4. Gwidon Stachowiak, Andrew W Batchelor, Engineering tribology, Elsevier Butterworth –Heinemann, USA	
Mode of Evaluation	Internal and External Examinations	
Recommendation by Boardof Studies on	31-03-2018	
Date of approval by theAcademic Council	11-06-2018	

Course Outcome for ME3811

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	S
CO2	Student should be able to understand the formation of steam and calculate the efficiency of different power cycles.	2	S
CO3	Student should be able to understand the functioning of steam power plant, gas power plant and their major components.	2	S
CO4	Student should be able to analyze the performance of boilers and flow through nozzles used in existing thermal system.	2	S
CO5	Student should be able to know and apply thermodynamics concepts of compressor and Evaluate the efficiency of compressor.	2	S

CO-PO Mapping for ME 3811

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	3	1	1	1	1	1	1	2	2	2
CO 2	3	3	1	3	2	1	1	1	1	1	2	2	2	2
CO 3	3	2	1	2	2	2	1	1	2	1	1	2	3	3
CO 4	3	2	2	2	2	1	1	1	1	1	1	2	2	2
CO 5	2	2	2	3	2	2	1	1	2	1	2	3	2	3
Avg	2.6	2.2	1.4	2.4	2.2	1.4	1	1	1.4	1	1.4	2.2	2.2	2.4

ME3812	**Title: Automotive Pollution and Control**	**L T P C** **3 0 0 3**
Version No.	**1.0**	
Course Prerequisites	Nil	
Objectives	To impart knowledge of various automotive pollution constituents and control techniques.	
Unit No.	**Unit Title**	**No. of hours (per Unit)**
Unit I	**Introduction**	6
Pollutants, sources, formation, effects of pollution on environment, human, transient operational effects on pollution,regulated, unregulated emissions, emission standards.		
Unit II	**Emissions in SI Engine**	8
Chemistry of SI engine combustion, HC and CO formation in SI engines, NO formation in SI engines, smoke emissionsfrom SI engines, effect of operating variables on emission formation.		
Unit III	**Emissions in CI Engine**	9
Basics of diesel combustion, smoke emission and its types in diesel engines, NOx emission and its types from diesel engines, particulate emission in diesel engines. odor, sulfur and aldehyde emissions from diesel engines, effect of operating variables on emission formation.		
Unit IV	**Control Techniques for Reduction of Emission**	9
Design modifications, optimization of operating factors, fuel modification, evaporative emission control, Exhaust gas recirculation, DOC, SCR, fumigation, secondary air injection, PCV system, particulate trap, CCS, exhaust treatment in SI engines, thermal reactors, catalytic converters, catalysts, use of unleaded petrol.		
Unit V	**Test Procedure, Instrumentation and Emission Measurement**	8
Test procedures CVS1, CVS3, Test cycles, IDC, ECE Test cycle, FTP Test cycle, NDIR analyzer, flame ionizationdetectors, chemiluminescent analyzer, dilution tunnel, gas chromatograph, smoke meters, SHED test.		
Text Books	1. Pundir. B.P, IC Engines Combustion and Emissions, Narosa Publishers, 2. Springer and Patterson, Engine Emission, Plenum Press,	
Reference Books	1. Automobiles and Pollution SAE Transaction, 2. Ganesan V., Internal Combustion Engines, Tata McGraw Hill Co., 3. Heywood, J. B., Internal Combustion Engine Fundamentals, McGraw Hill Book Co.,	
Mode of Evaluation	Internal and External Examinations	
Recommendation byBoard of Studies on	31-03-2018	
Date of approval by the Academic Council	11-06-2018	

Course Outcome for ME3812

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 Pollutants, sources	2	Em
CO2	Student should be able to understand about Emissions in SI Engine	2	S
CO3	Student should be able to know about Emissions in CI Engine	2	S
CO4	Student should be able to understand about Control Techniques for Reduction of Emission	2	S
CO5	Student should be able to know about the Test Procedure, Instrumentation and Emission Measurement	2	S

CO-PO Mapping for ME3812

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	2	2	1	1	1	1	1	1	1	2	2	2
CO 2	3	3	2	2	2	2	1	1	1	1	1	2	2	2
CO 3	3	2	2	2	1	2	2	1	2	1	2	2	3	3
CO 4	3	2	2	2	1	2	2	1	1	2	1	2	2	2
CO 5	2	2	2	2	1	3	3	2	2	1	2	3	3	3
Avg	2.6	2.2	2	2	1.2	2	1.8	1.2	1.4	1.2	1.4	2.2	2.4	2.4