

K L UNIVERSITY
DEPARTMENT OF MECHANICAL ENGINEERING
MINUTES OF BOARD OF STUDIES MEETING

The Board of Studies meeting was conducted in **HOD Chamber** on **20th June 2013** at **12.00 Noon**.

Agenda:

- To consider B.Tech course structure and syllabus for 2013-2014 admitting batch.
- To consider M.Tech (Thermal Engineering) course structure and syllabus for 2013-2014 admitting batch.
- To consider M.Tech (Mechatronics) course structure and syllabus for 2013-2014 admitting batch.
- To consider Pre-PhD courses for 2013-14 admitting batch.

The following members were present:

- | | |
|-----------------------------|---------------------------|
| 1. Dr. Y. V. Hanumantha Rao | |
| 2. Dr. K. Rama Krishna | 8. Prof. G. Satyanarayana |
| 3. Dr. K. L. Narayana | 9. Dr. S. S. Rao |
| 4. Dr. A. Srinath | 10. Dr. P. V. Chalapathi |
| 5. Dr. K. Rama Kotaiah | 11. Mr. T. Vijaya Kumar |
| 6. Dr. B. Raghu Kumar | 12. Mr. G. L. Narayana |
| 7. Dr. B. Nageswara Rao | 13. Mr. K. Babu Raja |

The following External members gave their valuable suggestions through mails:

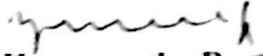
1. Dr. C. S. Kumar, IIT Kharagpur
2. Dr. A. Seshadri Sekhar IIT Madras
3. Mr. K. Suryanarayana, CEO, TCS-Hyderabad

The following points were discussed

1. Dr. Y. V. Hanumantha Rao, Chairman of BoS opened the meeting by going through the suggestions given by Dr. A. Seshadri Sekhar, Professor, Dept. of Mechanical Engg, IIT Madras.
2. It is decided to replace the "Precision Engineering" subject by "Metrology and Instrumentation" subject as per the suggestion by Dr. A. Seshadri Sekhar.
3. Dr. A. Seshadri Sekhar also suggested offering "Principles of Product Design" instead of "Human Factors in Engineering Design".
4. BoS members also decided that all the core courses with analytical nature be dealt using a tutorial component.
5. Part of the two hour slots allotted for the project based labs to be utilized for tutorial purpose where ever applicable for all the 15 core courses.
6. BoS members suggested using data tables wherever applicable instead of using and allowing data books in the examinations.

7. Dr. Y. V. Hanumantha Rao requested Dr. B. Raghu Kumar to look into the changes suggested by Dr. A. Seshadri Sekhar in subjects related to Design Research Group in the absence of Mr. D. V. A. Rama Sastry and resubmit them by Saturday 22nd June 2013.
8. Dr. Y. V. Hanumantha Rao requested Dr. K. Rama Kotaiah to look into the changes suggested by Dr. A. Seshadri Sekhar in subjects related to Production Research Group and resubmit them by Saturday 22nd June 2013.
9. Dr. Y. V. Hanumantha Rao requested Mr. G. L. Narayana to look into the changes suggested by in subjects related to Thermal Research Group and resubmit them by Saturday 22nd June 2013.
10. Dr. A. Srinath announced to the BoS members that the subject 13 ME-321 will be referred as "Robotics" for Mechanical Engineering Department core subject and "Robotics Sensing and Control" for Open Elective and suggested changes will be incorporated.
11. Dr. A. Srinath announced to the BoS members that the subject 13 ME-324 will be referred as "Mechatronics" for Mechanical Engineering Department core subject and "Mechatronics Systems Approach" for Open Elective and suggested Changes will be incorporated.
12. Dr. Y. V. Hanumantha Rao announced that the department will form a project review committee headed by a professor of the department to look into B.Tech. and M.Tech student final projects.
13. Course codes will be reconsidered by Dean Academics and Dean Academics will be requested to look into changing of the codes and reassigning them as deemed suitable.
14. Dr. K. Rama Krishna suggested reframing of competencies subjects to the tune with higher order competencies wherever applicable.
15. Dr. K. Rama Krishna suggested that pre-requisites be carefully incorporated.
16. It is resolved that all the labs will be dealt with project based lab structure.
17. Dr. Y. V. Hanumantha announced to the BoS members that M.Tech. (Engineering Design) will not be offered based on the feedback received while M.Tech. (Thermal Engineering) will be offered.
18. M.Tech. (Mechatronics) will also be offered in place of M.Tech. (CAD/CAM).
19. Dr. A. Srinath announced that Robotics and Mechatronics Research group has preliminary discussion with ABB (Pune), Honeywell Automation (Pune), ARAI (Pune), Hyundai Motors R&D (Hyderabad), Infotech (Hyderabad), Siemens India Pvt. Ltd. (Hyderabad), FMCA Technologies (Hyderabad) and Honeywell (Hyderabad) to acquire MoU's for M.Tech. (Mechatronics) program.
20. Dr. A. Srinath also announced that FMCA Technologies, Siemens India Pvt. Ltd., Hyundai Motors R&D already sent a draft of MoU and the MoU will be signed by the end of the month of June and another MoU with ARAI (Pune) will be signed by the second week July.

21. Dr. Y. V. Hanumantha Rao announced that the syllabus of M.Tech. (Thermal Engineering) was forwarded to IIT Kharagpur for suggestions and the BoS is taking a wait and see approach.
22. It is requested that the IRP cell helps the department in getting MoU's from industries for M.Tech program.
23. The proposed and approved B.Tech course structure for 2013-14 admitting students is shown in Annexure-1
24. The proposed and approved M.Tech-Thermal Engineering course structure for 2013-14 admitting students was shown in Annexure-2
25. The proposed and approved M.Tech-Mechatronics course structure for 2013-14 admitting students was shown in Annexure-3
26. The proposed and approved Pre-PhD courses for 2013-14 admitting students were shown in Annexure-4.
27. It was resolved to approve all the recommendations of DAC meeting conducted on 23rd March 2013 except point 7.


(Dr. Y. V. Hanumantha Rao)
Head of the Department

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Annexure-1

B.Tech 2013-14 Admitted Batch Course Structure

S.No	Course Code	L-T-P	Cr	Pre-Req.	Student Outcomes											Course status	Rationale	
					a	b	c	d	e	f	g	h	i	j	k			
I HUMANITIES & SOCIAL SCIENCES																		
1	13HS101	English	2-0-2	3	Nil		1				2	3					Course is retained from previous curriculum	Aims at developing the skill in Communication
2	13HS102	Language and Reasoning Skills	2-0-2	3	Nil						2						Introduced as a new course	Aims at enhancing the skills requires for Employability
3	11BS105	Ecology and Environment	2-0-0	2	Nil								1	1	1		Course is retained from previous curriculum	Aims at understanding the responsibility towards environment and Sustainability
4	13HS104	Human Values	2-0-0	2	Nil						3				2		Introduced as a new course	Aims at understanding the importance of Human Values in Society
5	13AC201	Energy and Society (Audit Course)	2-0-0	Nil	Nil								3		1		Course is modified from previous curriculum	Aims at understanding the responsibility towards environment and Sustainability
6	13AC202	Employability Skills (Audit Course)	1-0-2	Nil	Nil		1										Introduced as a new course	Aims at enhancing the skills required for Employability
7	13AC302	Quantitative Aptitude and Reasoning (Audit Course)	0-0-2	Nil	Nil		1										Introduced as a new course	Aims at enhancing the skills required for Employability
8	13AC301	Advanced Employability Skills (Audit Course)	1-0-2	Nil	Nil		1										Introduced as a new course	Aims at enhancing the skills required for Employability
II BASIC SCIENCES																		
1	13BS101	Linear Algebra and Multivariate Calculus	3-0-2	4	Nil												Introduced as a new course	Aims at developing basic knowledge in Linear Algebra and Multi Variate calculus
2	13BS102	Differential Equations	3-1-0	4	Nil												Introduced as a new course	Aims at developing basic knowledge in Differential Equations applied to engineering



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S.No	Course Code		L-T-P	Cr	Pre-Req.	Student Outcomes											Course status	Rationale	
						a	b	c	d	e	f	g	h	i	j	k			
3	13BS103	Engineering Physics	3-0-2	4	Nil	1	1											Course is retained from previous curriculum	Aims at developing basic knowledge in the area of physics applied to engineering
4	11BS104	Engineering Chemistry	3-0-2	4	Nil		2	2										Course is retained from previous curriculum	Aims at developing basic knowledge in the area of chemistry applied to engineering
5	13BS201	Mathematical Methods	3-0-0	3	13BS101 13BS102					2								Course is retained from previous curriculum	Aims at developing basic knowledge in Mathematical models
6	13BS202	Complex Variables and Discrete Mathematics	3-0-0	3	13BS101 13BS102	2												Introduced as a new course	Aims at developing basic knowledge in complex variables and discrete mathematics
ENGINEERING SCIENCES																			
1	13ES103	Engineering Materials	3-0-0	3	Nil	1												Course is retained from previous curriculum	Aims at developing basic knowledge in materials selection
2	13ES102	Measurements	3-0-2	4	Nil	2				2								Course is retained from previous curriculum	Aims at developing skill in Measuring instruments related to engineering
3	11ES104	Engineering Graphics with CAD	0-0-4	2	Nil					2								Course is retained from previous curriculum	Aims at developing basic knowledge in Engineering graphics
4	13ES105	Workshop Practice	0-0-4	2	Nil											2		Course is retained from previous curriculum	Aims at developing Skill in handling various tools and equipments
5	13ES101	Problem Solving Through Programming	3-0-2	4	Nil	2				2								Course is retained from previous curriculum	Aims at developing skills in solving problems using programming language
6	13ES106	Engineering Mechanics	3-0-2	4	Nil	2	2			2								Course is modified from previous curriculum	Aims at developing the Skill in Mechanics through laboratory
7	13ES201	Thermodynamics	3-0-0	3	13BS103	2				2								Course is retained from previous curriculum	Aims at developing basic knowledge in Thermodynamic principles
8	13ES202	Object Oriented Programming	3-0-2	4	13ES101	2				2								Introduced as a new course	Aims at developing skills in solving problems by using programming language



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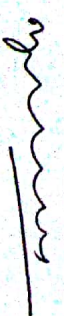
S.No	Course Code	L-T-P	Cr	Pre-Req.	Student Outcomes											Course status	Rationale		
					a	b	c	d	e	f	g	h	i	j	k				
9	13ES203	Network Theory	3-0-2	4	13BS101					2								Introduced as a new course	Aims at developing the Skill in Network Theory through laboratory
10	13ES204	Data Structures	3-0-2	4	13ES101	2	2			2								Introduced as a new course	Aims at developing the Skill in Data Structure Theory through laboratory
11	13ES205	Signal Processing	3-0-2	4	13BS102					2							2	Introduced as a new course	Aims at developing the Skill in signal processing through laboratory
12	14ME221	Machine Drawing (Audit Course)	0-0-2	Nil	Nil	2				2								Introduced as a new course	Aims at developing skill in drawing the machine components
IV	PROFESSIONAL CORE COURSES																		
1	13ME201	Fluid Mechanics & Hydraulic Machines	3-0-2	4	13ES106		2			2								Course is modified from previous curriculum	Aims at developing the Skill in applying the principles of Fluid Mechanics through laboratory
2	13ME202	Applied Thermodynamics	3-0-2	4	13ES201	2	2											Course is retained from previous curriculum	Aims at developing the Skill in applying principles of thermodynamics through laboratory
3	13ME301	Internal Combustion Engines and Gas Turbines	3-0-2	4	13ES201		2			2								Course is retained from previous curriculum	Aims at developing the Skill in analyzing the performance of IC Engines through laboratory
4	13ME401	Heat Transfer	3-0-2	4	13ME201		2			2								Course is retained from previous curriculum	Aims at developing the Skill in applying Heat Transfer through laboratory
5	13ME203	Metallurgy	3-0-2	4	13ES103	2	2											Introduced as a new course	Aims at developing the Skill in Materials selection and processing through laboratory
6	13ME204	Manufacturing Processes	3-0-2	4	13ES103	1	1											Course is retained from previous curriculum	Aims at developing the Skill in applying manufacturing techniques through laboratory
7	13ME302	Machine Tool Engineering	3-0-2	4	11ES105		2											Introduced as a new course	Aims at developing the Skill in Operating Machine Tools through laboratory
8	13ME303	Operations Research	3-0-2	4	Nil					2								Course is retained from previous curriculum	Aims at developing skills in solving business problems

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S.No	Course Code	L-T-P	Cr	Pre-Req.	Student Outcomes											Course status	Rationale					
					a	b	c	d	e	f	g	h	i	j	k							
9	13ME304	Metrology & Instrumentation	3-0-2	4	13BS101 13ES102	2	2												2	Introduced as a new course	Aims at developing the Skill in Metrology & Instrumentation through laboratory	
10	13 ME205	Strength of Materials	3-0-2	4	13ES106		2			2										Course is retained from previous curriculum	Aims at developing the Skill in analyzing the materials strength through laboratory	
11	13ME206	Mechanisms and Machine Theory	3-0-2	4	13ES106	2	2			2										Introduced as a new course	Aims at developing the Skill in analyzing kinematics and dynamics of machines through laboratory	
12	13ME305	Finite Element Methods	3-0-2	4	13ME205	2	2													Introduced as a new course	Aims at developing the Skill in Analysis using FEM through laboratory	
13	13ME306	Mechanical Engineering Design	3-0-2	4	13ME205			3		2										Course is retained from previous curriculum	Aims at developing the Skill in designing machine elements through laboratory	
14	13ME402	Machine Design	3-0-2	4	13ME205			3												Course is retained from previous curriculum	Aims at developing the Skill in designing transmission elements through laboratory	
15	13ME403	Industrial Engineering Techniques	3-0-2	4	Nil															Course is retained from previous curriculum	Aims at developing skill in practicing the industrial techniques	
V	PROFESSIONAL ELECTIVES																					
Automobile Engineering																						
1	13ME335	Automobile Engineering	3-0-0	3	13ME301	1				1										Course is retained from previous curriculum	Develops basic knowledge in the field of Automobile Engineering	
2	13ME345	Computer Aided Design	3-0-0	3	13ME205	2														Course is retained from previous curriculum	Develops basic knowledge in the field of modeling through CAD	
3	13ME346	Vehicle Dynamics	3-0-0	3	13ME206					2										Introduced as a new course	Develops basic knowledge in understanding the vehicle dynamics	
4	13ME364	Automobile Chassis and Body Engineering	3-0-0	3	13ME301	1														Introduced as a new course	Develops basic knowledge in the design of automobile chassis	

S.No	Course Code	L-T-P	Cr	Pre-Req.	Student Outcomes											Course status	Rationale				
					a	b	c	d	e	f	g	h	i	j	k						
Flexible Manufacturing Systems																					
5	13ME369	Engine Systems and Performance	3-0-0	3	13ES201		2										1	Introduced as a new course	Develops basic knowledge in understanding performance of engine		
1	13ME349	Fatigue, Creep and Fracture	3-0-0	3	13ME205		2			2								1	Introduced as a new course	Develops basic knowledge in understanding the mechanics related to fracture and fatiguing conditions	
2	13ME365	Flexible Manufacturing Systems	3-0-0	3	13ME302					2								1	Introduced as a new course	Develops basic knowledge in the field of Flexible Manufacturing Systems	
3	13ME366	Modern Manufacturing Processes	3-0-0	3	13ME204					2									Course is retained from previous curriculum	Develops basic knowledge in the field of modern manufacturing processes	
4	13ME367	Cellular Manufacturing	3-0-0	3	13ME302					2									Introduced as a new course	Develops basic knowledge in the field of cellular manufacturing	
5	13ME368	Computer Integrated Manufacturing	3-0-0	3	13ME302					1									Course is retained from previous curriculum	Develops basic knowledge in the field of computer integrated manufacturing	
Mechatronics																					
1	13ME356	Mechatronics System and Control	3-0-0	3	NIL				2		2								Introduced as a new course	Develops basic knowledge in the field of Mechatronics	
2	13ME357	Modelling and Simulation of Mechatronic Systems	3-0-0	3	NIL					3									Introduced as a new course	Develops basic knowledge in the field of Mechatronics	
3	13ME358	Signal Processing in Mechatronic Systems	3-0-0	3	13ES205					2									Introduced as a new course	Develops basic knowledge in the field of Mechatronics	
4	13ME359	Fuzzy Sets and Artificial Intelligence	3-0-0	3	NIL														2	Introduced as a new course	Develops basic knowledge in the field of Mechatronics
5	13ME360	Engineering Smart Materials for Mechatronic Applications	3-0-0	3	13ME203		2													Introduced as a new course	Develops basic knowledge in the field of Mechatronics



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S.No	Course Code	L-T-P	Cr	Pre-Req.	Student Outcomes											Course status	Rationale	
					a	b	c	d	e	f	g	h	i	j	k			
General Electives																		
1	13ME331	Refrigeration and Air Conditioning	3-0-0	3	13ES201	2				2							Course is retained from previous curriculum	Develops basic knowledge in the understanding the working principles of Refrigeration and Airconditioning
2	13ME341	Advanced Strength of Materials	3-0-0	3	13ME205	2				2							Course is retained from previous curriculum	Develops basic knowledge in applying the methods for analyzing different structures
3	13ME334	Power Plant Engineering	3-0-0	3	13ME202					2							Course is retained from previous curriculum	Develops basic knowledge in the understanding the Power plant Engineering
4	13ME337	Computational Fluid Dynamics	3-0-0	3	NIL					2							Course is retained from previous curriculum	Develops basic knowledge in the understanding the computational fluid dynamics
5	13ME344	Vibrations Engineering	3-0-0	3	13ES106	2				2							Course is retained from previous curriculum	Develops basic knowledge in the understanding the concepts of Vibrations and its effects
6	13ME374	Operations Management	3-0-0	3	NIL					2							Course is retained from previous curriculum	Develops basic knowledge in the understanding the management principles required in an organization
Management Electives																		
1	11HS202	Paradigms in Management Thought	3-0-0	3	NIL								1	1			Course is retained from previous curriculum	Aims at developing knowledge required to become an entrepreneur
2	11HS203	Indian Economy	3-0-0	3	NIL	1	1										Course is retained from previous curriculum	Aims at developing knowledge required to become an entrepreneur
3	11HS208	Managing Personal Finance	3-0-0	3	NIL	1	2	3									Course is retained from previous curriculum	Aims at developing knowledge required to become an entrepreneur
4	11HS209	Basics of Marketing for Engineers	3-0-0	3	NIL		3										Course is retained from previous curriculum	Aims at developing knowledge required to become an entrepreneur
5	11HS211	Organization Management	3-0-0	3	NIL	1		1									Introduced as a new course	Aims at developing knowledge required to become an entrepreneur

S.No	Course Code		L-T-P	Cr	Pre-Req.	Student Outcomes											Course status	Rationale		
						a	b	c	d	e	f	g	h	i	j	k				
VI		OPEN ELECTIVES																		
1	12OE442	Mechatronics	3-0-0	3	NIL			2		2									Course is retained from previous curriculum	Aims at developing employability skills
2	12OE443	Robotics	3-0-0	3	NIL	3		2											Course is retained from previous curriculum	Aims at developing skills in the field of Robotics
VII		PROJECT																		
1		Industrial Training		2	NIL				2	2					3	3	2		Course is retained from previous curriculum	Aims at developing skill by undergoing to Industrial internship
2	13TP401	Term Paper		2	NIL				2	2					3	2			Course is retained from previous curriculum	Aims at developing skill by doing a project
3		Minor Project		2	NIL				2	2					3	2			Introduced as a new course	Aims at developing skill by doing a project
4	13PS401/ 13PW401	Practice School/Project Work		12	NIL				3	3					3	3			Course is retained from previous curriculum	Aims at developing skill by doing a project/internship in a industry


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2013-2017 BATCH Course Outcomes
Course Articulation Matrix

Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k
					11BS104	ENGINEERIN G CHEMISTRY	4	CO1	Examine water quality and select appropriate purification technique for intended problem		2	2			
			CO2	Predict potential complications from combining various chemicals or metals in an engineering setting		2	2								
			CO3	Discuss fundamental aspects of electrochemistry and materials science relevant to corrosion phenomena		2	2								
			CO4	Apply phase rule, polymers, conducting polymers and nano chemistry to engineering processes			2								
			CO1	Understand the concept of forces and apply the static equilibrium equations.	1				2						
			CO2	Analyze co-planar and non co-planar system of forces.	2				2						
			CO3	Apply the concept of centroid & centre of gravity to determine moment of inertia.	2				2						
			CO4	Analyze the rigid bodies under translation and rotation with and without considering forces.	2				2						
13ES106	ENGINEERIN G MECHANICS	4	CO1	Explain how ultrasonic waves are produced and detected, Determine flaws present inside a material using NDT techniques.	1										
			CO2	Compute the magnetic induction produced by current carrying conductors by using Biot-Savart law & Ampere's	1										
			CO3	Understand different aberrations in lenses and their corrections, phenomenon of interference in thin films of	1										
			CO4	Explain the working of optoelectronic devices like LED, photodiode, photo transistor and solar cells, Explain the	1										
13BS103	ENGINEERIN G PHYSICS	4													

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k	
13HS102	LANGUAGE AND REASONING SKILLS	3	CO1	Understand the method of identifying the meaning of words and apply them in contexts.							2					
			CO2	Understand and analyze different cultures and the importance of empathy in cross-cultural communication.						2						
			CO3	Understand and analyze seven techniques of reading and improve reading speed.							2					
			CO4	Understand and apply writing strategies in office/ formal communication								2				
13BS102	DIFFERENTIAL EQUATIONS	4	CO1	Describe different situations required to model differential equations. Classify the differential equations and identify	2	2										
			CO2	Illustrate modeling an engineering problem as a first order ordinary differential equation (ODE) and solving it using	2	1										
			CO3	Analyze engineering problem solutions in particular electric circuits, deflection of beams, free oscillations,	2	2										
			CO3	Illustrate to model an engineering problem second order PDEs namely one dimensional wave and heat equations,	2	2										
			CO1	Understand the importance of environmental education and conservation of natural resources									1			
			CO2	Understand the importance of ecosystems and biodiversity.										1		
11BS105	ECOLOGY AND ENVIRONMENT	2	CO3	Understand the knowledge on solid waste management										1		
			CO4	Understand the knowledge on disaster management and EIA process											1	
			CO1	Project based workshop to prepare different models with the aid of workshop trades i.e., Carpentry and Tin smithy												2
			CO2	Project based workshop to prepare different models with the aid of workshop trades i.e., House wiring and Fitting												2
13BS105	WORKSHOP PRACTICE	2	CO3	Project based workshop to prepare different models with the aid of workshop trades i.e., Fitting											2	

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k	
13BS101	LINEAR ALGEBRA AND MULTIVARIABLE CALCULUS	4	CO1	Perform elementary operations on matrices including determination of rank and inverse, demonstrate mastery in	2	2			2							
			CO2	Interpret and apply differential calculus on problems involving rate of change. Explain the geometrical	2	1			2							
			CO3	Illustrate the applications of integral calculus in solving problems on area, volume, displacement, work, etc.	2	2			2							
			CO4	Determine gradient, divergence and curl of vector point functions with their properties. Calculate the line, surface	2	2			2							
13ES101	PROBLEM SOLVING THROUGH PROGRAMMING	4	CO1	Illustrate how problems are solved using computers and programming.	2				2							
			CO2	Interpret & Illustrate user defined C functions and different operations on list of data.	2				2							
			CO3	Implement Linear Data Structures and compare them.		2										
			CO4	Implement Binary Trees.		2										
13ES102	MEASUREMENTS	4	CO1	Understand and apply the fundamentals of a measurement system, characteristics, transducers and metrology using	2	2										
			CO2	Understand various electrical & computer parameters, and apply different measuring techniques on various electrical	2	2										
			CO3	Understand electronic & electro-physiological parameters, and apply measuring techniques on electronic parameters	2	2										
			CO4	Understand and apply different measuring techniques on civil and mechanical parameters using simulation and	2	2										
13HS101	ENGLISH	3	CO1	Kinesics: To enable the students with the study of body language as it is an essential component of soft skills.		1				2	3					
			CO2	Lexis: Vocabulary building		1				2	3					
			CO3	English usage and mechanics: Grammar and verbal reasoning		1					2	3				
			CO4	Office communication to improve learning skills		1					2	3				



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k	
13ES103	ENGINEERING MATERIALS	3	CO1	Understands structure of crystalline solids, kinds of crystal imperfections and appreciates structure-property	1											
			CO2	Understands the role of electronic energy band structures of solids in governing various electrical and optical properties	1											
			CO3	Understands role of molecular vibrations in determining thermal properties of materials and deformation of	1											
			CO4	Understands spin and orbital motion of electrons in determining magnetic properties of materials and identifies	1						1				1	
13HS104	HUMAN VALUES	2	CO1	realize and understand the basic aspiration, harmony in the human being.						1					1	
			CO2	envisage the roadmap to fulfill the basic aspiration of human beings.												
			CO3	Analyze the profession and his role in this existence.						2					2	
			CO4	Develops holistic perception by understanding harmony in nature							2					2
11ES104	ENGINEERING GRAPHICS WITH CAD	2	CO1	Draft Orthographic views, projections of planes and, solidsmanually and by using CAD software Tool					2							
			CO2	Drafting Sectional views, Isometric views manually and by using AutoCAD					2							
			CO3	Development of surfaces and perspectives views manually and by using AutoCAD					2							
			CO1	Identify different mathematical problems and reformulate them to facilitate numerical treatment using an appropriate	2											
13BS201	MATHEMATICAL METHODS	3	CO2	Apply Fourier series, Fourier transforms and Z-transforms to analyze various signals.	2											
			CO3	Construct the probability distribution of a random variable, based on a real-world situation, and use it to compute	2											



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k			
13ESS203	NETWORK THEORY	4	CO1	Understand the VI characteristics of electrical elements, solution of complex problems of DC circuits using	1	1									1			
			CO2	Understand the fundamentals and interconnection relations of 3 – phase circuits	1												1	
			CO3	Analyze the series and parallel resonance and magnetic circuits	2	2												2
			CO4	Analyze the transient analysis of DC / AC circuits, two port networks and solve complex networks using topology	2	2												2
13ME201	FLUID MECHANICS & HYDRAULIC MACHINES	4	CO1	Apply physical laws related to fluid static (Pascal's law and Hydrostatic law) in applications involving fluid flow.					2									
			CO2	Apply fluid governing equations related to Fluid kinematics and dynamics (Continuity, Euler's, and Bernoulli's					2									
			CO3	Estimate different losses in pipe and use impulse momentum equation to analyze impact of jet on various					2									
			CO4	Demonstrate and analyze the appropriate use of water turbine and centrifugal pump in given application.					2									
			CO5	Demonstrate the use of flow and pressure measuring devices in fluid flow applications.		2												
13 ME204	MANUFACTURING PROCESSES	4	CO1	Understand the concepts of manufacturing processes and engineering materials.	1													
			CO2	Choose appropriate casting technique's and apply them for making the desired castings with specified size and shape.	1													
			CO3	Create the components of desired geometry by identifying appropriate forming processes.	1													
			CO4	Evaluate the welded components produced by inspection and testing methods.	1													
			CO1	Apply concepts of stress and strain to analyze members with axial load and torsion individually					2									

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k			
13ME205	STRENGTH OF MATERIALS	4	CO2	Analyze the members subjected to combination of stresses;														
				Examine the behavior of beams subjected to lateral loads by														
				sketching shear force and bending moment diagrams														
			CO3	Analyze structural behavior of beams by determining normal and														
				shear stresses and determining slopes and deflections								2						
			CO4	Analyze structural behavior of columns under load and thin pressure vessels									2					
				Identify various mechanical properties of materials by performing tests		2												
			CO1	Apply first law of thermodynamics to non flow systems		2												
				Apply steady flow energy equation and second law of thermodynamics to various processes and engineering		2												
				apply principle of entropy and thermodynamic relations to thermodynamic system and process		2							2					
Evaluate the performance of Otto, Diesel, Dual cycles and Refrigeration cycles		2																
CO2	Apply first law of thermodynamics to non flow systems		2															
	Apply steady flow energy equation and second law of thermodynamics to various processes and engineering		2															
	apply principle of entropy and thermodynamic relations to thermodynamic system and process		2															
	Evaluate the performance of Otto, Diesel, Dual cycles and Refrigeration cycles		2															

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k	
13ME202	APPLIED THERMODYNAMICS	4	CO1	Understand the properties of Pure substances and analyze the Rankine cycle efficiency	2		2									
			CO2	Understand the working of Boilers and Analyze the performance of Steam turbines	2		2									
			CO3	Apply the principles of nozzle and analyze the performance of Condensers	2		2									
			CO4	Apply the principles of Refrigeration and Psychrometry to refrigeration and air conditioning units	2		2									
			CO5	Able to do design a power plant , air conditioning unit and a refrigeration plant			2									
13ME206	MECHANISMS AND MACHINE THEORY	4	CO1	Identify various possible 4 link mechanisms and their inversions and applicability	1											
			CO2	Analyze mechanisms kinematically using velocity and acceleration diagrams	2											
			CO3	Generate cam profiles and Analyze gears and gear trains kinematically	2											
			CO4	Perform balancing of rotating and reciprocating parts and identify gyroscopic effects on Ships & Automobiles					2							
			CO5	Design Kinematically and Simulate mechanisms by using ADAMS software and analyze the data			2									
13ES202	OBJECT ORIENTED PROGRAMMING	4	CO1	Understand Basic Concepts of OOP and apply the concepts of classes and objects through Java Language.	2			2								
			CO2	Apply the concepts of constructors, Overloading, parameter passing, access control, Inheritance.	2			2								
			CO3	Apply Packages, Interfaces, Exception Handling.	2			2								
			CO4	Apply I/O Streams and understand Basic Concepts of Multi-Threading	2			2								
			CO5	Develop programs and projects in Java.	2			2								



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k		
13ES204	DATA STRUCTURES	4	CO1	Student will be able to apply measures of efficiency to algorithms and Compare various linear data structures like	2				2								
			CO2	Student will be able to analyze and compare linear data structures and analyze different searching and hashing	2				2								
			CO3	Student will be able to analyze and compare various non – linear data structures like Trees and Graphs.	2				2								
			CO4	Student will be able to analyze and compare various sorting algorithms, to select from a range of possible options, to	2					2							
			CO5	Student will be able to understand and execute lab experiments and develop a project along with his/her		2											
13ES205	SIGNAL PROCESSING	4	CO1	Understand the representation, manipulation and processing operations of DT signals and systems				1	1								
			CO2	Interpret the analysis of DT systems using Z.T.				2	2								
			CO3	Apply the Fourier Transformation techniques for DT sequences and their applications.				2	2								
			CO4	Ability to design, Implementation and realization of digital filters.				2	2								
			CO5	Design and Implementation of the Signal processing algorithms in Matlab.													3



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k		
13 BS 202	COMPLEX VARIABLES AND DISCRETE MATHEMATICS	3	CO1	Construct the analytic function and evaluate the contour integrals also represent analytic function as a series.	2												
			CO2	Evaluate the integrals involving Bessel and Legendre polynomials and Model the given phenomena as difference	2												
			CO3	Use graphs and trees as tools to visualize network problems	1												
			CO4	Apply algorithms and theorems for construction of spanning	2												
14ME221	CHINE DRAWING	Nil	CO1	Draw various machine elements and parts						2					2		
			CO2	To Draw Assembly drawing from the given part drawings; To draw Part Drawings from the given assembly drawing							2					2	
			CO1	Understand the various forms of available energy and energy related aspects.									1			1	
			CO2	Apply energy auditing methodology to estimate energy conservation of different case studies.									2			2	
13AC201	ENERGY AND SOCIETY	Nil	CO3	Understand the environmental and geological impacts on the energy vice versa.								1			1		
			CO4	Apply the planning and controlling aspects for economical energy usage.								2			2		
			CO1	Identify and differentiate various types of materials, apply concepts of Miller indices and understand various material	2												
			CO2	Analyze the concept of cooling curves, equilibrium phase diagrams, and heat treatment techniques.	2												
13ME203	METALLURGY	4	CO3	Identify the importance of composites, ceramics and strengthening mechanisms.	1												
			CO4	Identify various nano, smart, bio-materials and powder metallurgy process and their applications.	1												
			CO5	Identification of metals and their alloys from microstructure study.		2											

Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k
13ME301	INTERNAL COMBUSTION ENGINES AND GAS TURBINES	4	CO1	To analyze various operating variables that affects I.C engines.					2						
			CO2	To analyze the normal combustion and abnormal combustion in I.C engines					2						
			CO3	Analyze the performance parameters of I.C engines, and able to solve the problems.					2						
			CO4	Analyze various methods for improving efficiencies of gas turbines. Evaluate the efficiencies of Gas Turbines and Jet					2						
			CO5	To design and conduct experiments as well as to analyze and interpret data			2								
13ME302	MACHINE TOOL ENGINEERING	4	CO1	Explain about phenomenon of metal cutting, chip formation, types of chips and chip breakers, tool materials					2						
			CO2	Identify and describe the functions of the parts of lathe, shaper, planar and slotting machines, explain operations					1						
			CO3	Describe the components of drilling, boring, milling and grinding machines and also explain operations performed					1						
			CO4	Identify and describe elements of Jigs and Fixtures and also explain types of locators and clamps used. Students can					1						
			CO5	Demonstrate various operations performed on lathe, mill, shaper, slotter, and drill and grinding machines and also											2
13ME303	OPERATIONS RESEARCH	4	CO1	Identify Optimum solutions for various single objective problems using Linear Programming models					2						
			CO2	Identify Optimum Solutions through Transportation and Assignment models					2						
			CO3	Identify Optimum Solutions through Game theory, DPP, Queuing theory & Simulation models					2						
			CO4	Solve project management problems using CPM, PERT and Crashing					2						
			CO5	Solve Various Linear Programming, Transportation, Assignment, Game Theory and Simulation models through											2



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k			
13ME305	FINITE ELEMENT METHODS	4	CO1	Analyze and evaluate 3D stresses & strains and the basic concepts of FEM	2													
			CO2	Analyze and evaluate 1D structural problems and plane trusses using FEM													2	
			CO3	Analyze and evaluate 2D problems including axis-symmetric solids subjected to axis-symmetric loading using														2
			CO4	Analyze and evaluate Scalar field (thermal) problems and structural dynamic problems using FEM														2
			CO5	Apply the theoretical concepts to conduct various interpretation by using Analysis software's		2												
13AC301	ADVANCED EMPLOYABILITY SKILLS	Nil	CO1	Understand and adopt appropriate behavior patterns		1												
			CO2	Understand, remember and apply lexical, syntactic skills related to grammar, usage and composition					2									
			CO3	Analyze and apply various interpersonal skills in day-to-day communication					2									
			CO4	Understand, learn and apply the principles of various types of GDs and Personal Interviews					2									
13ME306	MECHANICAL ENGINEERING DESIGN	4	CO1	Analyze the stress and strain on mechanical components; and understand, identify and quantify failures resulting					2									
			CO2	Design of Shafts and Couplings			3											
			CO3	Design of Power Screws temporary and permanent joints			3											
			CO4	Design of Springs and Flywheels			3											
			CO5	Analyze machine elements using ANSYS software														2



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k		
13ME304	METROLOGY AND INSTRUMENTATION	4	CO1	Understand the elements of measurement system, experimental test plan and to identify the importance of	2												
			CO2	Apply gear measurements coordinate measuring machines, slip gauges, comparators, transducers, sine bar and angle	2												
			CO3	Select profile projectors, autocollimators, stylus instruments and to understand temperature measurement	2												
			CO4	Analyze strain, pressure, force & torque measurements and to understand D/A & A/D conversion	2												
			CO5	Experimental Analysis with Measuring Equipment and Instrumentation Equipment's	2												
13ME401	HEAT TRANSFER	4	CO1	Apply Fourier law of conduction for one dimensional heat conduction in various systems					2								
			CO2	Analyze combined conduction and convective heat transfer under steady and unsteady state condition					2								
			CO3	Apply Newton's law of cooling and evaluate convective heat transfer coefficient for different fluids					2								
			CO4	Thermal design of two fluid heat exchangers. Understand and apply laws of radiation and evaluate radiate heat					2								
			CO5	Experimental verification of various heat transfer parameters (Lab)		2											
13ME335	AUTOMOBILE ENGINEERING	3	CO1	Understand different types of chassis, engine components, fuel systems and its working principles	1				1								
			CO2	Understand different components of transmission system, cooling and lubrication systems	1				1								
			CO3	Understand different components of suspension, steering and braking systems	1				1								
			CO4	Understand different electric and electronic systems used in automobiles and pollution control techniques used in SI and	1				1								



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k		
13ME365	FLEXIBLE MANUFACTURING SYSTEMS	3	CO1	Apply Group Technology concept to identify cells and machine sequencing with basic concepts of manufacturing					2								
			CO2	Apply Operational parameters and System performance measures to evaluate FMS Components					2								
			CO3	Schedule jobs in FMS Environment by understanding FMS Host Computer and Tool Management System						2							
			CO4	Understand Implementation Issues, Applications of FMS and Robot Classification, Programming, applications												1	
13ME356	MECHATRONICS SYSTEM AND CONTROL	3	CO1	Understanding the basic concepts of Modeling, Testing in terms of time domain and frequency domain			1										
			CO2	Analyze the basic designing concepts of Modern and optimal controllers such as state feedback and state					2								
			CO3	Analyze the basic designing concepts of Digital controller for digital systems			2										
			CO4	Analyze the basic designing concepts of Non-linear controllers for non-linear systems				2									
13ME331	REFRIGERATION AND AIR CONDITIONING	3	CO1	Analyze COP of different refrigeration cycles with different methods of refrigeration using different						2							
			CO2	Analyze the performance of Vapor Compression Refrigeration with modification of cycle and its						2							
			CO3	Understanding the working of Cascade systems for low temperature Production and of VAR system						1							
			CO4	Analyze cooling load for comfort and industrial air conditioning on basis of processes on psychometric charts							2						
13ME345	COMPUTER AIDED DESIGN	3	CO1	Understand the Fundamentals of CAD and display devices											1		
			CO2	Apply the concept of geometric modeling												2	
			CO3	Able to apply concept of Surface and solid modeling													2
			CO4	Application of various Geometric transformations													2



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k	
13ME366	MODERN MANUFACTURING PROCESSES	3	CO1	Select an appropriate mechanical energy based machining processes for suitable application.		2	2		2			2				
			CO2	Select an appropriate chemical energy and electro-chemical energy based machining processes for suitable	2	2	2		2			2				
			CO3	Select an appropriate thermo electric energy based machining processes for suitable application.		2	2		2				2			
			CO4	Select an appropriate advanced welding and advanced forming processes for suitable application.		2	2		2				2			
13ME357	MODELLING AND SIMULATION OF MECHATRONIC SYSTEMS	3	CO1	Build mathematical models of mechatronic systems comprising of combinations of mechanical, electrical,					3						3	
			CO2	Represent system models using transfer function and /or state space approach.					2						2	
			CO3	Understand and apply system identification techniques for synthesizing system models					2							2
			CO4	Evaluate time and frequency response of systems					3							3
13ME341	ADVANCED STRENGTH OF MATERIALS	3	CO1	Analyze Indeterminate Beams					2							
			CO2	Analyze Curved Beams and Beams subjected to Unsymmetrical bending					2							
			CO3	Apply Energy methods to find deflections in simple Structures					2							
			CO4	Analyze Stresses in Rotating members and Thick cylinders					2							
13ME337	COMPUTATIONAL FLUID DYNAMICS	3	CO1	Understand the Fundamentals of CFD and governing equations					2						2	
			CO2	Understand different CFD techniques and methods of solutions					2						2	
			CO3	Understand time integration methods and grid generation					2						2	
			CO4	Solving N-S equations and understand turbulence modeling					2						2	

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k
13ME402	MACHINE DESIGN	4	CO1	Design and selection of various belt and chain drives			3								
			CO2	Design and Selection of the suitable bearing for the given loading condition			3								
			CO3	Analyze kinematic and dynamic aspects in design of brakes, clutches and IC engine components			3								
			CO4	Design and analysis of different types of gear drives			3								
			CO5	Analyze machine elements using analysis software							2				
13ME403	INDUSTRIAL ENGINEERING TECHNIQUES	4	CO1	Apply various work-study techniques to determine the standard time and efficiency.										2	
			CO2	Analyze various quality control techniques for bringing out the best quality output.										2	
			CO3	Apply various plant layout and production scheduling techniques to optimize productivity.										2	
			CO4	Calculate future demand for the product in the market by applying appropriate forecasting technique.										2	
			CO1	Analysis of loads acting on vehicle with different conditions and Understanding of Aerodynamics						2					
13ME346	VEHICLE DYNAMICS	3	CO2	Understanding of tires and Analysing performance of vehicle on braking conditions					2						
			CO3	Understanding of Multi Body dynamics and Analyzing roll over					2						
			CO4	Analysis of steering and suspension systems					2						
			CO1	Assess the failure of unflawed structural components			2			2					
13ME349	FATIGUE, CREEP AND FRACTURE	3	CO2	Assess the fatigue life of structural components under the specified load spectrum			2			2					
			CO3	Evaluate the fracture toughness and assess the life of flawed structural components			2			2					
			CO4	Assess the life of structural components under creep			2			2					
			CO1	Understand the sampling theorem and its importance in the digital world			1								
13ME358	SIGNAL PROCESSING	2	CO2	Understand the concepts of z-transform, dtf, fft algorithms and their computations, Design of fir and iir filters			1								

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k
13ME334	POWER PLANT ENGINEERING	3	CO1	Understand the working of system and subsystems of Hydro power plant and to Draw their layout diagrams.					2						
			CO2	Understand the working of system and subsystems of Diesel and Thermal power plants and to draw their layout					1						
			CO3	Understand the working of system and subsystems of Nuclear and Non-conventional energy sources power plants					1						
			CO4	Understand power plant economics, methods of tariff and conservation of energy.					2						
13ME364	AUTOMOBILE CHASSIS AND BODY ENGINEERING	3	CO1	Understand different car body types and safety in car	1										
			CO2	Understand construction of bus bodies and commercial vehicles	1										
			CO3	Understand vehicle aerodynamics, body loads and noise reduction techniques	1										
			CO4	Understand different materials used in the vehicle body construction and painting	1										
13ME367	CELLULAR MANUFACTURING	3	CO1	Understand the concept of group machining, objectives, terminologies, factors influencing success, implementation	1										
			CO2	Apply cell formation techniques to identify cells and part families.					2						
			CO3	Evaluate solutions obtained by cell formation techniques using performance measures					2						
			CO4	Apply production control activities to cellular manufacturing problems.					2						

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k		
13ME359	FUZZY SETS AND ARTIFICIAL INTELLIGENCE	3	CO1	Basic concepts of Fuzzy Sets, Fuzzy Logic, Operations on Fuzzy sets and Probability and Possibility Measures.											2		
			CO2	Fuzzy Methodologies, Relations and Applications of Fuzzy sets in various domains.												2	
			CO3	Introduction to AI, Production system, Interpret the Problems and search related to AI and Predicate Calculus													2
			CO4	Knowledge Representation, Semantics Nets, Frames, and developing Knowledge base expert systems for various													2
13ME369	ENGINE SYSTEMS AND PERFORMANCE	3	CO1	Review analysis on Engine Basic Theory and Different Engine Technologies		2											
			CO2	Performance Analysis on Mixture preparation systems for SI and CI Engines, Combustion in Engines		2											
			CO3	Analysis of Engine Friction and Lubrication, Cooling Systems, Speed Governing and Air Induction		2											
			CO4	Performance Analysis of Engine Exhaust and Emission, Engine Testing and Performance, New Engine technologies		2											
13ME368	COMPUTER INTEGRATED MANUFACTURING	3	CO1	Apply the concept of group technology to identify part families and applications											2		
			CO2	Understand the concepts of Flexible Manufacturing System and computerized manufacturing planning systems	1												
			CO3	Comprehend Computer aided quality control and automatic identification techniques	1												
			CO4	Understand aspects of Computer networks and trends in Manufacturing systems	1												
13ME360	ENGINEERING SMART MATERIALS FOR MECHATRONIC APPLICATIONS	3	CO1	Piezo electric materials to Sensing & Actuation	2												
			CO2	Shape memory alloys(SMA) to Sensing & Actuation	2												
			CO3	Electro-active polymers(EAPs) to Sensing & Actuation	2												
			CO4	Magnetostrictive materials for Sensing & Actuation. Future applications, trends of smart materials and smart material												2	



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	h	i	j	k		
13ME574	OPERATIONS MANAGEMENT NT	3	CO1	Classify and explain the benefits of various production systems, layouts and usage of material handling equipment.											1		
			CO2	Calculate future demand for the product in the market by applying appropriate forecasting technique.												2	
				Apply various production scheduling techniques to optimize productivity.													2
			CO4	Analyze various quality control techniques for bringing out the best quality output.													2
13ME344	VIBRATIONS ENGINEERING	3	CO1	Develop a mathematical model of a vibrating system and Perform detailed analysis of the response of 1DOF	2												
			CO2	Perform detailed analysis of the response of 1DOF damped systems under free vibration regime						2							
			CO3	Perform detailed analysis of the response of 1DOF systems under forced vibration regime							2						
			CO4	Perform detailed analysis of the response of two and multi DOF systems under both free and forced vibration regimes							2						
			CO1	Identify appropriate sensors, Identify appropriate actuation system for a given application.				2									
			CO2	Identify appropriate microcontroller for a given application and to build a mathematical Model of system for evaluating								2					
			CO3	Suggest an appropriate closed loop control strategy to attain the desired system behavior									2				
			CO4	Suggest a Mechatronic product design for a given application and evaluate its performance.						3							
12OE442	MECHATRON ICS	3	CO1	Analyze existing robotic systems with respect to their anatomy, type, performance specifications, end effectors					2								
			CO2	Suggest a robotic system design with respect to the suitable sensors, actuators for an intended application and simulate												3	
			CO3	Analyze robot manipulator performance with respect to digital control architecture comprising of PLC's													2
			CO4	Comprehensive understanding and identification of suitable Robotic system													2
12OE443	ROBOTICS	3	CO4	Applying basic methods of photography for Engineering problems.											2		

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Department of Mechanical Engineering

Annexure-2

M.Tech in Thermal Engineering

2013-14 Admitted Batch Course Structure

S.No	Course Code	Course Title	Course Category	L-T-P	Credits	Pre-Requisite	Program Outcome							Course Status	Rationale		
							a	b	c	d	e	f	g				
1	13TE501	Numerical Methods in Thermal Engineering	Core	3-1-0	4	Nil	1	2	2							Introduced as a new course	Aims at inducing skill of applying numerical methods having complete generality for heat and mass transfer, fluid flow
2	13TE502	Advanced Thermodynamics	Core	3-1-0	4	Nil	3	2	3	2	2					Course is modified from previous curriculum	Aims at inducing basic knowledge of understanding kinetic theory of gases and to give insight on statistical thermodynamics
3	13TE503	Design of Thermal Systems	Core	3-1-0	4	Nil	3	2	3	2	2		2			Course is modified from previous curriculum	Aims at inducing basic knowledge of understanding of design of different types of thermal systems
4	13TE504	Advanced Heat & Mass Transfer	Core	3-1-0	4	Nil	3		3	3						Introduced as a new course	Aims at inducing skill of applying principles of heat transfer to develop mathematical models
5	13TE601	Incompressible and Compressible Flows	Core	3-1-0	4	Nil	2	2								Introduced as a new course	Aims at inducing basic knowledge of principles and applications of fluid mechanics
6	13TE602	Computational Fluid Dynamics	Core	3-1-0	4	Nil	2		2	2						Introduced as a new course	Aims at inducing skill of analyzing fluid dynamic problems
7	13TE603	Refrigeration and Cryogenics	Core	3-1-0	4	Nil	2		2							Introduced as a new course	Aims at inducing skill to develop systems for liquefaction of gases and in achieving super conductivity.
8	13TE604	Measurements in Thermal Engineering	Core	3-1-0	4	Nil		3	2	2	2					Introduced as a new course	Aims at inducing skill of applying the scientific and engineering methods for field measurement and derived quantities
9	13TE531	Heat Exchanger Design		3-0-0	3	Nil	2		2		2					Course is modified from previous curriculum	Aims at inducing basic knowledge of understanding construction and design of different types of heat exchangers
10	13TE532	Convection and Two Phase Flow	Elective 1	3-0-0	3	Nil	2		2		2					Course is retained from previous curriculum	Aims at inducing skill of understanding of fluid dynamic mechanisms involved in convection and two phase heat transfer
11	13TE533	Compact Heat Exchangers		3-0-0	3	Nil	2		2		2					Course is retained from previous curriculum	Aims at inducing skill of understanding the principles of design, and operation of heat exchangers of different types



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S.No	Course Code	Course Title	Course Category	L-T-P	Credits	Pre-Requisite	Program Outcome							Course Status	Rationale
							a	b	c	d	e	f	g		
12	13TE541	Engine Systems and Performance	Elective 2	3-0-0	3	Nil	3				3	3		Course is retained from previous curriculum	Aims at inducing basic knowledge of engine development and its performance
13	13TE542	IC Engine Combustion and Pollution		3-0-0	3	Nil	3				3	3		Course is modified from previous curriculum	Aims at inducing basic knowledge of understanding pollution formation in SI and CI engines and to give insight about various devices
14	13TE543	Alternative Fuels	Elective 3	3-0-0	3	Nil	3				3	3		Course is retained from previous curriculum	Aims at inducing basic knowledge on the properties, applications, limitations and environmental impacts of different fuels
15	13TE641	Principles of Turbomachinery		3-0-0	3	Nil	2							Course is retained from previous curriculum	Aims at inducing basic knowledge on different types of turbomachinery used for energy transformation
16	13TE652	Gas Turbine Engineering	Elective 4	3-0-0	3	Nil	2							Course is modified from previous curriculum	Aims at inducing basic knowledge of in-depth analysis on thermodynamics of gas turbine cycles
17	13TE653	Turbo Compressors		3-0-0	3	Nil	2							Course is retained from previous curriculum	Aims at inducing basic knowledge of understanding the performance and operation of turbo compressors
18	13TE641	Energy Conservation, Management and Audit	Elective 4	3-0-0	3	Nil	3	3						Course is retained from previous curriculum	Aims at inducing basic knowledge of understanding energy audit and management
19	13TE642	Renewable Energy Technology		3-0-0	3	Nil	3	3						Course is modified from previous curriculum	Aims at inducing basic knowledge of understanding the issues relevant to energy efficiency and energy storage
20	13TE643	Solar Energy and Wind Energy	Elective 4	3-0-0	3	Nil	3	3						Course is retained from previous curriculum	Aims at inducing basic knowledge of understanding solar energy and wind energy
21	13TE551	Seminar		0-0-4	2	Nil	2	2			2			Course is retained from previous curriculum	Aims at inducing skill of delivering a seminar
22	13TE351	Term Paper	TL	0-0-4	2	Nil				3	3	3		Course is retained from previous curriculum	Aims at inducing skill of doing project
23	TL	Project				36	Nil				3	3	3		Course is retained from previous curriculum

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Course Outcomes vs Program Outcomes

Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	Program Outcomes							
					a	b	c	d	e	f	g	
13TE501	Numerical Methods in Thermal Engineering	4	CO1	Realize the importance of Numerical and Experimental Investigations	1							
			CO2	Acquire the knowledge in the behavior of fluid flows and heat transfer		2						
			CO3	Develop the discretization equations to the governing equations			2					
			CO4	Adopt a suitable solution technique to the discretization equations				2				
13TE502	Advanced Thermodynamics	4	CO1	Understanding the concepts of energy, thermodynamic potential and calculation of exergy of a system		3						
			CO2	Understanding kinetic theory of gases and intermolecular forces		2			3			
			CO3	Understanding various methods of statistical distribution of particles					2	1		
			CO4	Ability to construct figures for particle allocations depending on various probability distributions					2	2		
13TE503	Design of Thermal Systems	4	CO1	Studying in detail about the Design and Modeling of Thermal Systems.	3							
			CO2	Understanding about acceptable design of thermal system and studying its Economic Considerations.					2			2
			CO3	Studying about the problem formulation for optimization and its search methods and understanding Lagrange multiplier.				3			2	
			CO4	Understand about Geometric, linear and dynamic Programming and modeling of thermal equipment.		2				2		



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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g
13TE504	Advanced Heat & Mass Transfer	4	CO1	Understand both the physics and the mathematical treatment of one-dimensional, steady-state and transient conduction heat transfer.	2		2				
			CO2	Analyze free and forced convection problems involving complex geometries with proper boundary conditions			3	3			
			CO3	Apply the concepts of radiation heat transfer for enclosure analysis			3	3			
			CO4	Understand physical and mathematical aspects of mass transfer. Analyze combined heat and mass transfer from plates and in pipes.	3			3			
13TE531	Heat Exchanger Design	3	CO1	Classify heat exchangers and understand thermo hydraulic fundamentals of the exchangers	1						
			CO2	Apply LMTD and e- NTU methods in the design of different types of heat exchangers	2		2				
			CO3	Apply different methods in the design of shell and tube heat exchangers	2				2		
			CO4	Design of Compact heat exchangers and study of fouling control techniques	2		2				
13TE542	IC Engine Combustion and Pollution	3	CO1	Estimate the emissions from the I C Engines, Understand the combustion in IC Engines and emissions formation	3				3		
			CO2	Understand the SI Engine emission control technology and treatments	2						
			CO3	Understand the CI Engine emission control technology and treatments	2						

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g
13TE601	Incompressible and Compressible Flows	4	CO1	Follow the conservation equations based on control mass system and control volume formulation	1						
			CO2	Familiar with the techniques for analysis of inviscid incompressible flows		2					
			CO3	Familiar with the techniques for the solution of boundary layer equations			2				
			CO4	Understand the formulation of normal and oblique shock waves	2						
13TE602	Computational Fluid Dynamics	4	CO1	Understand the Fundamentals of CFD and deriving governing equations	2			2			
			CO2	Apply different CFD techniques to diffusion problems	2				2		
			CO3	Solving convection-diffusion problems and N-S equations	2				2		
			CO4	Understand numerical grid generation and apply time integration and turbulence methods to complex flows	2					2	
13TE603	Refrigeration and Cryogenics	4	CO1	Apply basic thermodynamic principles to produce low temperature and to the liquefaction systems.	2						
			CO2	Evaluate different types of cryogenic refrigerators and insulations and their applications.	2			2			
			CO3	Examine the properties of matter at low temperature and their measurement.				2			

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g
13TE604	Measurements in Thermal Engineering	4	CO4	Apply the principle of superconductivity, adiabatic demagnetization and dilution refrigeration etc.to produce low temperatures	2						
			CO1	Apply the scientific and engineering methods for field measurement and derived quantities			2	2			
			CO2	Analyze principles of presentation, estimation and data analysis				2	2	2	
			CO3	Apply the measurement of field quantities with probe and non-instructive techniques		3		2			
13TE632	Gas Turbine Engineering	3	CO4	Evaluate the measurement of derived quantities and analytical methods				2	2		
			CO1	Analysis of gas turbine cycles	2						
			CO2	Analyze performance characteristics of compressor and turbine	2						
			CO3	Understand material selection and fabrication techniques of gas turbine components	2						
13TE642	Renewable Energy Technology	3	CO4	Analyze gas turbine power generation and cogeneration systems	2						
			CO1	Understand different types of renewable energy sources and analyze their energy production	2	2					
			CO2	Understand the principle of OTEC, wind power and Analyze their effects in power generation	2	2					
			CO3	Understand different conversion techniques of biomass to useful fuel	3	3					
13TE642	Renewable Energy Technology	3	CO4	Analyze various types of Geo Thermal energy sources and their extraction techniques and apply them for conversion	3	3					

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Annexure-3

M.Tech in Mechatronics

2013-14 Admitted Batch Course Structure

S.No	Course Code	Course Title	Course Category	L-T-P	Credits	Pre-Requsite	Programme Outcome							Rationale		
							a	b	c	d	e	f	g			
1	13MT501	Fundamentals of Mechatronics	Core	3-0-0	3	Nil	2	2								Aims at inducing basic knowledge in Fundamentals of Mechatronics
2	13MT502	Advanced Engineering Mathematics	Core	3-1-0	4	Nil			2	2						Aims at inducing skill of applying mathematics to Engineering
3	13MT503	Sensors and Actuators	Core	3-0-0	3	Nil				2	1					Aims at inducing basic knowledge in selection of appropriate sensors and actuators in mechatronic applications
4	13MT504	Modeling and Simulation of Mechatronic Systems	Core	3-1-0	4	Nil	3		2	2						Aims at inducing skill of Evaluating time and frequency response of systems and control system design
5	13MTL550	Mechatronics Lab-I	Core	0-0-4	2	Nil			2						2	Aims at inducing skill in mechatronics through laboratory
6	13MT601	Robotics: Advanced Concepts and Analysis	Core	3-2-0	4	Nil			2	3	2	2				Aims at inducing skill of analyzing the dynamics of an existing robotic system
7	13MT602	Control of Mechatronic Systems	Core	3-2-0	4	Nil	2		2							Aims at inducing skill of designing different control approaches to mitigate the disturbances
8	13MT603	Mechatronics Product Design	Core	3-2-0	4	Nil	2	3	2	3						Aims at inducing an ability to model a mechatronic system and estimate its expected performance
9	13MT604	Precision Engineering	Core	3-2-0	4	Nil					1	2				Aims at inducing basic knowledge in design and the manufacture of high-precision machine tools
10	13MTL650	Mechatronics Lab-II	Core	0-0-4	2	Nil			2						2	Aims at inducing skill in mechatronics through laboratory

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S.No	Course Code	Course Title	Course Category	L-T-P	Credits	Pre-Requisite	Programme Outcome							Rationale	
							a	b	c	d	e	f	g		
11	13MT533	Signal Processing in Mechatronic Systems	Elective 1	3-0-0			1	2							Aims at inducing skill of analyzing multirate signal processing and various processors
12	13MT534	MEMS & NEMS			3-0-0	3	Nil	1	2						
13	13MT535	Vehicle Dynamics and Multi-body Systems	Elective 2	3-0-0			1	2							Aims at inducing an ability to analyze suspension system, steering system
14	13MT633	Emerging Smart Materials for Mechatronics Applications							2						
15	13MT634	Intelligent Visual Surveillance	Elective 3					2							Aims at inducing a basic knowledge in Intelligent Visual surveillance
16	13MT635	Microprocessors and Embedded Systems			3-0-0	3	Nil		2						
17	13MT531	Computational Fluid Dynamics	Elective 4				2		2						Aims at inducing skill of analyzing fluid dynamic problems
18	13MT532	Non Linear Optimization			3-0-0	3	Nil	2		2	1				3
19	13MT631	Industrial Automation	Elective 4	3-0-0	3	Nil		2	2						Aims at inducing skill of applying inspection technology to different products in the industries.
20	13MT632	Fuzzy Sets and Artificial Intelligence							2	2					
21	13MT551	Seminar		0-0-4	2	Nil	2	2				2			Aims at inducing skill of delivering a seminar
22	13MT651	Term Paper		0-0-4	2	Nil						3	3	3	Aims at inducing skill of doing project
23	MT	Project			36	Nil						3	3	3	Aims at inducing skill of doing project

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Course Outcomes vs Program Outcomes

Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g
13MT501	Fundamentals of Mechatronics	3	CO1	Analyze mechatronics in manufacturing and distinguish between traditional and mechatronics approaches	2						
			CO2	Be proficient in the use of Data conversion devices and Microprocessors controllers.	1						
			CO3	Be able to analyze and select suitable drives and mechanisms for industrial applications		2					
			CO4	Design and analyze the Hydraulic systems and understand PID controllers and CNC machines.		2					
13MT502	Advanced Engineering Mathematics	4	CO1	Perform elementary operations on matrices including determination of rank and inverse, demonstrate mastery in using matrix algebra			2	2			
			CO2	Interpret and apply differential calculus on problems involving rate of change			2	2			
			CO3	Illustrate the applications of integral calculus in solving problems on area, volume, displacement, work			2	2			
			CO4	Determine gradient, divergence and curl of vector point functions with their properties			2	2			
13MT503	Sensors and	3	CO1	Identify appropriate sensor for a particular Mechatronic system.				2			
			CO2	Analysis of hydraulic and pneumatic actuation systems for selection of appropriate actuation method for a particular Mechatronic system.				2			

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g
13MT504	Modeling and Simulation of Mechatronic Systems	4	CO1	Build mathematical models of mechatronic systems comprising of combinations of mechanical, electrical, pneumatic/ hydraulic			2	2			
			CO2	Analyze systems for their time response to a certain input using transfer function and /or state space approach	3						3
			CO3	Apply system identification techniques to synthesize system models	2			2			
			CO4	Evaluate time and frequency response of systems and control system design	1				2		
13MT534	MEMS & NEMS	3	CO1	Introduction to MEMS and Microelectronic technologies used for MEMS	1	2					
			CO2	Microsensors & MEMS applications in Biological, Chemical and Acoustic field.	1	2					
			CO3	Introduction to MEMS based nanotechnology	1	2					
			CO4	NEMS physics and NEMS architecture	1	2					
13MT635	Microprocessors and Embedded Systems	3	CO1	Understand the fundamentals of embedded applications		1					
			CO2	Architectural understanding of processors through interfacing (8086)		1					
			CO3	Programming model of microcontroller (8051 family)		1					

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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g	
13MT601	Robotics: Advanced Concepts and Analysis	3	CO1	Perform Velocity and Static analysis of Manipulators		2						
			CO2	Formulation of equation of motions by computer simulations			3	2				
			CO3	Apply the Planning and control methods for robots						2		
			CO4	Modeling and Controlling of flexible manipulators						2		
13MT602	Control of Mechatronic Systems	3	CO1	Understanding the basic concepts of Modeling, Testing in terms of time domain and frequency domain			1					
			CO2	Analyze the basic designing concepts of Modern and optimal controllers such as state feedback and state observers.	2							
			CO3	Analyze the basic designing concepts of Digital controller for digital systems			2					
			CO4	Analyze the basic designing concepts of Non-linear controllers for non-linear systems			2					
13MT603	Mechatronics Product Design	4	CO1	Identify appropriate sensors, Identify appropriate actuation system for a given application.	1		1					
			CO2	Identify appropriate microcontroller for a given application and to build a mathematical Model of system for evaluating open loop system			2	3				
			CO3	Suggest an appropriate closed loop control strategy to attain the desired system behavior.			1					

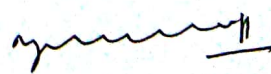
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Course Code	Course Title	Credits	CO NO	Description of the Course Outcome	a	b	c	d	e	f	g
13MT604	Precision Engineering	4	CO1	To understand concept of accuracy, errors & its causes.					1		
			CO2	To know about geometrical dimensioning and tolerance						2	
			CO3	To understand concept of surface roughness and learn methods to improve surface finish.					1		
			CO4	To understand precision engineering methods					1		
13MT531	Computational Fluid Dynamics	3	CO1	Understand the Fundamentals of CFD and deriving governing equations	2		2				
			CO2	Apply different CFD techniques to diffusion problems	2			2			
			CO3	Solving convection-diffusion problems and N-S equations	2			2			
			CO4	Understand numerical grid generation and apply time integration and turbulence methods to complex flows	2				2		
13MT631	Industrial Automation	3	CO1	Apply principles of automation towards material handling and analyze their performance.		2					
			CO2	Analyze performance of storage systems and product flow in different GT methods and cellular manufacturing.		2					
			CO3	Application and analysis of transfer line without internal storage and describe Inspection Technology			2				
			CO4	Describe different manufacturing supporting systems.			2				

Annexure-4

Pre-PhD Courses for 2013-14 Admitted Batch

S.No	PAPER-1	Course Status
1	Research Methodology	Course is modified from previous curriculum
S.No	PAPER-2	
1	Computational Fluid Dynamics	Introduced as a new course
2	Non Linear Optimization	Introduced as a new course
3	Fuzzy sets & Artificial Intelligence	Introduced as a new course
4	Systems Dynamics	Introduced as a new course
5	Finite Element Methods	Introduced as a new course
6	Performance Modeling & Analysis of Manufacturing Systems	Introduced as a new course
7	Advanced Vibrations	Introduced as a new course
8	Flexible Manufacturing Systems	Introduced as a new course
9	Tribology	Introduced as a new course
10	Cellular Manufacturing	Introduced as a new course
11	Industrial Hydraulic and Pneumatic Drives & Control	Introduced as a new course
12	Quality Engineering & Manufacturing	Introduced as a new course
13	Concurrent Engineering	Introduced as a new course
14	Design of Thermal Systems	Introduced as a new course
15	Engine Systems & Performance	Introduced as a new course
S.No	PAPER-3	
1	Alternative Fuels	Introduced as a new course
2	Incompressible & Compressible flows	Introduced as a new course
3	Computer Integrated Manufacturing	Introduced as a new course
4	Precision Engineering	Introduced as a new course
5	Advanced Engineering Mathematics	Introduced as a new course
6	Industrial Automation	Introduced as a new course
7	Advanced Heat and Mass Transfer	Introduced as a new course
8	Advanced Thermodynamics	Introduced as a new course
9	Convection and Two-Phase Flow	Introduced as a new course
10	Renewable Energy Technology	Introduced as a new course
11	World Class Manufacturing	Introduced as a new course
12	Robotic Modeling Analysis and Control	Introduced as a new course
13	Machine Tool Engineering	Introduced as a new course
14	Product design and Development	Introduced as a new course
15	Gas Turbine Engineering	Introduced as a new course



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