MIT | Academy of Engineering

MIT ACADEMY OF ENGINEERING, ALANDI

An Autonomous Institute Affiliated to

Savitribai Phule Pune Univeristy

Curriculum

For

Master of Technology

In

Heat Power

(Choice Based Credit System)

2016 Pattern

BoS Chairman
(Dean, SMCE)

Member Secretary
Academic Council
(Dean, Academics)

Chairman
Academic Council
(Director, MiTAoE)

M Tech

Mechanical Engineering

2016 Course

(w.e.f.: Academic Year 2016-17)

MIT | Academy of Engineering

AN AUTONOMOUS INSTITUTE

Credit Table

Year	Semester	Credits
F Y M Tech	I	12
F Y M Tech	II	10
F Y M Tech	III	12
S Y M Tech	IV	10
S Y M Tech	V	10
S Y M Tech	VI	10
Total Credits		**64**

MIT | Academy of Engineering (An Autonomous Institute)	CURRICULUM STRUCTURE (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.	W. E. F	:	2016-17
FY MTECH	RELEASE DATE	:	01/06/2017
	REVISION NO.	:	0.0

TRIMESTER: I

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	T	CREDIT
1.	PC1	AS501	Computing and Mathematics	2	2	4
2.	PC2	CS501	Management System	2	2	4
3.	PC3	CS502	Modern Technology	2	2	4
TOTAL				6	6	12

TRIMESTER: II

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC4	EX501	Research Methodology	2	-	2
2.	DC1	ME511	Advanced Thermodynamics and Combustion Technology	3	2	4
3.	DC2	ME512	Advanced Heat Transfer	3	2	4
TOTAL				8	4	10

TRIMESTER: III

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	PC5	EX502	Technical Writing	2	-	2
2.	DC3	ME521	Advanced Fluid Mechanics	3	2	4
3.	DC4	ME522	Design of Heat Transfer equipment's	3	2	4
4.	DC5	ME523	Project Work - I	-	4	2
TOTAL				8	8	12

MIT | Academy of Engineering (An Autonomous Institute)	CURRICULUM STRUCTURE (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.	W. E. F	:	2017-18
SY MTECH	RELEASE DATE	:	01/06/2017
	REVISION NO.	:	0.0

TRIMESTER: IV

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DE1	ME63*	Elective course – I	3	-	3
2.	DE2	ME64*	Elective course – II	3	-	3
3.	DC6	ME601	Project Work - II	-	8	4
TOTAL				6	8	10

TRIMESTER: V

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC7	ME611	Project Work - III	-	20	10
TOTAL				-	20	10

TRIMESTER: VI

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DC8	ME621	Project Work - IV	-	20	10
TOTAL				-	20	10

DICIPLINE ELECTIVE DETAILS

1) Any one course to be selected for Trimester IV from elective course I and elective course II.
2) The corresponding course to be chosen from same domain.

Elective course – I

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DE1.1	ME631	Advances in IC engines	3	-	3
2.	DE1.2	ME632	Energy Conservation and Management	3	-	3
3.	DE1.3	ME633	Computational Fluid Dynamics	3	-	3
4.	DE1.4	ME634	Compressible Fluid flow and Gas Dynamics	3	-	3

Elective course – II

SL. No.	COURSE TYPE	COURSE CODE	COURSE	TEACHING SCHEME		
				L	P	CREDIT
1.	DE2.1	ME641	Advanced Air Conditioning and Refrigeration Technology	3	-	3
2.	DE2.2	ME642	Industrial Hydraulics and Pneumatics	3	-	3
3.	DE2.3	ME643	Cryogenics and Vacuum Technology	3	-	3
4.	DE2.4	ME644	Steam Engineering	3	-	3

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016-2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
FY MTECH			**COURSE NAME**	**:**	Computing and Mathematics
			COURSE CODE	**:**	AS501
			COURSE CREDITS	**:**	04
RELEASE DATE	**:**	1/08/2016	**REVISION NO.**	**:**	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**TUTORIAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
2	2	40	50	10	NIL	NIL	100

PRE-REQUISITE:

NIL

COURSE OBJECTIVES:

1. AS501.CEO.1: To learn different numerical methods to solve differential equations and obtain the solution.
2. AS501.CEO.2: To understand different sampling techniques, analyze the data and process it to obtain a quality product.
3. AS501.CEO.3: To learn mathematical methodologies, techniques and mathematical tools to obtain an optimal solution of the problems.

COURSE OUTCOMES:

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

1. AS501.CO.1: Identify the accurate solution method (minimizing the error) to solve the differential equation with given conditions and obtains the particular solution of the problem.
2. AS501.CO.2: Collect, categorize, analyze, processing mathematically the data, thereby to obtain a quality proven product.

3. AS501.co.3: Understand the physical situation, identify the accurate mathematical model and solve the problem mathematically or with the use of Statistical tools available and finally interpret it in the original context

THEORY:

Computational Methods to Ordinary Differential Equations: Euler's Method, Heun's Method, Mid-point Method, Runge-Kutta Method and Multi step Methods- Explicit Adams-Bash forth technique and Implicit Adams-Moulton techniques, Adaptive RK Method, Embedded RK Method, Higher Order Ordinary differential equation- Shooting Method.

Operations Research: Simplex method: Feasible solution to system of equations, reduction of feasible to basic feasible solution, solution of LPP: computational procedure, Penalty (Big M) method. Transportation problem: North-West corner method, Least-cost method, Vogel's approximation method.

Statistics and Quality Control: Central Tendency of data, Variance, Standard Deviation, Coefficient of Variance, Moments, Correlation, Coefficient of Correlation, Regression lines. Control Charts for Process Location: $\bar{X}$ Chart, Control Charts for Process Variation: S Chart, R charts.

PRACTICAL:

Practical No. 1	**Title:** First Degree Differential equation	**2 Hours**
Introduction to first order first degree Differential equation and its actual solution		
Practical No. 2	**Title:** Differential equation methods	**2 Hours**
Euler's Method, Heun's Method, Mid- point Method, Runge-Kutta Method.		
Practical No. 3	**Title:** Differential equation Methods	**2 Hours**
Adams-Bash forth technique and Implicit Adams-Moulton techniques.		
Practical No. 4	**Title:** Differential equation Methods	**2 Hours**
Adaptive RK Method Embedded RK Method, Shooting Method.		
Practical No. 5	**Title:** Simplex method Feasible solution	**2 Hours**
Solution of system of equations using simplex method (Feasible solution).		
Practical No. 6	**Title:** simplex method (Feasible to basic feasible solution).	**2 Hours**
Solution of system of equations using simplex method (Feasible to basic feasible solution).		
Practical No. 7	**Title:** Transportation problem	**2 Hours**
Transportation problem: North-West corner method, Least-cost method.		
Practical No. 8	**Title:** Vogel's approximation method	**2 Hours**
Transportation problem: Vogel's approximation method.		

Practical No. 9	**Title:** Central Tendency of data, Variance, Standard Deviation	**2 Hours**
Central Tendency of data, Variance, Standard Deviation.		
Practical No. 10	**Title:** Moments, Correlation, Coefficient of Correlation	**2 Hours**
Moments, Correlation, Coefficient of Correlation.		
Practical No. 11	**Title:** Regression Lines.	**2 Hours**
Regression Lines.		
Practical No. 12	**Title:** Charts	**2 Hours**
$\overline{X}$ Chart, S Chart, R chart		

TEXT BOOKS:

1. Numerical Methods for Engineers by Steven C. Chapra& Raymond P. Canale, sixth edition, ISBN 978–0–07–340106–5, MHID 0–07–340106–4.
2. Operations Research by KantiSwarup, P.K.Gupta, Man Mohan, ISBN: 81-8054-226-2.
3. Statistical Methods Vol. 2 by Das, ISBN:9780070263512.

REFERENCES:

1. Numerical Methods by V.N. Vedamurthy&N.Ch.S.N.Iyenger, First edition, ISBN: 9788125906308.
2. Operations Research by S.D.Sharma.
3. Statistical Methods Vol. 1 by Das, ISBN:9780070263505.
4. AHA Statistical Update, AS Go, D Mozaffarian, VL Roger, EJ Benjamin… - Circulation, 2013 - Am Heart Assoc.

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016-2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	:	2016-17
FY MTECH			**COURSE NAME**	:	Management System
			COURSE CODE	:	CS501
			COURSE CREDITS	:	04
RELEASE DATE	:	1/08/2016	**REVISION NO.**	:	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**TUTORIAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
2	2	40	50	10	NIL	NIL	100

PRE-REQUISITE:
NIL

COURSE OBJECTIVES:

1. CS501.CEO.1: To enable M.Tech Students in efficiently and effectively discharging any business related roles, which they may be assigned, after successful completion of their Post- Graduation from MITAOE.
2. CS501.CEO.2: To inculcate a spirit of entrepreneurship by promoting inquisitiveness for technological innovations, their conversion into business ideas and evolving strategy for induction of new products in new markets for growth of their entrepreneurial projects.

COURSE OUTCOMES:

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

1. CS501.CO.1: Describe and explain the Significance of Businesses in Society, their Management and linking these up with other relevant systems.
2. CS501.CO.2: Critically analyze the organizational structure, systems, competencies and identify the areas of improvement
3. CS501.CO.3: Draw a model of power structure and critically analyse with a view to improving it for achieving greater heights in objectives
4. CS501.CO.4: Identify and describe potential problem areas and advise proactive measures to install efficient measures.
5. CS501.CO.5: Identify Key Result Areas (KRAs), new area of growths, draw plans to achieve, implement them and provide effective leadership in the process, creating conducive environment in the organization

THEORY:

Concept of Systems; Concept of Business; Concept of Management; Concept of Learning and its mapping with Bloom's Taxonomy.

Nature and Process Management with an Input-Output Model, seen in scenarios of different aspects of social life.

Role of a Business Firm as a national economic entity with understanding of Macro, Micro and International economics. An understanding of products and services, circular model of flow of money, products and services in a society.

Essentials of Business Management, functioning and growth of a Business Unit with understanding of Break-Even Analysis, Abell's Three Dimensional model of business growth, various business functions in an organization and changing focus from production oriented business to customer orientation and value co-creation.

Various Schools of Thought on Management based on changing concepts of economics and evolution of Business Strategy. Need to understand innovative ways to evolve a new suitable management system for an organization with special focus on new Strategies at the bottom of the pyramid, quality as strategy, disruptive innovation and diffusion of technology.

Decision making, as an essence of management. Concept of Games Theory and its use in decision making.

Essentials of Project Management with use of Critical Path Method (CPM) and Programme Evaluation

and Review Techniques (PERT).

Utilization of concepts of commanding, directing, managing and leading towards effective management of an organization. Skillful use of Emotional Intelligence in conflict management. Techniques for Self Management and Stress Management for improving personal efficiency and effectivity.

Growing significance of Human Relations, with use of Virtual and Informal Organizations and use of Social Media for management of emerging organizations with preponderance of knowledge workers and growing use of robotics and Artificial Intelligence. Process of evolving a Training needs in an organization and methodology for their fulfillment.

Concepts of Invention Innovation, Entrepreneurship and Technology Management for induction of new products in market. Business startups and growth in current Indian Environment. Presentation on Entrepreneurial plans

PRACTICAL:

Practical No. 1	Corporate management case presentation	**4 Hours**
A corporate management case to be selected by students on their own choice, writing a Synopsis (2.5 Marks) and its Presentation before the class in 5 Minutes including answers to questions by class (2.5 Marks		
Practical No. 2	Entrepreneurial Business Plan presentation	**4 Hours**
Preparation and submission of an innovative and entrepreneurial Business Plan of student's own choice, submitting a Power Point Presentation to be evaluated by Faculty (2.5 Marks), and its presenting/ defending it before the class, to be evaluated by two peers on a Format to be given by Faculty (2.5 Marks)		

TEXT BOOKS:

1. Management – A Global and Entrepreneurial Perspective; Harold Koontz, Heinz Weihrich and Mark V Cannice, Tata McGraw Hill Publications, 12thEdition, 2008.
2. Management and Entrepreneurship in Indian Environment – A Perspective through Joining the Dots; Vachaspati Mishra; Himalaya Publishing House, First Edition, 2016.

REFERENCES:

1. Dr A Sivathanu Pillai; Technology Leadership – A Revolution in the Making; Tata McGraw Hill Publishing Company Ltd, New Delhi, 2005
2. James A Alexander and Mark W Hordes; S-Business: Reinventing the Services Organisations, Select Books Inc Biztantra, 2006
3. Vohra ND, Quantitative Techniques in Management; Tata McGraw Hill Publishing Company Limited, Third Edition 2007
4. Nakkiran S and Karthikeyan M; Training Techniques for Management Development; Deep and Deep Publications Pvt Ltd; 2007
5. Kshetri, Nir, “The Indian Environment for Entrepreneurship and Small Business Development” in *StudiaNegotia*, 56 (LVI), 4, 2011, 35-52

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016-2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	:	2016-17
FY MTECH			**COURSE NAME**	:	Modern Technologies
			COURSE CODE	:	CS502
			COURSE CREDITS	:	04
RELEASE DATE	:	1/08/2016	**REVISION NO.**	:	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**TUTORIAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
2	2	40	50	10	NIL	NIL	100

PRE-REQUISITE:

NIL

COURSE OBJECTIVES:

1. CS502.CEO.1: To get familiar with big data, wireless sensor networks and Internet of Things technology.
2. CS502.CEO.2: To acquire the knowledge of geometrical transformation and grasp the animation techniques.
3. CS502.CEO.3: Study basic principles of nano car and different modern technologies
4. CS502.CEO.4: Apply their knowledge to understand different statistical tools and analysis software.

COURSE OUTCOMES:

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

1. CS502.CO.1: Understand the knowledge of advanced software's.
2. CS502.CO.2: Apply their knowledge in different fields.
3. CS502.CO.3: Apply advance technologies in automobile industry.

THEORY:

Big Data: Big Data, Hadoop Distributed File System, Network: Types of Networks, Internet Architecture, Wired and Wireless MAC, RFID, Internet of Things, IoT Applications, R Programming.

2D and 3D Geometrical Transformations: Scaling, Translation, Rotation, Reflection, Viewing Transformations: Parallel and Perspective Projection, Curves and Surfaces: Cubic Splines, Bezier Curves, B-Splines, Animation Technology – OpenGL, Maya, Blender.

Advance technologies: Nano Car Air velocity, Air conditioning system, Different modern energy storage devices, Modern evacuated tube technologies, Advanced Sensor technology, recent photovoltaic technology, Controlling of thermal power plants and its instrumentation, Agricultural robot, Closed ecological systems, Artificial photosynthesis, Energy harvesting.

Modern statistical tools like MATLAB, SPSS, etc., Mathematical Modeling, Data interpretation technologies like ANOVA, Introduction of Analysis software's like ANSYS, Star CD, etc., ERP system, SCADA, PLC System, Electronic Control Unit (ECU), Sources of Energy storage, fuel efficient engine through closed loop control system. Advances in Electronic Cooling Equipments. Bio-medical devices, their Applications, FDA approval procedures, A Certification.

Advances in automotive electronics: Night vision systems, Driver alertness monitoring, Event data recorders (automotive black boxes), Accident recorders, Adaptive cruise control systems, Autonomous emergency breaking systems, Electronic throttle control, On-Board diagnostics systems, Blind spot detection, Navigation systems, Communication systems, Engine control

PRACTICAL:

Practical No. 1	**Title:** Animation Technologies	**2 Hours**
Case study on Animation Technologies		
Practical No. 2	**Title:** Wireless Sensor Application	**2 Hours**
Case study on Wireless Sensor Application.		
Practical No. 3	**Title:** Internet of Things	**4 Hours**
Case study on IoT (Smart City, Healthcare, Agriculture).		
Practical No. 4	**Title:** Hadoop	**4 Hours**
Case study on Big Data – Hadoop Configuration.		
Practical No. 5	**Title:** Data interpretation	**2 Hours**
Case study on Data interpretation technologies.		
Practical No. 6	**Title:** Agricultural robot	**2 Hours**
Case study on Agricultural robot.		
Practical No. 7	**Title:** Electronic cooling equipments.	**2 Hours**

Case study on Electronic cooling equipments.		
Practical No. 8	**Title:** Adaptive cruise control system	**2 Hours**
Case study on Adaptive cruise control system		

TEXT BOOKS:

1. S. Harrington, S. Harrington, “Computer Graphics”, 2nd Edition, McGraw-Hill Publications, 1987, ISBN 0 – 07 –100472 – 6.
2. Anthony F. Collings , Christa Critchley,”Artificial Photosynthesis: From Basic Biology to Industrial Application.” 2014, ISBN: 978-3-527-31090-6.
3. NasimulAlam Syed, Sanjib Islam, Saroj Kumar Patel, “Advanced Guide to MATLAB: Practical Examples in Science and Engineering” I K International Publishing House Pvt. Ltd., 2015, ISBN: 978-9384588359.
4. William B. Ribbens, Ph.D., Norman P. Mansour, Gerald Luecke, Charles W. Battle, Edward C. Jones and Leslie E. Mansir, “Understanding Automotive Electronics”, ISBN: 978-0-7506-7599-4.
5. Bosch Automotive Electrics and Automotive Electronics: Systems and edited by Robert Bosch GmbH, Springer science and digital media,ISBN-13: 978-3658017835, 2013.

REFERENCES:

1. J. Foley, V. Dam, S. Feiner, J. Hughes, “Computer Graphics Principles and Practice”, 2nd Edition, Pearson Education, 2003, ISBN 81 – 7808 – 038 – 9.
2. Donald Norris, “ The Internet of Things: Do-It-Yourself at Home Projects for Arduino, Raspberry Pi and BeagleBone Black”, McGraw-Hill Education, ISBN-13: 978-0071835206, 2015.
3. MadhuJagadeesh, SoumendraMohanty, HarshaSrivatsa, “Big Data Imperatives: Enterprise Big Data Warehouse, BI Implementations and Analytics”, 1st Edition, Apress,ISBN-13: 978-1430248729, 2013.
4. Pritpal Singh, TanjotSethi , Bunil Kumar Balabantaray, BibhutiBhushanBiswal, “Advanced vehicle security system”, IEEE, International Conference on “Innovations in Information, Embedded and Communication Systems (ICIIECS)”, pages 1-6, 2015.
5. Hermann Kopetz , Stephan Poledna, “Autonomous Emergency Braking: A System-of-Systems perspective”, IEEE, Conference on “Dependable Systems and Networks Workshop (DSN-W)”, 43rd Annual IEEE/IFIP, pages 1-7, 2013.

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 -2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
FY MTECH			**COURSE NAME**	**:**	Research Methodology
			COURSE CODE	**:**	EX501
			COURSE CREDIT	**:**	2
RELEASE DATE	**:**	**1/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
2	Nil	40	50	10	Nil	Nil	100

PRE-REQUISITE:

NIL

COURSE OBJECTIVES:

1. EX501.CEO.1: To develop understanding of the basic framework of research process.
2. EX501.CEO.2: To develop an understanding of various research designs and techniques.
3. EX501.CEO.3: To identify various sources of information for literature review and data Collection.
4. EX501.CEO.4: To develop an understanding of the ethical dimensions of conducting applied research.
5. EX501.CEO.5: Appreciate the components of scholarly writing and evaluate its quality.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. EX501.CO.1: Illustrate the objective & paradigm for the research.
2. EX501.CO.2: Establish & validate the results & analysis.
3. EX501.CO.3: Explore the ethical issues concerning the participation & data collection.

THEORY:		
Unit I	**Research - Introduction**	**8 Hours**
What is research, Research definition, Objective & paradigm for the research, Terminologies, Identifying & defining the research problem, Type of research , Literature &it's analysis.		
Unit II	**Research Framework**	**6 Hours**
Development of theoretical and conceptual frame work , Ethical Issues concerning research participants, Ethical issues in data collection, Data collection methods.		
Unit III	**Hypothesis**	**6 Hours**
What is Hypothesis - Definition and functions of hypothesis, Processing operations, Different types of Hypothesis ,		
Unit IV	**Data processing**	**6 Hours**
Problems in data processing, Coding descriptive data and quantitative data, Sampling techniques.		
Unit V	**Statistics in research**	**6 Hours**
Multivariate analysis, Concept of regression, Establishing validity and reliability of the result, Principal component analysis, variance & covariance- ANOVA, ANOCOVA.		
Unit VI	**Writing research proposal**	**4 Hours**
Interpretation and its meaning, Readability of Manuscript, techniques, Contents, Report writing, structure, types of report, Procedure of writing research proposal, Writing as thinking, Habit of writing, Skills and thought process in technical writing, Role of computer in technical writing .		

TEXT BOOK:

1. John W. Creswell," Research Design-Qualitative & Quantitative Approaches", SAGE publications, New Delhi ISBN: 0-8039-5254-6
2. Ranjit Kumar," Research Methodology- A Step by Step Guide for Beginners", 2nd ed., Pearson publication, New Delhi ISBN: 978-81-317-0496-7

REFERENCEs:

1. C. R. Kothari," Research Methodology, Methods & Techniques", 2nd Edition, New Age International Publication ISBN: 978-81-224-1522-3
2. Hamdy A. Taha, "Operation Research- An Introduction", 8th Edition, Pearson Publication.

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
F.Y. MTECH			**COURSE NAME**	**:**	Advance Thermodynamics and Combustion Technology
			COURSE CODE	**:**	ME 511
			COURSE CREDITS	**:**	4
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	2	40	50	10	NIL	NIL	100

PRE-REQUISITE:
NIL

COURSE OBJECTIVES:

1. ME511.CEO.1 To understand the thermodynamic process and the methods for analyzing thermodynamic properties.
2. ME511.CEO.2 To determine the direction of the process by the analysis of exergy, entropy, free energy, etc.
3. ME511.CEO.3 To master the property equations and thermodynamic properties of real gases, master the methods for analyzing multi-component systems.
4. ME511.CEO.4 To acquire basic knowledge of chemical thermodynamics, and grasp the thermodynamic processes and properties of special systems.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME511.CO.1: The ability to perform thermodynamic analysis of realistic problems using computer software
2. ME511.CO.2: The ability to apply the first and second laws to combustion processes.
3. ME511.CO.3: Knowledge with property equations and thermodynamic properties of real gases.
4. ME511.CO.4: The thermodynamic properties and basic concepts of phase equilibrium of multi component systems.
5. ME511.CO.5: Ability to understand the chemical thermodynamic basis and the thermodynamic process and properties of special systems.

THEORY:

Unit I	**Equation of State and Laws Of Thermodynamics**	**8 Hours**

State postulate for Simple System and equation of state, Ideal gas equation, Deviation from ideal gas, Equation of state for real gases, generalized Compressibility chart, Law of corresponding states 2nd law Analysis for Engg. Systems, Entropy flow & entropy generation, Increase of entropy principle, entropy change of pure sub, T-ds relations, entropy generation, thermoelectricity.

Unit II	**Availability Analysis and Thermodynamic Property Relations**	**8 Hours**

Reversible work - availability - irreversibility and second – law efficiency for a closed system and steady – state control volume. Availability analysis of simple cycles. Thermodynamic potentials. Maxwell relations. Generalized relations for changes in entropy - internal energy and enthalpy - generalized relations for Cp and Cv Clausius Clayperon equation, Joule – Thomson coefficient. Bridgeman tables for thermodynamic relations.

Unit III	**Real Gas Behavior and Multi – Component Systems**	**6 Hours**

Different equations of state – fugacity – compressibility - principle of corresponding States - Use of generalized charts for enthalpy and entropy departure - fugacity coefficient, Lee – Kesler generalized three parameter tables. Fundamental property relations for systems of variable composition. Partial molar properties. Real gas mixtures - Ideal solution of real gases and liquid - activity - equilibrium in multi-phase systems - Gibbs phase rule for non – reactive components.

Unit IV	**Chemical Thermodynamics and Equilibrium**	**6 Hours**

Thermochemistry - First law analysis of reacting systems - Adiabatic flame temperature-entropy change of reacting systems - Second law analysis of reacting systems - Criterion for reaction equilibrium. Equilibrium constant for gaseous mixtures - evaluation of equilibrium composition.

Unit V	Statistical Thermodynamics	6 Hours
Microstates and Macrostates - thermodynamic probability - degeneracy of energy levels - Maxwell – Boltzman, Fermi – Diarc and Bose – Einstein statistics - microscopic interpretation of heat and work, evaluation of entropy, partion function, calculation of the Macroscopic properties from partition functions.		
Unit VI	**Irreversible Thermodynamics**	**4 Hours**
Conjugate fluxes and forces - entropy production Onsager's reciprocity relations - thermo – electric phenomena, formulations.		

PRACTICAL: Perform ANY THREE Lab experiments/Assignment.		
Practical No. 1	Steady flow cyclic system.	**4 Hours**
Computer aided energy analysis of steady flow cyclic system.		
Practical No. 2	Mixture of gases, gas and vapour.	**4 Hours**
Study of mixture of gases, gas and vapour, estimation of properties and preparation of charts.		
Practical No. 3	Statistical thermodynamic techniques.	**4 Hours**
Analysis of ideal gas system using statistical thermodynamic techniques.		
Practical No. 4	Behavior of pure substance	**2 Hours**
Study of behavior of pure substance with change in pressure and temperature.		
Practical No. 5	Adiabatic flame temperature	**2 Hours**
Preparation of computer program to study the effect of percentage of theoretical on adiabatic flame temperature and equilibrium composition for a hydrocarbon fuel. (Program to be run for variable input data.)		

TEXT BOOK:

1. Adrian Bejan, "Advanced Engineering Thermodynamics", John Wiley and Cons, 3rd Edition,2006, (ISBN: 978-0-471-67763-5)
2. J.P. Holman, "Thermodynamics", McGraw – Hill Inc., 1988. Fourth Edition, (ISBN: 9780070296084) 3.
3. Yunus A. Cengel , Michael A. Boles, " Thermodynamics- An Engineering approach", McGraw-Hill Education , 8th International edition, (ISBN13 9789814595292)

REFERENCES:

1. Kenneth Wark Jt.m, “Advanced Thermodynamics for Engineers”, McGrew – Hill Inc., 1995, (ISBN : 9780071135504)
2. Smith J.M. and Van Ness H.C.,“Introduction to Chemical Engineering Thermodynamics”, McGraw – Hill Inc., Fourth. Edition, 1987. (ISBN : 0070587019)
3. Sonntag R.E., and Van Wylen G, “Introduction to Thermodynamics, Classical and Statistical Thermodynamics”, John Wiley and Sons, Third Edition, 1991, (ISBN :978-0471614272)
4. Sears F.W. and Salinger G.I., ”Thermodynamics, Kinetic Theory and Statistical Thermodynamics”, Narosa Publishing House, New Delhi, Third Edition 1993, (ISBN : 978-81-85015-71-2)

MIT Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
F.Y. MTECH			**COURSE NAME**	**:**	Advanced Heat Transfer
			COURSE CODE	**:**	ME 512
			COURSE CREDITS	**:**	4
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	NIL	40	50	10	2	NIL	100

PRE-REQUISITE:
NIL

COURSE OBJECTIVES:

1. ME 512.CEO.1 To identify different mode of heat and mass transfer occurring in thermal system.
2. ME 512.CEO.2 To understand the methods of analyzing a heat exchanger.
3. ME 512.CEO.3 To analyze steady and transient conduction problem.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME512.CO.1: Recall basic Knowledge while working in Industries.
2. ME512.CO.2: Understand the phenomenon of Natural Convection and Forced Convections of heat transfer.
3. ME512.CO.3: Apply analytical/logical skill while Modeling various Heat transfer phenomenon.
4. ME512.CO.4: Demonstrate the real life Heat transfer problems.

THEORY:		
Unit I	**Introduction to Modes and Laws of Heat Transfer**	**6 Hours**
Simultaneous Heat Transfer Mechanism, Steady and Transient Heat Transfer, Multidimensional Heat Transfer, Thermal Conductivity, Thermal diffusivity, Various Boundary and Initial Conditions, General Heat Conduction Equation, Thermal Resistance, Generalized Thermal Resistance Networks, Thermal Contact Resistance.		
Unit II	**Transient Heat Conduction**	**6 Hours**
Lumped capacitance and its validity, General lumped capacitance analysis, spatial effects. Problems related with conventional geometries. Use of Haisler and Grober charts, Biot and Fourier numbers.		
Unit III	**Principle of Fluid flow and Convective heat transfer**	**6 Hours**
Concept of velocity and thermal boundary layers: Laminar and Turbulent flow. Navier-stokes equations and convection equation. Boundary layer approximations and special conditions. Boundary layer similarity. The normalized convection transfer equations. Dimensionless parameters & physical significance. Reynolds analogy, Chilton-Colburn analogy.		
Unit IV	**Natural Convection Physical Mechanism**	**6 Hours**
Equation of motion and Grashoff's Number, Natural Convection over surfaces, Natural convection from finned surfaces and PCBs, Natural Convection inside enclosures (Rectangular, Cylinder and Sphere), Combined Natural Convection and Radiation, Combined Natural and Forced Convection		
Unit V	**Forced Convection External Forced Convection**	**6 Hours**
Parallel flow over Flat plates, Flow across cylinders and spheres, Flow across tube banks Internal Forced Convection Entrance region, Constant surface heat flux, Constant surface temperature, Laminar and Turbulent flow in tubes.		
Unit VI	**Boiling and Condensation**	**6 Hours**
Boiling: Boiling modes, the boiling curve, modes of pool boiling, correlations. Forced convection boiling. Two phase flow. Condensation: Physical mechanisms, laminar film condensation on a vertical plate. Turbulent film condensation, film condensation on radial systems, film condensation in horizontal tubes, on banks of tubes, Drop-wise condensation correlations. Thermal Radiation: Thermal radiation, Blackbody radiation, Radiation intensity, Radiation properties, Atmospheric and Solar radiation, Shape factor, Radiation heat transfer in two surface enclosures, Radiation shields, Radiation exchange between Emitting and Absorbing gases.		

PRACTICALS:		
Practical No. 1		**4 Hours**
Transient Heat Conduction using Heisler and Grober charts.		
Practical No. 2		**4 Hours**
Numerical method in heat conduction & convection.		
Practical No. 3		**4 Hours**
Combined Natural and Forced Convection heat transfer.		
Practical No. 4		**4 Hours**
Boiling and Condensation.		
Practical No. 5		**4 Hours**
Radiation Heat Transfer in Two Surface Enclosures.		

TEXT BOOK:

1. John H Lienhard, “A Heat Transfer Textbook: Fourth Edition”, Dover Publications, (ISBN-13 : 978-0-486-47931-6)
2. S.P. Sukhatme, “Heat Transfer” Fourth Edition, Universities press, (ISBN: 81 7371 544 0)
3. Y V C Rao, “Heat Transfer” First Edition, Universities press, (ISBN: 81 7371 384 7)
4. Suhas V. Patankar, “Numerical Heat Transfer and Fluid Flow”, (ISBN: 0-89116-522-3)

REFERENCES:

1. Bergman, Theodore L.; Lavine, Adrienne S.; Incropera, Frank P.; DeWitt, David P., “Fundamentals of Heat and Mass Transfer, Fundamentals of Heat and Mass Transfer“, New York,1985,Wiley Publication, 2011,(ISBN 0470501979)
2. Frank Kreith:, “Principles of Heat Transfer”, Harper and Row Publishers, New York, Fourth edition,1986, (ISBN 0060437855)
3. Donald Q. Kern, “Process Heat Transfer”, Tata McGraw Hill Publishing Company Ltd., New Delhi. 1950, (ISBN 9780074632178)
4. Oszisik, “Heat Transfer”, McGraw Hill,1985, (ISBN 9780070664609)

5. Yunus A. Cengel, “Heat Transfer A Practical Approach”, McGraw Hill International Edition, 2007, (ISBN 0073129305)
6. J P Holman, “Heat Transfer”,McGraw-Hill Companies;1996, 8th edition, (ISBN 0078447852)

MIT Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 -2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
FY MTECH			**COURSE NAME**	**:**	Technical Writing
			COURSE CODE	**:**	EX 502
			COURSE CREDIT	**:**	2
RELEASE DATE	**:**	**1/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**TW**	**IA**			
2	Nil	40	50	10	Nil	Nil	100

PRE-REQUISITE:

NIL

COURSE OBJECTIVES:

1. EX502.CEO.1: Provide overview of technical English for research paper writing,
2. EX502.CEO.2: Research methods for classroom based studies of pedagogical innovations.
3. EX502.CEO.3: Study guidelines for review of technical publications.

COURSE OUTCOMES:

Students successfully completing the course will be able to,

1. EX502.CO.1: Apply correct verb tenses; write more effectively in English for argument essays.
2. EX502.CO.2: Evaluate plagiarism and explain how to prevent it
3. EX502.CO.3: Analyze several articles to form your own opinion on a topic - make connections between several articles.
4. EX502.CO.4: Summarize a 7-8 page research paper - use source material correctly with MLA format

THEORY:

Introduction to Technical Communication, Reading Skill, Basics of English Grammar, Technical Writing, Reports and Proposals, Referencing and Styling.

Anatomy of a Research Article , Sternberg's 12 steps of Writing, Research Paper Writing, Technology- enabled Communication, Interpretation and Use of Charts, Graphs and Tables, Software Tools for Technical Writing

PRACTICAL/TUTORIAL:

1. A Group Discussion or 'Role Play' on a topic / case to be assigned to students well in time, with groups comprising six students drawn from various disciplines. Members of the group will be evaluated by two peers, all to be assigned impromptu in the class. Faculty attending will modulate the evaluations.
2. Preparation, submission of an innovative research article in the field of their interest / specialization.

TEXT BOOK:

1. Advanced Learners's Dictionary. 8th edition, 2013., Oxford University Press; 9th Edition (2014), ISBN : 978-0194799485
2. Paul V. Anderson, Technical Communication: A Reader-centered Approach, 8th edition, 1st Indian reprint, new Delhi: Cengage Learning, 2014, ISBN: 9788131514030

REFERENCES:

1. Martin Hewings, Advanced Grammar in Use, Cambridge University Press, 2013, ISBN: 9780521532921.
2. Michael Swan, Practical English Usage. 3rd Edition, Oxford University Press-New Delhi, 2006, ISBN: 9780195679892
3. John Seely, The Oxford Guide to Effective Writing and Speaking, Oxford University Press, 2005, ISBN: 9780199652709.
4. [http://onlinestatbook.com/Online_Statistics_Education.pdf

MIT Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
S.Y. MTECH			**COURSE NAME**	**:**	Advanced Fluid Mechanics
			COURSE CODE	**:**	ME 521
			COURSE CREDITS	**:**	4
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	2	40	50	10	2	NIL	100

PRE-REQUISITE:

NIL

COURSE OBJECTIVES:

1. ME 521.CEO.1 To remember the fundamentals of fluid mechanics.
2. ME 521.CEO.2 To understand the concept of governing equations in different forms.
3. ME 521.CEO.3 To apply knowledge of parallel flow for several airfoils.
4. ME 521.CEO.4 To analyze viscous flow and compressible flow.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME502.CO.1: Recall basic of fluid mechanics.
2. ME502.CO.2: Understand the concept of governing equations in different forms.
3. ME502.CO.3: Apply knowledge of parallel flow for several airfoils.
4. ME502.CO.4: Analyze viscous flow and compressible flow.

THEORY:		
Unit I	**Governing Equations: Review of Fluid Mechanics**	**6 Hours**
Definition and properties of Fluids, Fluid as continuum, Continuum model, and Flow kinematics: - Langragian and Eulerian description, Basic flow-analysis techniques, Flow Patterns: Streamlines, Streak lines, and Pathlines. Reynolds transport theorem, Conservation of mass, Linear momentum equation, Energy equation, Frictionless flow, Bernoulli equation. Acceleration field of a fluid, differential equation of mass conservation, Boundary Conditions for the basic equations, Velocity Potential, Stream Function, Vorticity.		
Unit II	**Navier-Stokes Equations**	**6 Hours**
Generalized form of NSE, Special forms: Euler equations, Bernoulli equation **Exact solutions:** fully developed flow in channel, pipe, flow between concentric rotating cylinders, Couette flow, Stokes First problem (unsteady flow), Creeping flow past a sphere, cylinder.		
Unit III	**Potential Flows**	**6 Hours**
Elementary Plane-Flow Solutions: Circulation, Superposition of Plane-Flow Solutions: Irrotational vortex, Vortex flow, Doublet, Flow past a circular cylinder, Magnus effect; Kutta-Joukowski lift theorem; Concept of lift and drag. .Complex potential functions. Conformal transformation to analyze the flow over flat plate, cylinder, oval body and airfoils. Thin airfoil theory – generalized airfoil theory for cambered and flapped airfoils.		
Unit IV	**Boundary Layers**	**6 Hours**
Boundary layer assumptions, equations, Flow over a flat plate, Similarity (Blasius) solution, Falkner-Skan equation, Momentum integral method, Flow separation.		
Unit V	**Viscous flow**	**6 Hours**
Laminar and turbulent Flow - laminar flow between parallel plates, circular pipes. Turbulent flow, losses during flow through pipes. Pipes in series and parallel – transmission of power through pipes, characteristics of turbulence, laminar-turbulent transition, Correlation functions, Mean and fluctuations, Governing equations, Turbulent boundary layer, Boundary conditions, shear stress models, Prandtl's mixing length, Velocity profile over a flat plate and in pipes, Equations for free shear layers: mixing layer, plane and axisymmetric jet, and wake, two equation model (k-ε), Large Eddy Simulation, Various Turbulent Models.		
Unit VI	**Compressible Flow**	**6 Hours**
One-dimensional flow: Fanno and Rayleigh curve, Normal shock relations, Introduction to oblique shocks, Prandtl-Meyer expansion waves, and simple supersonic wind tunnel – Design of supersonic		

wind tunnel Nozzle. Two dimensional Subsonic flow: - Flow with small perturbations, Flow past a wave shaped wall – Gothert's rule-Laitone's modification of Prandtl Glauret rule – affine transformations – Hodograph method –Tangent Gas approximations – Rayleigh Johnson method.

PRACTICALS:		
Practical No. 1		
Flow over a cylinder/sphere at different Re. Pressure variation over the body and drag Estimation.		
Practical No. 2		**2 Hours**
Flow past an aerofoil: Pressure measurements, calculation of lift.		
Practical No. 3		**4 Hours**
Flow through a converging-diverging nozzle: subsonic and supersonic flows.		
Practical No. 4		**4 Hours**
Friction factor determination: incompressible flow through pipes/ducts of variable cross section.		
Practical No. 5		**4 Hours**
Laminar/Turbulent boundary layer over a flat plate.		

TEXT BOOK:

1. Dr. R K Bansal, Fluid Mechanics and Hydraulic Machines, Laxmi Pulications,2010, (ISBN: 978-81-318-0815-3)
2. E. Ratha Krishnan, "Gas Dynamics", PHI Learning Pvt. Ltd New Delhi, 2004, (ISBN : 9788120348394)

REFERENCES:

1. S.M.Yahya, "Fundamentals of Compressible flow", New Age Publishers, Third edition, 1992, (ISBN: 8122414680)
2. Streeter, "Fluid Dynamics", McGraw Hill, New York, 2010, (ISBN: 9780070701403)
3. William Graebel, "Advanced Fluid Mechanics", Academic Press,2007, (ISBN: 9780123708854)
4. A J Raudkivi , Owls books, Toledo, "Advanced Fluid Mechanics", USA, 1972, (ISBN : 0470709405)

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
F.Y. MTECH			**COURSE NAME**	**:**	Design of Heat Transfer Equipment's
			COURSE CODE	**:**	ME 522
			COURSE CREDITS	**:**	4
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	2	40	50	10	NIL	NIL	100

PRE-REQUISITE:

1. ME 512 Advanced Heat Transfer

COURSE OBJECTIVES:

1. ME 522.CEO.1 To understand the functioning of different heat transfer equipment's.
2. ME 522.CEO.2 To Understand thermal behavior of heat transfer equipment's.
3. ME 522.CEO.3 To Design the heat transfer equipment's from thermal point of view.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME522.CO.1:List the different types heat exchangers, cooling towers and furnaces
2. ME522.CO.2: Select the different types of heat exchangers, cooling towers and furnaces according to application.
3. ME522.CO.3: Apply the different methods to calculate effectiveness and pressure drop in heat exchanger.
4. ME522.CO.4: Analyze different heat transfer Equipment's from thermal point of view.
5. ME522.CO.5 Select and design appropriate heat transfer equipment for a given application.

THEORY:

Unit I	**Classification of Heat Exchangers**	**8 Hours**

Introduction, Classification, Overview of Heat Exchanger Design Methodology, Process and Design Specifications, Thermal and Hydraulic Design, Mechanical Design, Optimum Design , Heat Exchanger Variables and Thermal Circuit, Assumptions, Basic Definitions, ε - NTU Method , The P-NTU Method , TEMA , Multi-pass Exchangers, LMTD, Heat Exchanger Arrays and Multi-passing, Sizing and Rating Problems, Kern Method, Bell Delaware Method, Numerical on Shell and tube HEX.

Unit II	**Solution Methods for Determining Exchanger Effectiveness**	**8 Hours**

Exact Analytical Methods, Approximate Methods, Numerical Methods, Matrix Formalism, Chain Rule Methodology , Flow-Reversal Symmetry, Design Problems, Longitudinal Wall Heat Conduction Effects, Multipass Exchangers, Non-uniform Overall Heat Transfer Coefficients, Temperature - Length - Combined Effect.

Unit III	**Heat Exchanger Pressure Drop Analysis**	**6 Hours**

Importance of Pressure Drop, Devices, Extended Surface Heat Exchanger Pressure Drop, Tubular Heat Exchanger Pressure Drop, Tube Banks, Shell-and-Tube Exchangers, Plate Heat Exchanger Pressure Drop, Pipe Losses, Non-dimensional Presentation of Pressure Drop Data.

Unit IV	**Heat Transfer Characteristics**	**6 Hours**

Dimensionless Surface Characteristics, Experimental Techniques for Determining Surface Characteristics, Steady-State Kays and London Technique, Wilson Plot Technique, Transient Test Techniques, Friction Factor Determination, Hydrodynamic ally Developing Flows, Thermally Developing Flows, Extended Reynolds Analogy, Heat Exchanger Surface Geometrical Characteristics, Selection of Heat Exchangers and Their Components, Temperature Difference Distributions.

Unit V	**Cooling tower fundamentals**	**8 Hours**

Types, Nomenclature, material for construction, Structural components in details, Mechanical components (Fan, Speed reducer, Valves, Safety), Electrical components, Thermal performance testing – conduction and evaluation.

Unit VI	**Furnace and Thermal Devices**	**6 Hours**

Furnace, Types, Parts used in furnace, Nozzles used, Heat transfer related design of systems, Insulations, Applications in process industries. Heat pipe, Thermal interface material, use of nano

particle in heat transfer equipments, Steam Trap, Electronics cooling systems, Thermal interface materials, Heat transfer augmentation techniques.

PRACTICAL: Perform the following experiments.		
Practical No. 1		**4 Hours**
Visit to study heat exchanger manufacturing.		
Practical No. 2		**4 Hours**
Study of Instrumentation used related to Heat exchanger.		
Practical No. 3		**4 Hours**
Study of plate heat exchanger		
Practical No. 4		**4 Hours**
Experimentation on any one Heat exchanger		
Practical No. 5		**4 Hours**
Experimentation on Heat pipe		

TEXT BOOK:

1. Process Heat Transfer – Donald Q. Kern, Tata McGraw-Hill
2. Process Heat Transfer – Hewitt ,Shires & Bott, CRC Press

REFERENCES:

1. Cooling Tower, Fundamentals- John C. Hensley, SPX Cooling Technologies
2. Heat exchangers Selection, Rating and Thermal Design – Sadik Kakac,Hongtan Liu, Anchasa Pramunjanaroenkij, CRC Press
3. Heat Pipes Theory, Design & Applications – D.A. Reay, P.D.Dunn, Pergamon
4. Cooling Techniques for Electronic Equipment– Dave S. Steinberg, Wiley-InterScience Publication
5. Fundamentals of Heat Exchanger Design -Ramesh K. Shah, Dusan P. Sekulic,Wiley-India

MIT | Academy of Engineering (An Autonomous Institute)			**COURSE SYLLABI (2016-2018)**		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2016-17
FY MTECH			**COURSE NAME**	**:**	Project Work I
			COURSE CODE	**:**	ME523
			COURSE CREDIT	**:**	2
RELEASE DATE	**:**	**1/06/2016**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
Nil	4	---	---	---	NIL	50	50

PRE-REQUISITE:

1. EX501 : Research Methodology
2. CS502 : Technical Writing

COURSE OBJECTIVES:

1. ME523.CEO.1: To Manage the selection and initiation of individual projects.
2. ME523.CEO.2: To conduct project planning activities that accurately forecast project costs, timelines, and quality.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME523.CO.1: Identify important concepts / real time problems from the knowledge of current trends /survey.
2. ME523.CO.2: Develop effective communication and presentation skills.
3. ME523.CO.3: Describe the time needed to successfully complete a project, considering factors such as task dependencies and task lengths.

CONTENTS

Project work is divided into four stages namely Project Stage I, Project Stage II, Project Stage III and Project Stage IV.

Project Stage I is entirely related with selection of topic/problem by the students related to thrust areas identified by respective departments. Synopsis submission and mid trimester presentation will be conducted by department based on following points,

- Literature survey
- Motivation and Problem Statement
- Goals and Objectives

Final Project Stage I Report submission and Presentation shall be conducted at the end of the trimester. End-Trimester Assessment (ETA) presentation shall be conducted in front of eminent expert from Academics or Industry.

MIT Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
S.Y. MTECH			**COURSE NAME**	**:**	Advances in IC engines
			COURSE CODE	**:**	ME 631
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	NIL	30	50	20	NIL	NIL	100

PRE-REQUISITE:

1. ME511 Advanced Thermodynamics and Combustion Technology.

COURSE OBJECTIVES:

1. ME 201.CEO.1 To recall the fundamentals of I.C engines, construction and working principle of an engine, and testing of an engine for analyzing its performance.
2. ME 201.CEO.2 To study the combustion and its controlling factors in order to design efficient engine
3. ME 201.CEO.3 To study emissions from I.C. engines and its controlling methods, various emission norms.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME201.CO.1: Recall basics of alternative fuel technology.
2. ME201.CO.2: Apply fundamentals of IC engines to enhance its performance-emission
3. characteristics.
4. ME201.CO.3: Develop models and simulate them for diesel engine, petrol engine, gas engine.

5. ME201.CO.4: Demonstrate the emission controlling methods and emission standards for various engines.

THEORY:

Unit I	**Measurement & Testing**	**6 Hours**
Introduction, engine performance parameters, measurement and testing, engine operating characteristics, performance maps, Mathematical models of SI and CI Engines.		
Unit II	**Alternate Fuels**	**6 Hours**
Solid fuels, liquid fuels, gaseous fuels, hydrogen engines, new generation alternative fuels.		
Unit III	**Engine Design**	**6 Hours**
Preliminary analysis, cylinder number, size and arrangement, experimental development.		
Unit IV	**Electronic Injection System**	**6 Hours**
Gasoline injection, EFI system, MPFI system, electronic control system, injection timing, electronic diesel injection system and control.		
Unit V	**Engine Emissions & Control**	**6 Hours**
Air pollution due to IC engines, norms, engine emissions, HC, CO, NOx, particulates, other emissions, emission control methods, exhaust gas recirculation, modern methods, crankcase blow by. EURO and Bharat norms for emission.		
Unit VI	**Simulation Technique**	**6 Hours**
Application of simulation technique for engine tuning, engine selection parameters, recent trends in IC engines. Detail study of VVT, VGT, DTSI, HCCI. Details mechanism of NVH (Noise vibration and Harshness) in engine.		

TEXT BOOK:

1. V Ganesan, “Internal Combustion Engines”, 4th edition, Tata McGraw Hill, 2012, (ISBN-10: 1259006190)
2. Jack Erjavec and Rob Thompson, “Automotive Technology”, 6th edition, Delmar Thomson Learning, 2014, (ISBN-10: 1133933734)
3. Mathur M. L., “Internal Combustion Engine”, 4th edition, Dhanpat Rai Publication, (ISBN-10: 8189928465)

4. Shyam K. Agrawal. , “Internal Combustion Engine”, 4th edition, New Age publishers, 2007, (ISBN-10: 8122417825)

REFERENCES:

1. Charles Fayette Taylor, ”The Internal Combustion Engine in Theory and Practice”, Volume I & II, 2nd The MIT Press, 1985, (ISBN: 9780262200523)
2. Bosch Gmbh, Robert Bosch GmbH, “Gasoline Engine Management, Bosch handbook”,2nd edition, Professional Engineering Publishing, 2004, (ISBN 10: 1860584349)
3. Gordon P Blair, “Design and Simulation of four stroke engines”, 4th edition, SAE International, 1999, (ISBN-10: 0768004403)

MIT Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2020)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
S.Y. MTECH			**COURSE NAME**	**:**	Energy Conservation and Management
			COURSE CODE	**:**	ME 632
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	**01/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	-	40	50	10	-	NIL	100

PRE-REQUISITE:
NIL

COURSE OBJECTIVES:

5. ME 521.CEO.1 To remember importance of energy conservation and management.
6. ME 521.CEO.2 To understand the concept of thermal and electrical systems.
7. ME 521.CEO.3 To apply knowledge of various modes of energy conservation.
8. ME 521.CEO.4 To analyze the energy management and economics.

COURSE OUTCOMES:

The students after completion of the course will be able to

5. ME502.CO.1: Recall importance of energy conservation and management.
6. ME502.CO.2: Understand the concept of thermal and electrical systems.
7. ME502.CO.3: Apply knowledge of various modes of energy conservation.
8. ME502.CO.4: Analyze the energy management and economics.

THEORY:		
Unit I	**Importance of Energy Conservation and Management**	**6 Hours**
World, national Energy consumption, environmental aspects, Energy prices, policies, Energy auditing: methodology, analysis, energy accounting-Measurements- Thermal and Electrical.		
Unit II	**Electrical Systems**	**6 Hours**
AC / DC current systems, Demand control, power factor correction, load Management, Motor drives : motor efficiency testing, energy efficient motors, motor speed control, Lighting : lighting levels, efficient options, day lighting, timers, Energy efficient windows electrical distribution systems, Transformers, Power quality, harmonic distortion.		
Unit III	**Thermal Systems**	**6 Hours**
Boiler efficiency testing, excess air control, Steam distribution & use, steam traps, condensate recovery, flash steam utilization, Thermal Insulation. Heat exchanger networking, concept of pinch, target settling, problem table approach.		
Unit IV	**Energy Conservation**	**6 Hours**
Boundary layer assumptions, equations, Flow over a flat plate, Similarity (Blasius) solution, Falkner-Skan Energy conservation in Pumps, Fans (flow control) and blowers, Compressed Air Systems, Refrigeration and air conditioning systems, Waste heat recovery recuperators, heat sheets, heat pipes, heat pumps.		
Unit V	**Energy Management, Economics**	**6 Hours**
Energy resource management, Energy Management information systems, Computerized energy management, Energy economics, discount rate, payback period, internal rate of Return, life cycle costing, financing energy conservation Projects.		

TEXT BOOK:

1. L.C. Witte, P.S. Schmidt, D.R. Brown, “Industrial Energy Management and Utilisation”, Hemisphere Publication, Washington, 1988, (ISBN 0891163220)
2. O. Callaghn, P.W., “Design and Management for Energy Conservation”, Pergamon Press, Oxford, 1981, (ISBN: 0080272878)

REFERENCES:

1. G.C. Dryden, “The Efficient Use of Energy”, Publ. Butterworth-Heinemann, London, 1982, (ISBN 1483107914)
2. W.C. turner, “Energy Management Hand book”, Wiley, New York, 1982, (ISBN 1466578289)
3. W.R. Murphy and G. Mc KAY, “Energy Management”, Butterworth’s, London 1982, (ISBN 0408005084)

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
SY MTECH			**COURSE NAME**	**:**	Computational Fluid Dynamics
			COURSE CODE	**:**	ME633
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	**01/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	--	40	50	10	----	---	100

PRE-REQUISITE:

1. ME512- Advanced Heat Transfer
2. ME521- Advanced Fluid Mechanics

COURSE OBJECTIVES:

1. ME 633.CEO.1 Recall the knowledge of fluid mechanics and heat transfer.
2. ME 633.CEO.2 Develop a two dimensional flow problem by using CFD.
3. ME 633.CEO.3 Apply the Discretization scheme to solve Navier-stokes equation and Reynold's transport theorem.
4. ME 633.CEO.4 Analyze different turbulence models to the flow problems

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME 633.CO.1 Identify the key aspects of fluid mechanics and heat transfer relevant to the setting up of a problem for CFD, and to the interpretation of the results.
2. ME 633.CO.2 Develop a two-dimensional flow problem for CFD solution, including geometry, boundary conditions, flow models and solution parameters.
3. ME 633.CO.3 Appreciate the significance of error control and validation in CFD.

4. ME 633.CO.4 Describe the nature of turbulent flows and explain why 'turbulence models' are necessary to many CFD solutions

THEORY:

Unit I	**Introduction to CFD**	**8 Hours**

Governing equations: the continuity equation, momentum equation and energy equations, convective forms of the equations and general description, Reynolds transport theorem. Classification of partial differential equations; physical examples of elliptic, parabolic and hyperbolic equations. Mathematical nature of the flow equations & their boundary conditions.

Discretization: Basic discretization techniques applied to model equations and systems of equations: finite difference, finite volume and finite element methods.

Unit II	**Finite Difference Methods and Finite Volume Methods**	**8 Hours**

Finite Difference Methods Taylor series expansion, different means for formula ting finite difference equation; accuracy of finite difference method.

Finite Volume Methods: Finite volume methods; approximation of surface and volume integrals; interpolation methods; central, upwind and hybrid formulations and comparison for convection-diffusion problem.

Analysis of numerical schemes: Concept of consistency, accuracy, stability andconvergence; Error and stability analysis; some applications.

Unit III	**Euler's equations and Navier-Stokes Equations**	**8 Hours**

Solution to Euler's equations: Formulations of Euler equations, Discretization methods for Euler equations. High resolution schemes and TVD

Navier-Stokes Equations: Governing equation, Properties of Navier-Stokes equation, discretization of NS equation, Boundary Condition, Convergence acceleration techniques.

Numerical Grid Generation: Structuredgrid generation: a) Algebraic method, b) Ellipticgeneration systems. Unstructured grid generation: Voronoi diagram and Delaunay triangulation; Advancing frontgrid generation.

Unit IV	**Turbulence Modeling**	**6 Hours**

Introduction, Statistical representation of turbulent flows: General Properties of turbulent quantities, Closure problem: Necessity of turbulence modeling, Reynolds average Navier stokes (RANS) equation,

Different types of turbulence model: Eddy viscosity models, Mixing lengths model, Turbulentkineticenergyanddissipation,Theκ-εmodel,Advantagesanddisadvantages of κ-ε model, Two-equation models: κ-ε model and κ-ω model, Reynolds stress equation model (RSM).

TEXT BOOKS:

1. Taylor, C and Hughes J.B., “Finite Element Programming of the Navier Stock Equation”, Pineridge Press Ltd. U.K., 1st Edition 1981, (ISBN: 0-906674-16-6)
2. Fletcher C. A. J., “Computational Techniques for Fluid Dynamics: Fundamental and General Techniques”, Springer-Verlag, 1st Edition, 1987, (ISBN: 0387181512/ 978-0387181516)
3. Bose T. K., “Numerical Fluid Dynamics”, Narosa Publishing House, 1st Edition, 1997, (ISBN: 8173191662, 9788173191664)

REFERENCES:

1. Versteeg H. K., Malalasekera. W., “ An introduction to computational fluid dynamics: The finite volume method”, Prentice Hall, 2nd Edition, 2007, (ISBN: 9780131274983/ 978-0131274983)
2. Anderson, D.A., Tannehill, I.I., and Pletcher, R.H., “Computational Fluid Mechanics and Heat Transfer”, Hemisphere Publishing Corporation, New York, USA, 3rd Edition, 2012, (ISBN: 1591690374/ 978-1591690375)
3. Niyogi P., Laha M.K., Chakrabarty S.K., “Introduction to Computational Fluid Dynamics”, Pearson Education, India, 1st Edition, (ISBN: 8177587641/ 9788177587647)
4. Muralidhar, K and Sundararajan T., “Computational Fluid Flow and Heat Transfer”, Narosa Publishing House, New Delhi, 1st Edition, 2003, (ISBN: 1842651722)
5. Ghoshdastidar, P. S., “Computer Simulation of flow and heat transfer”, Tata McGraw-Hill Publishing Company Ltd.,1st Edition, 1998, (ISBN: 0074631500/9780074631508)

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
S.Y. MTECH			**COURSE NAME**	**:**	Compressible Fluid Flow and Gas Dynamics
			COURSE CODE	**:**	ME634
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	**01/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	-	30	50	20	NIL	-	100

PRE-REQUISITE:

1. ME521- Advanced Fluid Mechanics

COURSE OBJECTIVES:

5. ME 634.CEO.1 To basic fundamentals of compressible flow concepts
6. ME634.CEO.2 To understand non-dimensional numbers in compressible flow and to solve the simple compressible flow problems.
7. ME 634.CEO.3 To apply the effect of compressibility in nozzles and diffusers, design criteria of nozzles and diffusers.
8. ME 634.CEO.4 To analyze isentropic compressible flow problems
9. ME 634.CEO.5 To judge fluid properties, and their static-dynamic nature.

COURSE OUTCOMES:

The students after completion of the course will be able to

4. ME634.CO.1: Understanding of fluid properties, and their static-dynamic nature.
5. ME634.CO.2: Understanding fundamental behavior of compressible fluid.
6. ME634.CO.3: Ability to apply their understanding in solving real life problem.

7. ME 634.CO.4 Analyze isentropic compressible flow problems
8. ME 634.CO.5 Judge fluid properties, and their static-dynamic nature.

THEORY:

Unit I	**Basic concepts and isentropic flows**	**8 Hours**

Energy and momentum equations of compressible fluid flows – Stagnation states, Mach waves and Mach cone – Effect of Mach number on compressibility – Isentropic flow through variable ducts – Nozzle and Diffusers – Use of Gas tables.

Unit II	**Flow through Constant Area Ducts**	**8 Hours**

Flows through constant area ducts with heat transfer (Rayleigh flow) and Friction (Fanno Flow) – variation of flow properties – Use of tables and charts – Generalized gas dynamics.

Unit III	**Normal Shock**	**6 Hours**

Governing equations – Variation of flow parameters across the normal and oblique shocks – Prandtl – Meyer relations – Use of table and charts – Applications.

Unit IV	**Jet propulsion**	**6 Hours**

Theory of jet propulsion – Thrust equation – Thrust power and propulsive efficiency –Operation principle, cycle analysis and use of stagnation state performance of ram jet, turbojet, turbofan and turbo prop engines.

Unit V	**Space propulsion**	**8 Hours**

Types of rocket engines – Propellants-feeding systems – Ignition and combustion –Theory of rocket propulsion – Performance study – Staging – Terminal and characteristic, Velocity – Applications – space flights.

TEXT BOOK:

1. J. D. Anderson, “Modern Compressible flow”, McGraw Hill, 3rd Edition, 2003, (ISBN-13: 978-0072424430)
2. H. Cohen, G.E.C. Rogers and Saravanamutto, “Gas Turbine Theory”, Longman Group Ltd., 2008. ISBN-13: 978-0132224376

3. J. D .Anderson, “Fundamentals of Aerodynamics”, McGraw Hill, 5th Edition, (ISBN-13: 978-0073398105)

REFERENCES:

1.G.P. Sutton, “Rocket Propulsion Elements”, Oscar Biblarz, 2010, (ISBN-13: 978-0470080245)

2. A.H. Shapiro, “Dynamics and Thermodynamics of Compressible fluid Flow”, John Wiley & Sons; Volume 1 edition (1 March 1977), (ISBN-13: 978-0471066910)
3. Robert D. Zucker Oscar Biblarz, “Fundamentals of Gas Dynamics”, Wiley; 2 edition (July 15, 2002), (ISBN-13: 978-0471059677)
4. N.J. Zucrow, “Aircraft and Missile Propulsion”, vol.1 & II, John Wiley, 1975, (ISBN-13: 978-1124142098)
5. Gas Turbines, V. Ganesan, Tata McGraw Hill Publishing Co., New Delhi, 1999. (ISBN: 9780070681927)

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
S.Y. MTECH			**COURSE NAME**	**:**	Advanced Air Conditioning and Refrigeration Technology
			COURSE CODE	**:**	ME 641
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	0	40	50	10	NIL	NIL	100

PRE-REQUISITE:

NIL

COURSE OBJECTIVES:

1. ME 641.CEO.1 To Tell variety of air conditioning systems and its applications
2. ME 641.CEO.2 To state complete control systems and its choice
3. ME 641.CEO.4 To Apply various methods in duct system design.
4. ME 641.CEO.5 To Solve numericals on Applied Psychrometry and summer and winter load calculations

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME641.CO.1: Solve numericals on Applied Psychrometry and summer and winter load calculations
2. ME641.CO.2: Apply various methods in design of duct system

3. ME641.CO.3: State variety of air conditioning systems, its applications, complete control systems and its choice

THEORY:

Unit I	**Psychrometry**	**6 Hours**

Composition of moist air, Important psychrometric properties, Methods for estimating moist air properties, Ideal Adiabatic saturation process, Relationship between Wet-Bulb Temperature and Thermodynamic Wet -Bulb Temperature, Sling and Aspiration psychrometers, Relations between psychrometric properties, Psychrometric chart, ASHRAE Psychrometric charts. Use of psychrometric charts and moist air tables, Goff and Gratch tables. Psychrometric Processes, Air washer, Bypass Factor, ADP, Applied Psychrometry –RSHF, GSHF and ESHF. Numerical on Applied Psychrometry.

Unit II	**Thermal Comfort**	**6 Hours**

Thermal comfort, Heat transfer from human body by sensible and latent heat transfer. Metabolic heat generation, steady state and unsteady state model for heat transfer, effect of clothing and definition of effective temperatures. PMV and PPD. ASHRAE comfort chart, Infiltration and ventilation, Indoor Air Quality (IAQ), Sources of indoor air pollution, Methods of control of IAQ, Fresh air requirements for IAQ.

Unit III	**Heating and Cooling load calculations**	**6 Hours**

Differences between winter and summer load calculations, Inside and Outside design conditions, Various sources of the internal and external heat gains, heat losses, Solar radiation, Solar radiation through glass, SHGC and shading coefficients, Heat transfer through building structure, Methods of heat load calculations, Numerical on summer and winter load calculations.

Unit IV	**Duct systems**	**6 Hours**

Frictional pressure drops in straight ducts of circular and rectangular cross-section, equivalent diameter for rectangular duct, Pressure losses in fittings, due to sudden enlargements, contractions, Sizing of ducts, Velocity Reduction method, Equal friction method, Static Regain method, Selection of fans, Fan laws and fan characteristic curves, Air distribution in rooms, Selection and location of supply and return grills, diffusers etc.

Unit V	**Air conditioning systems**	**6 Hours**

All air systems, All water systems, Air water systems, Direct Refrigerant, Unitary systems, Chilled ceilings and chilled beams, displacement ventilation, VAV Air Conditioning, Air cooled VRV (VRF)

systems, Water cooled VRV (VRF), Two stage Evaporative cooling, Desiccant Dehumidification, Heat Pumps and their types Air Conditioning applications –Supermarkets, Restaurants, Kitchen exhaust ventilation systems Hospitals, Office buildings.		
Unit VI	**Control systems for Refrigeration and Air conditioning applications**	**6 Hours**
Closed loop and open loop control systems, Choice of control systems, Types of control action, Energy sources, controllers and controlled devices, Control based on space temperature, Control based on outside temperature, Control based on heating and cooling medium, Control of humidity, Complete control systems.		

TEXT BOOK:

1. Jan F.Kredier, “Handbook of Heating, Ventilation and Air Conditioning” CRC Press LLC, 1st edition, Year-2000, (ISBN 9780849395840).
2. C P Arora, “Refrigeration and Air conditioning”, Tata McGraw Hill Publication, 3rd edition,Year-2008, (ISBN-13:9780070083905).

REFERENCES:

1. Jones W. P., “Air conditioning Applications and Design”, Edward Arnold Publishers Ltd.,2nd edition,Year-2011, (ISBN-13: 978-0415502931).
2. R.C. Arora, Ramesh Chandra, “Refrigeration and Air conditioning”, Publisher-PHI Learning Pvt. Ltd., Eastern economy edition, Year-2010, (ISBN: 978-81-203-3915-6).
3. Robert McDowall, “Fundamentals of HVAC systems”, Publisher-Elsevier Science; SI Ed edition,, Robert McDowall(editor), Year-2007, (ISBN-13: 978-0123739988).
4. ASHRAE Handbooks,ASHRAE, Cdr edition,Year-2014, (ISBN: 9781936504725).

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
S.Y. MTECH			**COURSE NAME**	**:**	Industrial Hydraulics and Pneumatics
			COURSE CODE	**:**	ME 642
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ITA	**ETA**	**IA**			
3	0	30	50	20	NIL	NIL	100

PRE-REQUISITE:

1. ME521- Advanced Fluid Mechanics

COURSE OBJECTIVES:

1. ME 642. CEO.1: To identify various components used for hydraulic and pneumatic systems.
2. ME 642.CEO.2 To select appropriate components required for hydraulic and pneumatic systems
3. ME 642.CEO.3 To examine the hydraulic or pneumatic circuit for its functionality.
4. ME 642.CEO.4 To evaluate the hydraulic or pneumatic devices for their performance.
5. ME 642.CEO.5 To design suitable hydraulic and pneumatic circuit for given application

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME642.CO.1: Identify various components used for hydraulic and pneumatic systems.
2. ME642.CO.2: Select appropriate components required for hydraulic and pneumatic systems.
3. ME642.CO.3: Examine the hydraulic or pneumatic circuit for its functionality.
4. ME642.CO.4: Evaluate the hydraulic or pneumatic devices for their performance.
5. ME642.CO.5: Design suitable hydraulic and pneumatic circuit for given application.

THEORY:

Unit I	**Introduction to Industrial Fluid Power Systems**	

Power transmission modes and comparison. Fluid power and its history. Definition and interrelationships of various terms (properties) used in hydraulics and pneumatics. Laws governing fluid flow: Pascal's law, continuity equation, Bernoulli's theorem, Boyle's, Charles's, Gay-Lussac's laws). Flow through pipes - types, pressure drop in pipes. Working fluids used in hydraulic & pneumatic systems- types, ISO/BIS standards and designations, properties, advantages and limitations. Hydraulic systems - concept, application areas, advantages and limitations. Pneumatic systems - concept, application areas, advantages and limitations.

Unit II	**Hydraulics and pneumatics systems**	

Basic Hydraulic System. Types, Construction, Working, Applications and Selection criteria of Hydraulic pipes, Hydraulic Pumps, Hydraulic Actuators, cylinder cushions and mountings. Hydraulic Control valves, Hydraulic Accessories

Basic Pneumatic System. Pneumatic Pipes - materials, designations, standards, properties and piping layout. Types, construction, working, specifications, selection criteria and Applications of following air preparation and conditioning elements: Air compressors. Air receivers and air dryers. Air Filters, Regulators, Lubricators (FRL unit). Pneumatic Actuators, Pneumatic Control valves.

Unit III	**Hydraulic and pneumatic circuits**	

ISO symbols used in hydraulic and pneumatic circuits. Guiding rules/ norms/ steps/ methods for designing hydraulic and pneumatic circuit. Basic Hydraulic Circuits – intensifier, regenerative, synchronizing, sequencing, speed control, safety, circuit diagram, components, working and applications. Basic Pneumatic Circuits - speed control, two step feed control, automatic cylinder reciprocation, time delay, quick exhaust, circuit diagram, components, working and applications. Pneumatic Logic circuit design.

Unit IV	**Hydraulic and pneumatic devices**	

Concept and applications. Construction, working principle, major elements, performance variables and applications of following devices: Automotive hydraulic brake. Industrial Fork lift. Hydraulic jack. Hydraulic press. Automotive power steering. Automotive pneumatic brake. Automotive air suspension. Pneumatic drill. Pneumatic gun (tools).

Unit V	Installation of hydraulic and pneumatic system	
Causes and remedies for common troubles arising in hydraulic elements. Maintenance of hydraulic systems. Maintenance schedule. Troubleshooting of hydraulic system. Causes and remedies for troubles arising in pneumatic elements. Maintenance of pneumatic system. Maintenance schedule. Troubleshooting of pneumatic system.		
Unit VI	**Hydro-pneumatics**	
Concept, advantages and disadvantages. Types, construction, working, Circuit diagram and application of following hydro pneumatic elements: Air oil reservoir. Hydraulic series check unit. Hydraulic parallel check unit. Hydro pneumatic cylinder. Air oil intensifier. Comparison between hydro pneumatic, hydraulic and pneumatic systems.		

REFERENCES:

1. Andrew Jaico, “Hydraulic And Pneumatics A Technician’s & Engineer’s Guide”,Butterworth-Heinemann; 3 edition (March 11, 2011) Publishing House, 2/e, 2013, (ISBN-13: 978-0080966748)
2. Noah Manring, “Hydraulic Control Systems”, Wiley; 1 edition (April 15, 2005), (ISBN-13: 978-0471693116)
3. Fluid Power Generation, Transmission and Control Jagadeesha, T. Universities Press (India) Private Limited, 1/e, 2014, (ISBN: 9788126539543)

MIT Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2020)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
SY MTECH			**COURSE NAME**	**:**	Cryogenics and Vacuum Technology
			COURSE CODE	**:**	ME 643
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	**01/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	--	40	50	10	----	---	100

PRE-REQUISITE:
NIL

COURSE OBJECTIVES:

1. ME 643.CEO.1 To recall the fundamentals of cryogenic and air gas Liquefaction system
2. ME 643.CEO.2 To classify Gas Separation and Purification Systems
3. ME 643.CEO.3 To summarize various Vacuum Process and cryogenic fluid storage system
4. ME 643.CEO.4 To identify the advance application of Cryogenic Engineering

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME 643.CO.1 Analyze the cryogenic and air gas liquefaction system using thermodynamic cycle
2. ME 643.CO.2 Measure the performance of gas separation and purification system with respect to thermodynamically ideal Separation System
3. ME 643.CO.3 Design the Cryogenic fluid storage system
4. ME 643.CO.4 Adapt the advanced cryogenic system in various industrial and domestic applications

THEORY:

Unit I	**Introduction to Cryogenic Systems and Air –Gas Liquefaction**	**8 Hours**

Introduction to Cryogenic Systems: Definition, cryogenic temperature scale, History of cryogenics, Properties of materials at Low temperature, Properties of Cryogenic Fluids.

Air and Gas Liquefaction Systems: Thermodynamically ideal system, Production of low temperatures. Liquefaction systems for gases other than neon, hydrogen and helium, liquefaction Systems for neon hydrogen and helium. Cryogenic Refrigeration System.

Unit II	**Gas Separation and Purification System**	**8 Hours**

Gas separation and Gas Purification systems: The thermodynamically ideal separation System Properties of mixtures, Principles of gas separation, air separation systems, Hydrogen, Argon, helium air separation systems, Gas purification methods.

Unit III	**Vacuum Techniques**	**6 Hours**

Vacuum Techniques: System for production of high vacuum such as mechanical, diffusion, ion and cryopumps. Cryogenics Measurement Systems: Temperature pressure, flow rate, liquid level measurement, Introduction to Cryocoolers.

Cryogenic fluid storage systems: Introduction, Basic storage vessels, inner vessels, outer vessel design, piping, access manways, safety device. Cryogenic Insulations, gas filled powders and fibrous materials, solid foam, selection and comparison of insulations. Cryogenic fluid transfer systems. Transfer through uninsulated line vacuum insulated lines porous insulated lines etc

Unit IV	**Advances in Cryogenics**	**6 Hours**

Vortex tube and applications, Pulse tube refrigerator Cryogenic Engine for space vehicles Cryogenic Applications: Applications in gas industry cryogenic fluids space research, Cryobiology, food processing, electronics nuclear and high energy physics, chemical Processing metal manufacturing cryogenic power generation, medicine, analytical Physics and chemistry.

REFERENCES:

1. Barron R. F., “Cryogenic Systems”, 2nd Ed., Oxford University Press, 1985, (ISBN-0-19-503567-4).
2. Timmerhaus K. D. and Flynn T. M., “Cryogenic Process Engineering”, 1st ed., Springer, 1989, ISBN-0-19-503567-4. ISBN-10: 1468487582, (ISBN-13: 978-1468487589.

MIT | Academy of Engineering (An Autonomous Institute)			COURSE SYLLABI (2016 - 2018)		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
S.Y. MTECH			**COURSE NAME**	**:**	Steam Engineering
			COURSE CODE	**:**	ME 644
			COURSE CREDITS	**:**	3
RELEASE DATE	**:**	01/06/2017	**REVISION NO.**	**:**	0.0

TEACHING SCHEME:		**EVALUATION SCHEME:**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**TUTORIALS**	**TOTAL**
		ICE	**ECE**	**IA**			
3	NIL	40	50	10	NIL	NIL	100

PRE-REQUISITE:

ME511 Advanced Thermodynamics and Combustion Technology.

COURSE OBJECTIVES:

1. ME 644.CEO.1 To recall the fundamentals of different boilers and significance of mountings and accessories.
2. ME 644.CEO.2 To explain fundamentals energy conservation.
3. ME 644.CEO.3 To analyze thermal systems for energy conservation.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME644.CO.1: Recall basics of steam piping system, its components for a process and also economical and effective insulation.
2. ME644.CO.2: Apply knowledge of thermal system for sources of waste heat design a systems for waste heat recovery.
3. ME644.CO.3: Develop controls and instrumentation for effective monitoring of the process.

4. ME644.CO.4: Design a steam piping system, its components for a process and also economical and effective insulation.

THEORY:		
Unit I	**Introduction:**	**6 Hours**
Fundamentals of steam generation, Quality of steam, Use of steam table, Mollier Chart Boilers,Types, Mountings and Accessories, Combustion in boilers, Determination of adiabatic flame temperature, quantity of flue gases, Feed Water and its quality, Blow down; IBR, Boiler standards.		
Unit II	**Piping & Insulation:**	**6 Hours**
Water Line, Steam line design and insulation; Insulation-types and application, Economic thickness of insulation, Heat savings and application criteria, Refractory-types, selection and application of refractory, Heat loss.		
Unit III	**Steam Systems:**	**6 Hours**
Assessment of steam distribution losses, Steam leakages, Steam trapping, Condensate and flash steam recovery system, Steam Engineering Practices; Steam Based Equipment's / Systems.		
Unit IV	**Boiler Performance Assessment:**	**6 Hours**
Performance Test codes and procedure, Boiler Efficiency, Analysis of losses; performance evaluation of accessories; factors affecting boiler performance.		
Unit V	**Energy Conservation and Waste Minimization:**	**6 Hours**
Energy conservation options in Boiler; waste minimization, methodology; economic viability of waste minimization.		
Unit VI	**Instrumentation & Control:**	**6 Hours**
Process instrumentation; control and monitoring. Flow, pressure and temperature measuring and controlling instruments, its selection.		

TEXT BOOK:

1. T. D. Estop, A. McConkey, Applied Thermodynamics, Parson Publication.
2. Domkundwar; a Course in Power Plant Engineering; Dhanapat Rai and Sons.
3. Yunus A. Cengel and Boles, “Engineering Thermodynamics “, Tata McGraw-Hill Publishing Co. Ltd.

REFERENCES:

1. Energy Efficiency in Thermal Utilities; Bureau of Energy Efficiency.
2. Energy Performance Assessment for Equipment & Utility Systems; Bureau of Energy Efficiency.
3. Edited by J. B. Kitto & S C Stultz; Steam: Its Generation and Use; The Babcock and Wilcox Company.
4. P. Chatopadhyay; Boiler Operation Engineering: Questions and Answes; Tata McGrawHill Education Pvt Ltd, N Delhi.

MIT | Academy of Engineering (An Autonomous Institute)			**COURSE SYLLABI (2016-2018)**		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
SY MTECH			**COURSE NAME**	**:**	Project Work II
			COURSE CODE	**:**	ME604
			COURSE CREDIT	**:**	4
RELEASE DATE	**:**	**1/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
NIL	8	---	---	50	NIL	50	100

PREREQUISITES:

1. ME 523 Project Work I

COURSE OBJECTIVES:

1. ME604.CEO.1: To develop self-management, documentation & technical skills.
2. ME604.CEO.2: To Demonstrate a strong working knowledge of ethics and professional responsibility.

COURSE OUTCOMES:

The students after completion of the course will be able to

1. ME604.CO.1: Develop self-management, documentation & technical skills.
2. ME604.CO.2: Design, analyze & troubleshoot schematics, connection diagrams, block diagrams, timing diagrams for a given electronics circuit or system.

CONTENTS

Project Stage II is related with Goals and Objectives, System Architecture, Algorithm /Methodology. Project report submission and mid trimester presentation will be conducted by department based on following points,

- Literature survey
- Motivation and Problem Statement
- Goals and Objectives
- Problem statement
- System Architecture
- UML, DFD, Design Details
- Proposed Algorithm
- Expected Outcome and Result
- Preparation of manuscript (paper) on Literature survey

Final Project Stage II Report submission and Presentation shall be conducted at the end of the trimester. End-Trimester Assessment (ETA) presentation shall be conducted in front of eminent expert from Academics or Industry.

MIT | Academy of Engineering (An Autonomous Institute)			**COURSE SYLLABI (2016-2018)**		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
SY MTECH			**COURSE NAME**	**:**	Project Work III
			COURSE CODE	**:**	ME611
			COURSE CREDIT	**:**	10
RELEASE DATE	**:**	**1/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
NIl	20	---	---	150	NIL	50	200

PREREQUISITES:

1. ME523 Project Work I
2. ME601 Project Work II

COURSE OBJECTIVES:

1. ME611.CEO.1: Demonstrate effective project execution and techniques that result in successful projects.

COURSE OUTCOME:

1. ME611.CO.1: To execute work within prescribed guidelines, project specifications, and within a proposed budget.

CONTENTS

Project Stage III is related with Design, Algorithm /Methodology Implementation Results. Project report submission and mid trimester presentation will be conducted by department based on following points,

- Literature survey
- Motivation and Problem Statement
- Goals and Objectives
- Problem statement
- System Architecture
- UML, DFD, Design Details
- Proposed Algorithm
- Methodology
- Implementation
- Results
- Preparation of manuscript (paper) on Literature survey as mentioned in Project Work II
- Preparation of manuscript (paper) on design
- Publication details of paper on Literature survey and Design (Peer reviewed International conference like IEEE, ACM, Elsevier, Springer etc)

Final Project Stage III Report submission and Presentation shall be conducted at the end of the trimester. End-Trimester Assessment (ETA) presentation shall be conducted in front of eminent expert from Academics or Industry

MIT | Academy of Engineering (An Autonomous Institute)			**COURSE SYLLABI (2016-2018)**		
DEPARTMENT OF MECHANICAL ENGG.			**W.E.F.**	**:**	2017-18
SY MTECH			**COURSE NAME**	**:**	Project Work IV
			COURSE CODE	**:**	ME621
			COURSE CREDIT	**:**	10
RELEASE DATE	**:**	**1/06/2017**	**REVISION NO.**	**:**	0.0

TEACHING SCHEME :		**EVALUATION SCHEME :**					
LECTURE	**PRACTICAL**	**THEORY**			**PRACTICAL**	**PRESENTATION/ DEMONSTRATION**	**TOTAL**
		ITA	**ETA**	**IA**			
NIL	20	---	---	200	NIL	100	300

PREREQUISITES:

1. ME523 Project Work I
2. ME601 Project Work II
3. ME611 Project Work III

COURSE OBJECTIVES:

1. ME621.CEO.1: Demonstrate effective project execution and techniques that result in successful projects.

COURSE OUTCOME:

1. ME621.CO.1: To execute work within prescribed guidelines, project specifications, and within a proposed budget.

CONTENTS

Project Stage IV is related with Algorithm /Methodology Implementation, Results, Result Analysis using various charts/ graphs. Project report submission and mid trimester presentation will be conducted by department based on following points.

- Literature survey
- Motivation and Problem Statement
- Goals and Objectives
- Problem statement
- System Architecture
- UML, DFD, Design Details
- Proposed Algorithm
- Methodology
- Implementation
- Results
- Result Analysis
- Preparation of manuscript (paper) on Literature survey as mentioned in Project Work II
- Preparation of manuscript (paper) on design as mentioned in Project Work III
- Publication details of paper on Literature survey and Design (Peer reviewed International conference like IEEE, ACM, Elsevier, Springer etc) as mentioned in Project Work III
- Publication details of paper on Result analysis (Peer reviewed /Free International Journal)

Final Project Stage III Report submission and Presentation shall be conducted at the end of the trimester. End-Trimester Assessment (ETA) presentation shall be conducted in front of eminent expert from Academics or Industry.