SHRI VENKATESHWARA UNIVERSITY

Syllabus

M. TECH
Thermal Engineering
I Semester

(w.e.f. 2019-20)

SCHOOL OF ENGINEERING & TECHNOLOGY

M. TECH
Thermal Engineering
SEMESTER-I

Sl. No.	Subject Codes	Subject	Periods			Evaluation Scheme				End Semester			
			L	T	P	CT	TA	Total	PS	TE	PE	Total	Credit
1	MTE-101	Thermodynamics and Combustion	3	1	0	20	10	30		70		100	4
2	MTE-102	Advanced Fluid Dynamics	3	1	0	20	10	30		70		100	4
3	MTE-012	Energy Conservation and Management.	3	0	0	20	10	30		70		100	3
4	MTE-022	Gas Turbines	3	0	0	20	10	30		70		100	3
5	MLC-101	Research Methodology and IPR	2	0	0	20	10	30		70		100	2
6	MTE-111	Thermal Engineering Lab Practice-I	0	0	4				25		25	50	2
7	MTE-112	Thermal Engineering Lab Practice-II	0	0	4				25		25	50	2
8	AUD-101	English for Research Paper Writing	2	0	0								0
		Total										**600**	**20**

MTE-101 Thermodynamics and Combustion

Course Outcomes:

At the end of the course:

udent will get Knowledge of exergy, basic laws governing energy conversion in multi- component systems and application of chemical thermodynamics.

Student will be aware about advanced concepts in thermodynamics with emphasis on thermodynamic relations, equilibrium and stability of multiphase multi-component

systems.

3. Student will be aware about the molecular basis of thermodynamics.
4. To present theoretical, semi-theoretical and empirical models for the prediction of thermodynamic properties.
5. Student will be acquire the confidence in analyze the motion of combusting and non- combusting fluids whilst accounting for variable specific heats, non-ideal gas properties, chemical non-equilibrium and compressibility
6. Student should apply the fundamental principles of thermodynamics to non-ideal models of numerous engineering devices

Student can use a systems approach to simplify a complex problem

Syllabus Contents: **L T P**

3 -0 -0

Unit 1

First law and State postulates, Second law and Entropy, Availability and Irreversibility, Transient flow analysis

Unit 2

Nonreactive Ideal-Gas Mixture, PvT Behavior of Real gases and Real Gas mixture

Unit 3

Generalized Thermodynamic Relationship

Unit 4

Combustion and Thermo-chemistry, Second law analysis of reacting mixture, Availability analysis of reacting mixture,Chemical equilibrium

Unit 5

Statistical thermodynamics, statistical interpretations of first and second law and Entropy, Third law of thermodynamics, Nerst heat theorem.

References:

1. Cengel, “Thermodynamics”, Tata McGraw Hill Co., New Delhi, 1980.
2. Howell and Dedcius, “Fundamentals of Engineering Thermodynamics”, McGraw Hill Inc., U.S.A.
3. Van Wylen & Sonntag, “Thermodynamics”, John Wiley and Sons Inc., U.S.A.
4. Jones and Hawkings, “Engineering Thermodynamics”, John Wiley and Sons Inc., U.S.A, 2004.
5. Holman, “Thermodynamics”, McGraw Hill Inc., New York, 2002.
6. Faires V.M. and Simmag, “Thermodynamics”, Macmillan Publishing Co. Inc., U.S.A.
7. Rao Y.V.C., “Postulational and Statistical Thermodynamics”, Allied Publishers Inc, 1994.

MTE-102 Advanced Fluid Dynamic

Course Outcomes:

At the end of the course:

1. The Students shall be able to understand and define the fluid flow problems along with range of governing parameters
2. The student shall be eligible to take up the fluid flow problems of industrial base.
3. The students shall be able to devise the experiments in the field of fluid mechanics.
4. The Students shall be able understand the flow patterns and differentiate between the flow regimes and its effects.

Syllabus Contents: **L T P**

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Unit 1

Governing equations in Fluid Dynamics: Derivation of Continuity and Momentum equations using integral and differential approach, dimensionless form of governing equations, special forms of governing equations, integral quantities

Unit 2

Exact Solutions of Navier-Stokes Equations: Fully developed flows, parallel flow in straight channel, Couette flow, Creeping flows Potential Flow: Kelvin's theorem, Irrotational flow, Stream function-vorticity approach,

Unit 3

Laminar Boundary layers: Boundary layer equations, flow over flat plate, Momentum integral equation for boundary layer, approximate solution methodology for boundary layer equations

Unit 4

Turbulent Flow: Characteristics of turbulent flow, laminar turbulent transition, time mean motion and fluctuations, derivation of governing equations for turbulent flow, shear stress models, universal velocity distribution

Unit 5

Experimental Techniques: Role of experiments in fluid, layout of fluid flow experiments, sources of error in experiments, data analysis, design of experiments, review of probes and transducers, Introduction to Hot wire Anemometry, Laser Doppler Velocimetry and

Particle Image Velocimetry

References:

1. Muralidhar and Biswas, Advanced Engineering Fluid Mechanics, , Alpha Science International, 2005
2. Irwin Shames, Mechanics of Fluids, , McGraw Hill, 2003
3. Fox R.W., McDonald A.T , Introduction to Fluid Mechanics, John Wiley and Sons Inc, 1985
4. Pijush K. Kundu, Ira M Kohen and David R. Dawaling, Fluid Mechanics, Fifth Edition, 2005

MTE-011 Nuclear Engineering

Course Outcomes:

At the end of the course:

1. Student will understand the basic concepts and processes taking place inside a nuclear reactor, such as nuclear fission, neutron production, scattering, diffusion, slowing down and absorption.
2. The student will also be familiar with concepts of reactor criticality, the relationship between the dimension and fissile material concentration in a critical geometry.
3. The student will also be familiar with Time dependent (transient) behaviour of power reactor in non-steady state operation and the means to control the reactor.
4. The student will also be familiar with concepts of heat removal from reactor core, reactor safety and radiation protection.

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Unit 1

Basics of nuclear fission and power from fission

Radioactivity, nuclear reactions, cross sections, nuclear fission, power from fission, conversion and breeding

Unit 2

Neutron transport and diffusion

Neutron transport equation, diffusion theory approximation, Fick's law, solutions to diffusion equation for point source, planar source, etc., energy loss in elastic collisions, neutron slowing down

Unit 3

Multigroup, multiregion diffusion equation, concept of criticality

Solution of multigroup diffusion equations in one region and multiregion reactors, concept of criticality of thermal reactors

Unit 4

Reactor kinetics and control

Derivation of point kinetics equations, inhour equation, solutions for simple cases of reactivity additions, fission product poison, reactivity coefficients

Unit 5

Heat removal from reactor core

Solution of heat transfer equation in reactor core, temperature distribution, critical heat flux

Reactor safety, radiation protection

Reactor safety philosophy, defence in depth, units of radioactivity exposure, radiation protection standards

References:

1. Introduction to Nuclear Engineering (3rd Edition) by John R. Lamarsh, Anthony J.Barrata, Prentice Hall, (2001)
2. Introduction to Nuclear Reactor Theory, by John R. Lamarsh, Addison-Wesley, 1966)
3. Nuclear Reactor Analysis, by James J. Duderstadt and Lewis J. Hamilton, John Wiley(1976)

MTE-012 Energy Conservation and Management

Course Outcomes:

At the end of the course:

1. The student should acquire insight about the importance of energy
2. The student should capable to analyze all scenarios from energy consumption
3. The student should generate scenarios of energy consumption and predict the futuretrend The student should Suggest and plan energy conservation solutions

Syllabus Contents: **L T P**

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Unit 1

The energy market, energy scenario, planning, utilization pattern and future strategy, Importance of energy management.

Unit 2

Energy auditing- methodology and analysis,

Unit 3

Energy economics,

Unit 4

Energy conservation in industries, Cogeneration, Combined heating and power systems,

Unit 5

Relevant international standards and laws.

References:

1. L.C. Witte, P.S. Schmidt, D.R.Brown, “Industrial Energy Management and Utilization”, Hemispherical Publication, 1988.
2. Callaghan “Energy Conservation”.
3. D.A. Reeg, “Industrial Energy Conservation”, Pergamon Press, 1980.
4. T.L. Boyen, “Thermal Energy Recovery” Wiley, 1980.
5. L.J. Nagrath, “Systems Modeling and Analysis”, Tata McGraw Hill, 1982.
6. W.C. Turner, “Energy Management Handbook “, Wiley, New York, 1982.
7. I.G.C. Dryden, “The Efficient Use of Energy “, Butterworth, London, 1982.
8. R. Loftnen, Van Nostrarid Reinhold C. “Energy Handbook”, 1978.
9. TERI Publications.

MTE-013 Air conditioning system Design

Course Outcomes:

At the end of the course:

1. Student should understand construction and design features Air-conditioning system
2. Student should understand various types and its adoptability in the various environment and application areas.
3. Student should understand various health issues

   Student should design seasonal energy efficient system

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Unit 1

Air conditioning systems,

Unit 2

various air-conditioning processes,

Unit 3

Enthalpy deviation curve, psychrometry , SHF, dehumidified air quantity, human comfort, indoor air quality,

Unit 4

Design conditions and load calculations, air distribution, pressure drop, duct design, fans &, blowers,

Unit 5

Performance & selection, noise control.

References:

1. ASHRAE Handbook.
2. "Handbook of air-conditioning system design", Carrier Incorporation, McGraw Hill Book Co.,
3. U.S.A, 1965.
4. "Refrigeration and air-conditioning", ARI, Prentice Hall, New Delhi, 1993.
5. Norman C. Harris, "Modern Air Conditioning", New York, McGraw-Hill,1974.
6. Jones W.P., "Air Conditioning Engineering", Edward Arnold Publishers Ltd., London, 1984.
7. Hainer R.W., "Control Systems for Heating, Ventilation and Air-Conditioning", Van Nostrand
8. Reinhold Co., New York, 1984. 7. Arora C.P., "Refrigeration & Air Conditioning", Tata Mc Graw Hill, 1985.
9. Manohar Prasad, "Refrigeration & Air Conditioning", New Age Publishers.
10. Stoecker, "Refrigeration & Air Conditioning", Mc Graw Hill, 1992.
11. 10. Stoecker, "Design of Thermal Systems", Mc Graw Hill, 1992.

MTE-014 Gas Turbines

Course Outcomes:

At the end of the course:

1. Student should understand construction and design features of gas turbines as used for power generation.
2. Student should understand thermodynamics cycles a, and different sizes and layouts of gas turbine plant.
3. Able to understand thermodynamics and fluid mechanics component for enhancing the efficiency and effectively of gas turbines.

Syllabus Contents:

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Unit 1

Introduction, Cycles, Performance characteristics and improvement,

Unit 2

Gas dynamics, Centrifugal, axial and mixed flow compressor, principles and characteristics, Turbine construction, Blade materials, manufacturing techniques, blade fixing,

Unit 3

Problems of high temperature operation, blade cooling, practical air cooled blades Combustion Systems, various fuels and fuel systems,

Unit 4

Jet propulsion cycles and their analysis, parameters affecting performance, thrust augmentation, environmental considerations and applications.

References:

1. H Cohen, GFC Rogers and HIH Saravanamuttoo, "Gas Turbine Theory", Pearson Education, 2000.
2. V. Ganesan, "Gas Turbines", Tata McGraw Hill, 2003.
3. S.M.Yahya "Turbines, Compressors and Fans", Tata McGraw Hill, 1992.
4. Vincent "The theory and design of Gas Turbine and Jet Engines", McGraw Hill, 1950.
5. W W Bathic, "Fundamentals of Gas Turbines", John Wiley and Sons.

MTE-103 & MTE-104 Thermal Engineering Lab Practice – I and II

Syllabus Contents:

- The lab practice consists of the tutorials and experiments as decided by the course supervisors of the Program Core Courses (PCC) namely Fluid Dynamics, Advanced Heat Transfer, Thermodynamics and Combustion, Refrigeration and Cryogenics.

MLC-101 Research Methodology and IPR

Course Outcomes:

At the end of this cours

Students will be able to Understand research problem formulation.

1. Analyze research related information
2. Follow research ethics
3. Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
4. Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
5. Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

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Unit 1: Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

Unit 2: Effective literature studies approaches,analysis Plagiarism, Research ethics,

Unit 3: Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a reviewcommittee

Unit 4: Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

Unit 5: Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

Unit 6: New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs**.**

References:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students'"
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"

3. Ranjit Kumar, 2 nd Edition, “Research Methodology: A Step by Step Guide for beginners”
4. Halbert, “Resisting Intellectual Property”, Taylor & Francis Ltd ,2007.
5. Mayall , “Industrial Design”, McGraw Hill, 1992.
6. Niebel , “Product Design”, McGraw Hill, 1974.
7. Asimov, “Introduction to Design”, Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, “ Intellectual Property in New Technological Age”, 2016.
9. T. Ramappa, “Intellectual Property Rights Under WTO”, S. Chand, 2008