Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

M. Tech. Mechanical- Heat Power Engineering

Curriculum Structure

Semester I

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	HP101	Advanced Heat Transfer	3	1	-	4	4	15	15	10	60	100
2	HP102	Advanced Thermodynamics & Combustion	3	1	-	4	4	15	15	10	60	100
3	HP1*3	Elective –I	3	1	-	4	4	15	15	10	60	100
4	HP1*4	Elective –II	3	1	-	4	4	15	15	10	60	100
5	HP107	Experimental Methods in Thermal and Fluid Engineering	3	-	-	3	3	15	15	10	60	100
6	HP 106	Industrial Instrumentation Lab.	-	-	4	4	2	-	-	50	50	100
Total			15	04	04	23	21	75	75	100	350	600

L: Lecture T: Tutorial P: Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment for lab courses

CT2- Class Test 2 ESE- End Semester Examination

*-Elective I and Elective II list is provided at the end of the structure

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

M. Tech. Mechanical- Heat Power Engineering

Curriculum Structure

Semester II

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	HP 201	Numerical Computation of Fluid Flow & Heat Flow	3	1	-	4	4	15	15	10	60	100
2	HP 202	Energy Analysis of Thermal Systems	3	1	-	4	4	15	15	10	60	100
3	HP 203	Design of Heat Transfer Equipments	3	1	-	4	4	15	15	10	60	100
4	HP 2*4	Elective-III	3	1	-	4	4	15	15	10	60	100
5	HP 2*5	Elective-IV	3	1	-	4	4	15	15	10	60	100
6	HP 206	Thermal Engineering Lab.	-	-	4	4	2	-	-	50	50	100
7	HP 207	Seminar I	-	-	2	2	1	-	-	50	-	50
		Total	15	05	06	26	23	75	75	150	350	650

L: Lecture T: Tutorial P: Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment for lab courses

CT2- Class Test 2 ESE- End Semester Examination

*-Elective III and Elective IV list is provided at the end of the structure

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

M.Tech. Mechanical- Heat Power Engineering

Curriculum Structure

Semester III

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	HP 301	Seminar II	-	-	2	2	1			50	-	50
2	HP 302	Dissertation Phase I	-	-	20	20	10			100	-	100
		Total	-	-	22	22	11			150	-	150

L: Lecture T: Tutorial P: Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment

CT2- Class Test 2 ESE- End Semester Examination (For Laboratory: End Semester Performance)

Semester IV

Sr. No.	Course Code	Course Title	L	T	P	Contact Hrs/Wk	Credits	EXAM SCHEME				
								CT1	CT2	TA/CA	ESE	TOTAL
1	HP 402	Dissertation Phase II	-	-	30	30	20			100	200	300
		Total	-	-	30	30	20			100	200	300

L: Lecture T: Tutorial P: Practical

CT1- Class Test 1 TA/CA- Teacher Assessment/Continuous Assessment for lab courses

CT2- Class Test 2 ESE- End Semester Examination

Government College of Engineering, Karad

(An Autonomous Institute of Government of Maharashtra)

Programme: Mechanical Engineering Department

List of Electives

Elective- I	**Elective - II**	**Elective - III**	**Elective - IV**
Semester - I	Semester - I	Semester - II	Semester - II
HP 113 Advanced IC Engines	**HP 114**Advanced Automobile Engineering	**HP 214**Design of Renewable Energy Equipments and Systems	**HP215**Gas Turbine and Jet Population
HP 123 Advanced Refrigeration	**HP 124** Design of Air Conditioning Systems	**HP 224**Cryogenics	**HP225**Advanced Mathematical Methods and Optimisation
HP 133 Advanced Fluid Mechanics	**HP 134**Energy Analysis & Management		**HP235**Design of Pumps, Compressors and Blowers

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 101: Advanced Heat Transfer

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credits	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Advanced Heat Transfer to cope up with requirements of industry.
2. To familiarize the students with developments in Advanced Heat Transfer
3. To provide a technical understanding of common engineering processes related with Advanced Heat Transfer
4. To provide a technical understanding of use of computer and advanced tools related with Advanced Heat Transfer

Course Contents		**Hours**
Unit I	**Review of Basics Of Heat transfer**: Differential Equation of Heat conduction in Cartesian conduction Cylindrical & Spherical coordinates of isotropic and anisotropic materials, Thermal conductivity variation with temperature for Solid, Liquid and Gases **Extended Surfaces:** Steady state analysis and optimization-Radial fins of rectangular and hyperbolic profiles-Longitudinal fin of rectangular profile radiating to free space, recent advances in Fins, their material and Heat Transfer enhancement Technique.	7
Unit II	**Multi Dimensions steady state conduction**: Introduction, Mathematical analysis of two-dimensional Heat Conduction, Graphical Analysis, The conduction shape – factor, Numerical method of analysis, Gauss-Seidel Iteration, Electrical analogy for two –dimensional conduction.	7
Unit III	**Unsteady state conduction**: Introduction, Lumped Heat Capacity system, Transient heat flow in a semi-finite solid, Convection Boundary Conditions, Multi-dimensional system Transient numerical method, Thermal resistance and capacity formulation, Graphical Analysis – The Schmidt plot, Micro scale heat transfer	7
Unit IV	**Convection :** Laminar Boundary Layer on a flat plate energy equation of the Boundary layer, The thermal Boundary layer, The relation between Fluid friction and Heat transfer, Turbulent Boundary – Layer Heat transfer thickness, Heat transfer in laminar tube flow, Turbulent flow in a tube. Analogy for Laminar and Turbulent Flow, Empirical relations for pipe and tube flow, Flow across cylinders, spheres, Tube banks. Liquid metal heat transfer, Electronic Cooling, Transpiration Cooling and Abrasion Heat Transfer **Natural Convection:** Free convection Heat transfer on a vertical flat plate, Empirical relations and flow field for free convection, free convection from vertical planes and cylinders, Horizontal plates and cylinders, inclined surface	7
Unit V	**Radiation:** Radiation mechanism, properties, Shape factor, Shields, Radiation heat exchange between non-black bodies. Radiation network for an absorbing and Transmitting, Reflecting and absorbing media. Formulation for numerical solution, Thermal Radiations from a Luminous Fuel, Oil, gas and Flames, Radiation of Gases and Vapor **Heat exchangers:** Types of heat exchangers and applications.	7
Unit VI	**Condensation and Boiling:** Introduction, condensation heat transfer phenomena, the condensation number, Film condensation on inclined plates, vertical and horizontal tubes, sphere, tube banks. Condensation and Boiling enhancement Technique, Boiling Heat Transfer, Bubble dynamics and their heat transfer correlations for pool and flow boiling, Heat Pipes and their types, Recent advances in Heat Pipes.	7

Course Outcome (CO):

1 Student will able to understand the basic concepts and principles of thermal process applications.
2 Student will analyze and design the thermal related equipments.
3 Student will develop simulation of thermal system using advanced software tools.
4 Student will identify the techniques to enhance the heat transfer in particular thermal applications.

Tutorial

1 Student should prepare Report/ Term Paper up to 10-15 pages based on topics in recent advances in Heat Transfer In consent with teacher and will present it.
2 Plotting of Schmidt Plot by a Computer program.
3 Determination of correlations between Nusselt, Prandtl and Reynolds number in forced convection Heat Transfer.
4 Determination Thermal conductivity of Liquids and gases.
5 Determination of Effectiveness in parallel and counter flow heat Exchanger.
6 Determination of heat transfer in Boiling and Condensation.
7 Two assignment involving computer programs based on above syllabus

Text Books

1 **Saddik Kakac**: Heat Conduction, McGraw-Hill Pub.
2 **S. P. Sukhatme:** Heat Transfer, Universities press.
3 **J.P. Holman,** Heat Transfer, McGraw-Hill Pub.
4 **A.J. Chapman:** Heat Transfer, Macmillan Publishing Co. New York
5

References

1 **W.M. Kays and Crawford:** Convective Heat and Mass transfer, McGraw-Hill Co
2 **Eckert and Drake:** Analysis of Heat Transfer, McGraw-Hill Co
3 **Naylor:** Introduction to Convective Heat Transfer Analysis,
4 **Burmister**: Convective Heat Transfer,
5 **Incropera:** Fundamentals of Heat and Mass Transfer,
6 **Cengel:** Heat Transfer Practical Approach, McGraw Hills Co.
7 **P.K. Nag:** Heat Transfer, TATA McGraw-Hill Co.
8 **Bejan:** Convective Heat and Mass transfer

Useful Links

1 http://www.sciencedirect.com/science/bookseries
2 http://www.thermalfluidscentral.org/e-books
3 http://www.elsevier.com/books/advances-in-heat-transfer
4 http://www.ecs.umass.edu/mie/faculty/rothstein/mie606_fall02.pdf

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	J	k	l
CO1	✓							✓				
CO2		✓	✓									✓
CO3					✓					✓	✓	✓
CO4		✓			✓	✓						✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	0	05
Understand	3	3	2	05
Apply	3	*3*	2	10
Analyze	2	3	2	15
Evaluate	2	2	2	15
Create	2	2	2	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mech - Heat Power Engg.
HP 102:Advanced Thermodynamics and Combustion

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Advanced Thermodynamics to cope up with requirements of industry.
2. To familiarize the students with developments in Advanced Thermodynamics
3. To provide a technical understanding of common engineering processes related with Advanced Thermodynamics
4. To provide a technical understanding of use of computer and advanced tools related with Advanced Thermodynamics

Course Contents		**Hours**
Unit I	**Thermodynamics Relations**:- Mathematical theorems, Maxwell relations, T-dS equations, Energy Equations, General Relations involving internal energy, enthalpy &entropy, Thermodynamics Relations involving specific heat , Clapeyron equation, Joule Thomson Coefficient, Developing Tables of Thermodynamics properties from experimental data.	7
Unit II	**Real Gases: -** Deviation from ideal gas behavior, equation of state for real gases, reduced properties, Generalizes equation of state, laws of corresponding states, Generalized compressibility charts, enthalpy deviation and entropy deviation charts and their applications, P-V-T surfaces of real substances, Fugacity and activity. **Kinetic Theory of Gases:-** Postulates, concept of elastic collisions and mean free path, Derivation of ideal gas laws from kinetic theory, Distribution of molecular velocities, Maxwellion speeds and temperature, Law of equi-partition of energy, Survival equation, Transport phenomenon.	7
Unit III	**Statistical Thermodynamics:-** Fundamental Principles, Equilibrium distribution, Significance of Lagrangian Multipliers λ & β, Partition function, Equi-partition of energy, Distribution of speeds in an Ideal monotomic gas, Statistical Interpolation of Work and Heat, Entropy & Information.	7
Unit IV	**Mixtures and Solutions:-** Dalton Model , Amagat Model, Simplified model of a mixture involving gases and a vapour, First law applied to Gas-Vapour mixtures, Adiabatic saturation process, Partial Molar properties, change in properties upon mixing, Thermodynamic properties relations for variable composition, Gibbs function and Enthalpy, Fugacity in a mixture, Ideal solution, Activity and Activity coefficient.	7
Unit V	**Chemical Reactions:-** Combustion process, Theoretical and actual combustion processes, Enthalpy of formation, Enthalpy of combustion, First law analysis of Reacting systems, Adiabatic flame temperature Enthalpy and internal energy of combustion, Entropy change of Reacting systems, Heat of reaction, Second law Analysis of Reacting systems, Evaluation of Actual combustion processes.	6
Unit VI	**Phase and Chemical Equilibrium:-** Equilibrium requirements, Equilibrium between two phases of a pure substances, Equilibrium of a multi-component , Multiphase system, Gibbs phase Rule, Meta stable Equilibrium, Chemical equilibrium, Simultaneous reactions, Ionization. **Combustion basics:-**Reaction rates and first, Second and higher order reaction in gaseous, liquid and solid phases. Combustion and flame	6

velocities, laminar and turbulent flames, premixed and diffusion flames, their properties and structures

Combustion Theories: - Theories of flame propagation, thermal, diffusion and comprehensive theories, problems of flame stability, flashback and blow off. Combustion of solid, liquid and gaseous fuels. Combustion of fuel droplets and sprays

Combustion applications:-Combustion system- combustion in closed and open systems, application to boiler, gas turbine combustors and rocket motors.

Course Outcome (CO):

1 Student will understand the physical phenomena of thermodynamic process in a coherent and lucid manner.
2 Student will clearly visualize the physics behind every thermodynamic process.
3 Student will identify the governing principles, the assumptions to be made with development in applicability.
4 Student will apply the principles to the solution of practical engineering problems characteristic of engineering design.
5 Student can obtain a single numerical solution and investigate the effects of varying parameters using software tool Interactive Thermodynamics.

Tutorial Eight assignments on syllabus

Text Books

1 **V. Wylen& E. Sonntag.** "Fundamentals of Classical Thermodynamics" Wiley Eastern Limited, New Delhi,
2 **J. P. Holman,** "Thermodynamics", McGraw Hill, London.
3 **Adrian Bejan, George T., Michael Moran,** "Thermal Design and Optimization" John Willey and Sons, Inc.,
4 **T.J. Kotas,** "The Energy Method of Thermal Plant Analysis", Butterworth,

References

1 **J.L. Thrdkeld,** "Thermal environmental engineering", Prentice Hall, Inc. New Jersy.
2 **M.W. Zemansky,** "Heat and Thermodynamics",
3 **M.L. Mathur& S.C. Gupta,** "Thermodynamics for Engineers", Dhanpatrai and Sons Ltd., New Delhi.
4 **Howell &Duckins,** "Fundamentals of Engineering Thermodynamics
5 **Lee-Sears,** "Engineering Thermodynamics".
6 **N.A. Chigier,** Energy Combustion and Environment –McGraw-Hill 1981
7 **A. Murthy Kanury, Gordon and Breach,** Introduction to combustion phenomena,1975
8 **S. P. Sharma and Chandra Mohan,** Fuels and combustion –Tata McGraw –Hill. 1984

Useful Links

1 https://www.handbook.unimelb.edu.au/view/2015
2 http://www.webserver.dmt.upm.es/~isidoro/.../Combustion%20thermodynamics.pdf
3 http://www.sanfoundry.com/best-reference-books-advanced-thermodynamics
4 http://web.itu.edu.tr/~sorusbay/ICE/index_files/LN05.pdf

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	J	k	l
CO1	✓							✓				
CO2	✓				✓						✓	
CO3	✓	✓								✓		
CO4		✓	✓					✓				✓
CO5			✓									✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	2	05
Understand	3	3	2	15
Apply	3	*3*	2	10
Analyze	2	3	2	10
Evaluate	2	2	2	15
Create	2	2	0	05
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 113: Elective I - Advanced I.C. Engines

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Advanced I.C. Engines to cope up with requirements of industry.
2. To familiarize the students with developments in Advanced I.C. Engines
3. To provide a technical understanding of common engineering processes related with Advanced I.C. Engines
4. To provide a technical understanding of use of computer and advanced tools related with Advanced I.C. Engines

Course Contents		**Hours**
Unit I	**Spark Ignition Engines** Air-fuel ratio requirements, Design of carburetor –fuel jet size and venturi size, Stages of Combustion-normal and abnormal combustion, Factors affecting knock, Combustion chambers, Introduction to thermodynamic analysis of SI Engine combustion process	7
Unit II	**Compression Ignition Engines** Stages of combustion-normal and abnormal combustion – Factors affecting knock, Direct and Indirect injection systems, Combustion chambers, Turbo charging, Introduction to Thermodynamic Analysis of CI Engine Combustion process	7
Unit III	**Engine Exhaust Emission Control** Formation of NOX, HC/CO mechanism, Smoke and Particulate emissions, Green House Effect, Methods of controlling emissions, Three way catalytic converter and Particulate Trap, Emission (HC,CO, NO and NOx) measuring equipments, Smoke and articulate measurement, Indian Driving Cycles and emission norms	7
Unit IV	**Alternate Fuels** Alcohols, Vegetable oils and bio-diesel, Bio-gas, Natural Gas, Liquefied Petroleum Gas, Hydrogen, Properties, Suitability, Engine Modifications, Performance, Combustion and Emission Characteristics of SI and CI Engines using these alternate fuels.	6
Unit V	**Recent Trends** Homogeneous Charge Compression Ignition Engine, Lean Burn Engine, Stratified Charge Engine, Surface Ignition Engine, Four Valve and Overhead cam Engines, Electronic Engine Management, Common Rail Direct Injection Diesel Engine, Gasoline Direct Injection Engine, Data Acquisition System – pressure pick up, charge amplifier PC for Combustion and Heat release analysis in Engines	7

Course Outcome (CO):

1. Student will able to familiarize with latest developments in Advanced I.C. Engines

industries

2 Student will able to investigate the performance of engine using environmental-friendly alternative fuels available

3 Student will motivate for current research to enhance the existing performance of I.C. Engine

4 Student will aware of standard performance tests on I.C. Engines using advanced computerized software tools

Tutorial Eight assignments on above syllabus.

Text Books

1 John B Heywood, “Internal Combustion Engine Fundamentals”, Tata McGraw-Hill

2 Patterson D.J. and Henein N.A., “Emissions from combustion engines and their control”, Ann Arbor Science publishers Inc, USA

3 Gupta H.N, “Fundamentals of Internal Combustion Engines”, Prentice Hall of India.

References

1 Ultrich Adler, “Automotive Electric / Electronic Systems”, Robert Bosh GmbH.

Useful Links

1 http://www.slideshare.net/ravirajan1257/advanced-ic-engines-unit

2 https://www.erc.wisc.edu

3 http://www.scientific.net

4 http://www1.eere.energy.gov/hydrogenandfuelcells/pdfs/28890yy.pdf

Mapping of CO and PO

	a	B	c	d	e	f	g	h	i	j	k	L
CO1	✓							✓		✓		
CO2		✓				✓		✓				✓
CO3			✓							✓	✓	✓
CO4				✓				✓		✓	✓	✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	10
Understand	3	3	2	10
Apply	3	*3*	2	10
Analyze	3	3	2	15
Evaluate	3	3	2	15
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 123: Elective I - Advanced Refrigeration

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Advanced Refrigeration to cope up with requirements of industry.
2. To familiarize the students with developments in Advanced Refrigeration
3. To provide a technical understanding of common engineering processes related with Advanced Refrigeration
4. To provide a technical understanding of use of computer and advanced tools related with Advanced Refrigeration

Course Contents		**Hours**
Unit I	**Conventional Refrigeration Systems:** Multi-evaporator system; Multi expansion system; Cascade systems; study of P-h; T-s; h-s and T- h charts for various refrigerants, Concept of Heat Pump	7
Unit II	**Vapour absorption refrigeration:** Standard cycle and actual cycle, thermodynamic analysis, Li-Br-water, NH3-water systems, Three fluid absorption systems, half effect ,single effect, single-double effect, double effect, and triple effect system **Refrigerants:** Refrigerant recycling, reclaim and charging, alternative refrigerants, refrigerant-lubricant mixture behavior, ODP, GWP concepts	7
Unit III	**Non-conventional refrigeration system (Principle and thermodynamic analysis only):** Thermoelectric refrigeration, thermo-acoustic refrigeration, adsorption refrigeration, Steam jet refrigeration, vortex tube refrigeration, and magnetic refrigeration.	7
Unit IV	**Refrigeration Equipments**- Reciprocating, screw, Scroll and Centrifugal Compressor based on applications **Evaporators**-Design & Selection**,** types, thermal design, effect of lubricants accumulation, draining of lubricants, selection and capacity control **Condenser:** Design and selection, types, thermal design, purging, selection and capacity control Selection of\expansion devices, Design of refrigerant piping, refrigeration system controls and safety devices, Solenoid valves, suction and evaporator pressure regulators, Thermal Insulation **Motor selection:** Single phase, Three phase, Starters, Constant speed and Variable speed Drive	7
Unit V	**Control & Instrumentation:** Refrigeration system controller, high pressure receiver, Thermal design of low pressure receiver, accumulator, Filters, driers, oil separators, relief valves, safety valves, high and low pressure cut out, thermostats, water regulators System controller.	8
Unit VI	**Cooling load estimation Equipment selection and design:** Component Balancing, Analysis of designed equipment (thermodynamic), cost analysis and feasibility analysis for designed equipments, tools and equipments used in refrigeration. **Case studies** to be dealt with selection and design of various components for	6

various Industrial refrigeration applications: Cold storage, Process applications - textile, Pharmaceuticals, chemical, transport, food preservation, dairy etc.

Course Outcome (CO):

1 Students will able to familiarize with basic refrigeration cycles with respect to latest developments.
2 Students will aware for the use of alternative refrigerants in advanced Refrigeration
3 Students will analyze with appropriate selection of components in order to increase the COP
4 Students will understand the various controls and instrumentation in advanced refrigeration
5 Students will able to design a refrigeration system with appropriate load estimation

Tutorial

1 Study and trial on cascade refrigeration system.
2 Study and trial on multi evaporator system.
3 Trial on multi compressor system.
4 Study and trial on heat pump.
5 Study and trial on conventional refrigeration system.
6 Study and trial on nonconventional refrigeration system.
7 Component selection case study.

Text Books

1 R.J. Dossat, Principles of refrigeration, Pearson Education Asia
2 C.P. Arora, Refrigeration and Air-Conditioning
3 Stoecker and Jones, Refrigeration and Air-conditioning

References

1 Jordan and Priester, Refrigeration and Air-conditioning
2 A.R. Trott, Refrigeration and Air-conditioning, Butterworths
3 J.L. Threlkeld, Thermal Environmental Engineering, Prentice Hall
4 W.F. Stoecker, Industrial Refrigeration Handbook, McGraw-Hill
5 John A. Corinchock, Technician's guide to Refrigeration systems, McGraw-Hill
6 P.C. Koelet, Industrial Refrigeration: Principles, design and applications, b Mcmillan
7 ASHRAE Handbook (i) Fundamentals (ii) Refrigeration
8 ISHRAE handbooks
9 ARI Standards
10 Refrigeration Handbook, Wang, McGraw Hill, Int
11 Refrigeration –Malhotra Prasad

Useful Links

1 http://www.cimcorefrigeration.com/training.asp
2 https://www.davidsonccc.edu
3 http://www.handbook.curtin.edu.au › Handbook
4 http://www.energy.gov/eere/success-stories/articles

Mapping of CO and PO

	a	b	C	D	e	f	g	h	i	j	k	L
CO1	✓							✓	✓			
CO2		✓				✓		✓		✓	✓	
CO3			✓		✓							
CO4				✓					✓	✓	✓	
CO5		✓	✓								✓	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	0	10
Understand	3	3	2	10
Apply	3	*3*	2	10
Analyze	3	3	3	15
Evaluate	3	3	3	15
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 133: Elective I - Advanced Fluid Mechanics

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1	To familiarize the students with latest developments in Advanced Fluid Mechanics to cope up with requirements of industry.
2	To familiarize the students with developments in Advanced Fluid Mechanics
3	To provide a technical understanding of common engineering processes related with Advanced Fluid Mechanics
4	To provide a technical understanding of use of computer and advanced tools related with Advanced Fluid Mechanics

Course Contents		**Hours**
Unit I	**Concept of Continuum & Fluid**: Body and Surface Forces, Scalar and Vector fields, Eulerian and Lagrangian description of flow, Motion of Fluid element- Translation, Rotation& Velocity **Governing Equations:** Mass conservation in differential and integral forms, Flow kinematics, and Momentum equation: substantial derivative, differential and integral Form, stress tensor, stress strain relations, Ideal Fluid flow concepts	7
Unit II	**Mechanics of Laminar Flow**: Introduction Laminar and Turbulent flows, Viscous flow at different Reynolds number-wake frequency, Laminar plane Poiseuille flow, stokes flow, Flow through Concentric annulus, Laminar Flow in Pipes and Channels.	7
Unit III	**Navier-Stokes Equations:** Special forms: Euler equations, Bernoulli equation, stream function, vorticity. Exact solutions: fully developed flow in channel, pipe, flow between concentric rotating cylinders, Couette flow, Stokes First problem (unsteady flow), Creeping.	6
Unit IV	**Boundary Layers:** Boundary layer assumptions, equations, flow over a flat plate similarity (Blasius) solution, Falkner-Skan equation, momentum integral method external lows: drag, lift, flow separation	7
Unit V	**Turbulent flow:** Introduction to hydrodynamic stability, characteristics of turbulence governing equations, turbulent boundary layer, algebraic models (Prandtl's mixing length),and velocity profile over a flat plate and in pipes. **Turbulent Shear Flows**: Equations for free shear layers: mixing layer, plane and axis symmetric jet, wake. Turbulent energy equation, two equation model(k-epsilon),Large Eddy Simulation, Various Turbulent Models	7
Unit VI	**Compressible Flow:** One-dimensional Flow: speed of sound, variable cross-section flow, converging diverging nozzle, effect of friction and heat transfer, normal shock relations, Introduction to oblique shocks, 2-dimensional flows(subsonic and supersonic) past slender bodies, compressible boundary layers.	6

Course Outcome (CO):

1	Students will familiarize with properties of fluids and their influence on the operation of various fluid flow applications
2	Students will analyze governing equestrians, pressure variation and pressure loss due to friction in flowing fluid
3	Students will identify forces due to flow of fluids over bodies using boundary layer theory
4	To provide a technical understanding of use of computer and advanced tools related with Advanced Fluid Mechanics
5	Students will develop skill to analyze various fluid flows using latest fluid simulation techniques

Tutorial

1	Expt. On Flow over a cylinder/sphere at different Re. Pressure variation over the body and drag
2	Expt. On Flow past an aerofoil: Pressure measurements, calculation of lift
3	Flow through a converging-diverging nozzle: subsonic and supersonic flows
4	Expt. on Friction factor determination: incompressible flow through pipes/ducts of variable cross-section
5	Laminar/Turbulent boundary layer over a flat plate.
6	Minimum Five Assignments Based on above Syllabus

Text Books

1	Mohanty A.K.-Fluid Mechanics, II edition, PHI private Ltd. New Delhi.
2	E. Rathakrishnan- Fluid Mechanics, II edition, PHI private Ltd. New Delhi.
3	James A. Fay-Introduction to Fluid Mechanics, PHI private Ltd. New Delhi.
4	Streeter-“Fluid Mechanics”, Tata McGraw Hill, New Delhi.

References

1	Schlichting-Boundary layer theory, Springer Pub.
2	G. Biswas and K. Muralidhar- Advanced Fluid mechanics.
3	F.M. White- Viscous Fluid Flow. Tata McGraw Hill, New Delhi.
4	Fox R.W. and McDonald A.T- “Introduction to Fluid Mechanics” John Wiley & Sons.
5	Bird R.B. Stewart W.F.-“Transport Phenomena”, John Wiley & Sons.

Useful Links

1	http://www.elsevier.com/books/advanced-fluid-mechanics
2	http://www.eng.uwo.ca/research/afm/main.htm
3	http://www.nptel.ac.in/courses/112104118/ui/TOC.htm

Mapping of CO and PO

	A	b	C	D	e	f	g	h	i	j	k	L
CO1	✓							✓	✓			
CO2		✓			✓						✓	
CO3	✓							✓				
CO4										✓	✓	
CO5		✓	✓		✓						✓	✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	0	05
Understand	3	3	2	05
Apply	3	*3*	2	10
Analyze	2	3	2	15
Evaluate	2	2	2	15
Create	2	2	2	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 114: Elective II - Advanced Automobile Engineering

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Advanced Automobile Engineering to cope up with requirements of industry.
2. To familiarize the students with developments in Advanced Automobile Engineering
3. To provide a technical understanding of common engineering processes related with Advanced Automobile Engineering
4. To provide a technical understanding of use of computer and advanced tools related with Advanced Automobile Engineering

Course Contents		**Hours**
Unit I	**The Future Of The Automotive Industry**: Challenges and Concepts for the 21stcentury. Crucial issues facing the industry and approaches to meet these challenges. Fuel Cell Technology For Vehicles: What is fuel cell, Type of fuel cell, Advantages of fuel cell	6
Unit II	Current state of the technology. Potential and challenges. Advantages and Disadvantages of hydrogen fuel. Hybrid vehicles - Stratified charged/learn burn engines- Hydrogen engines - battery vehicles – Electric propulsion with cables – Magnetic track vehicles	7
Unit III	**Volt System**: Need, benefits, potentials and challenges, Technology Implications for the Automotive Power system; power steering, power brakes, windows, Automated systems; computer controlled front collision prevention, navigation, GPS etc. Computer Control for pollution and noise control and for fuel economy - Transducers and actuators -Information technology for receiving proper information and operation of the vehicle like optimum speed and direction	7
Unit IV	**Electrical And Hybrid Vehicles**: Types of hybrid systems, Objective and Advantages of hybrid systems. Current status, Future developments and Prospects of Hybrid Vehicles Integrated Starter Alternator: Starts stop operation, Power Assist, Regenerative Braking. Advanced lead acid batteries, Alkaline batteries, Lithium batteries. Development of new energy storage systems. Deep discharge and rapid charging ultra-capacitors.	7
Unit V	**X-By Wire Technology**: Introduction to X-By Wire, Advantage over hydraulic systems, Use of Automotive micro controllers, Types of censors, Use of actuators in an automobile environment, Vehicles Systems: Constantly Variable Transmission, Benefits, Brake by wire, Advantages over power Braking System, Electrical assist steering, Steering by wire, Advantages of Steering by wire, Semi-active and fully-active suspension system, Advantages of fully active suspension system.	6

Course Outcome (CO):

1. Student will able to familiarize with latest developments in Automobile Engineering industries
2. Student will aware of current development in electrical and hybrid vehicles.
3. Student will identify the use of controls and automation in Advanced Automobile

	Engineering
4	Student will get appropriate knowledge in computerization of various components in vehicle systems

Tutorials Eight assignment based on syllabus.

Text Books

1	Heinz Heisler, “Advanced Vehicle Technologies”, SAE International Publication
2	Ronald K. Jurgen, “Electric and Hybrid Electric Vehicles”, SAE International Publication
3	Daniel J. Holt, “42 Volt system”, SAE International Publication
4	Electronic Braking, Traction and Stability control-SAE Hardbound papers

References

1	Electronics steering and suspension systems- SAE Hardbound papers
2	J.H. Johnson, “Diesel Paniculate Emission”, SAE Hardbound papers
3	Richard Stobart, “Fuel Cell Technologies for vehicles”, SAE Hardbound papers

Useful Links

1	http://www.nptel.ac.in
2	http://www.slideshare.net/ghormade/recent-trends-in-automobile
3	http://www.iaeng.org/publication/WCE2008/WCE2008_pp1517-1520.pdf
4	http://www.engg.nagoya-u.ac.jp/en/nusip/poster/leaflet.pdf

Mapping of CO and PO

	A	B	c	D	e	F	g	h	i	j	k	L
CO1					✓			✓		✓		
CO2				✓	✓				✓			✓
CO3					✓						✓	
CO4		✓				✓				✓	✓	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3	2	10
Understand	3	3	2	10
Apply	3	*3*	2	10
Analyze	3	3	2	15
Evaluate	3	3	2	15
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 124: Elective II - Design of Air Conditioning systems

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1	To familiarize the students with latest developments in Design of Air Conditioning systems to cope up with requirements of industry.
2	To familiarize the students with developments in Design of Air Conditioning systems
3	To provide a technical understanding of common engineering processes related with Design of Air Conditioning systems
4	To provide a technical understanding of use of computer and advanced tools related with Design of Air Conditioning systems

Course Contents		**Hours**
Unit I	**Basic Air-conditioning Principles**: Review of Psychometric processes using chart, Air conditioning systems-VAU, AVA, All air systems, All water systems, Application & Safety in various industries like,Pharma,Electronic,Paper,Paint,Metallurgy,Foundry,Hospitals,Hotel& Recreation, Automobile, Rail-Road, food& Aircraft. **Load Estimation**: solar heat gain, study of various sources of the internal and external heat gains, heat losses, etc. Methods of heat load calculations: Equivalent Temperature Difference Method, Cooling Load Temperature Difference and Radiance Method, Inside and outside design conditions, Use of load Estimation by software	7
Unit II	**Air Distribution**: Fundamentals of air flow in ducts, pressure drop calculations, design ducts by velocity reduction method, equal friction method and static regain method, duct materials and properties, insulating materials, types of grills, diffusers, wall registers, etc. VAV. **Acoustics & Noise Control**: Definitions of various terms like level, pitch, attenuation, frequency, sources of noise in air conditioning plants, design procedure for noise prevention, noise and vibration study and elimination techniques (description only).	7
Unit III	**Ventilation and Infiltration**: Requirement of ventilation air, various sources of Infiltration air, ventilation and infiltration as a part of cooling load. **Equipment Selection:** Performance& selection of compressors ,fans ,blowers, Pumps &cooling towers	6
Unit IV	**Direct and Indirect Evaporative Cooling**: Basic psychometric of evaporative cooling, types of evaporative coolers, design calculations, indirect evaporative cooling for tropical countries.	6
Unit V	**Air Conditioning Equipments and Controls**: Pre cooling, Chillers, Condensing units, Cooling coils, bypass factors, humidifiers, dehumidifiers, various types of filters, air washers, Thermostat, humidistat, cycling and sequence controls, modern control of parity, odor and bacteria, Air filtration- Study of different types of filters, BMS applications, Clean Air Practices	7
Unit VI	**Standards and Codes**: ASHRAE/ARI, BIS standards study and	6

interpretation, ECBC, NBC codes

Course Outcome (CO):

1	Students will able to familiarize with basic air conditioning systems with respect to latest developments.
2	Students will able to design of air distribution, acoustic and noise controls in air conditioning systems.
3	Students will analyze with appropriate selection of components in order to increase the COP
4	Students will understand the various controls and instrumentation in advanced air conditioning.
5	Students will able to design a air conditioning systems with appropriate load estimation
6	Students will aware about standards and codes used in air conditioning systems.

Tutorial

1	Design Project for system selection, load estimation, duct design, equipment selection, Control systems, cost estimation, lay out diagrams (line sketches) for any two application from: Hospital, Hotel, Auditorium, Computer lab, Operation Theater etc.
2	Draw Psychometric chart for a non- standard Pressure
3	Study & Trial on Air-Conditioning systems
4	Industrial visit report

Text Books

1	Refrigeration and Air conditioning, ARI Prentice Hall, New Delhi.
2	Norman C. Harris, Modern air conditioning
3	Jones W. P., Air conditioning Engineering, Edward Arnold Publishers Ltd, London, 1984.
4	Hainer R. W., Control System for Heating, Ventilation and Air conditioning, Van Nastrand Reinhold Co., New York, 1984.

References

1	ASHRAE Handbooks
2	ISHRAE Handbook.
3	Handbook of Air Conditioning System Design, Carrier Incorporation, McGraw Hill Book Co., USA.
4	Trane air conditioning manual
5	Refrigeration and Air conditioning- C P Arora, Tata McGraw Hill Publication, New Delhi.
6	McQuiston, Faye; Parker, Jerald; Spitler, Jeffrey 2000, Heating, Ventilating and Air Conditioning-Analysis
7	Refrigeration & Air-Conditioning by Dr. S. N. Sapli-PHI Publication

Useful Links

1	http://www.sciencedirect.com/science/book/9781933742137
2	http://www.iaeng.org/publication/IMECS2009/IMECS2009_pp1828-1833.pdf
3	http://www.nptel.ac.in/courses/112105129/pdf/R&AC%20Lecture%2038.pdf
4	http://www.slideshare.net/.../hvac-basic-concepts-of-air-conditioning

Mapping of CO and PO

	a	b	c	D	e	F	g	h	i	j	k	L
CO1	✓									✓		
CO2		✓	✓		✓				✓			✓
CO3			✓		✓				✓			
CO4				✓					✓		✓	
CO5		✓	✓		✓						✓	
CO6	✓								✓		✓	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	0	05
Understand	2	2	2	05
Apply	3	*3*	2	10
Analyze	3	3	2	15
Evaluate	3	3	2	15
Create	2	2	2	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 134: Elective II - Energy Analysis and Management

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To learn various alternative energy sources and technologies
2. To know economical & environmental aspects of alternatives
3. To learn energy management

Course Contents		**Hours**
Unit I	Energy Scenario: World's production and reserves of commercial energy sources. India's production & reserves energy alternatives.	7
Unit II	Alternative energy sources and technologies (a) Solar Energy:-devices for thermal collection and storage. Thermal applications, liquid flat plate collectors, performance analysis, testing procedures, concentrating collectors-various types, orientation and tracking modes, performance analysis of cylindrical parabolic concentrating collector, effect of various parameters on collector performance. (b) Other methods for solar Energy/Wind Energy utilization Applications, Geothermal Resources. Geothermal Electrical Power Plants. Scope for Geothermal systems in India.	7
Unit III	Economical & Environmental Aspects of Alternatives Initial & annual costs, Definitions of annual solar savings, Life cycle savings, Present worth calculations, Repayment of loan in equal Annual instalments, Annual solar savings, Cumulative Solar Savings and life cycle Savings, Pay-back period, Environmental Problems Related with utilization of Geothermal and Wind energy.	7
Unit IV	Energy Auditing Introduction, Types, Preliminary audit, Intermediate and Comprehensive audit, Procedure of auditing, Case studies and Recommendations.	7
Unit V	Energy Conservation Importance, Principles, Planning for Energy Conservation- Electrical energy, Thermal energy, Human & animal muscle energy. Waste Recovery/Recycling, Cogeneration.	6
Unit VI	Energy Management Energy Strategic Planning, Management of supply side, Elements, steps, flow. Management of Utilization side- Elements, transmission, Equipment and control systems, principles of Energy Management.	6

Course Outcome (CO):

1. Student will aware of various alternative energy sources and technologies
2. Student will able to estimate the calculations regarding economical & environmental aspects of alternatives energy sources.
3. Students will understand to prepare energy audits in concerned with various

applications.

4 Students will interpret the importance and principles of energy conservation.

5 Students will familiar of energy management of engineering systems.

Tutorials 6 assignments /exercises based on above.

Text Books

1 Solar Energy- S.P. Sukhatme, Tata Mc Graw Hill Pub. Co. ltd., New Delhi.

2 Hand Book of Industrial Energy Conservation – S. David Hik,Van. Nostrand Reinhold Co. New York.

3 Hand Book of Energy Technology- V. Daniel Hunt, Van. Nostrand Reinhold Co. New York.

References

1 Energy Technology, Non conventional ,Renewable & Conventional.- S. Rao & Dr. B.B. Parulekar, Khanna Publishers, Delhi.

2 Solar Energy- H. P. Garg & J. Prakash, Tata Mc Graw Hill Pub. Co. ltd., Delhi

Useful Links

1 http://www.energy.gov/eere/buildings/analysis-tools

2 http://www.sciencedirect.com/science/article/pii/S0306261907000153

3 https://www.aspentech.com/Products/Activated-Energy-Analysis

4 http://www.nptel.ac.in/courses/108106022

Mapping of CO and PO

	a	B	c	d	e	f	g	h	i	j	k	L
CO1	✓							✓		✓		
CO2		✓				✓		✓				
CO3	✓								✓	✓	✓	
CO4	✓								✓			
CO5	✓							✓	✓			

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	2	05
Understand	2	3	2	05
Apply	3	*3*	2	15
Analyze	4	3	2	20
Evaluate	4	4	2	15
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech. - Heat Power Engg.
HP107: Experimental Methods in Thermal and Fluid Engineering

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs/week	**CT1**	15
Tutorial	-	**CT2**	15
Total Credits	3	**TA**	10
		ESE	60

Course Objectives:

1. Understand basic concepts of measurements, testing and calibration
2. Prepare engineering experimental setup
3. Understand functions and advantages of different measuring instruments
4. Correlate numerical results and approximations with actual field results.

Course Contents

		Hours
Unit I	**BASIC CONCEPTS** Meaning and objectives of research, Types of research, Research approaches, Research process, Selection of research problem, Defining research problem, Literature review, Integrating research findings, identification of research gaps, Errors in research.	**6**
Unit II	**DATA COLLECTION AND ANALYSIS** Primary data collection through observations and interviews, Questionnaire surveys, Secondary data collection, Data processing, Measures of central tendency and dispersion, mean, median, mode, range, variance, standard deviation, inter-quartile range, histogram, box-plot, normal probability plot	**8**
Unit III	**ANALYSIS OF EXPERIMENTAL DATA** Null and alternative hypothesis, Level of significance, Type I and type II error, Two-tailed and one-tailed tests, Procedure of hypothesis testing. Analysis of experimental data and determination of overall uncertainties in experimental investigation, uncertainties in measurement of temperature under various conditions.	**8**
Unit IV	**DYNAMIC MEASUREMENT** The Generalized Measurement System, Basic Concepts in Dynamic Measurements, System Response, Description Planning of experiments: preliminary, intermediate and final stages in experimental investigations. Steady state and transient techniques. Selection of measuring devices based on static, dynamic characteristics and allowable uncertainties.	**8**

Unit V	**FLOW MEASUREMENT** Introduction, Positive-Displacement Methods, obstruction Methods, Practical Considerations for Obstruction Meters, The Sonic Nozzle, Flow Measurement by Drag Effects, Hot-Wire and Hot-Film Anemometers, Magnetic Flowmeters, Flow-Visualization Methods, The Shadowgraph, The Interferometer, The Laser Doppler Anemometer, Smoke Methods, Pressure Probes, Impact Pressure in Supersonic Flow	**6**
Unit VI	**TEMPERATURE MEASUREMENT** Optical and radiation methods of temperature measurement. Steady state and transient methods of measuring heat fluxes. Measurement of thermal radiation and associated parameters Thermocouple Compensation, Temperature Measurements in High-Speed Flow	**6**

Course Outcome (CO):

Student will able to

1 Calibrate different temperature measuring instruments.
2 Measure fluid flow and temperature with various instruments
3 Student will correlate numerical results and approximations with actual field results.
4 Select and define appropriate research problem and its related parameters

Text Books:

1 “Experimental Methods for Engineers”, JP Hollmann
2 “Measurements and Instrumentation in Heat Engineering”, Prebrashensky V, Vol. 1 and 2, MIR Publishers, 1980

REFERENCES:

1. E.O. Doebelin "Measurement systems, Application and Design", McGraw-Hill 1990
2. J.P. Holman "Experimental Methods for Engineers", McGraw-Hill, 1994

Mapping of COs and POs

A	b	c	d	e	f	g	h	i	j	k
√								√		
√								√		
√					√			√		
	√		√					√		√

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	3		10
Understand	3	3		10
Apply	3	3	0	10
Analyze	3	3	5	15
Evaluate	3	3	5	15
Create				
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 106: Industrial Instrumentation laboratory

Laboratory Scheme		**Examination Scheme**	
Practical	4 Hrs./week	**CA**	50
Total Credit	2	**ESE**	50

Course Objectives

1. To familiarize the students with latest developments in Numerical Computation of Fluid Flow and Heat Transfer to cope up with requirements of industry.
2. To familiarize the students with developments in Numerical Computation of Fluid Flow and Heat Transfer
3. To provide a technical understanding of common engineering processes related with Numerical Computation of Fluid Flow and Heat Transfer
4. To provide a technical understanding of use of computer and advanced tools related with Numerical Computation of Fluid Flow and Heat Transfer

Course Contents

Experiment 1-6 **Measurement and calibration of:**
Pressure gauge and vacuum gauges
Thermocouple
Load cell and strain gauge
Dynamometers
Flow meter
LVDT/RVDT
Hygrometer
Tachometer
Anemometer

Experiment 7 Study and use of computerized data acquisition/ data logger system

Experiment 8 Analysis of errors in measurement systems.

Experiment 9 Experimental dynamic response characterization of first order/second order instruments

Experiment 10 Simulation of dynamic response characteristics of first order/second order instruments using MATLAB® Simulink

List of Submission

1. Total number of Experiments - 05
2. Total number of sheets - 00
3. Project/Dissertation Report -00
4. Seminar report- 00
5. Field Visit Report - 00

Course Outcome(CO):

1 Student should understand how measurement systems are designed, calibrated, characterised, and analysed.

2 Student should understand the fundamental principles of various types of sensors including thermal, mechanical, electrical, electromechanical and optical sensors. understand their general characteristics, terminologies, sensing and transduction principles;

3 Student should be familiar with criteria for sensors and transducers selection and choose appropriate measurement methods for engineering tasks and scientific researches.

4 Student should possess a reasonable level of competence in the design, construction, and execution of a mechanical measurements project using MATLAB

5 Student should have developed an awareness and understanding of the crucial part that measurement plays in industrial and scientific activities.

Mapping of CO and PO

	a	B	C	d	e	f	g	h	i	j	k	L
CO1	✓	✓			✓				✓			
CO2	✓			✓							✓	
CO3		✓			✓							✓
CO4		✓	✓		✓			✓			✓	
CO5		✓						✓		✓		

Assessment Pattern

Skill Level	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	CA	ESA
Assembling	00	00	00	00	00	00	00
Testing	02	00	00	02	01	05	00
Observing	02	02	01	01	01	07	00
Analyzing	00	00	03	01	01	05	00
Interpreting	00	02	01	00	01	04	00
Designing	00	00	00	00	00	00	00
Creating	00	00	00	00	01	01	00
Deducing conclusions	01	01	00	01	00	03	00
Total	05	05	05	05	05	25	00

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 201: Numerical Computation of Fluid Flow & Heat Flow

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Industrial Instrumentation to cope up with requirements of industry.
2. To familiarize the students with developments in Industrial Instrumentation
3. To provide a technical understanding of common engineering processes related with Industrial Instrumentation
4. To provide a technical understanding of use of computer and advanced tools related with Industrial Instrumentation

Course Contents		**Hours**
Unit I	**Introduction to CFD.** Computational approach to Fluid Dynamics and its comparison with experimental and analytical methods, Basics of PDE: Elliptic, Parabolic and Hyperbolic Equations **Governing Equations**. Review of Navier-stokes Equation and simplified forms, Solution Methodology: FDM and FVM with special emphasis on FVM, Stability, Convergence and Accuracy	7
Unit II	**Finite Volume Method**. Domain discretizations, types of mesh and quality of mesh, SIMPLE, pressure velocity Coupling Checkerboard pressure field and staggered grid approach Geometry Modeling and Grid Generation	7
Unit III	Practical aspects of computational modeling of flow domains, Grid Generation, Types of mesh and selection criteria, Mesh Quality, Key parameters and their importance Methodology of CFDHT	6
Unit IV	Objective and importance of CFDHT, CFDHT for Diffusion Equation, Convection Equation and Convection- Diffusion Equation	6
Unit V	Solution of N-S Equation for Incompressible Flows	7
Unit VI	Semi-Explicit and Semi-Implicit Algorithms for Staggered Grid System and Non Staggered grid System of N-S Equations for Incompressible Flows.	7

Course Outcome (CO):

1. Students will familiar with CFD and analyze governing equations to compare with experimental and analytical methods.
2. Students will develop a technique to grid approach with geometry modeling using finite volume method.
3. Students will think about practical aspects of computational modeling of flow domains in CFD software.
4. Students will able to solve N-S equation for any application of incompressible flows.

Tutorial

Eight assignment based on syllabus.

Text Books

1. Computational Fluid Dynamics, The Basic with applications by John A. Anderson, Jr., McGraw hill International editions, Mechanical Engineering series.
2. Numerical Methods in Fluid Flow & Heat Transfer by Dr. Suhas Patankar.
3. An Introduction to Computational Fluid Flow (Finite Volume Method) , by H. K. Versteeg, W. Malalasekera, Printice Hall.

References

1. Computational Methods for Fluid Dynamics by Ferziger and Peric, Springer publication.
2. An Introduction to Computational Fluid Mechanics by Chuen-Yen Chow, Wiley Publication
3. Computational Fluid Flow & Heat Transfer by Murlidhar and Sundarrajan, Narosa Publication

Useful Links

1. http://www.sciencedirect.com/science/article/pii/S0017931002002235
2. http://www.ewp.rpi.edu/hartford/~ernesto/F2012/.../Patankar-NHTFF-1980.pdf
3. http://www.diva-portal.org/smash/get/diva2:512504/fulltext03
4. http://www.cfd.com.au/cfd_conf09/PDFs/001EJL.pdf

Mapping of CO and PO

	A	B	c	D	e	f	g	h	i	j	k	L
CO1	✓	✓								✓	✓	
CO2			✓		✓			✓	✓			
CO3			✓							✓	✓	
CO4					✓				✓			✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	0	05
Understand	2	2	2	05
Apply	3	*3*	2	10
Analyze	3	3	2	15
Evaluate	3	3	2	15
Create	2	2	2	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 202: Energy Analysis of Thermal System

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Energy Analysis of Thermal System to cope up with requirements of industry.
2. To familiarize the students with developments in Energy Analysis of Thermal System
3. To provide a technical understanding of common engineering processes related with Energy Analysis of Thermal System
4. To provide a technical understanding of use of computer and advanced tools related with Energy Analysis of Thermal System

Course Contents		**Hours**
Unit I	**Introduction to Thermal System Design:** Introduction; Workable, optimal and nearly optimal design; Thermal system design aspects; concept creation and assessment; Computer aided thermal system design	7
Unit II	**Thermodynamic modeling and design analysis:** First and second law of thermodynamics as applied to systems and control volumes, Entropy generation; Thermodynamic model – Cogeneration system.	7
Unit III	**Energy Analysis: -**Energy definition, dead state and energy components; Physical energy – Energy balance; Chemical energy ; Applications of energy analysis; Guidelines for evaluating and improving thermodynamic effectiveness.	7
Unit IV	**Heat transfer modeling and design analysis: -**Objective of heat transfer processes; Review of heat transfer processes involving conduction, convection and radiation and the corresponding heat transfer equations used in the design.	6
Unit V	**Design of piping and pump systems:-** Head loss representation ;Piping networks ; Hardy – Cross method ; Generalized Hardy – Cross analysis; Pump testing methods; Cavitation considerations ;Dimensional analysis of pumps; piping system design practice	6
Unit VI	**Thermo-economic analysis and evaluation:-**Fundamentals of thermo-economics, Thermo-economic variables for component evaluation; thermo-economic evaluation; additional costing considerations. **Thermo-economic optimization:-** Introduction ; optimization of heat exchanger networks; analytical and numerical optimization techniques; design optimization for the co-generation system- a case study; thermo-economic optimization of complex systems	7

Course Outcome (CO):

1. Student will familiarize with various aspects of Thermal System Design
2. Student will aware of Thermodynamic modeling and design analysis
3. Students will analyze thermal systems to evaluate and improve its thermodynamic effectiveness
4. Students will simulate the thermal systems using computer based various software’s
5. Students will optimize the thermal systems with Thermo-economic analysis and

evaluation

Tutorial Eight assignment based on syllabus

Text Books

1 **Thermal Design & Optimization -** Bejan, A., et al., John Wiley, 1996

2 **Analysis & Design of Thermal Systems -** Hodge, B.K., 2nd edition, Prentice Hall, 1990.

References

1 **Design of Thermal Systems -** Boehm, R.F., John Wiley, 1987

2 **Design of Thermal Systems -** Stoecker, W.F., McGraw-Hill

Useful Links

1 http://www.eolss.net/sample-chapters/c08/e3-03-30.pdf

2 http://www.nptel.ac.in/courses/112106064

3 http://www.sciencedirect.com/science/article/pii/S0196890402001796

4 http://www.researchgate.net

Mapping of CO and PO

	a	B	c	D	e	f	g	h	i	j	k	L
CO1	✓	✓									✓	
CO2		✓	✓		✓						✓	
CO3					✓	✓			✓			✓
CO4			✓							✓	✓	✓
CO5		✓	✓						✓	✓		✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	2	05
Understand	2	2	2	05
Apply	3	*3*	2	10
Analyze	4	4	2	20
Evaluate	4	4	2	20
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 203: Design of Heat Transfer Equipments

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Design of Heat Transfer Equipments to cope up with requirements of industry.
2. To familiarize the students with developments in Design of Heat Transfer Equipments
3. To provide a technical understanding of common engineering processes related with Design of Heat Transfer Equipments
4. To provide a technical understanding of use of computer and advanced tools related with Design of Heat Transfer Equipments

Course Contents		**Hours**
Unit I	**Different Classification Of Heat Exchangers**: Parallel flow, counter flow and cross flow; shell and tube and plate type; single pass and multi pass; once through steam generators etc.	6
Unit II	**Design of Shell and Tube Heat Exchanger:** Thickness calculation, Tube sheet design using TEMA formula, concept of equivalent plate for analyzing perforated analysis, flow induced vibration risks including acoustic issues and remedies, tube to tube sheet joint design, buckling of tubes, thermal stresses	6
Unit III	**Boiler furnace design:** Heat transfer in coal fired boiler furnace (gas side) – Estimation of furnace exit gas temperature, estimation of fin-tip temperature. Heat transfer in two phase flow- Estimation of inside heat transfer coefficient using Jens & Lottes equation and Thom's correlation. Estimation of pressure drops in two phase flow using Thom's method.	7
Unit IV	**Design of Steam Condenser and evaporative condensers:** Effect of tube side velocity on surface area and pressure drop for various tube sizes (It involves estimation of tube side velocity, surface area and pressure drop for various tube sizes & Plot the graph) and estimation of shell diameter of steam condenser.	7
Unit V	Design of Fuel Oil Suction Heater, Design of Fuel Oil Heater, Design of Recuperative Air Pre Heater, Design of Economizer: Design includes estimation of heat transfer area, pressure drop etc. Super heater and Reheater Design, Design of heat pipe.	6
Unit VI	**Design of Cooling Tower:** Design of surface and evaporative condensers cooling tower, performance characteristics.	6

Course Outcome (CO):

1. Student will able to design of Shell and Tube Heat Exchanger used in process industries
2. Student will able to understand the various design aspects in boiler furnace
3. Student will able to design Steam Condenser used in process industries
4. Student will able to design different heat recovery equipments used in industrial applications
5. Student will understand performance characteristics of different Cooling Tower

Tutorial Eight assignment based on syllabus

Text Books

1 **Design of Cooling Tower :** Design of surface and evaporative condensers ,cooling tower, performance characteristics

2 **Applied Heat Transfer -** V. Ganapathy, Penn Well Publishing Company, Tulsa, Oklahoma.

References

1 **Process Heat Transfer -** Sarit Kumar Das, A. R. Balakrishan, Alpha Science International, 2005

Useful Links

1 http://www.ou.edu/class/che-design/design%201.../Heat%20Exchangers.pdf
2 http://www1.diccism.unipi.it/.../01-Heat%20Transfer%20equipment.pdf
3 http://www.nptel.ac.in/syllabus/103106102
4 http://www.sciencedirect.com/science/book/9780123970169

Mapping of CO and PO

	a	B	c	D	e	f	g	h	i	j	k	L
CO1		✓	✓					✓			✓	
CO2		✓	✓		✓					✓		
CO3		✓						✓			✓	
CO4		✓			✓					✓	✓	✓
CO5	✓							✓	✓			

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	0	05
Understand	2	2	2	05
Apply	3	*3*	2	10
Analyze	4	4	3	20
Evaluate	4	4	3	20
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 214: Elective III - Design of Renewable Energy Equipments and Systems

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Design of Renewable Energy Systems and Optimization to cope up with requirements of industry.
2. To familiarize the students with developments in Design of Renewable Energy Systems and Optimization
3. To provide a technical understanding of common engineering processes related with Design of Renewable Energy Systems and Optimization
4. To provide a technical understanding of use of computer and advanced tools related with Design of Renewable Energy Systems

Course Contents		**Hours**
Unit I	**Solar Energy** Present status of energy scenario. Renewable and non-renewable energy sources. Availability, limitations, application of solar energy.	6
Unit II	**Solar Radiation** Structure of the sun, energy radiated by the sun, angular relationship of earth, and sun position, measurement of solar radiation. Derivations and Numerical Problems	7
Unit III	**Design of Flat Plate Collectors and Solar Concentrator** Types and Design of constructional details of flat plate collector, energy simple equation and performance curves, selection of flat plate collector, Limitations of flat plate collectors ,Design of various types of concentrators: selection of various materials for concentrators and reflecting surfaces and designing	7
Unit IV	**Design of Solar Heating Systems** Solar water and space heating systems, passive solar heating systems, solar heating economics, solar air-heating systems, typical solar ponds. Design of Various solar stills and selection, constructional details, Solar Energy Storage Systems, Design of solar photovoltaic system, materials used and their performance.	7
Unit V	**Wind Energy** Availability of wind, various types of windmills and their constructional detail sand performance study, Power generated by windmills. Offshore Windmills. Derivations and Numerical Problems. Design of wind mills and installation, operation and maintenance.	6
Unit VI	**Tidal Energy** Tidal energy available in India, suitable locations, study of various tidal energy power plants, and characteristics of turbines required, Design of tidal energy power plants. Chemistry of biogas generation variables affecting simple gas plants, types of digesters, their working and construction, application of biogas, use of bio-gas, case study of “pura” village bio gas electricity generation”. Design of Bio gas plants	7

Course Outcome (CO):

1 Student will aware of present status of energy scenario of Renewable and non-renewable sources.
2 Student will design and analyze the performance of Solar Heating Systems
3 Student will design and analyze the performance of wind mills
4 Student will able to understand the suitable locations and availability of tidal energy power plants
5 Student will identify the chemistry of biogas generation and variables affecting Bio gas plants,

Tutorial

Eight assignment based on syllabus.

Text Books

1 Sukhatme S.P., " Solar Energy", Tata McGraw Hill Publishing Company Limited, New Delhi, 1994
2 Rai G.D., " An Introduction to Power Plant Technology", Khanna Publishers, Third Edition, Delhi, 1996
3 Bansal N K and others " Non-Conventional Energy Sources

References

1 S. Rao and Dr. B. B. Parulekar, Energy Technology, Khanna Publishers, New Delhi.
2 Krieth and Krieder, "principles of solar engineering", Tata McGraw Hill Publishing Company Limited, New Delhi, 1994
3 Wakil M.M., "Power Plant Technology", McGraw Hill International Book Company, 1984.
4 Pai B.K., and Ramprasad M.S., " Power generation through renewable sources of energy
5 Garg H.P. and Prakash J., " Solar Fundamental and Application" Tata McGraw Hill Publishing Company Limited, New Delhi, 1997

Useful Links

1 www.nptel.ac.in/courses/112105051
2 www.sciencedirect.com/science/book/9780123749918
3 www.elsevier.com/books/renewable-energy-system-design

Mapping of CO and PO

	a	b	c	d	e	f	G	h	i	j	k	L
CO1	✓					✓		✓		✓		
CO2		✓	✓		✓						✓	
CO3		✓	✓		✓						✓	
CO4					✓				✓			✓
CO5					✓			✓		✓		✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	2	2	2	05
Understand	2	2	2	05
Apply	4	*3*	2	15
Analyze	4	4	2	20
Evaluate	3	4	2	15
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 224: Elective III – Cryogenics

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1	To familiarize the students with basic Refrigeration and liquefaction principles with respect to current low cooling technology
2	To aware students for the use of cryogenic fluids in advanced low cooling applications
3	To provide with appropriate selection of Cryogenic insulation for various Gas liquefaction systems
4	To understand the various controls and instrumentation in advanced Cryogenic equipments
5	To design a Storage and transfer of cryogenic liquids with appropriate considerations

Course Contents		**Hours**
Unit I	**Refrigeration and liquefaction principles;** Joule Thomson effect and inversion curve; Adiabatic and isenthalpic expansion with their comparison.	6
Unit II	**Properties of cryogenic fluids;** Properties of solids at cryogenic temperatures; Superconductivity.	6
Unit III	**Gas liquefaction systems:** Recuperative – Linde – Hampson, Claude, Cascade, Heylandt, Kapitza, Collins, Simon; Regenerative – Stirling cycle and refrigerator, Slovay refrigerator, Gifford-McMahon refrigerator, Vuilleumier refrigerator, Pulse Tube refrigerator; Liquefaction of natural gas.	7
Unit IV	**Cryogenic insulation:** Vacuum insulation, Evacuated porous insulation, Gas filled Powders and fibrous materials, Solid foams, Multilayer insulation, Liquid and vapour Shields, Composite insulations.	7
Unit V	**Storage of cryogenic liquids;** Design considerations of storage vessel; Dewar vessels; Industrial storage vessels; Storage of cryogenic fluids in space; Transfer systems and Lines for cryogenic liquids; Cryogenic valves in transfer lines; Two phase flow in Transfer system; Cool-down of storage and transfer systems.	6
Unit VI	**Cryogenic instrumentation:** Measurement of strain, pressure, flow, liquid level and Temperature in cryogenic environment; Cryostats. **Cryogenic equipment:** Cryogenic heat exchangers – recuperative and regenerative;	7

Course Outcome (CO):

1	Students will able to familiarize with basic Refrigeration and liquefaction principles with respect to current low cooling technology
2	Students will aware for the use of cryogenic fluids in advanced low cooling applications
3	Students will analyze with appropriate selection of Cryogenic insulation for various Gas liquefaction systems
4	Students will understand the various controls and instrumentation in advanced Cryogenic equipments
5	Students will able to design a Storage and transfer of cryogenic liquids with appropriate considerations

Tutorial

Eight assignment based on syllabus.

Text Books

1 Cryogenics: Applications and Progress, A. Bose and P. Sengupta, Tata McGraw Hill
2 Cryogenic Engineering, T.M. Flynn, Marcel Dekker
3 Cryogenic Systems, R. Barron, Oxford University Press.

References

1 Handbook of Cryogenic Engineering, Editor – J.G. Weisend II, Taylor and Francis
2 Cryogenic Process Engineering, K.D. Timmerhaus and T.M. Flynn, Plenum Press.
3 Cryogenic Fundamentals, G.G. Haselden, Academic Press.
4 Advanced Cryogenics, Editor – C.A. Bailey, Plenum Press.
5 Applied Cryogenic Engineering, Editors – R.W. Vance and W.M. Duke, John Wiley & sons

Useful Links

1 http://www.journals.elsevier.com/cryogenics
2 http://www.nptel.ac.in/courses/112101004
3 http://www.textofvideo.nptel.iitm.ac.in/112101004/lec1.pdf

Mapping of CO and PO

	a	b	c	D	e	f	G	h	i	j	k	L
CO1	✓							✓		✓		
CO2						✓			✓		✓	✓
CO3			✓		✓	✓			✓			
CO4								✓		✓	✓	
CO5		✓	✓		✓						✓	

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	4	4	2	10
Understand	4	3	2	10
Apply	3	*3*	2	10
Analyze	2	3	2	15
Evaluate	2	2	2	15
Create	0	0	0	00
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 215: Elective IV - Gas Turbine and Jet Propulsion

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To familiarize the students with latest developments in Gas Turbine and Jet Propulsion to cope up with requirements of industry.
2. To familiarize the students with developments in Gas Turbine and Jet Propulsion
3. To provide a technical understanding of common engineering processes related with Gas Turbine and Jet Propulsion
4. To provide a technical understanding of use of computer and advanced tools related with Gas Turbine and Jet Propulsion

Course Contents		**Hours**
Unit I	**Introduction**: Historical development, comparison with reciprocating I.C. Engines. Applications of gas turbine power plants. **Thermodynamics Cycles For Gas Turbines**: Air standard Brayton cycle, Calculation of the thermal efficiency, cycle air rate, cycle work-ratio, optimum pressure ratio for maximum work output of the cycle. Simple open cycle gas turbine. Modification of gas turbine cycle with inter-cooling, reheating and regeneration and effect on thermal efficiency and specific output. Closed cycle gas turbine and semi-closed cycle gas turbine. Their comparison with open cycle, Co generative power plant(Numerical problems to be taught)	7
Unit II	**Compressors** Types commonly used for gas turbine power plants. (Numerical problems to be taught) A. **Centrifugal Compressors:** Principal of operation, work done and pressure rise. Vane- less pace, slip factor, power input factor and Mach number at intake to impeller. B. **Axial Flow Compressors:** Working principal, work done degree of reaction, poly-tropic efficiency, overall performance of the compressors	7
Unit III	**Fuels and Combustion Chambers** Requirement of combustion chamber, combustion process, pressure loss and pressure loss factor. Combustion chamber geometry and types. Solid, liquid and gaseous fuels used for gas turbine power plants. Fuel burning arrangements and ignition	6
Unit IV	**Turbines:** Impulse and reaction turbines, turbine efficiencies, nozzle efficiency, blade efficiency, mechanical and overall efficiency. Theory of impulse and reaction turbines, number of stages and limitations. Constructional details of shafts, bearings, blades and casings. Cooling of blades, Lubrication and governing of turbines. Maintenance and troubleshooting(Numerical problems to be taught) **Materials For Gas Turbine:** Factors influencing selection of materials, materials used for different component like compressor component, combustion chamber, disc and rotors, turbine blades, nozzle guide vanes turbine casing and heat exchanges	7
Unit V	**Component Machining And Performance Evaluation**	6

Performance characteristics, dimensionless numbers linking component Equilibrium points and procedure to find it transient operation

Unit VI **Jet Propulsion And Rocket Propulsion** 7

Theory of jet propulsion features and types of different jet engines performance efficiencies and applications, Types of rocket power plants and their application(Numerical problems to be taught)

Course Outcome (CO):

1 Students will able to familiarize with basic thermodynamics Cycles for Gas Turbines and Jet Propulsion
2 Students will able to design Combustion Chambers of gas turbine with respect to fuel analysis
3 Students will analyze with appropriate selection of compressor for advanced Gas Turbines and Jet Propulsion
4 Students will identify the selection of materials for gas turbine based on component matching and performance
5 Students will aware with theoretical and analytical approach of Jet Propulsion And Rocket Propulsion

Tutorial Eight assignment based on syllabus.

Text Books

1 Gas Turbine Theory", H. Cohen, GFC Rezers and HIH Saravanamutto.
2 Jet Air Craft Power Systems", Jack Casamassa, Ralph Bent.
3 Gas Turbine", V. Ganesan
4 Gas Turbine And Propulsion System", P.R. Khajuria and S.P. Dubey

References

1 Vincent "The Theory And Design Of Gas Turbines And Jet Propulsion" McGraw-Hill Publication
2 W.W. Battic "Fundamentals Of Gas Turbines" John Wily& Sons.
3 Jack D. Mattingly "Elements Of Gas Turbines And Propulsion" McGraw-Hill Publication.

Useful Links

1 http://www.nptel.ac.in/syllabus/112102013
2 http://www.sfu.ca/~mbahrami/ENSC%20461/.../JetPropulsion%20Cycle.pdf
3 http://www.slideshare.net/.../gas-turbine-and-jet-propulsion-26455618
4 http://www.cast-safety.org/pdf/3_engine_fundamentals.pdf

Mapping of CO and PO

	A	B	c	D	e	f	g	h	i	j	k	L
CO1	✓							✓				
CO2		✓			✓						✓	
CO3			✓								✓	✓
CO4					✓			✓		✓		
CO5	✓	✓			✓			✓				

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	2	10
Understand	3	3	2	10
Apply	3	3	2	10
Analyze	2	3	2	15
Evaluate	3	4	2	15
Create	0	0	0	0

Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 225: Elective IV - Advanced Mathematical Methods and Optimization

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1 Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1. To solve Linear Algebraic Equations using different numerical methods
2. To study and draw Least square regression of Curve fitting and Interpolation
3. To utilize differentiation & integration methods for varieties of engineering problems
4. To determine exact solution of Ordinary and Partial differential equations based on appropriate methods

Course Contents		**Hours**
Unit I	Linear Algebraic Equations:- Gauss – Elimination, Gauss – Seidel, LU Decomposition. Roots of equations: - Bisection Method, False position method, Newton – Raphson Method, Muller's method, Bairstow's Method.	7
Unit II	Curve fitting – Least square regression:- i) Linear regression, multiple linear regressions, polynomial regression. ii) Non linear regression – Gauss – Newton method, multiple non linear regressions.	7
Unit III	Interpolation: - Newton's Divided Difference, Lagrange's Inverse, Spline, Hermite Interpolation, Extrapolation technique of Richardson's Gaunt.	7
Unit IV	Differentiation & Integration:- Divided difference formulae, Romberg integration, Gauss quadrature for double & triple integration. Eigen Values & Eigen Vectors of Matrices – Faddeev- Laeverrier's method, Power Method, Householder & Given's method	7
Unit V	Ordinary differential equations:- Euler's method, Heun's method, Mid – point method, Runge – Kutta methods, Multi step Methods - explicit Adams – Bashforth technique & Implicit Adams – Moulton Technique, Adaptive RK method, Embedded RK method, step size control. Higher order ODE – Shooting method. Non linear ODE – Collocation technique.	6
Unit VI	Partial Differential Equations:- Solution of Parabolic and Hyperbolic equations –Implicit & Explicit Schemes, ADI methods, Non linear parabolic equations- Iteration method. Solution of elliptic equation – Jacobi method, Gauss – Seidel &SOR method. Richardson method. Numerical methods should have orientation in thermal and fluid engineering	6

Course Outcome (CO):

1. Students will able to solve Linear Algebraic Equations using different numerical methods
2. Students will able to draw Curve fitting using least square regression and Interpolation
3. Students will understand differentiation & integration methods for all type of engineering problems
4. Students will interpret the expected solution of Ordinary and Partial differential

equations based on appropriate methods

Tutorial

Eight assignment based on syllabus.

Text Books

1. Numerical Methods for Engineers, Steven C Chapra& Raymond P Canale, TMH, Fifth Edition
2. Applied Numerical Methods, Alkis Constantinides, McGraw Hill
3. Numerical Solution of Differential Equations, M.K. Jain, 2nd Edition, Wiley Eastern.

References

1. Numerical methods for scientific and engineering computation, Jain, Iyangar, Jain, New Age International Publishers
2. Numerical methods in Engineering and Science, Dr. B.S. Garewal, Khanna Publishers

Useful Links

1. http://www.home.iitk.ac.in/~dasgupta/MathBook/lmastertrans.pdf
2. http://www.springer.com >Home › Mathematics
3. http://www.nptel.ac.in/courses/112104035

Mapping of CO and PO

	a	b	c	D	e	f	g	h	i	j	k	L
CO1		✓										✓
CO2		✓			✓				✓		✓	✓
CO3			✓						✓		✓	
CO4			✓		✓							✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	0	05
Understand	3	3	2	05
Apply	3	*3*	2	10
Analyze	2	3	2	15
Evaluate	2	2	2	15
Create	2	2	2	10
Total	15	15	10	60

Government College of Engineering, Karad.
First Year M. Tech. Mech - Heat Power Engg.
HP 235: Elective IV - Design of Pumps, Compressors and Blowers

Teaching Scheme		**Examination Scheme**	
Lectures	3 Hrs./week	**CT1**	15
Tutorial	1Hr/week	**CT2**	15
Total Credit	4	**TA**	10
		ESE	60

Course Objectives

1 To familiarize the students with latest developments in Pumps, compressors and blowers to cope up with requirements of industry.
2 To familiarize the students with developments in Pumps, compressor and blowers
3 To provide a technical understanding of common engineering processes related with Pumps, compressor and blowers
4 To provide a technical understanding of use of computer and advanced tools related with Pumps, compressor and blowers

Course Contents		**Hours**
Unit I	**Centrifugal and Axial Flow Pumps** Law of momentum, Vortex theory of Euler's head. Hydraulic performance of pumps; Cavitation, Jet pumps. The centrifugal pump, definitions, pump output and efficiency, multistage centrifugal pumps, axial flow pump, Design of pumps,	6
Unit II	**Power Transmitting Turbo-machines**, Introduction, theory, fluid of hydraulic coupling, torque converter.	7
Unit III	**Rotary fans and blowers** Introduction, Centrifugal blower, types of Vane shapes, Size and speed of Machine, Vane shape: efficiency, stresses, and characteristics. Actual performance characteristics, the slip co-efficient, Fan laws and characteristics.	6
Unit IV	**Turbo blowers and their characteristics**. Cooling tower fan, Surging Design of blower sand fans.	7
Unit V	**Axial Compressors:** Stage velocity triangles, enthalpy – entropy diagrams, flow through blade rows, stage losses and efficiency, work done factor, low hub-tip ratio stages, supersonic and trans sonic stages, performance characteristics, problems and design.	7
Unit VI	**Centrifugal Compressors:** Elements of centrifugal compressor stage, stage velocity diagrams, enthalpy-entropy diagram, nature of impeller flow, slip factor, diffuser, volute casing, stage losses, performance characteristics, problems and design.	6

Course Outcome (CO):

1 Students will able to design and investigate the hydraulic performance of rotary machines
2 Students will understand theory of various Power Transmitting Turbo-machines
3 Students will able to study and design the characteristics of rotary fans and turbo blowers
4 Students will aware with theoretical and analytical approach of Axial and Centrifugal Compressors

Tutorial

Eight assignment based on syllabus.

Text Books

1 A.J. Stepanoff, Centrifugal and Axial /flow Pumps, Wiley, 1962.

2 A. Kovats, Design and Performance of Centrifugal and Axial Flow Pumps and Compressors, Oxford, Pergamon, 1958
3 V. Kadambi and Manohar Prasad: “An Introduction to energy conversion VolumeIII,2002

References

1 S M Yahya: “Turbines, Compressors and Fans”, Second Edition
2 V Ganesan: “Gas Turbines”, 2002.

Useful Links

1 http://ebooks.narotama.ac.id/files/Mechanical
2 http://www.conceptsnrec.com/conceptsnrec/media/data.../cn_eng_services.pdf
3 http://www.textofvideo.nptel.iitm.ac.in/103104044/lec1.pdf
4 http://www.gastmfg.com/catalogs/F-5_Rotary_Vane_Feb17-2012_lores.pdf

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	j	k	l
CO1		✓	✓		✓						✓	
CO2	✓							✓		✓		
CO3	✓		✓		✓						✓	
CO4	✓	✓	✓							✓		✓

Assessment Pattern

Knowledge Level	CT1	CT2	TA	ESE
Remember	3	2	0	05
Understand	3	3	2	05
Apply	3	*3*	2	10
Analyze	2	3	2	15
Evaluate	2	2	2	15
Create	2	2	2	10
Total	15	15	10	60

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 206: Thermal Engineering Lab

Laboratory Scheme		**Examination Scheme**	
Practical	4 Hrs./week	**CA**	50
Total Credit	2	**ESE**	50

Course Objectives

1. To familiarize the students with latest developments in Thermal Engineering to cope up with requirements of industry.
2. To familiarize the students with developments in Thermal Engineering
3. To provide a technical understanding of common engineering processes related with Thermal Engineering
4. To provide a technical understanding of use of computer and advanced tools related with Thermal Engineering

Course Contents

Experiment 1 Design/Simulation of a thermal system such as gas turbine systems, steam power plants

Experiment 2 Design/Simulation of thermal system components such as nozzles, pumps, heat exchanger

Experiment 3 Design/Simulation of pumps or compressors.

Experiment 4 Design/Simulation of refrigeration systems.

Experiment 5 Trial on thermal system and its validation.

Experiment 6 Design of heat exchanger.

Experiment 7 Design of Condenser.

Experiment 8 Design / simulation of Compressor.

Experiment 9 Design / simulation of Flow through duct.

Experiment 10 Design / simulation of air conditioning system.

Experiment 11 Design / simulation of solar thermal system.

Experiment 12 Modeling of regenerative heat exchanger.

List of Submission

1. Total number of Experiments - 09
2. Total number of sheets- 00
3. Project/Dissertation Report.- 00
4. Seminar report.- 00
5. Field Visit Report - 00

Laboratory Outcome (LO):

1 Student will able to understand the principle, operation and applications of thermal and fluid systems

2 Students will learn to select the proper components/elements of thermal and fluid systems

3 Student will be able to design of fluid turbo machines along with industrial thermal and

fluid systems

4 Student will be able to modelling of fluid turbo machines along with industrial thermal and fluid systems

5 Use of Fluid Simulation software, students will develop the ability to construct real thermal and fluid systems

Mapping of CO and PO

	a	b	c	D	e	f	g	h	i	j	k	l
LO1	✓							✓		✓		
LO2		✓			✓						✓	
LO3			✓		✓						✓	
LO4		✓									✓	✓
LO5		✓	✓		✓					✓	✓	✓

Assessment Pattern

Skill Level	Exp 1	Exp 2	Exp 3	Exp 4	Exp 5	Exp 6	Exp 7	Exp 8	Exp 9	CA	ESA
Assembling	00	00	00	00	00	00	00	00	00	00	00
Testing	00	00	00	00	00	00	00	00	00	00	00
Observing	00	00	00	00	00	00	00	00	00	00	00
Analyzing	01	01	01	01	01	01	01	01	01	05	00
Interpreting	01	01	01	01	01	01	01	01	01	05	00
Designing	03	03	03	03	03	03	03	03	03	15	00
Creating	00	00	00	00	00	00	00	00	00	00	00
Deducing conclusions	00	00	00	00	00	00	00	00	00	00	00
Total	05	05	05	05	05	05	05	05	05	25	00

Government College of Engineering, Karad
First Year M. Tech. Mech - Heat Power Engg.
HP 207: Seminar I

Laboratory Scheme		**Examination Scheme**	
Practical	**2 Hrs/week**	**CA**	**50**
Total Credit	1	**ESE**	

Course Objectives

1 Post graduate should know the state of the art in the relevant subjects of structural engineering.
2 Post graduate should know the experimental procedure to validate theories related to structural engineering.
3 Post graduate should learn how to prepare and present research project.

Course Contents

Seminar – It should be based on the literature survey on any topic relevant to manufacturing engineering and management. It may be leading to selection of a suitable topic of dissertation.

Each student has to prepare a write up of about 25 pages. The report typed on A4 sized sheets and bound in necessary format should be submitted after approved by the guide and endorsement of Head of Department.

The student has to deliver a similar talk in front of the faculty of the department and the students. The guide based on the quality of work and preparation and understanding of the candidate shall do assessment of the seminar.

List of Submission

1 Seminar report

Course Outcome (CO):

1 Post graduate will know the state of the art in the relevant subjects of structural engineering.
2 Post graduate will know the experimental procedure to validate theories related to structural engineering.
3 Post graduate will be able to prepare and present research project.

Mapping of CO and PO

	A	b	C	d	e	F	G	h	i	j	K
CO1	√	√	√	√	√	√	√	√		√	√
CO2	√	√	√	√	√		√	√	√	√	√
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√				√	√	√	

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			09	
Understand			09	
Apply			08	
Analyze			08	
Evaluate			08	
Create			08	
Total			50	

Government College of Engineering Karad
Second Year M. Tech. Mech - Heat Power Engg.
HP 301: Seminar II

Laboratory Scheme		**Examination Scheme**	
Practical	2Hrs/week	**CA**	50
Total Credit	1	**ESE**	

Course Objectives

1 Post graduate should know the state of the art in the relevant subjects of structural engineering.
2 Post graduate should know the experimental procedure to validate theories related to structural engineering.
3 Post graduate should be able to conduct extensive literature survey in subjects of structural engineering.
4 Post graduate should learn how to prepare and present research project.

Course Contents

Seminar - II shall be based on topic of the Dissertation Work. It may include literature review, required theoretical input, study and comparison of various approaches for the proposed dissertation work. The candidate shall prepare a report of about 25 pages. The report typed on A4 sized sheets and bound in the prescribed format shall be submitted after approval by the Guide and endorsement of the Head of Department. It will be assessed for term work by the evaluation committee (*) appointed by the Head of the Department.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

List of Submission

1 Seminar report

Course Outcome (CO):

1 Post graduate should know the state of the art in the relevant subjects of structural engineering.
2 Post graduate should know the experimental procedure to validate theories related to structural engineering.
3 Post graduate should be able to conduct extensive literature survey in subjects of structural engineering.
4 Post graduate should learn how to prepare and present research project.

Mapping of CO and PO

	a	b	c	d	e	f	g	h	i	J	k
CO1	√	√	√	√	√		√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√	√	√		√	√	√	√
CO4	√	√	√	√				√		√	√

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			09	
Understand			09	
Apply			08	
Analyze			08	
Evaluate			08	
Create			08	
Total			50	

DISSERTATION

The dissertation work to be carried out individually commences in the Semester III and extends through Semester IV. The topic of dissertation work should be related to the areas of Mechanical/ Heat Power Engg. Applications. Applications of computer as a tool for conceptualization, design, analysis, optimization, simulation of products / processes / systems, experimental study, etc. are to be encouraged and preferred.

SYNOPSIS APPROVAL

The Head of the Department shall appoint a committee comprising of the Guide and two experts to review and approve the synopses.

Government College of Engineering Karad
Second Year M. Tech. Mech - Heat Power Engg.
HP 302: Dissertation Phase I

Laboratory Scheme		**Examination Scheme**	
Practical	20 Hrs/week	**CA**	100
Total Credit	10	**ESE**	

Course Objectives

1 To perform extensive literature survey on the research topic of work.
2 To identify the problem statement for the research work.
3 To decide methodology for the research work.
4 To carry out initial mathematical modelling or experimental set up.

Course Contents

It shall include the problem definition, literature survey, approaches for handling the problem, finalizing the methodology for the dissertation work and design calculations / experimental design etc. A report of the work shall be submitted at the end of Semester III after approval by the Guide and endorsement of the Head of Department. It will be assessed for term work, by the evaluation committee (*) appointed by the Head of the Department, for appropriateness, sufficiency of contents and offer suggestions if any.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

The term work under this submitted by the student shall include.

1) Work diary maintained by the student and countersigned by his guide.

2) The content of work diary shall reflect the efforts taken by candidates for

(a)Searching the suitable project work.

(b) Visits to different factories or organizations.

(c) The brief report of feasibility studies carried to come to final conclusion.

(d) Rough sketches

(e) Design calculations etc. carried by the student.

3) The student has to make a presentation in front of panel of experts in addition to guide as decided by department head.

List of Submission

1 Dissertation Phase I Report

Course Outcome (CO):

1 Student will perform extensive literature survey on the research topic of work.
2 Student will be able to identify the problem statement for the research work.

3 Student will decide methodology for the research work.

4 Student will be able to carry out initial mathematical modelling or experimental set up.

Mapping of CO and PO

	a	B	C	d	e	F	g	h	i	j	k
CO1	√	√	√	√	√		√	√	√	√	√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√		√	√	√	√	√	√
CO4	√	√	√	√				√			

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			18	
Understand			17	
Apply			16	
Analyze			17	
Evaluate			16	
Create			16	
Total			100	

Government College of Engineering Karad
Second Year M. Tech (Mech - Heat Power Engg.)
HP 401: Dissertation Phase – II

Laboratory Scheme		**Examination Scheme**	
Practical	30 Hrs/week	**CA**	100
Total Credit	20	**ESE**	200

Course Objectives

1 To perform further literature survey on the research topic of work.
2 To carry out detailed mathematical modelling or experimental validation.
3 To draw inferences from the findings and present conclusion.
4 To learn presentation skills for technical report.

Course Contents

The candidate shall submit the detailed report as per the synopsis approved by the institute, in the prescribed format after approval by the Guide and endorsement by the Head of the Department. It will be assessed for term work by the evaluation committee appointed by the Head of the Department, for completion of the proposed work.

(*) Note: The evaluation committee shall consist of the Guide, one senior expert faculty member and the Head of the Department or his/her representative.

The dissertation submitted by the student on topic already approved by institute authorities on basis of initial synopsis submitted by the candidate, shall be according to following guide lines.
Format of dissertation report:
The dissertation work report shall be typed on A4 size bond paper. The total No. of minimum pages shall not less than 60. Figures, graphs, annexure etc be as per the requirement.
The report should be written in the standard format.
1. Title sheet
2. Certificate
3. Acknowledgement
4. List of figures, Photographs/Graphs/Tables
5. Abbreviations.
6. Abstract
7. Contents.
8. Text with usual scheme of chapters.
9. Discussion of the results and conclusions
10. Bibliography (the source of illustrative matter be acknowledged clearly at appropriate place IEEE/ASME/Elsevier Format)

List of Submission

1 Dissertation Report

Course Outcome (CO):

1 Student will be able to study technical reports on the research topic of work.
2 Student will be able to carry out detailed mathematical modelling or experimental validation.
3 Student will be able to draw inferences from the findings and present conclusion.
4 Student will be able to learn presentation skills for technical report.

Mapping of CO and PO

	a	B	c	d	e	f	g	h	i	j	k
CO1	√	√	√	√	√		√	√	√		√
CO2	√	√	√	√	√	√	√	√	√	√	
CO3	√	√	√	√	√	√	√	√	√	√	√
CO4	√	√	√	√				√			

Assessment Pattern

Knowledge Level	CT1	CT2	CA/TA	ESE
Remember			18	36
Understand			17	34
Apply			16	32
Analyze			17	34
Evaluate			16	32
Create			16	32
Total			100	200