PEOPLE'S UNIVERSITY, BHOPAL

(Applicable for Admitted from Academic Session 2019-20 onwards)

Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External	Internal	Total
MTTE12101	Environmental Pollution and Control	3	1	-	External (70)	Internal (30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test- Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz/Attendance- Max. Marks: Nil

Pre-Requisite	Nil
Course Outcome	1. Identify the air pollutant control devices.
	2. Have knowledge on the NAAQ standards and air emission standards.
	3. Appreciate the methods of environmental sanitation and the management of community facilities without spread of epidemics.

Unit	Contents *(Theory)*	Marks Weightage
I	**Air Pollution:**-Sources and Effects – Definition and Concentrations, Classification and Properties of Air Pollutants, Emission Sources, Major Emissions from Global Sources, Importance of Anthropogenic Sources, Photochemical Smog, Effects Of Air Pollution On Health, Vegetation And Materials Damages. Air Pollution Sampling And Measurement – Types Of Pollutant Sampling And Measurement, Ambient Air Sampling, Collection Of Gaseous Air Pollutants, Collection Of Particulate Pollutants, Stack Sampling, Analysis Of Air Pollutants; Air Pollution Control Methods And Equipment.	**14**
II	**Fundamentals Of Environmental Management:** ISO 14000 Series: Background And Development Of ISO 14000 Series. Environmental Management Plans, Principles And Elements; The ISO 14001- Environmental Management Systems Standard. Environmental Law In India.	**14**
III	**Solid And Hazardous Wastes :** Sources Need For Solid And Hazardous Waste Management; Municipal Solid Wastes Collection Handling And Segregation Of Wastes At Source - Storage And Collection Of Municipal Solid Wastes - Analysis Of Collection Systems; Labeling And Handling Of Hazardous Wastes Waste Processing - Processing Technologies - Biological And Chemical Conversion Technologies - Composting - Thermal Conversion Technologies - Energy Recovery-Incineration - Solidification And Stabilization Of Hazardous Wastes - Treatment Of Biomedical Wastes.	**14**
IV	**Solid Wastes Disposal In Landfills Site Selection** - Design And Operation Of Sanitary Landfills- Secure Landfills And Landfill Bioreactors And Landfill Gas Management - Landfill Closure And Environmental Monitoring - Landfill Remediation, Elements Of Integrated Waste Management.	**14**
V	**Air Pollution:**-Sources And Effects – Definition And Concentrations, Classification And Properties Of Air Pollutants, Emission Sources, Major Emissions From Global Sources, Importance Of Anthropogenic Sources, Photochemical Smog, Effects Of Air Pollution On Health, Vegetation And Materials Damages. Air Pollution Sampling And Measurement – Types Of Pollutant Sampling And Measurement, Ambient Air Sampling, Collection Of Gaseous Air Pollutants, Collection Of Particulate Pollutants, Stack Sampling, Analysis Of Air Pollutants; Air Pollution Control Methods And Equipment.	**14**

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Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Text Book/References Books/ Websites:

1. F Ruth, Weiner and Robin Matthews;W Environmental Engineering; Elesevier Publications.
2. J.G. Henry and G.W. Heinke: Environmental Science and Engineering; Pearson Education.
3. Mackenzie L Davis & David A Cornwell; Environmental Engineering; McGraw Hill Publishing Publications.
4. G.M Manster; Introduction to Engineering and Science, 2nd ed; Pearson Publishers Edward.
5. S.P Mahajan; Pollution Control in Process Industries; Tata McGraw-Hill, 1985.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTTE12012	Solar Energy Technology	3	1	-	External (70)	Internal (30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz/Attendance Max. Marks: Nil

Pre-Requisite	Nil
Course Outcome	1. To know the concept of solar radiation and principle of measuring instruments.
	2. To know the various applications of solar thermal energy.
	3.To understand the life cycle analysis method and uncertainties in solar economic analysis

Unit	Contents (Theory)	Marks Weightage
I	**Solar Radiation**: Source of Radiation, Solar Radiation geometry Solar Radiation measuring instruments, solar constant, Solar Radiation on tilted surface, solar chart.	**14**
II	**Solar Concentrating Collectors:** Optical and Thermal Analysis of Parabolic Collectors, Optical and Thermal Analysis of Parabolic through collectors, second law analysis, Minimum Entropy Generation rate, Optimum Collector Temperature, Non-Isothermal Collector, Solar Non-Concentrating Collectors, Design Consideration.	**14**
III	**Performance of Solar Collectors;** Collector Thermal Efficiency, Collector Energy Losses, Collector Incident Angle Modifier, Concentrating Collector Acceptance Angle, Collector Time Constant, Dynamic System Test Method, Collector Test Resulta And Preliminary Collector Selection, Quality Test Methods, Analysis of Concentric Tube Collector.	**14**
IV	**Solar Thermal Applications**: selection Criteria of storage Materials for Heating and Cooling applications, selection of Heat Transfer Fluid for Heating and Cooling Applications, active passive Solar Water Heating System, Solar Space Heating, Solar Cooling with Absorption and Adsorption Refrigeration, Solar Desalination, Solar Powered Absorption Air Conditioning System, Solar Irrigation System, Solar Chimney, Drier, Dehumidifier, Solar Still.	**14**
V	**Solar Thermal Power System:** Parabolic through Collector System, Solar Tower System, Dish Systems, Thermal Analysis of solar Thermal Power Plants, Solar Ponds.	**14**

Text Book/References Books/ Websites:

1. Duffie J A, Beckman W A Solar Engineering of Thermal Processes; Wiley Publications.
2. Soteris A Kalogirou: Solar Energy Engineering – Process and Systems; Academic Press Publications
3. S P Sukhatme; Solar Energy – Principles of Thermal Collection and Storage; Taylor and Francis Publications
4. H P Garg & Jai Prakash; Solar Energy: Fundamentals and Applications; McGraw Hill
5. Edward E Anderson ; Fundamentals for solar energy conversion; Wesley Publ. Co.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
MTTE12013	Gas Dynamics	3	1	-			Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz/Attendance Max. Marks: Nil

Pre-Requisite	Thermodynamics and fluid mechanics
Course Outcome	1. Ability to understand various fluids flows with analysis of Heat Addition.
	2. To understand the working of various systems related to gas dynamics and different thermal processes.

Unit	Contents (Theory)	Marks Weightage
I	**Fundamental Aspects of Gas Dynamics**: Introduction, Isentropic flow in a stream tube, speed of Sound, Mach Waves; One Dimensional Isentropic Flow: Governing Equations, Stagnation Conditions, Critical Conditions, Maximum Discharge Velocity, Isentropic Relations.	**14**
II	**Normal Shock Waves:** Shock waves, stationary normal shock waves, normal shock wave relations in terms of Mach number; Oblique Shock Waves: Oblique shock wave relations, reflection of oblique shock waves, interaction of Oblique Shock Waves, Conical Shock Waves; Expansion Waves: Prandtl-Meyer flow, reflection and interaction of expansion waves, flow over bodies involving shock and expansion waves.	**14**
III	**Variable Area Flow**: Equations for Variable Area Flow, Operating Characteristics of Nozzles, Convergent-Divergent Supersonic Diffusers, Adiabatic Flow in a Duct with Friction: Flow in a constant area duct, friction factor variations, and the Fanno line.	**14**
IV	**Flow with Heat Addition or Removal**: One-dimensional flow in a constant area duct neglecting viscosity, variable area flow with heat addition, One-Dimensional Constant Area Flow with both heat exchanger and friction, Generalized Quasi-One-Dimensional Flow: Governing equations and influence coefficients, solution procedure for generalized flow with and without sonic point.	**14**
V	**Two-Dimensional Compressible Flow:** Governing Equations, Vorticity Considerations, the Velocity Potential, Linearized Solutions, Linearized Subsonic Flow, Linearized Supersonic Flow, method of characteristics.	**14**

Text Book/References Books/ Websites:

1. H. W. Liepmann, and A. Roshko, Elements of Gas Dynamics, Dover Pub, 2001 :
2. L.D.Landau and E..M.Lifshitz, Fluid Mechanics. 2nd ed.,Butterworth-Heinemann, 1995
3. P. H. Oosthuizen and W. E. Carscallen. Compressible Fluid Flow. NY, McGraw-Hill, 1997
4. M.A.Saad:Compressible Fluid Flow. 2nd ed. Upper Saddle River, NJ: Prentice-Hall, 1993

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTTE1202	Advanced Refrigeration & Air Conditioning	3	1	-	(70)	(30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz Attendance Max. Marks: Nil

Pre-Requisite	Thermodynamic knowledge is required.
Course Outcome	1. Understand the various types of refrigeration systems and Psychometric.
	2. Learn the classification of refrigerants and its properties.
	3. Understand about different controls relays and motors employee in refrigeration.

Unit	Contents (Theory)	Marks Weightage
I	**Refrigeration Cycles Analysis:** Carnot Cycle, Air Refrigeration Cycles, Vapor Compression Refrigeration Cycle from Basic - Analysis Multi pressure Systems, Cascade Systems.	**14**
II	**Main system components**: Compressors, Condensers, Evaporators - Types and performance, Expansion devices - types and selection.	**14**
III	**Refrigerants Handling**: Classification of Refrigerants, Refrigerant properties, Oil Compatibility, Environmental Impact - Montreal / Kyoto protocols - Eco Friendly Refrigerants.	**14**
IV	**System Balancing & Controls:** Estimation of Cooling Load, System Equilibrium, Balancing and matching of components, and Cycling Controls, Electric Circuits in - Refrigerators, Window A/C, Types of motors, Relays, Different Types of Refrigeration Tools, Evacuation and Charging Unit, Recovery and Recycling Unit, Vacuum Pumps	**14**
V	**Unconventional Refrigeration Cycles**: Vapor Absorption Systems - Aqua Ammonia & Li-br Systems, Steam Jet Refrigeration Thermo Electric Refrigeration	**14**

Text Book/References Books/ Websites:

1. R.J Dossat; Principles of Refrigeration ;John Wiley, S.I. Version ,4th Edition , 2006..
2. W.F. Stoecker; Refrigeration and Air conditioning; McGraw-Hill Book Company, 1989.
3. Jordan and Priester;Refrigeration and Air Conditioning, 1985; McGraw-Hill Book
4. W.B Goshnay; Principles and Refrigeration;Cambridge, University Press, 1982.
5. Langley, Billy C; Solid state electronic controls for HVACR; Prentice-Hall 1989.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
MTTE1203	ADVANCED HEAT TRANSFER	3	1	-			Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz/ Attendance Max. Marks: Nil

Pre-Requisite	Basics Knowledge of thermodynamics.
Course Outcome	Understand the Concept of heat transfer.
	Heat transfer by gasses .
	Understand the working of heat transfer device.

Unit	Contents (Theory)	Marks Weightage
I	Transient heat conduction, Exact solution, Use of Heisler and Grober chart, Integrated method.	**14**
II	Extended surfaces , Steady state analysis and optimization, Radial fins of rectangular and Hyperbolic profiles, longitudinal fin of rectangular profile radiating to free space.	**14**
III	Thermal boundary layers, Momentum and energy equations, Internal and external flows, Forced convection over cylinders, spheres and bank of tubes.	**14**
IV	Heat transfer with phase change, condensation and boiling heat transfer, Heat transfer in condensation, Effect of non, condensable gases in condensing equipments. Flow boiling correlations.	**14**
V	Radiative exchange in furnaces, Radiation characteristics of particle systems, Thermal radiation of a luminous fuel oil and gas, Soot flame, overall heat transfer in furnaces.	**14**

Text Book/References Books/ Websites:

1. R.S Khurmi ; Heat and mass transfer ; S Chand Publications.
2. R.K Rajput; Heat and mass transfer ; Laxmi Publications
3. C P Arora ; Heat transfer ; Laxmi Publications
4. H P Garg & Jai Prakash; Heat and mass transfer ; McGraw Hill
5. Edward E Anderson ; Heat and mass transfer ; Wesley Publ. Co.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTTE1204	Computation Fluid Dynamics	3	1	-	(70)	(30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz/Attendance Max. Marks: Nil

Pre-Requisite	Nil
Course Outcome	1. To understand about basic concept of waste management.
	2. To understand about recycling of various wastes.
	3. To understand about waste collection, handling and disposal.

Unit	Contents (Theory)	Marks Weightage
I	**Introduction:** Need; Strategy of CFD modeling in engineering; CFD simulations, Types of Flow- Laminar flow, Turbulent flow, Single-phase flow, Multiphase flow, Introduction of CFD programs. Future of CFD - design process; Applications of Computational Fluid Dynamics.	**14**
II	**Methods of Solution:** Solution of Finite Difference Equations; Iterative Methods; Matrix Inversion Methods; ADI Method; Operator Splitting; Fast Fourier Transform. Model Equations, Wave Equations, Stability Analysis; Advanced Shock Capturing Schemes.	**14**
III	**Finite-Volume Methods:** Basic Concepts; Model Equations in Integral Form ; The Linear Convection Equation; Diffusion Equation ; One-Dimensional Examples ; A Second-Order Approximation to the Convection Equation ; A Second-Order Approximation to the Diffusion Equation. **Modeling:** Equation of continuity; Equation of Motion ; Boundary Conditions: Inlet and outlet boundaries ; Wall boundaries ;Symmetry and axis boundary conditions ; Initial conditions ; Domain settings ; Physical properties ; equation of state.	**14**
IV	**Numerical Aspects of CFD :** The Gauss–Seidel algorithm; Gauss–Seidel; Measures of convergence; Discretization schemes; Boundedness and transportiveness ; Taylor expansions ; Accuracy; Hybrid scheme; Power-law scheme; More advanced discretization schemes ; Solving the velocity field ; Under-relaxation ;Multi grid ; Unsteady flows ; time-dependent simulation; Conclusions on the different time discretization methods ; Meshing ; Mesh generation ;Adaptation; Numerical diffusion.	**14**
V	**Navier-Stokes Equations:** Introduction - Governing equations - Difficulties in solving Navier-Stokes equation - Stream function - Vorticity method - In viscid flow (steady) - Determination of pressure for viscous flow; Explicit and Implicit Methods; Numerical Solution of Hyperbolic Equations, Solution of parabolic flow problems.	**14**

Text Book/References Books/ Websites:

1. J. H Ferziger and M. Peric; Computational Methods for Fluid Dynamics; Springer-Verlag, Berlin.
2. H. K Versteeg and W Malalasekara; Introduction to Computational Fluid Dynamics: The Finite Volume Method. Second Edition (Indian Reprint) Pearson Education.
3. J.D. Anderson, Jr., Computational Fluid Dynamics: The Basic with Applications, McGraw Hill, Inc.,
4. http://ingegneriaterni.altervista.org/wp-content/uploads/2016/06/BOOK-Bengt-Andersson-et-al-Computational-fluid-dynamics-for-engineers-2012/

Suggested List of Laboratory Experiments (Expandable): Nil

PEOPLE'S UNIVERSITY, BHOPAL

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Programme: Master of Technology Specialization: Thermal Engineering Semester –II

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External	Internal	Total
MTTE1205	Energy Conservation Management & Audit	3	1	-	External (70)	Internal (30)	Min: 40 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 3 Hours

Theory Internal- Max Marks: 30	Best of Two Mid Semester Test – Max Marks: 15	Assignment/Quiz/Attendance- Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz/Attendance- Max. Marks: Nil

Pre-Requisite	Nil
Course Outcome	1. To impart knowledge in the domain of energy conservation.
	2. To bring out Energy Conservation Potential and Business opportunities across different user segments under innovative business models.
	3. To inculcate knowledge and skills about assessing the energy efficiency of an entity/ establishment.

Unit	Contents (Theory)	Marks Weightage
I	Energy Scenario, Basics of Energy and its various forms, Energy Management and, Audit, Material and Energy Balance, Energy Action Planning, Financial Management, Project Management, Energy Monitoring and Targeting, Global Environmental Concerns.	**14**
II	Energy Efficiency in Thermal Utilities, Fuels and Combustion, Boilers, Steam System, Furnaces, Insulation and Refractory, FBC Boilers, Cogeneration, Waste heat recovery.	**14**
III	Energy Efficiency in Electrical Utilities, Electrical Systems, Electric Motors, Compressed Air System, HVAC and Refrigeration System, Fans and Blowers, Pumps and Pumping System, Cooling Tower, Lighting System, Diesel Generating System, Energy Efficient Technologies in Electrical Systems	**14**
IV	Energy Performance Assessment for Equipment and Utility systems, Boilers, Furnaces, Cogeneration, Turbines (Gas, Steam), Heat Exchangers, Electric Motors and Variable Speed, Drives, Fans and Blowers, Water Pumps, Compressors.	**14**
V	HVAC Systems, Lighting Systems, Performing Financial Analysis, Applications of Non, Conventional and Renewable Energy Sources, Waste Minimization and Resource Conservation.	**14**

Text Book/References Books/ Websites:

1. L.C.Witte, P.S.Schmidt, D.R. Brown, "Industrial Energy Management and Utilization" Hemisphere Publication, Washington.
2. P.W. Callaghn,; Design and Management for Energy Conservation, Pergamon Press, Oxford.
3. I.G.C.Dryden.; The Efficient Use of Energy; Butterworths, London.
4. W.C.Turner.; Energy Management Hand book; Wiley, New York.
5. W.R. Murph and G. Mc KAY; Energy Management; Butterworths, London.

Suggested List of Laboratory Experiments :- (Expandable): Nil

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total	External	Internal	Total (100)
MTTE1206	Refrigeration & Air Conditioning. Lab	-	-	2	(Nil)	(Nil)	Nil	(70)	(30)	Min: 40 (D Grade)

Duration of Theory (Externals): Nil

Theory Internal- Max Marks: Nil	Best of Two Mid Semester Test – Max Marks: Nil	Assignment/Quiz/Attendance- Max. Marks: Nil
Practical Internal Max Marks: 30	Lab work & Sessional – Max Marks:15	Assignment / Quiz/Attendance Max. Marks: 15

Pre-Requisite	Nil
Course Outcome	1. Understand the various types of refrigeration systems and Psychometric.
	2. Learn the classification of refrigerants and its properties
	3. Understand about different controls relays and motors employee in refrigeration.

Unit	Contents (Theory)	Marks Weightage
	Students will study the Refrigeration & Air Conditioning system. It is playing an important role in all sectors of industry, commerce and household usage. A domestic refrigerator or any refrigeration plants work on the vapour compression cycle.	**100**

Text Book/References Books/ Websites:

Suggested List of Laboratory Experiments (Expandable):-

1. Experiment on Determination of COP of Refrigeration.
2. Experiment on Determination of COP for Heat pump.
3. Experiment of Determination of COP for Vapour absorption Refrigeration.
4. Experiment of Determination of COP for Thermoelectric Refrigeration-
5. Determination of COP for Room air conditioner.
6. Demonstration of frost free refrigerator.
7. Demonstration of conventional Refrigerator.
8. Study and demonstration of types of compressors.
9. Study and demonstration of types of condensers.
10. Study and demonstration of types of evaporators.

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total	External	Internal	Total (100)
MTTE1207	Computation Fluid Dynamics Lab	-	-	2	(Nil)	(Nil)	Nil	(70)	(30)	Min: 40 (D Grade)

Duration of Theory (Externals): Nil

Theory Internal- Max Marks: Nil	Best of Two Mid Semester Test – Max Marks: Nil	Assignment/Quiz/Attendance Max. Marks: Nil
Practical Internal Max Marks: 30	Lab work & Sessional – Max Marks: 15	Assignment / Quiz/ Attendance Max. Marks: 15

Pre-Requisite	Nil
Course Outcome	1. Students will be able to solve complex problem of thermal system.
	2. Students will able to design thermal system.

Unit	Contents (Theory)	Marks Weightage
	The focus of this lab is computational fluid dynamics (CFD). It involved in both development, and application of algorithms for fluid flow and heat transfer.	**100**

Text Book/References Books/ Websites:

Suggested List of Laboratory Experiments (Expandable):-

1. Calculation of flow in a rectangular duct.
2. Calculation of fully developed flow in a triangular duct.
3. Equations for incompressible flow and boundary conditions.
4. Study of basic concepts of Finite difference approximations.
5. Solution of Navier Stokes for compressible flows.
6. Solution of Navier Stokes equations for incompressible flows.
7. Solution of linear algebraic equations by using basic methods.
8. Basics of finite volume method including grid generation.
9. Turbulent flows and turbulence modeling.

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Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (50)	External	Internal	Total
MT1208	Audit Course - II (English For Research Paper Writing)	2	-	-	(35)	(15)	Min: 20 (D Grade)	Nil	Nil	Nil

Duration of Theory (Externals): 2 Hours

Theory Internal- Max Marks: 15	Best of Two Mid Semester Test – Max Marks: Nil	Assignment/Quiz/Attendance Max. Marks: 15
Practical Internal Max Marks: Nil	Lab work & Sessional – Max Marks: Nil	Assignment / Quiz Max. Marks: Nil

Pre-Requisite	**Nil**
Course Outcome	1. Student will understand that how to improve your writing skills and level of readability.
	2. Learn about what to write in each section of research article.
	3. Understand the skills needed when writing a Title.

Unit	Contents (Theory)	Marks Weightage
I	Planning and Preparation; Word Order; Breaking up long sentences; Structuring Paragraphs and Sentences; Being Concise and Removing; Redundancy; Avoiding Ambiguity and Vagueness.	**07**
II	Clarifying Who Did What; Highlighting Your Findings; Hedging and Criticizing; Paraphrasing and Plagiarism; Sections of a Paper; Abstracts; Introduction.	**07**
III	Review of the Literature; Methods; Results; Discussion; Conclusions; The Final Check.	**07**
IV	Key skills are needed when writing a Title; key skills are needed when writing an Abstract; key skills are needed when writing an Introduction; skills needed when writing a Review of the Literature.	**07**
V	Skills are needed when writing the Methods; skills needed when writing the Results; skills are needed when writing the Discussion; skills are needed when writing the Conclusions; useful phrases; how to ensure paper is as good as it could possibly be the first- time submission	**07**

Text Book/References Books/ Websites:

1. R. Goldbort (2006) Writing for Science; Yale University Press (available on Google Books).
2. R. Day (2006) How to Write and Publish a Scientific Paper; Cambridge University Press
3. N Highman (1998); Handbook of Writing for the Mathematical Sciences; SIAM. Highman's book
4. Adrian Wallwork ; English for Writing Research Papers; Springer New York Dordrecht Heidelberg London; 2011

Suggested List of Laboratory Experiments :- (Expandable): ***Nil***