PEOPLE'S UNIVERSITY, BHOPAL

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

Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
MT1101	Research Methodology & IPR	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	Nil
Course Outcome	1. Students will be able to understand research problem formulation.
	2. Able to analyze research related information and follow research ethics.
	3. Understand the importance of IPR and its protection for further research work.

Unit	Contents (Theory)	Marks Weightage
I	**Research Methodology**: Meaning; Objective & its types; Research Approaches ; Significance of Research; Research Methods vs. Methodology; Research Process; Criteria of Good Research; Meaning of research problem; Sources of research problem; Errors in selecting a research problem; Scope and objectives of research problem; Effective literature studies approaches; Plagiarism; Research Ethics; Problems Encountered by Researchers in India.	**14**
II	**Concept and Importance in Research:** Features of a good research design, Exploratory Research Design: concept types and uses, Descriptive Research Designs: concept, types and uses. Experimental Design: Concept of Independent & Dependent variables. Interpretation : Meaning & Technique; Precaution in Interpretation ; Significance of Report Writing; Layout of the Research Report ; Types of Reports; Precautions for Writing Research Reports ; Effective technical writing; Role of Computer software in report writing.	**14**
III	**Data Collection:** Collection of Primary Data ; Observation Method ; Interview Method ; Collection of Data through Questionnaires; Collection of Data through Schedules; Difference between Questionnaires and Schedules; Collection of Secondary Data.	**14**
IV	**Hypothesis**: Null Hypothesis & Alternative Hypothesis. Basic Concepts Concerning Testing of Hypotheses (Chi-square Test), Procedure for Hypothesis Testing; Flow Diagram for Hypothesis Testing. Qualities of a good Hypothesis.	**14**
V	**Nature of Intellectual Property:** Patents; Designs; Trade and Copyright. Process of Patenting and Development; technological research; innovation; patenting; development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents; Patenting under PCT. **Patent Rights:** Scope. Licensing and transfer of technology. Patent Information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. IPR of Biological Systems.	**14**

Text Book/References Books/ Websites:

1. C. R. Kothari; Research Methodology; New Age Publication.
2. Wayne Goddard and Stuart Melville; Research Methodology: An Introduction.
3. Ranjit Kumar; 2 nd Edition ; Research Methodology: A Step by Step Guide for beginners.
4. Robert P. Merges; Peter S. Menell; Mark A. Lemley; Intellectual Property in New Technological Age.
5. T. Ramappa; Intellectual Property Rights Under WTO; S. Chand; 2008.

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

PEOPLE'S UNIVERSITY, BHOPAL

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Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External	Internal	Total
MTTE1102	Advanced Thermodynamics	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	Basics knowledge of Thermodynamics Laws.
Course Outcome	1. Students will be able to define intensive/extensive properties and explain the law of thermodynamics.
	2. Students will able to define the ideal gas and state the ideal gas relation.
	3. Students will be able to solve the problems of steam Turbine and Boilers.

Unit	Contents (Theory)	Marks Weightage
I	**Classical Thermodynamics:** Concept of Classical Thermodynamics, Review of Zeroth, First and Second law of Thermodynamics. Availability analysis of Thermal System and Concept of Energy Conservation.	**14**
II	**Phase and Reaction Equilibriums:** Equilibrium Constants, Calculation of Equilibrium composition of Multi Components Gaseous Mixtures.	**14**
III	**Equations of State:** Equations of State & Calculations of Thermodynamics and Transport properties of substances, Reaction Rates of First , Second and higher order reactions, Reactions in Gaseous, Liquid and Solid Phases .	**14**
IV	**Pure Substance:** Equilibrium, Real Substances and Properties, Triple Point, Critical Point, Temperature Entropy, Entropy-Enthalpy Charts, Vander Wal's Equation of State, Claperon's Equation, Gibbs Phase Rule, Law of Corresponding States.	**14**
V	**Combustion and Flames:** Combustion and Flame Velocities, Laminar and Turbulent Flames. Premixed and Diffusion flames: their properties and structures. Theories of Flame Propagation, Combustion of solid, Liquid and Gaseous Fuels, Combustion of Fuel droplets and Sprays, Combustion Systems, Combustion in closed and Open Systems, Application to IC engines , boilers, Gas Turbine, Combustors and Rocket Motors.	**14**

Text Book/References Books/ Websites:

1. Ruth F. Weiner and Robin Matthews; Thermal Engineering; Elsevier Publications
2. J.G. Henry and G.W. Heike: Advance Thermodynamics; Pearson Education
3. R.K Rajput ; Thermal Engineering; Laxmi Publications
4. R.S. Khurmi; Thermal Engineering; S Chand Publications
5. P.K Nag; Thermal Engineering; Tata McGraw-Hill, 1985

Suggested List of Laboratory Experiments (Expandable):-Nil

PEOPLE'S UNIVERSITY, BHOPAL

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

Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
MTTE1103	Advanced Fluid Mechanics	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	Fundamentals of Fluid Mechanics and Hydraulic Machinery
Course Outcome	1. To provide the students with a solid foundation in fluid flow principles
	2. Conduct the experiments in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
	3. To understand Major and Minor Losses

Unit	Contents (Theory)	Marks Weightage
I	**Introduction:** Reviews of basic laws, Concept of Continuum, Fluid Flow in Integral & differential form. Kinematics of Fluid: Description of Properties in a Moving Fluid, Local and Material, Derivatives, Control Mass and Control Volume Analysis, Reynolds Transport theorem and its application.	**14**
II	**Ideal Fluid Flow:** Introduction, Elementary flows in a 2-D plane, Flow nets, and Superposition of Elementary Flows	**14**
III	**Viscous Incompressible Flows:** Introduction, Equations of motion, N-S equations and its application. Boundary Layer Theory: Prandtl's Boundary Layer Equations, Flat Plate Boundary Layer, Approximate Solution, Integral Method, Laminar and Turbulent Boundary layer, Separation, Lift and Drag.	**14**
IV	**Fundamental of Compressible Flows:** Introduction, Thermodynamic Relations of perfect gases, Speed of Sound, Pressure Wave Propagation, Stagnation and Sonic Properties, Shocks.	**14**
V	**Hydraulic Machines:** Theory and design of Hydro-Turbines and Centrifugal Pumps, their Proto-Type Testing.	**14**

Text Book/References Books/ Websites:

1. S .Ramamrutham: Hydraulic Fluid Mechanics & Fluid Machines; Dhanpat Rai and Sons New Delhi.
2. P. N Modi. and Seth S. M; Hydraulics and fluid mechanics including Hydraulic. Machines ; Standard Book House. New Delhi.
3. K. Subramanya ; One Thousand Solved Problems in Fluid Mechanics; Tata McGraw Hill

Suggested List of Laboratory Experiments (Expandable):-Nil

PEOPLE'S UNIVERSITY, BHOPAL

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

Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P			Total (100)	External	Internal	Total
MTTE1104	IC Engine & Alternate Fuels	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	Fundamental knowledge of Engines.
Course Outcome	1. To make students aware of the roles of fluid flow and heat transfer in engine operation.
	2. To teach students to analyze the combustion process of common fuels.
	3. To teach students methods to mitigate engine vibration, friction, and wear

Unit	Contents (Theory)	Marks Weightage
I	**SI Engines:** Fuels For Use In S.I. Engines; Rating Of S.I. Engines Fuels, Carburetors And Carburetion, Fuel Injection Systems	**14**
II	**Combustion In S.I. Engines**-Normal And Abnormal, Detonation, Stratification And Lean Mixture Operations. Carburetor Replacement By MPFI, Elements Of MPFI System Like Control Unit, Sensors, Switches, Effect On Engine Performance & Engine Emission	**14**
III	**Performance & Testing of I.C. Engine**: Introduction, Breathing Capacity, Pumping Losses, Friction Losses, Super Charging, Performance Parameters & Their Measurements For S.I.E. & C.I.E. Engine, Performance Maps. Air And Sound Pollution By Engines, Remedial Measures	**14**
IV	**Non Conventional I.C. Engines**: Dual Fuel, Multi Fuel, Stratified Charge Lean Burn Variable Compression Ratio, Rotary Engines, Description, Working And Comparison With Conventional I.C. Engines.	**14**
V	**Future Fuels For Ignition Engines:** Introduction, Necessity For Substitute Fuels. Substitute Future Fuels Like Ethanol, Methanol, Bio Gas, Hydrogen, Production, Transportation, Storage Of Substitute Fuel, Performance Of Engines Using These Fuels	**14**

Text Book/References Books/ Websites:

1. A.S. Khatchiian ;Theory of C.I. Engines Vol.1 and 2 IIT Bombay
2. C.F. Taylor and E.S. Taylor; Internal Combustion Engines, Stanton
3. P.G. Burman and B.Luca Fuel injection and Engines, Technical Press
4. L.C. Litchy, Combustion Engines Processes, McGraw-Hill
5. E.F. Obert, Internal Combustion Engines and Air Pollution, Intext Educational Publishers

Suggested List of Laboratory Experiments :- (Expandable):

PEOPLE'S UNIVERSITY, BHOPAL

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

Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External (70)	Internal (30)	Total (100)	External	Internal	Total
MTTE1105	Boiler Auxiliaries &Performance Evaluation	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	Nil
Course Outcome	1. Understand the concepts of boiler types, circulation systems and heaters.
	2. Understand the types of fuel and ash handling equipment
	3. Familiarize with the working principal of electrostatic precipitator

Unit	Contents (Theory)	Marks Weightage
I	**Boiler Types:** Efficiency calculation, Balance diagram, Boiler start up calculations, Boiler turbine matching, Power Plant balance diagram	**14**
II	**Fuel and Ash Handling Equipment:** Crushers and Mills, Drum internals, Specification and selection	**14**
III	**Feed Pumps:** Different types, Specifications, Operation and Maintenance Aspects, Fans, Blowers, Applications, Performance requirements, Selection, Operation and maintenance.	**14**
IV	**Dust Cleaning Equipment**: Selection criteria, Design, Operation and Maintenance of Electrostatic Precipitators, Bag filters.	**14**
V	**Soot Blowers:** Various types and their Constructional Features, Specifications, Selection, Operation and Maintenance.	**14**

Text Book/References Books/ Websites:

1. CEGB London; Modern Power Station Practice; Pergamon Press
2. B. Eck; Fans ; Pergamon Press, 1973
3. C.D.Shields; Boilers;Types Characteristics and Functions; McGraw-Hill, 1961.Manster

Suggested List of Laboratory Experiments :- (Expandable):

PEOPLE'S UNIVERSITY, BHOPAL

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

Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total	External	Internal	Total (100)
MTTE1106	Fluid Mechanics 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	Fundamentals of Fluid Mechanics and Hydraulic Machinery
Course Outcome	1. To provide the students with a solid foundation in fluid flow principles
	2.Conduct experiments (in teams) in pipe flows and open-channel flows and interpreting data from model studies to prototype cases, as well as documenting them in engineering reports.
	3. To understand Major and Minor Losses

Unit	Contents (Theory)	Marks Weightage
	Students will study the basic fluid mechanics set-up. The lab is equipped with different flow measuring set-ups such as venturimeter, Orifice-Plate, Pitot tube, Rota meter etc, where students can visualize the basic theory of working of the flow meter. The lab also has Reynolds's setup, free-forced vortices setup, flow over open channel and impact of jet set-up, where students can fortify their theoretical knowledge.	**100**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments :- (Expandable):

1. Study of Jet impact on flat and curved surfaces
2. Study of Measurement of drag on a circular cylinder in high Reynolds number flow
3. Study of Energy loss measurements in subcritical and supercritical open channel flow
4. Study of Measurement of fluid viscosity
5. Study of Determination of friction factor as a function of Reynolds number in pipe flow
6. Studying laminar-turbulent transition for flow in a tube
7. Study of Boundary layer flow over a flat plate
8. Study of Pressure distribution around a circular cylinder in high Reynolds number flow

PEOPLE'S UNIVERSITY, BHOPAL

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

Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (100)	External (70)	Internal (30)	Total (100)
MTTE1107	IC Engine Lab	-	-	2	(Nil)	(Nil)	Nil			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	Basic knowledge of IC Engine.
Course Outcome	1. Differentiate among different internal combustion engine designs
	2. Recognize and understand reasons for differences among operating characteristics of different engine types and designs
	3. Given an engine design specification, predict performance and fuel economy trends with good accuracy

Unit	Contents (Theory)	Marks Weightage
	The objective of this laboratory is to provide the student a good environment to understand the important concepts and applications in the field of IC engines. These fundamentals will be used to link the phenomenological processes taking place in the engine for issues of: power generation, emissions and environmental impact, fuel economy and fuel composition effects on engine operation and mechanical limitations of obtaining ideal performance. This laboratory also enhances the knowledge of internal combustion engines for research and academic purposes. The lab is well-equipped and enables the students to understand the basic construction of two stroke and four stroke diesel and petrol engine. The lab also contain basic parts of an engine like carburetor, Fuel injection system, engine cooling system, Single cylinder 4-stroke Diesel engine test rig, and Single cylinder 4-stroke Petrol engine test rig. etc.	**100**

Text Book/References Books/ Websites: Nil

Suggested List of Laboratory Experiments :- (Expandable):

1. Performance test on a single cylinder diesel engine.
2. Performance test on a single cylinder petrol engine.
3. Evaluation of the heat balance for single cylinder diesel engine.
4. Performance test on a multi-cylinder petrol engine.
5. Morse test on multi-cylinder engine.
6. Measurement of exhaust gas emission from S.I. engine.
7. Measurement of exhaust gas emission from CI engine.
8. Study of Bosch type single plunger fuel pump.
9. Study of various types of fuel injectors and nozzles.
10. Study of different types of carburetor.

PEOPLE'S UNIVERSITY, BHOPAL

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

Programme: Mater of Technology Specialization: Thermal Engineering Semester –I

Subject Code	Subject Title	Credit			Theory			Practical		
		L	T	P	External	Internal	Total (50)	External	Internal	Total
MT1108	Audit Course - I (Value Education)	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/Attendance Max. Marks: Nil

Pre-Requisite	Nil
Course Outcome	1. Knowledge of self-development.
	2. Learn the importance of Human values.
	3. Developing the overall personality.

Unit	Contents (Theory)	Marks Weightage
I	Values and self-development –Social values and individual attitudes; Work ethics, Indian vision of humanism; Moral and non- moral valuation; Standards and principles; Value judgments.	07
II	Importance of cultivation of values; Sense of duty. Devotion, Self-reliance. Confidence, Concentration; Truthfulness, Cleanliness; Honesty, Humanity; Power of faith, National Unity; Patriotism. Love for nature, Discipline	07
III	Personality and Behavior Development - Soul and Scientific; attitude; Positive Thinking. Integrity and discipline; Punctuality, Love and Kindness; Avoid fault Thinking; Free from anger, Dignity of labour.	07
IV	Universal brotherhood and religious tolerance; True friendship; Happiness Vs suffering, love for truth; Aware of self-destructive habits; Association and Cooperation; Doing best for saving nature.	07
V	Character and Competence –Holy books vs Blind faith; Self-management and Good health.; Science of reincarnation; Equality, Nonviolence, Humility, Role of Women; All religions and same message; Mind your Mind, Self-control; Honesty, Studying effectively.	07

 # Mandatory (Non Credit) subject according to AICTE. Non University Examination, End Sem marks not to be included in total marks and credit. Students must pass in this subject.

Text Book/References Books/ Websites:

1. S.K. Chakroborty; Values and Ethics organizations Theory and practice; Oxford University Press, New Delhi.

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