SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
(Engineering College), VIDISHA, M.P.
(An Autonomous Institute Affiliated to RGPV Bhopal)
Mechanical Engineering Department

Semester/Year		V/III	Program		B.Tech.
Subject Category	DC	Subject Code:	ME-501	Subject Name:	Heat and Mass Transfer

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:(Only for open electives)

Course Objective:

This course is designed to introduce a basic study of heat and mass transfer phenomena, develop methodologies for solving a wide variety of practical engineering problems, and provide useful information concerning the performance and design of particular systems and processes.

Course Outcomes:

After completion of the course, students would be able to -

1. **Understand the basic modes of heat transfer and compute temperature distribution in steady and unsteady state heat transfer through conduction.**
2. **Heat transfer analysis of extended surfaces**
3. **Interpret and analyse forced and free convection.**
4. **Understanding the Principle of Radiation, Evaluation of heat transfer by radiation between different Geometries and basics of Mass Transfer.**
5. **Understand the basic modes of heat transfer and compute temperature distribution in steady and unsteady state heat transfer through conduction.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3				2							1
CO2	3	3	2	2	2				1			1
CO3	3	3	2	2	1	1						1
CO4	3	3	2	2		1	1					1
CO5	3	2	3	2	1	1			1	1		1

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Basic Concepts: Modes of heat transfer, Fourier's law, Newton's law, Stefan Boltzmann law; thermal resistance and conductance, analogy between flow of heat and electricity, combined heat transfer process; Conduction: Fourier heat conduction equation, its form in rectangular, cylindrical and spherical coordinates, thermal diffusivity, linear one-dimensional steady-state conduction through a slab, tubes, spherical shells and composite structures, electrical analogies, critical-insulation-thickness for pipes, effect of variable thermal conductivity.**	**8**	**1**
II	**Extended Surfaces (fins): Heat transfer from a straight and annular fin (plate) for a uniform cross-section; error in measurement of temperature in a thermometer well, fin efficiency, fin effectiveness, applications; Unsteady heat conduction: heating and cooling of bodies with known temperatures distribution, systems with infinite thermal conductivity, response of thermocouples.**	**8**	**2**
III	**Convection: Introduction, free and forced convection; principle of dimensional analysis, Buckingham 'pie' theorem, application of dimensional analysis of free and forced convection, empirical correlations for laminar and turbulent flow over flat plate and tubular geometry; calculation of convective heat transfer coefficient using data book.**	**8**	**3**
IV	**Heat Exchangers: Types- parallel flow, counter flow; evaporator and condensers, overall heat transfers coefficient, fouling factors, long-mean temperature difference (LMTD), method of heat exchanger analysis, effectiveness of heat exchanger, NTU method;** **Mass Transfer: Fick's law, equimolar diffusion, diffusion coefficient, analogy with heat transfer, diffusion of vapour in a stationary medium.**	**8**	**4**
V	**Thermal Radiation: Nature of radiation, emissive power, absorption, transmission, reflection and emission of radiation, Planck's distribution law, radiation from real surfaces, radiation heat exchange between black and grey surfaces, shape factor, analogical electrical network, radiation shields.** **Boiling and Condensation: Film-wise and drop-wise condensation; Nusselt theory for film-wise condensation on a vertical plate and its modification for horizontal tubes; boiling heat transfer phenomenon, regimes of boiling, boiling correlations.**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

1. **Determination of Thermal Conductivity (k) of Metallic Solid.**
2. **Forced Convection Heat Transfer (h) analyses.**
3. **Plot the Temperature Distribution (Radial) in Lagged pipe and determinethe Thermal Conductivity (k) of pipe insulation.**
4. **Analysis of Parallel flow and counter flow heat exchanger, effectiveness and heat transfer**

rate (Parallel and counter flow heat exchanger Apparatus)

5. **Study of 'Twin Slab' Guarded Hot Plate Apparatus**
6. **Determine the Emissivity of the test plate (Emissivity Apparatus)**
7. **Determination of Thermal Conductivity (k) using Spherical Apparatus**
8. **Study of Composite Slab Apparatus**
9. **Analysis of Dropwise &Filmwise Condensation (Dropwise &Filmwise Apparatus)**
10. **Analysis of Critical Heat Flux (Heat Flux Apparatus)**

Text Books-

1. **Holman JP; Heat transfer; TMH**
2. **Sachdeva RC; Fundamentals of engineering heat and mass transfer.**

Reference Books-

1. **Sukhatme SP; Heat and mass transfer; University Press Hyderabad**
2. **Holman JP; Heat transfer; TMH**
3. **Dutta Binay K; Heat Transfer; PHI**
4. **Kumar DS; Heat and mass transfer; S.K. Kataria and Sons Delhi**
5. **Kreith; Heat transfer,**
6. **Gupta & Prakash; Engineering heat transfer.**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 30 sessional marks and 60 semester End-term Marks. The practical marks are 40, out of which 30 marks will be awarded for viva voce and 10 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid-semester, 20 marks to be awarded for day-to-day performance and Quizzes/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by the Board of Studies on	**Date:**
Approval by the Academic Council on	**Date:**
Compiled and designed by	**Name 1. Dr.Gopal Kumar Deshmukh**
Checked and approved by	**Name 1. Dr. Sanjay Katarey**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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Mechanical Engineering Department

Semester/Year	V/III	Program	B.Tech.
Subject Category: DC	Subject Code: ME-502	Subject Name:	Operations Research

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10				100	3	1		4

Prerequisites:(Only for open electives)

Course Objective:

- **To understand the methodology of OR problem solving and formulate linear programming problem.**
- **2. To develop formulation skills in transportation models and finding solutions**
- **To understand the basics in the field of game theory and assignment problems**
- **To know how project management techniques help in planning and scheduling a project**

Course Outcomes:

After completion of the course, students would be able to –

1. Analyze and solve linear programming by simplex method and Big M Method.

2. The students will be able to analyze and evaluate assignment and Transportation problems to find solutions and optimize costs.

3. The students will be able to apply PERT/ CPM tools for optimizing time and cost in project management.

4. Model competitive real-world phenomena using concepts from game theory. Analyse pure and mixed strategy games.

5. Provides students with analytical skills that are necessary for the understanding of inventory and warehousing management knowledge and principles

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2									
CO2	3	2	2	1								
CO3	3	2	2		2							
CO4	3	2	2									
CO5	3	3									3	

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Introduction: Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.** **Linear Programming (LP): Concepts, Formulation of model, Graphical solution, Maximisation / Minimisation – Simplex Algorithm, Use of slack / surplus / artificial variables, and Big M Method.Dual problem – relation between primal and dual, Dual simplex method – Interpretation of dual variables,**	**8**	**1**
II	**Transportation Problems: Types of transportation problems, mathematical models, transportation algorithms, methods for IBFS, Stepping Stone and MODI method.** **Assignment: Assignment Problem formulation, unbalanced assignment problem, Hungarian method, processing of job through machines.**	**8**	**2**
III	**Network Techniques: Role of network Techniques in project Management, Basic Tools and Techniques of Project management, PERT-background and development, networking, estimating activity time, Determination of Earliest Expected and Latest allowable times, Determination of Critical Path, Applications of PERT, Critical Path Method (CPM), Numbering the events, Crashing, Resource allocation and smoothening.**	**8**	**3**
IV	**Game Theory: Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2, mx2), Algebraic and graphical methods.** **Queuing Models: Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Preliminary examples of M/M/1:∞/FCFA**	**8**	**4**
V	**Inventory Control: Type of inventories, Concept of inventory control, Objectives of inventory control, Inventory Cost, Economic Order Quantity, Inventory Model, ABC Analysis.** **Materials Management: Definition, Objectives, Scope and Responsibilities of Materials Management, Just in Time (JIT), Kanban System, Materials Requirement Planning (MRP).**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Text and Reference Books-

1. **Wayne L. Winston, "Operations Research" Thomson Learning,2003.**
2. **Hamdy A. Taha, "Operations Research - An Introduction" Pearson Education,2003.**
3. **R. Panneer Seevam, "Operations Research" PHI Learning,2008.**
4. **Hira and Gupta "Introduction to Operations S.Chand and Co.2002**
5. **Hira and Gupta "Problems in Operations Research", S. Chand and Co2002.**
6. **Wagner," Operations Research", Prentice HalOf India,2000.**

Modes of Evaluation and Rubric	
There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.	
Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name : Jagdish Prasad Shakya**
Checked and approved by	**Name : Dr Sanjay Katarey**

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Mechanical Engineering Department

Semester/Year		V/III	Program		B.Tech.
Subject Category	DC	Subject Code:	ME-503	Subject Name:	Machine Design

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	-	2	4

Prerequisites:(Only for open electives)

Course Objective:

This course provides an understanding of design of machine component subjected to fluctuating load.

Course Outcomes:

After completion of the course, students would be able to -

1. **Understand concepts of stress concentration in machine members and fatigue loading.**
2. **Design shafts and couplings**
3. **Design spring in dynamic loading conditions**
4. **Design rolling contact bearing**
5. **Design sliding contact bearing**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3										
CO2		3	3	2		1	1					1
CO3		3	3	2		1	1					1
CO4		3	3	2		1	1					1
CO5		3	3	2		1	1					1

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Stress concentration and fatigue: causes of stress concentration; stress concentration in tension, bending and torsion; reduction of stress concentration, theoretical stress concentration factor, notch sensitivity, fatigue stress concentration factor, cyclic loading, endurance limit, S-N Curve, loading factor, size factor, surface factor. Design consideration for fatigue, Goodman and modified Goodman's diagram, Soderberg equation, Gerber parabola, design for finite life, cumulative fatigue damage factor.**	**8**	**1**
II	**Shafts: Design of shaft under combined bending, twisting and axial loading; shock and fatigue factors, design for rigidity; Design of shaft subjected to dynamic load; Design of keys and shaft couplings.**	**8**	**2**
III	**Springs: Design of helical compression and tension springs, consideration of dimensional and functional constraints, leaf springs and torsion springs; fatigue loading of springs, surge in spring**	**8**	**3**
IV	**Rolling Contact Bearings: Types of Rolling-contact Bearings, Principle of Self-aligning Bearing, Selection of Bearing-type, Static Load Carrying Capacity, Stribeck's Equation, Dynamic Load Carrying Capacity, Equivalent Bearing Load, Load-Life Relationship, Selection of Bearing Life, Load Factor, Design for Cyclic Loads and Speeds, Needle Bearings Bearing Failure—Causes and Remedies, Lubrication of Rolling Contact Bearings, Mounting of Bearing**	**8**	**4**
V	**Sliding Contact Bearings: Basic Modes of Lubrication, Viscosity Measurement of Viscosity, Viscosity Index, Petroff's Equation McKee's Investigation, Viscous Flow through Rectangular Slot, Hydrostatic Step Bearing, Energy Losses in Hydrostatic Bearing, Reynold's Equation, Raimondi and Boyd Method Temperature Rise Bearing Design—Selection of Parameters, Bearing Constructions Bearing Materials, Sintered Metal Bearings, Lubricating Oils, Additives for Mineral Oils, Selection of Lubricants, Greases, Bearing Failure—Causes and Remedies Comparison of Rolling and Sliding Contact Bearings**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	
Suggestive list of experiments:			

Text Books-

1. **V. B. Bhandari: Introduction to Machine Design**
2. **Shingley J.E; Machine Design; TMH**
3. **Ganesh Babu K and Srithar K; Design of Machine Elements; TMH**

Reference Books-

1. **Wentzell Timothy H; Machine Design; Cengage learning**
2. **Mubeen; Machine Design; Khanna Publisher**
3. **Maleev; Machine Design;**

Modes of Evaluation and Rubric	
There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.	
Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr. Chandra Pal Singh**
Checked and approved by	**Name 1.Prof. Sandeep Jain**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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Mechanical Engineering Department

Semester/Year		V/III	Program		B.Tech.
Subject Category	DE	Subject Code:	ME-504 (A)	Subject Name:	Energy Conversion Devices

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:(Only for open electives)

Course Objective:

This course provides a simple understanding of the basic components of steam turbines, hydraulic turbines and the various combustion processes in spark-ignition (SI) and compression-ignition (CI) engines. The course contains Energy transfer in turbo machines, Steam turbines, water turbines, normal combustion and abnormal combustion of internal combustion engines.

Course Outcomes:

After completion of the course, students would be able to -

1. **Understand the principles and application of Turbo Machines.**
2. **Analysis of steam turbine Machines.**
3. **Understand various types of hyrdaulic turbines and its applications.**
4. **Understand the Combustion phenomena and design for S.I. and C.I. Engines.**
5. **Understand the workings of various I.C. engine systems such as Fuel systems, and Lubrication systems.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	3	3	3	3						3
CO2	3	3		2	3	2						3
CO3	2	2	3			2						
CO4	3	1	2	1		1	2					1
CO5	2	3	3	2	2	3	1					

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Energy transfer in turbo machines: application of first and second laws of thermodynamics to turbo machines, moment of momentum equation and Euler turbine equation, principles of impulse and reaction machines, degree of reaction, energy equation for relative velocities, one dimensional analysis only.**	**6**	**1**
II	**Steam turbines: impulse staging, velocity and pressure compounding, utilization factor, analysis for optimum U.F Curtis stage, and Rateau stage, include qualitative analysis, effect of blade and nozzle losses on vane efficiency, stage efficiency, analysis for optimum efficiency, mass flow and blade height.** **Reactions staging: Parson's stages, degree of reaction, nozzle efficiency, velocity coefficient, stator efficiency, carry over efficiency, stage efficiency, vane efficiency, conditions for optimum efficiency, speed ratio, axial thrust, reheat factor in turbines, problem of radial equilibrium, free and forced vortex types of flow, flow with constant reaction, governing and performance characteristics of steam turbines.**	**9**	**2**
III	**Water turbines: Classification, Pelton, Francis and Kaplan turbines, vector diagrams and work-done, draft tubes, governing of water turbines.** **Centrifugal Pumps: classification, advantage over reciprocating type, definition of mano-metric head, gross head, static head, vector diagram and work done.** **Performance and characteristics: Application of dimensional analysis and similarity to water turbines and centrifugal pumps, unit and specific quantities, selection of machines, Hydraulic, volumetric, mechanical and overall efficiencies, Main and operating characteristics of the machines, cavitations.**	**9**	**3**
IV	**Combustion in S.I. engines: Flame development and propagation, ignition lag, effect of air density, temperature, engine speed, turbulence and ignition timings, physical and chemical detonation, effect of engine and fuel variables on knocking tendency, knock rating of volatile fuels, octane number, H.U.C.R., action of dopes, pre-ignition, its causes and remedy, salient features of various type combustion chambers, valve timing and firing order, MPFI and its features**	**8**	**4**
V	**Combustion in C.I. Engines: Times base indicator diagrams and their study, various stages of combustion, delay period, diesel knock, octane number, knock inhibitors, salient features of various types of combustion chambers, fuel, ignition, cooling, exhaust and lubrication systems; Simple problems on fuel injection, various types of engines, their classification and salient features. Rotary I.C. engines, their principles of working, CRDI and its features**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

1. **Study of Steam Power Plant Model (Steam Engine with Boiler) working.**
2. **Study of Impulse Turbine and Pure Reaction Turbine.**
3. **Performance of Pelton wheel turbine.**
4. **Performance of Francis turbine.**
5. **Performance of Kaplan turbine.**
6. **Study of Draft tubes.**
7. **Performance and analysis of four-stroke single-cylinder diesel engine test rig with electric dynamometer.**
8. **Performance and analysis of four-stroke four-cylinder petrol engine test rig with hydraulic dynamometer.**
9. **Load test in Ruston engine.**
10. **Load test in Variable compression ratio engine (VCR Engine).**

Text Books-

1. **Kadambi V Manohar Prasad; An introduction to EC Vol. III-Turbo machinery; Wiley Eastern Delhi.**
2. **Turbo Machines by A ValanArasu**
3. **Internal Combustion Engines by V. Ganeshan**
4. **Internal Combustion Engines by R.K. Rajput**

Reference Books-

1. **Venkanna BK; Turbomachinery; PHI**
2. **Shepherd DG; Turbo machinery**
3. **Bansal R. K; Fluid Mechanics & Fluid Machines;**
4. **Kearton W. J; Steam Turbine: Theory & Practice**
5. **A course in I.C. engines by M.L. Mathur& R.P. Sharma**
6. **Internal Combustion Engines by Domkundwar, Dhanpat Rai Publications**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1. Dr.Kamlesh Kumar Sharma**
Checked and approved by	**Name 1. Dr. Sanjay Katarey**

SAMRAT ASHOK TECHNOLOGICAL INSTITUTE
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Mechanical Engineering Department

Semester/Year		V/III	Program		B.Tech.
Subject Category	DE-I	Subject Code:	ME-504 (B)	Subject Name:	Gas Dynamics

Maximum Marks Allotted								Contact Hours			Total Credits
Theory				Practical			Total Marks				
End Sem	Mid-Sem	Assignment	Quiz	End Sem	Lab-Work	Quiz		L	T	P	
60	20	10	10	30	10	10	150	3	0	2	4

Prerequisites:(Only for open electives)

Course Objective:

This course provides the fundamentals of compressible fluid flow, emphasising a wide variety of steady, one-dimensional flow problems and a general understanding of the principles of multi-dimensional flow.

Course Outcomes:

After completion of the course, students would be able to -

1. **Solve flow equations for quasi-one-dimensional flow through variable area ducts.**
2. **Analyze the flow through constant area ducts with friction and heat transfer.**
3. **Analyze flows with normal and oblique shocks.**
4. **Solve flow problems with supersonic velocities using shock-expansion theory.**
5. **Design experimental setup.**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2				2	2					1
CO2	3	3	3	1	2	2	2					1
CO3	3	3	3	3	3	3	3					1
CO4	3	3	2	3	3	3	1					1
CO5	3	3	3	2	3	3	3	2	3	3	3	1

Contents:			
UNITs	**Descriptions**	**Hrs.**	**CO's**
I	**Introduction: Review of basic fluid dynamics, thermodynamic principles, and conservation equations for inviscid flows.**	**8**	**1**
II	**Dimensional Flow: One-dimensional wave motion, normal shock waves, Oblique shockwaves, Prandtl-Meyer expansions and applications, Generalized one.**	**8**	**2**
III	**Nozzle Flow: Isentropic Flow with area change, flow with friction (Fannoaddition (Rayleigh flow), Method of characteristics (application to one isentropic flow).**	**8**	**3**
IV	**Supersonic Flow: Velocity Potential Equation, Numerical Techniques for Steady SupersonicFlow, Time Marching Technique for Supersonic Blunt Bodies and Nozzles.**	**8**	**4**
V	**Experimental setups: Shock Tubes, Compressible flow facilities, Measurement Techniques, Experiment Design.**	**8**	**5**
Guest Lectures (if any)			
Total Hours		**40**	

Suggestive list of experiments:

Text Books-

1. **Balachandran P; Gas Dynamics for Engineers; PHI Learning**
2. **R. Yadav, Steam and Gas Turbines**

Reference Books-

1. **Mahesh M Rathore, Thermal Engineering, TMH**
2. **Anderson, J.D Jr., Modern Compressible Flows, Tata McGraw Hill, 2012.**
3. **Yahya, S.M., Fundamentals of Compressible Flow, New Age International Pub.,2013.**
4. **Zucrow, M., Gas Dynamics, Wiley India, 2013**

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 30 sessional marks and 60 semester End-term Marks.

Recommendation by the Board of Studies on	**Date:**
Approval by the Academic Council on	**Date:**
Compiled and designed by	**Name 1. Dr. Gopal Kumar Deshmukh**

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Mechanical Engineering Department

Semester/Year		V/III	Program		B.Tech.
Subject Category	DLC	Subject Code:	ME-506	Subject Name:	LAB-II

Maximum Marks Allotted						Contact Hours			Total Credits
Theory			Practical		Total Marks				
End Sem	Mid-Sem	Quiz	End Sem	Lab-Work		L	T	P	
-	-	-	30	20	50		1	2	3

Prerequisites:(Only for open electives)

Course Objective:

The main learning objective of this course is all about learning and completing the exposure required for effective usage of the Ansys Workbench Software.

Course Outcomes:

After completion of the course, students would be able to-

1. **Learn about different CAD software (including open source software)**
2. **Create virtual product in CAD environment**
3. **Create actual product using 3D printing machine**

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	3	1	3				2		2	3
CO2	3	3	3	1	3				2		2	2
CO3	3	3	3	1	3				2		2	2

Contents:

UNITs	Descriptions	Hrs.	CO's
	Creating CAD Parts in CAD software (CATIA, Open source software , produce assembly drawing, create at least one product using 3D printing machine. **Practical sessions includes industrial and academic examples for learning how to apply Ansys Workbench software for efficiently performing different kinds of Simulations, HyperMesh**	**30**	

Guest Lectures (if any)		
Total Hours		

Suggestive list of experiments: (if any)

1.
2.
3.
4.
5.
6.
7.
8.
9.
10.

Text Books-

1.

Reference Books-

1.

Modes of Evaluation and Rubric

There will be continuous evaluation for during the semester for 40 sessional marks and 60 semester End term Marks. The practical marks are 50, out of which 30 marks will be awarded for viva voce and 20 marks for lab work. Out of 40 sessional marks, 20 shall be awarded for Mid semester, 20 marks to be awarded for day to day performance and Quiz/Assignments. For the 60 Marks, there will be a semester – End examination as per the norms of AICTE.

Recommendation by Board of studies on	**Date:**
Approval by Academic council on	**Date:**
Compiled and designed by	**Name 1.Dr. Chandra Pal Singh** **Name 2:-**
Checked and approved by	**Name 1.Prof. Sandeep Jain**