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-351**	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 uniformcross-section; error in measurement of temperature in a thermometer well, fin efficiency, fineffectiveness, applications; Unsteady heat conduction:heating and cooling of bodies with known temperatures distribution, systems with infinitethermal 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 heattransfers coefficient, fouling factors, long-mean temperature difference (LMTD), method ofheat exchanger analysis, effectiveness of heat exchanger, NTU method; **Mass Transfer:** Fick's law, equimolar diffusion, diffusion coefficient, analogy with heattransfer, 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 heatexchange between black and grey surfaces, shape factor, analogical electrical network, radiationshields. **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

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Mechanical Engineering Department

Semester/Year		V/III	Program		B.Tech.
Subject Category	**DC**	Subject Code:	**MEC352**	Subject Name:	**Operation 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:	**MEC353**	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
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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**

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Mechanical Engineering Department

Semester/Year		V/III	Program		B.Tech.
Subject Category	**DLC**	Subject Code:	**MEL 356**	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)

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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**