Faculty of Engineering & Technology
P.K.University
Shivpuri (MP)

Evaluation Scheme & Syllabus for
Department of Mechanical Engg.

M.Tech
(Mechanical Engg.)
(I Semester)
(Effective from session 2025-26)

EVALUATION SCHEME

M.Tech MECHANICAL ENGG. (I SEMESTER)

STUDY AND EVALUATION SCHEME FOR M.TECH MECHANICAL ENGINEERING

SEMESTER-I

SUBJECT CODE	SUBJECTS NAME	STUDY SCHEME Periods/Week			Credits	MARKS IN EVALUATION SCHEME						Total Marks of Internal & External
						INTERNAL ASSESSMENT			EXTERNAL ASSESSMENT			
		L	T	P		Th	Pr	Tot	Th	Pr	Tot	
MSIMUME101	Simulation ,Modeling, & Analysis	3	1	0	4	30	-	30	70	-	70	100
MOPERME102	Operations Research	3	0	0	3	30	-	30	70	-	70	100
MCADME103	CAD/CAM	4	0	0	4	30	-	30	70	-	70	100
MADVAME104	Advanced I.C Engines	4	0	0	4	30	-	30	70	-	70	100
URESEME105	Research Process & Methodology	3	0	0	3	30	-	30	70	-	70	100
MSIMUME106	Simulation ,Modeling, & Analysis Lab	0	0	2	1		25	25	-	25	25	50
MOPERME107	Operations Research Lab	0	0	2	1		25	25	-	25	25	50
Total		17	1	4	20	150	50	200	350	50	400	600

Department Of Mechanical engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

L	T	P
3	1	0

MSIMUME101
Simulation, Modeling & Analysis

UNIT I:

Introduction: Simulation: a tool, advantages and disadvantages of simulation, areas of application, systems and system environment, components of a system, discrete and continuous systems, discrete event system simulation. General Principles: Concepts in discrete event simulation, time advance algorithm, manual simulation using event scheduling, basis properties and operations.

UNIT II:

Models In Simulation: Terminology and concepts, statistical models: queuing systems; inventory systems; reliability and maintainability, limited data, discrete distributions: Bernoulli distribution; Bionomial distribution; Geometric distribution, continuous distribution: Uniform distribution; Exponential distribution; Gamma distribution; Normal distribution; Weibull distribution; Triangular Distribution; Lognormal distribution, poisson process.

UNIT III:

Queuing Models: Characteristics of queuing systems, the calling population, system capacity, arrival process, service mechanism, queuing notations, long run measures of performance of queuing systems, server utilization in G/G/1/∞/∞ queues, server utilization in G/G/C/∞/∞ queues, server utilization and system performance, costs in queuing problems, Larkovian models.

UNIT IV:

Random Number Generation: Properties of random numbers, Pseudo random numbers, techniques of generating random numbers, tests of random numbers. Random Variate Generation: Inverse transform technique, Direct transformation for the Normal and Lognormal distribution, Convolution Method, Acceptance rejection technique.

UNIT V:

Input Modelling And Validation: Steps in the development of model, data collection, Distribution identification, Parameter estimation, Goodness of Fit Tests, selecting input models without data, verification and validation of simulation models.

Books:

1. Simulation Modelling and Analysis by Law and Kelton, Mc Graw Hill.
2. Simulation Model Design& execution by Fishwich, Prentice Hall.
3. Discrete event system simulation by Banks, Carson, Nelson and Nicol.

Department Of Mechanical engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

L	T	P
3	0	0

MOPERME102
Operations Research

Introduction: definition and scope of OR; Techniques and tools; Model formulation; general methods for solution; Classification of optimization problems; Optimization techniques. Linear

Optimization Models: Complex and revised simplex algorithms; Duality theorems, sensitivity analysis; Assignment, transportation and transshipment models; Traveling salesman problem as an Assignment problem; Integer and parametric programming; Goal programming.

Game Problems: Mini-max criterion and optimal strategy; Two person zero sum game; Games by simplex dominance rules.

Waiting Line Problems: Classification of queuing situations; Kendall's notation, Poisson arrival with exponential or Erlang service time distribution; Finite and infinite queues; Optimal service rates; Application of queuing theory to industrial problems.

Dynamic Programming: Characteristic of dynamic programming problems (DPPs); Bellman's principle of optimality; Problems with finite number of stages; Use of simplex algorithm for solving DPPs.

Non-linear Programming: One dimensional minimization methods; Unconstrained optimization techniques; Optimization techniques characteristics of a constrained problem; Indirect methods; Search and gradient methods.

Books:

1.Operations Research, H.A. Taha, Prentice Hall
2.Engg. Optimization, S.S. Rao, New Age Publication

Department Of Mechanical engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

L	T	P
4	0	0

MCADME103
CAD/CAM

Mathematical Elements, CAD, Solid modeling methods, Database structures for CAD, CSG formulation, B-rep and wire frame methods, Intersection surface generation methods, Boundary file generation methods,

Feature based modeling systems, Surface modeling, B- splines, Coons and Bezier surfaces, NURBS and surface patches, fitting surfaces for arbitrary digested points, Offset surfaces, Fillet surfaces, Sewn surfaces. Features recognition from the databases, IGES, STEP, PDES, and DXF data exchange formats, Graphic standards for CAD/CAM such as GKS, PHIGS and VDI.

Concurrent engineering integration of manufacturing principles and analytical principles in design, Manufacturing Information generation from CAD data, Planar sectioning, Penalty functions, cavity milling, Optimization of cutter path, Effect of tool profile geometry, Methods for multi-axis machining,

Methods for software design for CAD/CAM system, use of software libraries, Development of software package for a specific problem as part of course using software libraries.

Introduction to automation, CAM/CIM, Part programming, Interpolator & Control.

Books:

1.Computer Graphics D Hearn & M P Baker Prentice Hall
2.CAD/CAM Theory and Practice Ibrahim Zeid & R Sivasubramanian Tata McGraw-Hill
3.Mathematical Elements for Comp. Graphics D F Rogers and J A Adams McGraw-Hill International
4.Computer Aided Engineering & Design Jim Browne New ATC International
5.The Engineering Database D.N. Chorafas and S.J. Legg Butterworths
6.Principles of CAD J Rooney &P Steadman Longman Higher Education

Department Of Mechanical engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

L	T	P
4	0	0

MADVAME104
Advanced I.C. Engines

UNIT I:

INTRODUCTION: Historical Review – Engine Types – Design and operating Parameters. Cycle Analysis: Thermo-chemistry of Fuel – Air mixtures, properties – Ideal Models of Engine cycles – Real Engine cycles - differences and Factors responsible for – Computer Modeling.

UNIT II:
GAS EXCHANGE PROCESSES: Volumetric Efficiency – Flow through ports – Supercharging and Turbo charging. Charge Motion: Mean velocity and Turbulent characteristics – Swirl, Squish – Pre-chamber Engine flows.

UNIT III:
ENGINE COMBUSTION IN S.I ENGINES: Combustion and Speed – Cyclic Variations – Ignition –Abnormal combustion Fuel factors, MPFI, SI engine testing.

COMBUSTION IN CI ENGINES: Essential Features – Types off Cycle. Pr. Data – Fuel Spray Behavior – Ignition Delay – Mixing Formation and control, Common rail fuel injection system.

UNIT IV:
POLLUTANT FORMATION AND CONTROL: Nature and extent of problems – Nitrogen Oxides, Carbon monoxide, unburnt Hydrocarbon and particulate – Emissions – Measurement – Exhaust Gas Treatment, Catalytic converter, SCR, Particulate Traps, Lean, NOx, Catalysts.

UNIT V:
ENGINE HEAT TRANSFER: Importance of heat transfer, heat transfer and engine energy balance, Convective heat transfer , radiation heat transfer, Engine operating characteristics. Fuel supply systems for S.I. and C.I engines to use gaseous fuels like LPG, CNG and Hydrogen.

UNIT VI:
MODERN TRENDS IN IC ENGINES: Lean Burning and Adiabatic concepts,

Rotary Engines, Modification in I.C engines to suit Bio – fuels, HCCI and GDI concepts.

REFERENCES:

1. I.C. Engines / V.Ganesan/TMH
2. I.C. Engines Fundamentals/Heywood/TMH
3. I.C. Engines/G.K. Pathak & DK Chevan/ Standerd Publications
4. I.C. Engines /RK Rajput/Laxmi Publications

L	T	P
3	0	0

Department Of Mechanical engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

MRESEME105:
Research Process and Methodology

UNIT 1:

Introduction to Research and Problem Definition-Meaning, Objective and importance of research, Types of research, steps involved in research, defining research problem.

UNIT 2:

Research Design-Research design, Methods of research design, research process and steps involved, Literature Survey

UNIT 3:

Data Collection-Classification of Data, Methods of Data Collection, Sampling, Sampling techniques procedure and methods, Ethical considerations in research

UNIT 4:

Data Analysis and interpretation-Data analysis, Statistical techniques and choosing an appropriate statistical technique, Hypothesis, Hypothesis testing, Data processing software (e.g. SPSS etc.), statistical inference, Interpretation of results

UNIT 5:

Technical Writing and reporting of research-Types of research report: Dissertation and Thesis, research paper, review article, short communication, conference presentation etc., Referencing and referencing styles, Research Journals, Indexing and citation of Journals, Intellectual property, Plagiarism

Text Books:

1.C. R. Kothari, Gaurav Garg, Research Methodology Methods and Techniques , New Age International publishers, Third Edition.

2.Ranjit Kumar, Research Methodology: A Step-by-Step Guide for Beginners, 2nd Edition, SAGE, 2005

3.Business Research Methods – Donald Cooper & Pamela Schindler, TMGH, 9th edition.

L	T	P
0	0	2

Department Of Mechanical engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

MSIMUME106
Simulation, Modeling & Analysis Lab

LIST OF EXPERIMENTS:-

1. Study of simulation software Like ARENA , MATLAB.
2. Simulation of translational and rotational mechanical systems
3. Simulation of Queuing systems
4. Simulation of Manufacturing System 5. Generation of Random number
5. Modeling and Analysis of Dynamic Systems
6. Simulation mass spring damper system
7. Simulation of hydraulic and pneumatic systems.
8. Simulation of Job shop with material handling and Flexible manufacturing systems.
9. Simulation of Job shop with material handling and Flexible manufacturing systems 10. Simulation of Service Operations.

L	T	P
0	0	2

Department Of Mechanical engineering
(Faculty of Engineering & Technology)
P.K. University, Shivpuri (MP)
I Year I Semester

MOPERME107
Operations Research Lab

LIST OF EXPERIMENTS:-

1.Using queuing theory method to solve a given facility design problem.

2.Writing a program to solve a sequencing problem.

3.Using Monte Carlo simulation to solve a given problem.

4.Solving a given product mix problem.

5.Optimizing weight of a given truss or any machine element.

6.To optimize operational time by using Genetic Algorithm method.

7.To optimize system reliability by using simulated annealing method.

8.Optimization of maintenance time by using artificial neural network method.

9.Optimization of transport cost by using transportation problem.

10.Optimization of life cycle costing