Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1871 (E-IV) (A)	Refrigeration and Air Conditioning	70	20	10	-	-	3	1	-	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand basic concepts of refrigeration, different types of refrigeration systems and refrigeration cycles including air and vapor refrigeration including multi pressure system
CO 2	Apply knowledge to indentify applications of different refrigeration systems and commonly used refrigerants, impact on environment
CO 3	Understand psychrometric properties of air, psychrometric processes of air, Air-conditioning systems, Human comfort and regulation of human body
CO 4	Formulate and solve numerical problems based on air and vapour refrigeration system, psychrometry, air-conditioning processes and air-conditioning load calculations

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3		1									1
CO 2	3	2	2	1		1	2					
CO 3	3	2	3	2								
CO 4	3	2	3	3								
ME1871A	3	2	2.25	2		1	2					1

UNIT-I

Introduction: (A) History of refrigeration, Principles and methods of refrigeration, ice, evaporative, liquid gas, dry ice, vortex tube, and thermoelectric refrigeration, unit of refrigeration concept of refrigerator, heat engine, heat pump, co-efficient of performance.

(B) Air refrigeration system- reversed Carnot cycle, limitations joule cycle, Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles. Simple numerical problem

UNIT-II

Vapour compression system: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; multi-pressure system: removal of flash gas, multiple expansion and compression with flash inter cooling; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system,.

UNIT-III

(a) **Vapour absorption system**: Theoretical and practical systems such as aqua-ammonia, electrolux and other systems;

(b) **Steam jet refrigeration**: Principles and working, simple cycle of operation, description and working of simple system,

(c) **refrigerants:** nomenclature and classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

UNIT-IV

Psychrometric: Calculation of psychrometric properties of air by table and charts; psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature and chart, heat production and regulation of human body, bypass factor of coil

UNIT-V

Air conditioning loads: calculation of summer & winter air conditioning load, calculation of supply air rate & its condition, bypass factor, room sensible heat factor, grand sensible heat factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation.
Air distribution and ventilation systems, air conditioning system, and introduction to air conditioning equipment, introduction to cryogenics.

References:

1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI
3. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
4. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
5. Ameen; Refrigeration and Air Conditioning; PHI
6. Pita; Air conditioning Principles and systems: an energy approach; PHI
7. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
8. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA
9. Arora RC; Refrigeration and Air conditioning; PHI Learning

List of Experiments

01. Determination of Psychrometric Properties by Sling Psychrometer.
02. Study and Testing of Simple Vapour Compression Cycle.
03 Study and Testing of Water Cooling Tower.
04 Study of Ice Plant.
05 Determine the Coefficient of Performance of a Refrigeration Test Rig .
06. Study of Refrigerant Charging Unit.
07. Study of Window Air Conditioner.
08. Determine the COP of a Computer Controlled Refrigeration Test Rig .
09. Study of Air Conditioning Duct.
10. Study of Different Psychrometric Processes on Air Conditioning test Rig.
11. Study and Testing of Vapour Absorption Refrigeration System.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1871 (E-IV) (B)	Smart Material	70	20	10	-	-	3	1	-	4

UNIT -1

Overview of Smart Materials: Introduction to Smart Materials, Principles of Piezoelectricty, Piezoceramic Materials, Magnetostriction and Magneto-resistance Effect, Characterstics

UNIT-2

Introduction to Electro-active Materials, Electronic Materials, Electro-active Polymers, Ionic Polymer Matrix Composite (IPMC),

UNIT -3

Shape Memory Effect, Shape Memory Alloys, Shape Memory Polymers, Electro-rheological Fluids, Magneto Rhelological Fluids

UNIT -4

Smart Composites: Review of Composite Materials, Micro and Macro-mechanics, Modelling Laminated Composites based on Classical Laminated Plate Theory, Effect of Shear Deformation, Dynamics of Smart Composite Beam,

UNIT -5

Sensing and Actuation:Introduction,Characterstics, Applications and Principles of electro magnetic, acoustic, Chemical and Mechanical sensing Actuation.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1871 (E-IV) (C)	Tribology	70	20	10	-	-	3	1	-	4

Course Outcomes: At the end of the course, the student shall be able to:

CO1	Analyze properties of lubricant and selection of proper lubricant for the given application.
CO2	Identify the lubrication regime for the given mechanical application.
CO3	Determine tribological performance parameters of sliding contact in hydrodynamic lubrication regimes.
CO4	Evaluate the friction and wear behavior of the given materials.

UNIT-I

Introduction: History and basic concept of friction wear and lubrication, Types of lubricants, Objectives and selection of lubricant, Physical properties of lubricants.

UNIT-II

Lubrication: Regimes of lubrication - hydrodynamic, Elasto-hydrodynamic, mixed and boundary lubrication, Reynolds' equation, Hydrodynamic lubrication of roughened surfaces.

UNIT-III

Theories of other Lubrication: Externally pressurized lubrication, Squeeze-film lubrication, Elasto-hydrodynamic lubrication, Rheological lubrication regime, Functional lubrication regime.

UNIT-IV

Applications of hydrodynamic lubrication theory - Journal bearing, inclined thrust pad bearing, Rayleigh step bearing.

UNIT-V

Friction and Wear: Origin of sliding friction, Causes of Friction, Laws of Rolling Friction. Friction Instability, Contact between two bodies in relative motion, Wear classification - Wear between solids - Wear between solid and liquid - Factors affecting wear - Measurement of wear, Types of wear and their mechanisms - Adhesive wear-adhesion junction growth, Abrasive wear, Wear due to surface fatigue and wear due to chemical reactions, wear of metallic materials.

References:

1. Stachowaik, G.W., Batchelor, A.W., *Engineering Tribology*, 3rd Ed., Elsevier, 2010.
2. Majumdar B.C, *Introduction to bearings*, S. Chand & Co., Wheeler publishing, 1999.
3. Andras Z. Szeri, *Fluid film lubrication theory and design*, Cambridge University press, 1998.
4. Stolarski TA, *Tribology in Machine Design*, Butterworth Heinemann, 2000.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1871 (E-IV) (D)	Design of Heat Exchangers	70	20	10	-	-	3	1	-	4

Course Outcomes: At the end of the course, the students will able to:

CO1	Demonstrate a basic understanding of several types of heat exchangers and its performance
CO2	Design and analyze various heat exchangers using heat exchanger design standards and codes
CO3	Appreciate the consequences of fouling on performance of heat exchangers and determine fouling resistance
CO4	Carry out Thermal and Hydraulic design and analysis of heat exchangers for various real time problems including heat transfer coefficient enhancement and fouling effect.

Mapping of course outcomes with program outcomes:

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

Unit I

Heat Exchangers – Classification according to transfer process, fow arrangement, number of fluids, surface compactness, and construction features. Tubular heat exchanger, plate type heat exchangers, extended surface heat exchangers, heat pipe, Regenerators.

Unit II

Heat exchanger design methodology, assumption for heat transfer analysis, problem formulation, ϵ-NTU method, P-NTU method, Mean temperature diference method.

Unit III

Fouling of heat exchanger, effects of fouling, categories of fouling, fundamental processes of fouling, determination of fouling resistance and consequences of fouling on performance of heat exchangers.

Unit IV

Double Pipe Heat Exchangers: Thermal and Hydraulic design of inner tube, Thermal and hydraulic analysis of Annulus, Pressure drop analysis Compact Heat Exchangers: Thermal and Hydraulic design of compact heat exchanger.

Shell and Tube heat exchangers – Tinker's, kern's, and Bell Delaware's methods, for thermal and hydraulic design of Shell and Tube heat exchanger

Unit V

Mechanical Design of Heat Exchangers – design standards and codes, key terms in heat exchanger design, and thickness calculation for major components such as tube sheet, shell, tubes etc.

Reference Books:

Ramesh K. Shah and Dusan P. Sekulic, "Fundamentals of Heat• Exchanger Design" John Wiley & sons Inc., 2013

Reference Books D.C. Kern, "Process Heat Transfer", McGraw Hill, 1950.

- Sadik Kakac and Hongton Liu, "Heat Exchangers: Selection, Rating and Thermal Design" CRC Press, 1998
- Geofrey F. Hewitt, "Hand Book of Heat Exchanger Design",Begell• House, 1992.
- "T.E.M.A. Standard", New York, 1999.
- Kuppan Thulukkanam, "Heat Exchanger Design Handbook", CRC• Press, 2nd Edition, 2013

(ME) Introduction

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1872 (E-V) (A)	Machine Design-II	70	20	10	-	-	3	1	-	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand the Criteria and design of Components used in Power Transmission such as Belt, Ropes, Pulleys, Gears
CO 2	Design the I.C. Engine components like Piston, Connecting Rod etc
CO 3	Design Miscellaneous components like Pressures Vessels, Flanges and Coupling
CO 4	Understand concepts of Optimization and its application used in Machine Design

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	3	3	3	2				1			
CO 2	3	3	3	3	2				1			
CO 3	3	3	3	3	2				1			
CO 4	3	1	2	2	1				1			1
ME1872A	3	2.5	2.75	2.75	1.75				1			0.25

Note: PSG Design data book and/ or Mahadevan and Reddy's Mechanical design data book are to be provided/ permitted in exam hall (duly verified by authority)

UNIT – I

Design of Belt, Rope and Chain Derives: Methods of power transmission, selection and design of flat belt and pulley, selection of V-belts and sheave design, Design of chain drives, roller chain and its selection, Rope drives, Design of rope drives, hoist ropes.

UNIT - II

Spur and Helical Gears: Force analysis of gear tooth, modes of failure, beam strength, Lewis equation, form factor, formative gear and virtual number of teeth, gear materials, Surface strength and wear of teeth, strength against wear, Design of straight tooth spur and helical Gears.

Bevel Gears: Applications of Bevel gear, formative gear and virtual number of teeth, Force analysis, Lewis equation for bevel gears, strength against wear, Design of bevel gear.

UNIT - III

Design of I.C. Engine Components: General design considerations in I.C. engines, Design of cylinder, Design of Piston and Piston-rings, design of connecting rod, design of crank shaft.

UNIT - IV

Design of Miscellaneous components: Design of Flanged coupling, Rigid coupling, Design of Pressure vessels subjects to internal pressure, external pressure, design of penetration, design of flanges, cone cylinder junctions, materials, fabrication.

UNIT - V

Optimization: Basic concept of optimization, classification of optimization, classification of optimization, optimization techniques, engineering application of optimization, classical optimization techniques, unconstrained optimization single-variable optimization, multivariable optimization, solution by Langrange-multipliers method.

References:

1. Shingley J.E.; Machine Design; TMH
2. Bhandari VB; Design of Machine Elements; TMH
3. Sharma CS and Purohit K; Design of machine Elements; PHI Learning.
4. Hall and Somani; Machine Design; Schaum Series; TMH
5. Wentzell TH; Machine Design; Cegage Learning
6. Sharma and Agrawal; Machine Design; Kaston
7. Kulkarni SG; Machine Design; TMH
8. Abdul Mubeen; Machine Design; Khanna Publisher
9. Juvinall RC, Marshek KM; Fundamentals of Machine Component Design; Wiley
10. Norton R; Design of Machinery; TMH

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1872 (E-V) (B)	Mechanical Vibration & Noise Engineering	70	20	10	-	-	3	1	-	4

UNIT 1:

Fundamental Aspects of Vibrations: Vibration, main causes, advantages and disadvantages; engineering applications of vibration and noise; vector method of representing harmonic motion; characteristics of vibration, harmonic analysis and beats phenomenon, work done by harmonic forces on harmonic motion; periodic, non-harmonic functions- Fourier series analysis; evaluation of coefficients of Fourier series; elements of vibratory system; lumped and distributed parameter systems.

Undamped Free Vibrations: Derivation of differential equation of motion: the energy method, the method based on Newton's second law of motion, and Rayleigh's method. Solution of differential equation of motion: Natural frequency of vibration. Systems involving angular oscillations: the compound pendulum.

UNIT 2:

Damped Free Vibrations: Viscous damping: coefficient of damping; damping ratio; under damped, over damped and critically damped systems; logarithmic decrement; frequency of damped free vibration; Coulomb or dry friction damping; frequency, decay rate and comparison of viscous and Coulomb damping; solid and structural damping; slip or interfacial damping.

UNIT 3:

Harmonically excited Vibration: One degree of freedom- forced harmonic vibration; vector representation of forces; excitation due to rotating and reciprocating unbalance; vibration Isolation, force and motion transmissibility; absolute and relative motion of mass (Seismic Instruments). Whirling Motion and Critical Speed : Whirling motion and Critical speed : Definitions and significance. Critical speed of a vertical , light flexible shaft with single rotor : with and without damping . Critical speed of a shaft carrying multiple discs (without damping), Secondary critical speed.

UNIT 4:

Systems With Two Degrees of Freedom : Un-damped free vibration of 2 d.o.f and Principal modes of vibration; torsion vibrations; Forced, Un-damped vibrations with harmonic excitation ;

Coordinate coupling; Dynamic vibration absorber; torsion Vibration Absorber; Pendulum type of dynamic vibration.

UNIT 5:

Noise Engineering Subjective response of sound: Frequency and sound dependent human response; the decibel scale; relationship between, sound pressure level (SPL), sound power level and sound intensity scale; relationship between addition, subtraction and averaging, sound spectra and Octave band analysis; loudness; weighting networks; equivalent sound level, auditory effects of noise; hazardous noise, exposure due to machines and equipments; hearing conservation and damage risk criteria, daily noise doze.

Noise: Sources, Isolation and Control: Major sources of noise on road and in industries, noise due to construction equipments and domestic appliances, industrial noise control, strategies-noise control at source (with or without sound enclosures), noise control along the path (with or without partitions and acoustic barriers); noise control at the receiver, ear defenders, earplugs, semi-insert protectors.

References:

1-Ambekar A.G.,'Mechanical Vibrations and Noise Engineering PHI
2-Meirovitch Leonard; Element of Vibration Analysis; TMH Dukkdddd
3-Dukikipat RV Srinivas J Text book of Mechanical Vibrations; PHI
4-Kelly SG and kudari SK; Mechanical Vibrations; Schaum Series; TMH
5-Thomson W.T., Theory of Vibration with Applications , C.B.S Pub & distributors
6- Singiresu Rao, 'Mechanical Vibrations , Pearson Education
7-G.K. Grover, ' Mechanical Vibration , Nem chand and Bross , Roorkee

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1872 (E-V) (C)	Product Design & Developement	70	20	10	-	-	3	1	-	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	Put into practice various steps involved in the design of new product.
CO 2	Realize strategies involved in Industrial design.
CO 3	Understand the importance of economic factors in the product design.
CO 4	Apply principles of value engineering to new product development.
CO 5	Understand Product development cycle, especially Booz Allen & Hamilton new product development cycle & A T A R model in financial analysis
CO 6	To implement principles important from environment conservation point of view in product design

Unit I

Introduction, definition, design by innovation, evolution, essential factors of product design, production consumption cycle (pcc), fow and value addition in pcc, morphology of design, primary phases of design, role of allowances, process capability and tolerances in design and assembly .

Unit II

Product design strategies in industry , pricing, quality, utility, luxiriousness, product analysis, simplification, designer and his role, Industrial design considerations, procedures, problems, types of models, role of aesthetics, functional design practices.

Unit III

Economic factors influencing design, product value, economic analysis, profit , competitiveness, break even. Value engineering & product design, value, value analysis job plan, creativity, value analysis tests.

Unit IV

New product development and product management- defining product by nature and demand, New product strategy, product classification, product development & management, product life cycle, Booz Allen & Hamilton new product development cycle, A T A R model applied to financial analysis in business.

Unit V

Product design and development for environment, introduction, importance, factors, scope of impact, global & local issues, guidelines for design, life cycle assessment .

References:

 K. Chitale, R. C. Gupta, “Product Design and Manufacturing” , PHI Publication, 2013
Reference Books:
 Karl T. Ulrich, Stephen Eppinger, “Product Design and Development”, McGraw Hill Publication, 2012

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1872 (E-V) (D)	Metrology & Quality Control	70	20	10	-	-	3	1	-	4

Course Outcomes: At the end of the course, the students will able to:

CO 1	An ability to apply knowledge of various tools and techniques used to determine geometry and dimensions of components in engineering applications.
CO 2	An ability to perform experiments, as well as to analyze and interpret data.
CO 3	An ability to design gauges to meet desired needs within realistic constraints.
CO 4	An understanding of Quality Control Techniques and its applications in engineering industries

Unit I

Measurement standards and comparators: Principles of Engineering metrology, Measurement standards, Types and sources of errors, Accuracy and Precision, introduction to uncertainty in measurement, linear and angular measuring instruments and their applications. Calibration: Concept and procedure, traceability, Gauge R&R Comparators: Mechanical, Pneumatic, Optical, Electrical (LVDT).Checking all geometrical forms.

Unit II

Design of gauges, Interferometers and Surface Roughness measurements: Design of Gauges: Tolerances, Limits and Fits, Taylors principle, Types of gauges and gauge design (numerical). Interferometer: Principle, NPL Interferometer, Laser Interferometer and their applications. Surface Roughness Measurement: Surface texture, Parameters for measuring surface roughness, Contact & non-contact type surface roughness measuring instruments.

Unit III

Metrology of Thread, Gears and Advance Metrology: Measurement of Thread form: Thread form errors, Measurement of Minor, Major and Efective diameter (Three Wire Method), Flank angle, pitch, Floating Carriage Micrometer (Numerical). Gear Metrology: Types of errors, Gear tooth Vernier, Constant chord, Base tangent (Numerical), Gear Rolling Tester. Profile Projector, Tool makers microscope and their applications. Advancements in Metrology: Introduction & applications of: Co-ordinate Measuring Machine, Universal Measuring Machine, Laser in Metrology, Automatic inspection system, Machine vision for online-ofine inspection. [6 hrs]

Unit IV

Statistical quality control: Statistical quality control: Statistical concept, Frequency diagram, Concept of variance analysis, Control Chart for Variable (X & R Chart) & Attribute (P & C Chart), Process capability(Indices: cp, cpk, ppk), Statistical Process Control (Numerical). Production Part Approval Method (PPAP).

Unit V

Acceptance Sampling: Sampling Inspection, OC Curve and its characteristics, sampling methods, Sampling Plan: Single, Double (Numerical), Multiple, Comparison of Plan, calculation of sample size, AOQ, Probability of Acceptance (Numerical).

References:

 Hume K.J., “Engineering Metrology”, Macdonald Publications, ISBN no13-978-81-7409-153-X,1984.

 Jain R.K.,“Engineering Metrology”, Khanna Publication, ISBN no 13978-81-7409-153-X,1984

 Juran J. M., “Quality Handbook”, McGraw Hill Publications,1951.

 Grant S.P., “Statistical Quality Control”, Tata McGraw hill Publication,1988.

 Kulkarni V. A. and Bewoor A. K.,” Quality Control”, John Wiley Publication, ISBN no 13-978-8126519071,2009.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1873 (E-VI) (A)	Operations Research	70	20	10	-	-	3	-	-	3

Course Outcomes: At the end of the course, the students will able to:

CO 1	Understand the concept of Operations Research and its modeling approach
CO 2	Formulate and solve the allocation LPP by different methods
CO 3	Formulate and solve the managerial situations as transformation, assignment, game theory and queuing theory
CO 4	Formulate and solve the Project management problem by network techniques
CO 5	Solve the inventory problem

Mapping of course outcomes with program outcomes:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3											
CO 2	3	2	2		2		2					
CO 3	3	2	1		2		2					
CO 4	3	2	1		2		2					
CO 5	3	1	1		2		2					
ME1765	3	1.75	1.25		2		2					

UNIT-I

Introduction: Definition and scope of operations research (OR), OR model, solving the OR model, art of modeling, phases of OR study.

Linear Programming: Two variable Linear Programming model and Graphical method of solution, Simplex method, Dual Simplex method, special cases of Linear Programming, duality, sensitivity analysis.

UNIT-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.

UNIT-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.

UNIT-IV

Theory of Games : Rectangular games, Minimax theorem, graphical solution of 2 x *n* or *m* x 2 games, game with mixed strategies, reduction to linear programming model.

Queing theory: Elements of Queuing model, generalized Poisson queuing model, single server models and double server model.

UNIT-V

Inventory Control: Models of inventory, operation of inventory system, quantity discount.
Replacement: Replacement models: Equipments that deteriorate with time, equipments that fail with time.

Text / 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 Research", S. Chand and Co. 2002
5.Hira and Gupta "Problems in Operations Research", S. Chand and Co, 2002.
6. Wagner, "Operations Research", Prentice Hall Of India, 2000.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1873 (E-VI) (B)	Non Conventional Energy Sources	70	20	10	-	-	3	-	-	3

Unit-I

Introduction: Overview of the course; Global warming; Introduction to Renewable Energy Technologies , Energy Storage: Introduction; Necessity of Energy Storage; Energy Storage Methods.

Unit-II

Solar Energy: Fundamentals; Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data

Solar Thermal systems: Introduction; Basics of thermodynamics and heat transfer; Flat plate collector; Evacuated Tubular Collector; Solar air collector; Solar concentrator; Solar distillation; Solar cooker; Solar refrigeration and air conditioning; Thermal energy storage systems

Unit-III

Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module, panel and Array construction; Photovoltaic thermal systems

Unit-IV

Wind Energy: Introduction; Origin and nature of winds; Wind turbine siting; Basics of fluid mechanics; Wind turbine aerodynamics; wind turbine types and their construction; Wind energy conversion systems

Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics

Unit-V

Biomass Energy: Introduction; Photosynthesis Process; Biofuels; Biomass Resources; Biomass conversion technologies; Urban waste to energy conversion; Biomass gasification.

Other forms of Energy: Introduction: Nuclear, ocean and geothermal energy applications; Origin and their types; Working principles

Reference Books:

1. Sukhatme S.P. and J.K.Nayak, Solar Energy - Principles of Thermal Collection and Storage, Tata McGraw Hill, New Delhi, 2008.
2. Khan B.H., Non-Conventional Energy Resources,Tata McGraw Hill, New Delhi, 2006.
3. J.A. Duffie and W.A. Beckman, Solar Energy - Thermal Processes, John Wiley, 2001.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1873 (E-VI) (C)	Energy Conservation & Audit	70	20	10	-	-	3	-	-	3

UNIT –I

Energy Scenario: Commercial and Non-commercial energy, primary energy resources, commercial energy production, final energy consumption, energy needs of growing economy, long term energy scenario, energy pricing, energy sector reforms, energy and environment, energy security, energy conservation and its importance. Re-structuring of the energy supply sector, energy strategy for the future, air pollution, climate change.

UNIT-II

Energy Audit: Definition, need and types of energy audit; Energy management (Audit) approach: Understanding energy cost, bench marking, energy performance, matching energy use to requirement, maximizing system efficiencies, optimizing the input energy requirement; Fuel & energy substitution; Energy audit instruments; Energy conservation Act 2001 and its features; Duties and responsibilities of energy manager and auditors.

UNIT-III

Material energy balance: Facility as an energy system; Method for preparing process flow; material and energy balance diagrams.

Energy Action Planning: Key elements, force field analysis; Energy policy purpose, perspective, content, formulation, rectification

UNIT IV

Energy Monitoring and Targeting: Defining monitoring & targeting, elements of monitoring & targeting, data and information-analysis, techniques -energy consumption, production, cumulative sum of differences (CUSUM).

Global environmental concerns: United Nations Framework Convention on Climate Change (UNFCC), sustainable development, Kyoto Protocol, Conference of Parties (COP), Clean Development Mechanism (CDM), Prototype Carbon fund (PCF).

UNIT-V

Thermal energy management: Energy conservation in boilers, steam turbine and industrial heating system; Application of FBC; Cogeneration and waste heat recovery; Thermal insulation; Heat exchangers and heat pump; Building Energy Management.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1873 (E-VI) (D)	Jet Propulsion & Rocketry	70	20	10	-	-	3	-	-	3

Course Outcomes: At the end of the course, student will be able to:

C01	Understand the applications of jet and rocket propulsion and their energy requirements.
C02	Identify propellants available and factors influencing their burn rate and performance.
C03	Classify nozzles and their requirementsfor the development of thrust and impulse.
C04	Understand the principles of rocket propulsion, staging and boosting.
C05	Evaluate burn rate, propulsive power, Thrust and energy requirements in ideal cases of propulsion devices.

Mapping of course outcomes with program outcomes:

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	3	2	1	-	-	-	-	-	-	1	2	2
CO2	3	3	2	3	-	-	-	-	-	-	-	1	2	2
CO3	3	3	2	2	2	-	-	-	-	-	-	1	-	2
CO4	3	3	3	2	2	-	-	-	-	-	-	1	2	2
CO5	3	3	3	3	2	-	-	-	-	-	-	1	2	2

UNIT-I

Motion in Space-Requirements of Orbit: Introduction, Motion of Bodies in Space and Laws of Motion; Parameters describing Motion of Bodies, Newton's laws of Motion, Universal Law of Gravitational Force, Gravitational Field; Requirements for Motion in Space, Geosynchronous and Geostationary Orbits, Eccentricity and Inclination of Orbits, Energy and Velocity Requirements to reach a Particular Orbit; Escape Velocity, Freely Falling Bodies, Means of Providing the Required Velocities, small problems.

UNIT-II

Theory of Rocket Propulsion: Illustration by an Example of Motion of Sled Initially at Rest, Motion of Giant Squid in Deep Seas; Rocket Principle and the Rocket Equation, Mass Ratio of a Rocket, Desirable Parameters of a Rocket, Propulsive Efficiency of a Rocket, Performance Parameters of a Rocket, Staging and Clustering of Rockets, Classification of Rockets, problems.

UNIT-III

Rocket Nozzle and Performance: Expansion of gas from a high pressure chamber, Shape of the Nozzle, Nozzle area Ratio, Performance loss in a conical Nozzle, Flow Separation in Nozzles Contour or Bell Nozzles, Unconventional Nozzles Mass Flow rates and characteristic Velocity, Thrust developed by a Rocket; Thrust Coefficient Efficiencies, Specific Impulse and Correlation with C* and CF General Trends.

UNIT-IV

Chemical Propellants: Small Values of Molecular Mass and Specific Heat Ratio, Energy Release during Combustion of Propellants, Criterion for Choice of Propellants, Solid Propellants, Liquid Propellants, Hybrid Propellants.

Solid Propellant Rockets: Mechanism of Burning and Burn Rate, Choice of Index n for Stable Operation of Solid Propellant Rockets, Propellant Grain Configuration, Ignition of Solid Propellant Rockets, Pressure Decay in the chamber after propellant Burns Out, Action time and Burn Time, Factors influencing Burn RateComponents of a Solid Propellant Rocket.

UNIT-V

Liquid Propellant Rockets: Propellant Feed system, Thrust Chamber, Performance and Choice of Feed System Cycle, Turbo-pumps, Gas requirements for draining of propellants from storage tanks, drainingunder microgravity conditions, Complexity of Liquid Propellant Rocketsand simulation, Trends in the development of liquid propellant rockets.

Liquid Monopropellant rockets: Hydrazine, Monopropellant rockets, Catalyst bed loading, Performance and applications.

Hybrid Rockets: Working Principle, Choice of Fuels and Oxidizers, Future of Hybrid Rockets.

Recommended Textbooks:

1. Barrere, M., Rocket Propulsion, EIsevier Pub. Co., 1990.
2. Sutton, G. P., Rocket Propulsion Elements, John Wiley, New York, 1993.
3. Ramamurthi K., Rocket Propulsion, Macmillan Publishers India Ltd., 2010.
4. Feedesiev, V. I. and Siniarev, G. B., Introduction to Rocket Technology, Academic Press, New York, 2000.
5. Sarvanamuttoo, H.I.H., Rogers, G. F. C. and Cohen, H., Gas Turbine Theory, 6th Edition,Pearson Prentice Hall, 2008.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assign ment	End Sem	Lab Work	L	T	P	
	ME-1874 (OE-III)	MIS & ERP	70	20	10	-	-	3	-	-	3

UNIT-I
Management Information System (MIS) definition, Objectives and benefits, MIS as strategic tool, obstacles and challenges for MIS, functional and cross functional systems, hierarchical view of CBIS, structured and unstrutured decision, Operation and mgt support, Decision process and MIS, info system components and activities, value chain and MIS support.

UNIT-II
System concepts: types, definition, characteristics, feedback (Pull) and feed-forward (Push) control, system stress and entropy, computer as closed system, law of requisite variety, open and flexible (Adaptive) systems, work system model and comparison with input-process-output model, five view of work system: structure, performance infrastructure, context and risk and their effect on product performance.

UNIT-III
Planning and control concepts: terminologies, difficulties in planning, system analysis and development plan-purpose and participants, info planning, (SDLC) system development life cycle for in-house and licensed s/w, system investigatioon, analysis of needs, design and implementation phases, training of operational, personnel, evaluation, control and Maintenance of Information systems.

UNIT-IV
E-business components and interrelationship, Evolution of Enterprise Resource Planning (ERP) from MRP, Supply Chain Management (SCM) and Customer Relationship Management (CRM) Integrated data model, strategic and operational issues in ERP, Business Process Re-Engineering (BPR), significance and functions, BPR, information technology and computer NW support to MIS.

UNIT-V
ERP Implementation, role of consultants, vendors and users, customization, methodology of ERP implementation and guidelines for ERP implementation, ERP modules.

Recommended Textbooks:

1. Davis and Olson, MIS, TMH
2. James O' brian, MIS, TMH
3. Business Process Re-Engineering, Jayaraman, TMH
4. ERP by V.K. Garg, PHI
5. ERP by Alex leon and Manuals of SAPP

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1875 (OE-IV)	Industrial Automation	70	20	10	-	-	3	-	-	3

Course Outcomes: At the end of the course, the student will be able to:

CO1	Understand principles, strategies andadvantagesofindustrial automation.
CO2	Designmaterial handlingandmaterial storagesystemsforanautomatedfactory.
CO3	Devise automated shopfloorcontrolsandpartidentificationmethods.
CO4	Outline the IoT Technologies used in a manufacturing plant and their role in Industry.

UNIT-I

Principles and Strategies of Automation: Power to Accomplish the Automated Process, program of Instruction, Control System, Advanced automation Functions: safety Monitoring, maintenance and repair Diagnostics, error Detection and Recovery, levels of automations, Merits and Demerits of automation.

UNIT-II

Material Handling systems and Design: Introduction to Material Handling, Material Transport Equipment, analysis of Material Transport Systems, Storage systems-Storage System Performance and Location Strategies, Conventional Storage Methods and Equipment, Automation Storage Systems, Engineering Analysis of Storage Systems.

UNIT-III

Automatic identification methods: Overview of Automatic Identification Methods, Bar Code Technology, Radio Frequency Identification, Other AIDCTechnologies.

UNIT-IV

Industrial control systems: Process Industries Vs Discrete Manufacturing Industries, Levels of Automation in the two industries, Variables and Parameters in the two industries. Continuous Vs Discrete control- Continuous Control System, Discrete Control System. Control system components-Sensors, Actuators, Analog-to-Digital Convertors, Digital-to-Analog Convertors, Input/output Devices for Discrete Data.

UNIT-V

Industry 4.0: Introduction, IoT Techniques, Cloud computing, machine learning, Digital Twin.

Reading:

1. Groover M. P., "Automation production Systems and Computer Integrated Manufacturing", Pearson Education, 2013.
2. Krishna Kant, "Computer Based Industrial Control", Prentice Hall of India, New Delhi, 2010.
3. Tiess Chiu Chang and Richard A. W., "An Introduction to Automated Process Planning Systems", Tata McGraw-Hill Publishing Company, New Delhi, 2012.
4. Klafter, R.D., Chmielewski, T. A. and Negin M., "Robot Engineering-An Integrated Approach", Prentice Hall of India, New Delhi, 2012.

Samrat Ashok Technological Institute (Engg. College),Vidisha (M.P.)
Mechanical Engineering Department

VII-SEM B.Tech. Mechanical	Subject Code	Subject Name / Title	Maximum Marks Allotted					Contract Hrs. per weeks			Total Credits
			Theory			Practical					
			End Sem	Mid Sem MST	Quiz Assignment	End Sem	Lab Work	L	T	P	
	ME-1876	Refrigeration and Air Conditioning Lab.				30	20	-	-	2	1

List of Experiments

01. Determination of Psychrometric Properties by Sling Psychrometer.

02. Study and Testing of Simple Vapour Compression Cycle.

03 Study and Testing of Water Cooling Tower.

04 Study of Ice Plant.

05 Determine the Coefficient of Performance of a Refrigeration Test Rig .

06. Study of Refrigerant Charging Unit.

07. Study of Window Air Conditioner.

08. Determine the COP of a Computer Controlled Refrigeration Test Rig .

09. Study of Air Conditioning Duct.

10. Study of Different Psychrometric Processes on Air Conditioning test Rig.

11. Study and Testing of Vapour Absorption Refrigeration System.