2020-23

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

SEMESTER-III

MBAI301C ADVANCED HUMAN VALUES AND PROFESSIONAL ETHICS

SUBJECT CODE	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
		THEORY			PRACTICAL		L	T	P	CREDITS
		END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MBAI301C	Advanced Human Values and Professional Ethics	60	20	20	-	-	4	-	-	4

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Objective

The objective of the course is to disseminate the theory and practice of moral code of conduct and familiarize the students with the concepts of "right" and "good" in individual, social and professional context

Examination Scheme

The internal assessment of the students' performance will be done out of 40 Marks. The semester Examination will be worth 60 Marks. The question paper and semester exam will consist of two sections A and B. Section A will carry 36 Marks and consist of five questions, out of which student will be required to attempt any three questions. Section B will comprise of one or more cases / problems worth 24 marks.

Course Outcomes

1. Help the students to understand right conduct in life.
2. To equip students with understanding of the ethical philosophies, principles, models that directly and indirectly affect personal and professional life.

COURSE CONTENT

Unit I: Inculcating Values at Workplace

1. Values: Concept, Sources, Essence
2. Classification of Values.
3. Values in Indian Culture and Management: Four False Views, Value Tree
4. Eastern and Western Values; Values for Global Managers

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2020-23

Unit II: Professional Ethics

1. Ethics: Concept, Five P's of Ethical Power, Organisational Tools to Cultivate Ethics
2. Theories of Ethics: Teleological and Deontological
3. Benefits of Managing Ethics in an Organisation
4. Ethical Leadership

Unit III: Indian Ethos and Management Style

1. Indian Ethos and Workplace
2. Emerging Managerial Practices
3. Ethical Considerations in Decision Making and Indian Management Model
4. Core Strategies in Indian Wisdom and Ethical Constraints

Unit IV: Human Behavior – Indian Thoughts

1. Guna Theory
2. Sanskara Theory
3. Nishkama Karma
4. Yoga: Types, Gains; Stress and Yoga

Unit V: Spirituality and Corporate World

1. Spirituality: Concept, Paths to Spirituality
2. Instruments to achieve spirituality
3. Vedantic Approach to Spiritual and Ethical Development
4. Indian Spiritual Tradition.

Suggested Readings

1. Kausahl, Shyam L. (2006). ***Business Ethics – Concepts, Crisis and Solutions***. New Delhi: Deep and Deep Publications Pvt. Limited
2. Murthy, C.S.V. (2012). ***Business Ethics –Text and Cases.*** Himalaya Publishing House: Mumbai
3. Chakraborty, S. K. (1999). ***Values and Ethics for Organizations***. Oxford university press
4. D.Senthil Kumar and A. SenthilRajan (2008). ***Business Ethics and Values.*** Himalaya Publishing House: Mumbai

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P	CREDITS
MTME114	DCC	Energy Systems and Management	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Objectives:-

1. To explain energy conversions systems and classification, energy management, renewable energy technologies etc.
2. To classify various trends of energy systems and management

Course Outcomes:-

1. Students will be able to memories the energy conversion system and their classification, project management, renewable energy technologies and way of sustainable growth of energy.
2. Students will able to classify the various trends of energy systems and Management.
3. Students will be able to compare various energy systems each other.
4. Students will be able to solve various problems of energy systems and Management.
5. * Students will be able to interpret advanced energy conversion systems, project management, energy policies and sustainable development.

Syllabus

Unit-I **(8Hr)**

Advanced Energy Conversion Systems: Classification of energy sources- Utilization, economics and growth rates- Fossil fuels, nuclear fuels and solar energy, Gas turbine and combined cycle analysis – Inter-cooling, reheating and regeneration-gas turbine cooling, Nuclear energy conversion – Chemical and nuclear equations – Nuclear reactions – Fission and fusion, Fuel rod design – Steam cycles for nuclear power plants – reactor heat removal – Coolant channel orificing – Core thermal design – Thermal shields.

Unit-II **(8Hr)**

Energy Modeling, Project Management: Interdependence of energy-economy-environment; Modeling concept, and application, Methodology of energy demand analysis; Methodology for energy forecasting; Sectoral energy demand forecasting; Interfuel substitution models; SIMA model, and I-O model for energy policy analysis; Simulation and forecasting of future energy

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MTME114	DCC	Energy Systems and Management	60	20	20	0	0	2	1	0	3

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demand consistent with macroeconomic parameters in India, Project Evaluation & Management: Financial analysis: Project cash flows, time value of money, life cycle approach & analysis, conception, definition, planning, feasibility and analysis; Project appraisal criteria; Risk analysis; Project planning matrix; Aims oriented project planning; Social cost benefit analysis.

Unit-III **(8Hr)**

Electrical Energy Systems And Management: Overall structure of electrical systems – Supply and demand side – Economic operation – Input-output curves – Load sharing – Industrial Distribution, Energy efficiency – Energy accounting, monitoring and control – Electricity audit instruments – Energy consumption models – Specific Energy Consumption – ECO assessment and Evaluation methods, Electric loads of air conditioning and refrigeration – Energy conservation – Power consumption in compressors – Energy conservation measures – Electrolytic process – Electric heating, Optimal operation.

Unit-IV **(9Hr)**

Renewable Energy Technologies: Power in wind - Availability – Types of wind turbines - Aerodynamics of Wind turbine, Bio fuel classification- Biomass production for Energy farming- Direct combustion for heat- Paralysis- Thermo chemical process Anaerobic digestion, Concept of energy and power from waves – Wave characteristics – period and wave velocities - Different wave energy conversion devices (Tapchan, oscillating water column type), OTEC Principle - Lambert's law of absorption - Open cycle and closed cycle, The Hydrogen economy – Advantages of hydrogen as an energy carrier.

Unit-V **(9Hr)**

Energy Policies For Sustainable Development: Supply focus approach and its limitations – Energy paradigms – DEFENDUS approach – End use orientation – Energy policies and development, Energy conservation schemes – Statutory requirements of energy audit –

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(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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MTME114	**DCC**	Energy Systems and Management	60	20	20	0	0	2	1	0	3

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Economic aspects of energy audit, Social cost benefit analysis – Computation of IRR and ERR – Advance models in energy planning – Dynamic programming models in integrated energy planning – Energy planning case studies.

Reference Books:

1. IEEE Bronze Book: IEEE Standard 739-1984, "Practice for Energy Conservation and Cost Effective Planning in Industrial Facilities", IEEE Publications, 1996.
2. Nag PK, "Power plant Engineering", TMH, 2014
3. M. Munasinghe and P. Meier, "Energy Policy Analysis and Modeling", Cambridge University Press, 1993.
4. G.N.Tiwari, M.K.Ghosal and Narosa, "Renewable Energy Resources Basic Principles and Applications" 2010
5. J. Goldemberg, T.B. Johansson, A.K.N. Reddy and R.H. Williams, "Energy for a Sustainable World", Wiley Eastern, 1990.

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COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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MTME124	DCC	Advanced Refrigeration and Air-Conditioning	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Objectives:-

The basic objective of the subject is to impart the(A) basics of refrigeration and Air conditioning equipment design and theory. Fundamentals of thermodynamics, refrigeration cycles Psychometry. Pre requisites are Refrigeration & Air Conditioning.(B) to introduced the fundamentals Properties of Moist air- Psychrometric relations Psychrometric chart, (C)To classify the Construction Details of Room Air Conditioner, Duct Design – Equal Friction Methods. (D) to introduced the fundamentals of fan, blower and compressor types and working.

Course Outcomes:-

After the completion of the course, students will be able to

1. Acquire an overview of various common refrigeration systems.
2. Estimate the refrigeration compressor types and design.
3. Able to understand simple Applied Psychrometry
4. Student able to understand the Fundamentals of thermodynamics, refrigeration cycles Psychometry. Pre requisites are Refrigeration & Air Conditioning
5. Develop the skills to analyze the multi pressure refrigeration systems.

Syllabus

Unit-I **(8Hr)**

Refrigeration Cycles: Vapor compression cycle, multi-pressure systems, air refrigeration

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Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Thermal and Design Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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MTME124	DCC	Advanced Refrigeration and Air-Conditioning	60	20	20	0	0	2	1	0	3

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cycles, systems equilibrium and cycling controls, classification of refrigerants, refrigerant properties, oil compatibility, blends, ecofriendly refrigerants. Vapor absorption systems, steam jet refrigeration, thermo electric refrigeration

Unit-II **(8Hr)**

Compressors and Expanders: Refrigeration compressors, compressors types and control, expansion devices, valves, receivers, oil trap, oil regenerators, driers and strainers, accumulator, functional aspects of the above components & accessories

Unit-III **(9Hr)**

Applied Psychrometry: psychrometry: properties of moist air- psychrometric relations psychrometric chart – psychrometric processes in air-conditioning equipment – bypass factor – sensible heat factor, effective and grand sensible heat factors- selection of air- conditioning apparatus for cooling and dehumidification-high latent cooling load applications- all outdoor air application.

Unit-IV **(8Hr)**

Design of air-conditioning systems: Moist air, psychrometric chart and processes, cooling load estimation, controls of temperature, humidity and airflow, flow through ducts, losses, duct design – equal friction methods. Indoor air quality, thermal insulation, water piping in chilled water systems, construction details of room air conditioner – window type, package type, split type central units – air distribution devices – air circuits – air supply system.

Unit-V **(9Hr)**

Fans, blowers and compressors: Turbo machines, performance characteristics, fan laws, dimensionless parameters, specific speed, centrifugal, axial, mixed flow, axial flow machines.

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M.Tech in Thermal and Design Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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MTME124	DCC	Advanced Refrigeration and Air-Conditioning	60	20	20	0	0	2	1	0	3

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Centrifugal blowers: characteristic curves, velocity triangles, losses and efficiency, flow through impellers, casing, diffusers, cross-flow fans. Axial flow fans: rotor design, airfoil theory, vortex theory, cascade effects, degree of reaction, surge and stall, stator and casing, mixed flow impellers

References Books

1. C P Arora, "Refrigeration and air conditioning", McGraw Hill, 2018.
2. Stocker, "Refrigeration and air conditioning", McGraw Hill, 2017.
3. Threlked J L, Prentice Hall, N. Y, "Thermal Environmental Engineering", 2015, 2019.
4. Ozisik, M.N., "Design of Heat exchangers, condensers and evaporators", John Wiley, New York, 1e, 1985.
5. Nicholas Cheremisioff, "Cooling tower", Ann Arbor Science pub., 1e, 1981.
6. Austin H. Church, "Centrifugal pumps and blowers", John Wiley and Sons, 1e, 1980.
7. Carrier, "Air conditioning systems design", McGraw-Hill, 1e, 1985.
8. C.P. Arora, "Refrigeration and Air conditioning", Tata McGraw-Hill Pub. Company, New Delhi, 4e, 2006.

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M.Tech in Thermal and Design Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTME102	DCC	Advanced Machine Design	60	20	20	30	20	2	0	2	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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Course Objectives:-

The objective of the subject is to deal with failure analysis and advanced areas of design of machine elements based on reliability, fatigue, creep. Also deals with the fracture mechanics approach to design. Pre requisites are Material science, Machine Design I and Machine Design II.

Course Outcomes:-

1. Students will be able to understand Case studies of mechanical engineering design failures, theories of failure and will be able to analyze static strength failure.
2. Student will be able to apply knowledge of mathematics, science and engineering to design Equipments and Elements, Design of shaft and gear under fatigue, design of rolling contact bearings including linear bearings.
3. Student will be able to analyze various types of failures produced in Mechanical equipments and interpret data for Reliability and optimization.
4. Student will be able to Design for Dynamic Loading High cycle and low cycle fatigue, Fatigue strength, Design for Creep, Combined creep and fatigue failure prevention, Design for low temperature (Brittle failure). Design for corrosion, wear, hydrogen embrittlement, fretting fatigue and other combined modes of mechanical failure
5. Student will be able to understand ethics and responsibility while designing Mechanical components under creep, Dynamic loading fatigue, fretting fatigue and other combined modes of mechanical failure

Syllabus

Unit-I **(8Hr)**

Introduction to Advanced Mechanical Engineering Design Review of materials and processes for machine elements. Case studies of mechanical engineering design failures. Review of static strength failure analysis – theories of failure.

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Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Thermal and Design Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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MTME102	DCC	Advanced Machine Design	60	20	20	30	20	2	0	2	3

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Unit-II **(8Hr)**
Reliability and Optimum based Design Introduction to optimum design, analysis of simple machine members based on optimum design. Fundamentals of reliability, System concepts in Reliability engineering. Failure distributions, Statistical analysis of failure data, Weibull analysis, dimensioning

Unit-III **(9Hr)**
Design for Dynamic Loading High cycle and low cycle fatigue, Fatigue strength. Design of Mechanical Equipment Elements. Exercises of fatigue design of shafting and gears. Exercises of surface fatigue design of rolling contact bearings including linear bearings.

Unit-IV **(9Hr)**
Design for Creep Introduction to Design for creep. Combined creep and fatigue failure prevention. Design for low temperature (Brittle failure). Design for corrosion, wear, hydrogen embrittlement, fretting fatigue and other combined modes of mechanical failure

Unit-V **(10Hr)**
Fracture mechanics Introduction: Fracture mechanics approach to design, the energy criterion, the stress intensity approach, effect of material properties on fracture, dimensional analysis in fracture mechanics. Fundamental concepts: Stress concentration effect of flaws, the Grifith energy balance, the energy release rate, instability and the R curve, stress analysis of cracks, K as a failure criterion. Fracture toughness testing of metals

Note: Only Mechanical Engineer's Handbook, Data-books and certified notes are allowed in the examination hall.

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Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Thermal and Design Engineering
(2021-2023)

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MTME102	DCC	Advanced Machine Design	60	20	20	30	20	2	0	2	3

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References Books

1. Shingley J.E., "Mechanical Engineering Design, McGraw-Hill", 2017.
2. Dieter G.E., "Engineering Design, McGraw-Hill", 2008.
3. Spotts M.F., Shoup T.E., Hrnberger L.E., "Design of Machine Elements", Pearson Education, 2005.
4. Shariff A., "Design of Machine, Elements", Dhanpat Rai Publications (P), 2018.
5. Mubeen., "Machine Design", Khanna Publications (P), 2009.

List of Practical's:

1. Problem based on theories of failures.
2. Problem based on Reliability Criterion.
3. Problem based on Optimum Criterion.
4. Problem on Design of parts subjected to Fatigue Loading.
5. Problem on Design of parts subjected to Dynamic Loading
6. Problem on Design of parts subjected to Creep.
7. Problem on Design of shafts and gears subjected to fatigue loading.
8. Problem on Design of rolling contact bearings including linear bearings subjected to surface fatigue.
9. Experimental analysis of fracture mechanism for different materials.
10. Experimental analysis of Creep mechanism for different materials.

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Shri Vaishnav Institute of Technology and Science

Choice Based Credit System (CBCS) in Light of NEP-2020

M.Tech in Thermal and Design Engineering

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MTME106	**DCC**	**Stimulation Modeling Lab (FEA, FEM and CFD)**	0	0	0	30	20	0	0	2	1

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;

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Course Objectives:-

1. To provide the mathematical foundations of the finite element formulation for engineering applications
2. To expose students to some of the recent trends and research areas in finite element analysis.
3. This course brings together the knowledge gained in fluid mechanics, thermodynamics, heat transfer and numerical methods in order to develop computational techniques for the engineering analysis of heat and fluid flow processes.
4. This course also intends to provide the students with sufficient background to understand the mathematical representation of the governing equations of fluid flow, discretization techniques, grid generation, transformation equations and to numerically solve the flow field problems.

Course Outcomes:-

1. Student are able to solve problems related to finite element formulation for engineering purpose.
2. Define the element properties such as shape function and stiffness matrix for the various elements.
3. Formulate element properties for 1D and 2D elements.
4. Develop skill to solve simple Heat Transfer problems using the steps of FEM **Syllabus**
5. Under stand the governing of fluid flow, heat transfer and numerical solution.

Syllabus

Unit-I **(6Hr)**

Introduction to Finite Element Method & Finite Element Techniques :-

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Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Thermal and Design Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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MTME106	**DCC**	**Stimulation Modeling Lab (FEA, FEM and CFD)**	0	0	0	30	20	0	0	2	1

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Basic Concept, Historical Background, Engineering applications, general Description, comparison with other methods. Module boundary value problem, finite element decentralization, element shapes, sizes and node locations, interpolation functions,derivation of element equations, connectivity, boundary conditions, FEM solutions, post processing, Compatibility and completeness requirements, convergence criteria, higher order and iso parametric elements, natural coordinates, Lagrange and Hermit Polynomials

Unit-II **(6Hr)**

Applications to Solid and Structural Mechanics & Heat Transfer Problems :-

External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, axis symmetric and three dimensional stress strain problems, strain displacement relations, boundary conditions compatibility equations, analysis of trusses, frames and solid of revolution, computer programs.

Variational approach, Galerikn approach, one dimensional and two dimensional steady state problems for conduction, convection and radiation, transient problems.

Unit-III **(5Hr)**

Stimulation :-

Monte carlo simulation, generation of stochastic variates , continuous and discrete probability distributions , application of Monte carlo methods for production systems , computr simulation models , Marco dynamic model.

Unit-IV **(6Hr)**

Finite Element Methods :-

Introduction, Calculus of variation, Ritz method, weighted residual methods., Fundamental concepts of the FEM, discretization of the domain, one and two and three dimensional elements and interpolation functions, compatibility and completeness requirements. Assembly and

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Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P	CREDITS
MTME106	DCC	**Stimulation Modeling Lab (FEA, FEM and CFD)**	0	0	0	30	20	0	0	2	1

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; **C** - Credit;
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boundry conditions, formulation of FEM solutions., application to simple boundry value problems, computer implementation.

Unit-V **(6Hr)**

Computation Fluid Dynamics

Mathematical modeling: Governing equations of fluid flow and heat transfer; Introduction to discretization methods: Finite difference and finite volume methods for heat transfer problems; Time stepping methods for unsteady problems; Solution techniques for system of algebraic equations; Grid generation techniques; Solution techniques for Navier-Stokes equation; Finite element method for heat transfer and fluid flow problems; Turbulence modeling.

References Books

1. Fagan, "Finite Element Analysis-Theory & P,ctice", (Longman Scientific & Technical), 2011.
2. David Hutton, "Fundamentals of Finite Element Analysis", TMH, 2005.
3. H.S. Govinda Rao, "Finite Element Method versus Classical Methods", New Age International Publishers, 2011.
4. J. N. Reddy, "An Introduction to Finite Element Analysis", (Tata McGraw- Hill Pub. Co.), 2005.
5. Martin and Carey, "Introduction to Finite element analysis", Tata McGraw Hill, 2008.
6. Huebner John, "The finite element method for engineering",2000.
7. Ferziger, J. H. and Peric, M. "Computational Methods for Fluid Dynamics:, Third Edition, Springer-Verlag, Berlin., 2003.
8. Versteeg, H. K. and Malalasekara, W. "Introduction to Computational Fluid Dynamics: The Finite Volume Method", Second Edition (Indian Reprint) Pearson Education., 2008.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Science and Technology
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Industrial Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
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			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P	CREDITS
MTIE111	DSE	**Ergonomic and Industrial Safety**	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs):

To (A) Explain the psychology of human behavior as it relates to workplace safety, (B) Identify ergonomic hazards, (C) Recommend appropriate controls, and relate the human and workplace factors which contribute to ergonomic hazards.

Course Outcomes (COs):

After completion of this course the students are expected to be able to demonstrate following knowledge, skills and attitudes

1. Explain the psychology of human behavior as it relates to workplace safety.
2. Identify ergonomic hazards; recommend appropriate controls.
3. Relate the human and workplace factors which contribute to ergonomic hazards.

Syllabus

UNIT 1 (8Hr)

Ergonomics: Definition, Application, Brief History, Effectiveness and Cost-Effectiveness of Ergonomics Human Factors and Ergonomics, Systems of the Human Body, Anatomy of Spine and Pelvis Related to Posture Biomechanics, Muscular System, Ergonomics and the Musculoskeletal System, Costs of Back Injuries.

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Shri Vaishnav Institute of Science and Technology
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Industrial Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
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MTIE111	DSE	Ergonomic and Industrial Safety	60	20	20	0	0	2	1	0	3

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UNIT-2 **(9Hr)**

Muscular Work and Nervous Control of Movements, Types of Muscular Work, Muscular Fatigue, Types of Muscle Contractions, Measurement of Muscular Strength, Anthropometry: Definition, Terminology, Myth of the Average Human, Principles of Universal Design, Anthropometric Measurements

UNIT 3 **(9Hr)**

Design of Workplaces and Hand Tools, Work Design Analysis, Designing for Hand Use, Types of Injuries and Disorders. Work-Related Musculoskeletal Disorders, Types of Work-Related MSD's, Task-related Factors, Personal Risk Factors, Impact on Industry, Ergonomic Program for WMSD's.

UNIT 4 **(8Hr)**

Heavy Work and Evaluating Physical Workloads and Lifting, Heavy Work, Manual Material Handling & Lifting, Classification and Risks, NIOSH Lifting Guidelines, Job Demands and Workplace Stress, Mental Fatigue/Shift-work Fatigue.

UNIT 5 **(9Hr)**

Information Ergonomics: Controls, and Displays, Mental Workload Measurement, Primary and Secondary Task Performance, Controls and Displays (Types), Control Layout and Design, How

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Shri Vaishnav Institute of Science and Technology
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Industrial Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P	CREDITS
MTIE111	**DSE**	**Ergonomic and Industrial Safety**	60	20	20	0	0	2	1	0	3

Legends: **L** - Lecture; **T** - Tutorial/Teacher Guided Student Activity; **P** – Practical; C - Credit;
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to Implement An Ergonomic Program, Management and Employee Involvement, Setting Up the Ergonomics Program, Problem Identification, Hazard Prevention and Control, Training.

Text Books

1. Robert Bridger; "Introduction to Ergonomics; 2011.
2. Scott, P.A.; Charteris, J.; Bridger, R.S; "Industrial Safety and Health Management"; 2015
3. Joel M. Haight; Jeffery C. Camplin; Chritopher A. Janicak; Anjan K. Majumder; Linda S. Rowley; Kathy; "Principles of Industrial Safety"; 2015.
4. Nicholas P. Cheremisinoff; "Practical Guide to Industrial Safety"; 2014.

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Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Industrial Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P	CREDITS
MTIE231	**DSE**	**Reliability Analysis and prediction**	60	20	20	0	0	2	1	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

***Teacher Assessment** shall be based following components: Quiz/Assignment/ Project/Participation in Class, given that no component shall exceed more than 10 marks.

Course Educational Objectives (CEOs)

Topics covered include (A) reliability mathematics, organization and analysis of data, reliability modeling and system reliability evaluation techniques. (B) Environmental factors and stresses are taken into account in computing the reliability of the involved components. (C) The limitations of models, methods, procedures, algorithms and programmers are outlined. (D) The treatment of maintained systems is designed to aid the worker in analyzing systems with more realistic and practical assumptions. (E) Fault tree analysis is also extensively discussed, incorporating recent developments.

Course Outcomes (COs)

Having successfully completed the module, you should be able to demonstrate knowledge and understanding of the following:

1. Reliability, its model and evaluation techniques.
2. Factor affecting reliability.
3. Limitations.
4. Fault Tree Analysis.

Syllabus

Unit-I

Reliability Engineering: An overview. Historical development, Reliability: A birth-to-death problem. Reliability: An interdisciplinary effort. Reliability education and research, Problems of developing countries, Reliability prediction and analysis, Problems in prediction and analysis. Challenges for future. Scope of the book.

Reliability Mathematics. Classical set theory. Boolean algebra. Sample space. Definitions of

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Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Technology and Science

Choice Based Credit System (CBCS) in Light of NEP-2020

M.Tech in Industrial Engineering

(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P	CREDITS
MTIE231	DSE	**Reliability Analysis and prediction**	60	20	20	0	0	2	1	0	3

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probability. Basic properties of probability. Independent events. Conditional probability. Multiplication theorem. Total probability theorem. Bayes' theorem. Random variables. Probability distributions. Cumulative distributions. Mathematical expectation. Variance. Covariance and correlation. Moments. Moment generating functions. Probability distributions. Joint probability distributions. Distributions of several random variables. Some useful limit theorems. Estimation theory. Laplace transform. Markov processes. Random number generation.

Unit-II

Reliability Data Analysis and Management. The reliability function. Mean time to failure. Variance. The bathtub curve. Linear hazard models. Other hazard models. Analysis of failure data. Probability graph papers. Illustrations. Hazard function plots. Selection of a distribution. Statistical estimation of failure data. Interval estimates. Reliability data management.

Unit - III

Reliability Prediction from Stress-Strength Models. Stresses due to internal and external environments. Physics of failures. Reliability from stress-strength distributions. Reliability from similar stress-strength distributions. Reliability from dissimilar stress-strength distributions. Graphical approach. Time dependent stress-strength models. Environmental factors. Environmental testing; Test specifications. Stress derating. Estimation of part failure rate.

System Reliability Modeling. System modeling. Assumptions for modeling. Two state modeling. Three-state models.

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Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Industrial Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
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MTIE231	**DSE**	**Reliability Analysis and prediction**	60	20	20	0	0	2	1	0	3

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Unit – IV

Reliability Evaluation Techniques. Non path sets or cut sets approaches. Tie set and cut set approaches. Reliability evaluation of flow networks, Path sets/cut sets enumeration.

Maintainability Analysis Measures of system performance. State space approach. Network approach. Conditional probability approach. Three state systems. Preventive maintenance. Condition-based maintenance.

Unit-V

System Analysis Through Fault Trees. Important definitions. Event oriented analysis. Fault tree definitions and symbols. Structure function and coherence. Fault tree construction. Fault tree simplification. Fault tree evaluation. Importance measures of events. Measures of importance in multistate systems. Modularization in fault trees. Common cause/dependent failure analysis. Automatic synthesis of fault trees. Computer codes for fault tree analysis.

References:

1. K.B. Misra, "Reliability Analysis and Prediction", Volume 1, 1st Edition; Elsevier Science' 2012
2. Naikan, "Reliability Engineering and Life Testing" PHI, 2016
3. Patrick D. T. O'Connor, "Practical Reliability Engineering" wiley, 2008

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Vishwavidyalaya, Indore	Vishwavidyalaya, Indore		

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Thermal and Design Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*	L	T	P	CREDITS
MTME134	DSE	Advanced Thermodynamics and Combustion Engineering	60	20	20	0	0	2	1	0	3

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
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Course Educational Objectives:-

To make the student understand

1. The principle of entropy, and entropy generation in closed and open systems
2. The concepts of availability and irreversibility
3. Properties of gases and gas mixtures, and thermodynamic relations
4. Thermodynamics of reactive systems and chemical equilibrium

Course Outcomes:-

The student will be able to

1. Apply the principles of entropy and irreversibility to solve practical problems
2. Explain the equations of state for ideal and real gases and gas mixtures
3. Use thermodynamic relations to predict latent heats and other properties of substances
4. Explain combined power cycles
5. Explain thermodynamic distribution function and partition function in classical thermodynamics design parameters like fuel-air mixtures and cycle analysis

SYLLABUS-

UNIT I - Entropy **(9Hr)**

Entropy: Clausius theorem - the property of entropy , the inequality of Clausius, entropy change in an irreversible process, entropy principle, applications of entropy principle to the processes of transfer of heat through a finite temperature difference, and mixing of two fluids maximum work obtainable from a finite body and a thermal energy reservoir, entropy transfer with heat flow, entropy generation in a closed system, entropy generation in an open system.

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Board of Studies	Faculty of Studies	Shri Vaishnav Vidyapeeth	Shri Vaishnav Vidyapeeth
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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore
Shri Vaishnav Institute of Technology and Science
Choice Based Credit System (CBCS) in Light of NEP-2020
M.Tech in Thermal and Design Engineering
(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL					
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MTME134	DSE	Advanced Thermodynamics and Combustion Engineering	60	20	20	0	0	2	1	0	3

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UNIT II- Availability & Pure Substances **(9Hr)**

Available energy: Available energy referred to cycle, available energy from a finite energy source, maximum work in a reversible process, availability in a steady flow process, availability in non-flow process.

P-V-T Relationships for pure substances: P-v diagram for a pure substance, triple point line, critical point, saturated liquid and vapor lines, P-T diagram for a pure substance, T-s diagram for a pure substance, h-s diagram (Mollier diagram) for a pure substance, dryness fraction, problems using steam tables.

Properties of Gases: Equations of state – Vander Waal's equation, law of corresponding states, Beattie-Bridgeman equation, Redlich-Kwong equation.

Gas Mixtures: Dalton's law of partial pressures – enthalpy and entropy

UNIT III- **(9Hr)**

Thermodynamic Relations: Maxwell's equations –TdS equations – difference in heat capacities – ratio of heat capacities – Joule-Kelvin effect – Clausius-Clapeyron equation.

Power Cycles: Brayton cycle – comparison between Brayton cycle and Rankine cycle – effect of regeneration & reheat on Rankine cycle efficiency – Brayton-Rankine combined cycle, Carnot Cycle,

Statistical Thermodynamics-II: Maxwell-Boltzmann statistics and distribution, Fermi-Dirac statistics and distribution, Bose-Einstein statistics and distribution, phase space, Liouville equation, equilibrium constant by statistical thermodynamic approach

UNIT IV- **(8Hr)**

Engine types and their operation- engine design and operating parameters, Fuel-air mixtures and cycle analysis- thermo chemistry of fuel-air mixtures, properties of working fluids, fuel-air cycle analysis, and availability analysis of engine processes.

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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Shri Vaishnav Institute of Technology and Science

Choice Based Credit System (CBCS) in Light of NEP-2020

M.Tech in Thermal and Design Engineering

(2021-2023)

COURSE CODE	CATEGORY	COURSE NAME	TEACHING &EVALUATION SCHEME								
			THEORY			PRACTICAL		L	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
MTME134	DSE	Advanced Thermodynamics and Combustion Engineering	60	20	20	0	0	2	1	0	3

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Gas Exchange Processes - Volumetric efficiency, flow through valves, residual gas fraction, exhaust gas flow rate and temperature variation,supercharging and turbo charging.
Charge motion- Mean velocity and turbulence characteristics, swirl, squish, pre-chamber engine flows, crevice flows and blowby.
Fuel metering and manifold phenomenon-SI engine mixture requirements, carburetors, fuel injection systems, flow past throttle plate, and flow in intake manifolds.

UNIT V- **(8Hr)**

SI Engine combustion- Thermodynamic analysis of SI engine combustion, flame structure and speed, cyclic variations in combustion, and abnormal combustion.
Pollutant formation and control- Nature and extent of problem, nitrogen oxides, carbon monoxide, unburned hydrocarbon emissions, particulate emissions, exhaust gas treatment.
Modern trends in I.C. engines- lean burning engines-rotary engines, modification in I.C engines to suit Bio – fuels.
CI Engine combustion- Essential features, types of diesel combustion systems, analysis of cylinder pressure data, fuel spray behavior, ignition delay, and mixing-controlled combustion.

References Books:

1. Heinz Heisler, "Advanced Engine Technology", Trafalgar Square, 1997.
2. V. Ganesan, "Internal Combustion Engines", 2ndEdition, Tata McGraw Hill, 2002.
3. M.L.Mathur and R.P. Sharma, "Internal Combustion Engines", Dhanpat Rai, 2008.Y.A. Cengel and M.A. Boles, "Thermodynamics – An Engineering Approach", 5th Edition in SI Units, Tata McGraw Hill Publishing Company Limited, New Delhi, 2006.
4. C. Borganakke and R.E. Sonntag, "Fundamentals of Thermodynamics", 7th Edition, Wiley India, Delhi, 2012.

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