

1.2.1 Percentage of new courses introduced of the total number of courses across all programmes offered during the last five years (30)

SME1102	FUNDAMENTALS OF MECHANICAL ENGINEERING (Common to Mech, M&P & Auto)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Choose the material for a specified application based on the material selection criteria.
- CO2 - Recommend the appropriate method for product development and design process of a given product.
- CO3 - Prepare the list and the sequence of manufacturing operations required to make a given product.
- CO4 - Suggest the right machines, production resources and tools required for machining a given product.
- CO5 - Choose the components required to achieve the particular IC engine specifications.
- CO6 - Propose the type of power plant suitable for a specific case based on the location, power demand, sustainability, cost, availability, capacity and pollution.

UNIT 1 PRODUCT CYCLE

9 Hrs.

Need for new product development – Globalization – Product life cycle – Technology development cycle – Forward cycle – Forward engineering – Design process – Materials Used in Engineering and their Applications Metals – Ferrous and Non- Ferrous, Nonmetallic materials, Material selection criteria Design considerations Steps in Design, designing to codes and standards sequential engineering – simultaneous engineering – concurrent engineering – Reverse engineering – Re engineering.

UNIT 2 MANUFACTURING PROCESS

9 Hrs.

Introduction to manufacturing processes and Their Applications: Sheet metal forming, Sheet metal cutting, Fabrication, Metal joining processes. Principles of welding - fundamentals of arc welding, gas welding and gas cutting – brazing and soldering. Foundry – tools - patterns –moulding process – types – green sand moulding and dry sand molding, castings – sand casting – die casting – defects and remedies Forging - forging tools - open-die forging, closed-die forging, coining, nosing, upsetting, heading, - smithy tools

UNIT 3 PRODUCTION PROCESS (MACHINE TOOLS)

9 Hrs.

Metal machining process: Lathe -Specifications - Main components and their functions-Lathe operations. Machining Concept Drilling, Milling, Turning, Grinding and surface Finishing. Operations. Study of Pillar drilling machine, boring, milling, shaping, planing, broaching, grinding. Introduction to NC and CNC machines, Grinding machine, Power saw, Milling Machine.

UNIT 4 I.C.ENGINES

9 Hrs.

Working principle of S.I. and C.I.engines – four stroke and two stroke cycles – comparison of four stroke and two stroke engines, Ignition systems –single jet carburetor-spark plug-cooling systems- lubrication systems - fuel pump and fuel injector, function of piston, piston rings, cylinder, connecting rod and crankshaft. Steam Engine (Qualitative treatment only)

UNIT 5 POWER PLANT

9 Hrs.

Layout - components and working of Steam, Hydel, Diesel, Nuclear and Gas turbine Power Plants - comparison and selection of sites, High pressure and Super Critical Boilers – Fluidised Bed Boilers

Max.45 Hrs.

TEXT / REFERENCE BOOKS

1. George E.Dieter, Linda C.Schmidt, "Engineering Design", McGraw-Hill International Edition, 4th Edition, 2009, ISBN 978-007-127189-9
2. Hajra-Chaudhari "Workshop Technology"/
3. Ganesan V, "Internal Combustion Engines", Third Edition, Tata Mcgraw-Hill, 2011.
4. Arora S.C and Domkundwar S, "A Course in Power Plant Engineering", Dhanpat Rai, 2001.
5. Cagan, Jonathan; Vogel, Craig M.; Creating Breakthrough Products: Innovation from Product Planning to

- Program Approval, Publisher: Financial Times Prentice Hall; 2002
6. Collier J.G., and Hewitt G.F, "Introduction to Nuclear power", Hemisphere publishing, New York, 1987.
 7. John B Heywood, "Internal Combustion Engine Fundamentals", Tata McGraw-Hill, 2011.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

- | | | |
|---------|--|----------|
| PART A: | 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 – No choice | 20 Marks |
| PART B: | 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks | 80 Marks |

SCH1101	ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to Mech, M&P, Aero & Auto)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Understand the importance of the Environment.
- CO2 - Identify the Environmental impact due to Human activities and Disaster Management.
- CO3 - Identify the prevention and control measures of various pollutions.
- CO4 - Identify the threats to biodiversity and the ways for Conservation of Biodiversity.
- CO5 - Understand the water stress problems and energy crisis in present era.
- CO6 - Understand the issues involved in enforcement of environmental legislation.

UNIT 1 INTRODUCTION TO ENVIRONMENTAL STUDIES AND NATURAL RESOURCES 10 Hrs.

Definition, scope and importance, need for public awareness, forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams, floods, drought, conflicts over water, dams-benefits and problems, mineral resources: use effects on forests and tribal people. water resources: use and over-utilization of surface and ground water, exploitation, environmental effects of extracting and using mineral resources, case studies – food resources: world food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. Energy resources: growing energy needs, renewable and non renewable energy sources, use of alternate energy sources: Case studies. Land resources: land as a resource, land degradation, man induced landslides, soil erosion and desertification, role of an individual in conservation of natural resources, equitable use of resources for sustainable lifestyles.

UNIT 2 ECOSYSTEMS AND BIODIVERSITY

10 Hrs

Concept of an ecosystem, structure and function of an ecosystem - producers, consumers and decomposers - energy flow in the ecosystem, ecological succession, food chains, food webs and ecological pyramids. Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries). Introduction to biodiversity, definition: genetic, species and ecosystem diversity - biogeographical classification of India - value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, biodiversity at global, national and local levels. India as a mega-diversity nation, hot-spots of biodiversity, threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts, endangered and endemic species of India, conservation of biodiversity, in-situ and ex-situ conservation of biodiversity.

UNIT 3 ENVIRONMENTAL POLLUTION

9 Hrs.

Definition - causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards. Solid waste management: causes, effects and control measures of urban and industrial wastes, role of an individual in prevention of pollution, pollution case studies, disaster management: floods, earthquake, cyclone and landslides.

UNIT 4 SOCIAL ISSUES AND THE ENVIRONMENT

8 Hrs.

From unsustainable to sustainable development, urban problems related to energy, water conservation, rain water harvesting, watershed management, resettlement and rehabilitation of people; its problems and concerns, case studies, environmental ethics: issues and possible solutions, climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust, case studies. Wasteland reclamation, consumerism and waste products – environment protection act: air (prevention and control of pollution) act - water (prevention and control of pollution) act, wildlife protection act; forest conservation act. Issues involved in enforcement of environmental legislation, Key initiatives of Rio declaration, Vienna convention, Kyoto protocol, Johannesburg summit and public awareness.

UNIT 5 HUMAN POPULATION AND THE ENVIRONMENT

8 Hrs.

Population growth, variation among nations, population explosion, family welfare programme, environment and human health, human rights, value education, HIV / AIDS, women and child welfare, role of information technology in environment and human health, case studies. Visit to a local area to document environmental assets-river/forest/grassland/hill/mountain. Visit to a local polluted site-urban/rural/ industrial/agricultural-study of common plants, insects, birds-study of simple ecosystems, pond, river, hill slopes etc.

Max.45 Hrs.

TEXT / REFERENCE BOOKS

1. Meenakshi.P, Elements of Environmental Science and Engineering, 1st Edition, Prentice Hall of India, New Delhi, 2009.
2. Ravikrishnan. A, Environmental Science & Engineering, 3rd Edition, Sri Krishna Publications, Chennai, 2008.
3. Erach Bharucha, Text Book of Environmental Studies, 2nd Edition, University Press, Chennai, 2006
4. Wrigh.R.T & Nebel B.J, Environmental science-towards a sustainable future by Richard 8th edition, Prentice Hall of India, New Delhi, 2006.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 – 20 Marks

No choice

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks 80 Marks

SME1617	NON CONVENTIONAL ENERGY SYSTEMS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1: identify the energy demands and co relate with available energy resources

CO2: identify and to estimate the solar energy utilization and principles involved in solar energy Collection

CO3: understand the types of wind energy systems, and to implement the performance, safety and environmental aspects.

CO4: understand and pursue research work behind the concept of Bio mass, Bio gas and Bio diesel energy system

CO5: understand and evaluate tidal energy and other Renewable energies.

CO6: acquire knowledge on Geothermal energies and fuel cell systems.

UNIT 1 INTRODUCTION

9Hrs.

World Energy Use Reserves of Energy Resources Environmental Aspects of Energy Utilization Renewable Energy Scenario in Tamilnadu, India and around the World - Potentials - Achievements / Applications Economics of renewable energy systems

UNIT 2 SOLAR ENERGY

9Hrs.

Solar Radiation Measurements of Solar Radiation - Flat Plate and Concentrating Collectors Solar direct Thermal Applications Solar thermal Power Generation - Fundamentals of Solar Photo Voltaic Conversion Solar Cells Solar PV Power Generation Solar PV Applications. –

UNIT 3 WIND ENERGY

9Hrs.

Wind Data and Energy Estimation Types of Wind Energy Systems Performance - Site Selection Details of Wind Turbine Generator Safety and Environmental Aspects

UNIT 4 BIO ENERGY

9Hrs.

Biomass direct combustion Biomass gasifiers Biogas- plants Digesters Ethanol production Bio diesel Cogeneration -- Biomass Applications

UNIT 5 OTHER RENEWABLE ENERGY SOURCES

9Hrs.

Tidal energy Wave Energy Open and Closed OTEC Cycles Small Hydro-Geothermal Energy Hydrogen and Storage - Fuel Cell Systems Hybrid Systems, Magneto Hydro dynamometer.

Max: 45 Hrs

TEXT/ REFERENCE BOOKS

1. G.D. Rai, Non Conventional Energy Sources, Khanna Publishers, New Delhi, 2011.
2. Twidell, J.W. & Weir, A., Renewable Energy Sources, EFN Spon Ltd., UK, 2006.
3. S.P. Sukhatme, Solar Energy, Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Godfrey Boyle, Renewable Energy, Power for a Sustainable Future, Oxford University Press, U.K., 1996.
5. G.N. Tiwari, Solar Energy-Fundamentals Design, Modelling & Applications, Narosa Publishing House, New Delhi, 2002.
6. David M. Mousdale- Introduction to Biofuels, CRC Press, Taylor & Francis Group, USA 2010 Limited, New Delhi 2009.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6

SME1620	THEORY OF ELASTICITY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1: Understand the basic definitions of the theory of elasticity.
CO2: Understand the governing equations of elasticity.
CO3: Solve the 2D and 3D problems of elasticity
CO4: Evaluate the stress and strain conditions of beams.
CO5: Summarize the bending effects of various structures.
CO6: Evaluate the torsion effects on solid and hollow bars.

UNIT 1 INTRODUCTION

9 Hrs.

Definition, notations and sign conventions for stress and strain Stress - strain relations, Strain-displacement relations- Elastic constants. Coordinates and Tensors Transformation. Stress in Cartesian Coordinates. Principal Stresses and Principal Coordinates. Stress Ellipsoid.

UNIT 2 BASIC EQUATIONS OF ELASTICITY

9 Hrs.

Generalized Hooke's Law. Relationships between Elastic Moduli. Boundary-Value Problems in Elasticity. Navier's Equations. Beltrami-Michell's Equations. Saint-Venant's Principle.

UNIT 3 2D PROBLEMS OF ELASTICITY

10 Hrs.

Plane stress and plain strain problems -Airys stress function and cartesian coordinates. Biharmonic equations. 2-D-problems Cantilever and simply supported beams. Thick-Walled Cylindrical Pure Bending of a Curved Beam in polar coordinates.

UNIT 4 3D PROBLEMS OF ELASTICITY

9 Hrs.

Bar Stretched by its Own Weight. Torsion of a Circular Shaft. Bending of a Prismatic Bar. Thermo elasticity- General Approach- Plane Thermoplastic Problem in Polar Coordinates.

UNIT 5 TORSION

8 Hrs.

Torsion of a uniform circular shaft. Torsion of Elliptical and Triangular sections bars. Torsion of hollow bars. Prandtl's theory- Membrane analogy.

Max: 45 Hrs

TEXT / REFERENCE BOOKS:

1. S.P. Timoshenko and J.N. Goodier, Theory of Elasticity, McGraw-Hill, 1985.
2. Sechler, "Elasticity in Engineering" John Wiley & Sons Inc., New York, 1980.
3. Ugural, A.C and Fenster, S.K, Advanced Strength and Applied Elasticity, Prentice hall, 2003
4. Wang, C.T. Applied elasticity, McGraw Hill 1993
5. Enrico Volterra and Caines, J.H, Advanced strength of Materials, Prentice Hall, 1991.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 No choice

20

Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80

Marks

SME 1310	PRODUCT DESIGN (Mech)	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES

On completion of the course, student will be able to

CO1: Refine the product design ideas generated using different idea generation methods for a new product development case study.

CO2: Choose the most suitable product design from the alternatives based on the aesthetics, economy, performance, safety, reliability and ease of manufacturing.

CO3: Suggest the appropriate computer applications for each phase of the product development and design process.

CO4: Adapt the general design principles, guidelines, standards, and practices during the product design and development.

CO5: Recommend the suggestions to reduce the environmental impact of the given product design case study using DFE assessment methods and guidelines.

CO6: Evaluate the industrial design aspects of the given product design for the given case study.

UNIT I INTRODUCTION

9 Hrs

Definition of a product - Types of product- levels of product- New product development product-market mix-New product development (NPD) process- Idea generation methods-Creativity-Creative attitude, creative design process-Morphological analysis- analysis of interconnected decision areas, brain storming, synectics. Product life cycle- The challenges of product development- product analysis- product characteristics

UNIT II BASIC CONCEPTS

9 Hrs

Product design- definition-Design by evolution- design by innovation-design by imitation -factors affecting product design. Standards of performance and environmental factors.decision making and iteration - Morphology of design (different phases).-role of aesthetics in design. Introduction to optimization in design- economic factors in design-design for safety and reliability.

UNIT III ROLE OF COMPUTERS IN PRODUCT DESIGN

9 Hrs

Geometric Modeling – types – Wire frame surface and solid modeling – Boundary Representation, constructive solid geometry – Graphics standards – assembly modeling – use of software packages Modeling and simulation-the role of models in engineering design- Design for manufacturing, Rapid proto typing (RP) - application of RP in product design.

UNIT IV DESIGN FOR MANUFACTURE AND ENVIRONMENT

9 Hrs

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances - Assembly limits – Datum features - Tolerance stacks.Design for the Environment - Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines.

UNIT V INDUSTRIAL DESIGN

9 Hrs

Need for industrial design-impact in design process - investigation of customer needs - conceptualization - refinement- management of the industrial design process - technology driven products - user – driven products Integrating CAE, CAD, CAM tools

Max.45 Hrs

REFERENCE BOOKS:

1. Product Design and Development, Karl T.Ulrich and Steven D.Eppinger, Tata McGraw –Hill edition. 2.An Introduction to Engineering Design methods Vijay Gupta
- 3.Chitale A K and Gupta R C, "Product Design and Manufacturing", Prentice Hall of India, 2005. 4.Bralla, Design for Manufacture handbook, McGraw hill, 1999.
5. Boothroyd, G, Hartz and Nike, Product Design for Manufacture, Marcel Dekker, 1994.
6. Dickson, John. R, and Corroda Poly, Engineering Design and Design for Manufacture and Structural Approach, Field Stone Publisher, USA, 1995.
7. Fixel, J. Design for the Environment McGraw hill., 1996.
8. Graedel T. Allen By. B, Design for the Environment Angle Wood Cliff,Prentice Hall. Reason Pub., 1996.

9. Kevin Otto and Kristin Wood, Product Design. Pearson Publication, 2004.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 – No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80 Marks

SME1611	DESIGN OF MACHINE TOOL STRUCTURE	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

1. Understand machining process, needs of machine tools.
2. Modern machine tool development, calculation of basic needs of a machine tool.
3. Materials selection for the machine tool.
4. Designing the beds for the machine tool with rigid and stability.
5. Slide ways design calculations
6. Spindle design calculations.

UNIT 1 INTRODUCTION

9 Hrs.

Classification of machining processes, machine tools machine tool construction factors performance criteria trends in modern machine tool calculation of cutting forces and power requirements for turning, milling, boring and grinding force distribution on different parts of drilling, milling and grinding machine tools.

UNIT 2 STRENGTH AND RIGIDITY OF MACHINE TOOL STRUCTURES

9 Hrs.

Basic principles of design – comparison of materials used in machine tool construction – dependence of process capability on rigidity – static compliance – design of lathe beds – materials – typical construction – torsional modulus of rectangular and box sections methods of increasing rigidities.

UNIT 3 SLIDEWAYS

9 Hrs.

Slide ways – types – materials – constructions – clearance adjustments – Hydrostatically lubricated slide ways – slide way design – pressure distribution antifriction ways design construction.

UNIT 4 SPINDLES AND SPINDLE SUPPORTS

9 Hrs.

Spindle units – materials – spindle design – spindle bearings types of materials constructions.

UNIT 5 MACHINE TOOL DYNAMICS

9 Hrs.

Dynamic system elastic system working processes vibration in machine tools self excited vibration and dynamic stability basic principles of chatter effects of vibration vibration elimination damping – – –

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 – No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80 Marks

SME1612	WASTE HEAT UTILIZATION AND MANAGEMENT	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

1. Understand the fundamentals of cogeneration technology and its related thermodynamic cycles.
2. Understand the industrial applications of cogeneration.
3. Understand the waste heat recovery systems, their applications and the factors affecting their performance.
4. Explain the use of waste heat recovery systems on the boilers.
5. Select a suitable waste heat recovery system for an industrial application.
6. Enumerate and evaluate the techno economics of cogeneration.

UNIT 1 COGENERATION

9 Hrs.

Introduction, Principles of Thermodynamics, Combined Cycles, Topping, Bottoming, Organic Rankine Cycles, Advantages of Cogeneration Technology

UNIT 2 APPLICATION & TECHNO ECONOMICS OF COGENERATION

9 Hrs.

Cogeneration Application in various process industries. Sizing of waste heat boilers, Performance calculations, Part load characteristics selection of Cogeneration Technologies, Financial considerations, operating cost and Investments, Costs of Cogeneration

UNIT 3 WASTE HEAT RECOVERY

9 Hrs.

Introduction - Principles of Thermodynamics and Second Law, Sources of waste heat and its potential applications, Waste heat survey and measurements, Data collection, Limitations and affecting factors Heat recovery equipment and systems

UNIT 4 WASTE HEAT RECOVERY SYSTEMS & WASTE HEAT BOILERS

9 Hrs.

Waste heat recovery systems: Recuperators, Regenerators, Economizers: Waste heat boilers: Classification, Location, Service Conditions, Design Considerations, Unfired combined Cycle, Supplementary fired combined cycle, fired combined cycle, Thermic fluid heaters

UNIT 5 APPLICATIONS & TECHNO ECONOMICS OF WASTE HEAT RECOVERY SYSTEMS

9Hrs

Applications in industries, selection of waste heat recovery technologies - financial considerations - operations and investment costs of waste heat recovery

Max. 45 Hrs

TEXT / REFERENCE BOOKS

1. Charles H. Butler, Cogeneration, McGraw Hill Book Co., 1984.
2. Horlock JH, Cogeneration - Heat and Power, Thermodynamics and Economics, Oxford, 1987.
3. Institute of Fuel, London, Waste Heat Recovery, Chapman & Hall Publishers, London, 1963.
4. Sengupta Subrata, Lee SS EDS, Waste Heat Utilization and Management, Hemisphere, Washington, 1983.
5. De Nevers, Noel., Air Pollution Control Engineering, McGrawHill, New York, 1995.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 – No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80 Marks

SPR1604	DESIGN FOR MANUFACTURE AND ASSEMBLY	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES: On completion of the course, student will be able to

CO1: Understand the concept of a product design procedure and accepted levels of tolerances.

CO2: Classify products simply in terms of their basic shape and type of manufacturing process.

CO3: Apply a systematic approach in the field of design and redesigning of components in the manufacture of products.

CO4: Applying the design for assembly rules and application and design for reliability, quality and optimization to design new products

CO5: Understand and apply the concepts of value engineering in the design and manufacture of products.

CO6: Understand and apply the concepts of the reengineering in the design and manufacture of products. Performing case studies, brainstorming sessions to understand the concepts thoroughly to create new products.

UNIT 1 DFM METHOD AND TOLERANCE ANALYSIS

9 Hrs.

Elements of DFM-need for identification and problem definition concept generation and evaluation embodiment design-product architecture-configuration design-parametric design - Process capability - Feature tolerances-non Feature tolerances- Geometric tolerances ANSI symbol- Assembly limits Datum features - Tolerance stacks-computer aided tolerances.

UNIT 2 SELECTION OF MATERIALS AND MANUFACTURING PROCESS

8 Hrs.

Properties of engineering materials-materials selections (ASHBY) chart- selections of shapes and co selection of materials and shapes- -design for bulk deformation process- design for sheet metal process design for machining design for powder metallurgy-design for polymer processing case studies

UNIT 3 COMPONENT DESIGN FROM CASTING CONSIDERATIONS AND MACHINING CONSIDERATION 10 Hrs.

Review of casting process-Cast holes- cored holes and machined holes-Possible and probable- parting lines.-Design for reducing /eliminating sand cores-Design considerations for turning, drilling, tapping, milling and grinding operations-provisions for clamping, reduction in machining area-Simplification by separation and amalgamation-productive machines.- redesigning of cast members using elements.

UNIT 4 DESIGN FOR ASSEMBLY AND RELIABILITY

8 Hrs.

Introduction-fits and tolerances. Assembly processes-Handling and insertion process-Manual, automatic and robotic Assembly-Cost of Assembly-Number of Parts-DFA guidelines- exploration of DFA software- failure mode effective analysis- design for reliability design for quality-design for optimization

UNIT 5 VALUE ENGINEERING AND RE- ENGINEERING

10 Hrs.

Value-types-functional- operational- aesthetic cost- material design-process value and - worthiness procedure -brainstorming sessions- evaluation -case studies value estimation- value analysis - design for value - selection of alternatives -optimization implementation-Re-Engineering-Definition, Need & characteristics-frame work-case studies.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS:

1. Harry Peck, Designing for Manufacture, Pitman Publications, 1983
2. George E Dieter, Engineering Design, McGraw-Hill Int Editions, 2000
3. Michael F. Ashby, Materials Selection in Mechanical Design, Fourth Edition

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

SPR1616	RAPID PROTOTYPING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

CO1: Demonstrate an understanding of the concepts of Rapid Prototyping and their description. CO2: Explain the key characteristics of stereo lithography process and applications.

CO3: Analyze and select a rapid manufacturing technology for a given component.

CO4: Evaluate LENS, BPM processes; point out the application of RP system in medical field define virtual prototyping and identify simulation components.

CO5: Identify the errors during generation of STL files and minimize them.CO6: Develop the RP system with Optimization techniques.

UNIT 1 INTRODUCTION

9 Hrs.

Need for the compression in product development, history of Rapid Prototyping systems, survey of applications, and growth of RP industry and classification of RP systems.

Stereo lithography Systems- Principle, process parameters, process details, data preparation, data files and machine details, applications.

Fused Deposition Modeling- Principle, process parameters, path generation, applications

UNIT 2 RAPID PROTOTYPING TECHNIQUES

9 Hrs.

Selective Laser Sintering-Types of machines, principles of operation, process parameters, data preparation for SLS, applications.

Laminated Object Manufacturing-Principle of operation, LOM materials, process details, applications.

Solid Ground Curing- Principle of operation, machine details, applications.

UNIT 3 CONCEPT MODELERS

9 Hrs.

Principle, Thermo jet printer, Sander's model market, 3-D printer, Genisys Xs printer, object Quadra system. Laser Engineered Net Shaping (LENS) - Net shaping development at Sandia National Lab.

UNIT 4 RAPID TOOLING

9 Hrs.

Indirect rapid tooling - silicone rubber tooling, aluminum filled epoxy tooling, spray metal tooling, direct rapid tooling - quick cast process, sand casting tooling. Software for RP- STL files, overview of solid view, magics, mimics and internet based software's.

UNIT 5 RAPID MANUFACTURING PROCESS OPTIMIZATION

9 Hrs.

Factors influencing accuracy, data preparation errors, part building errors, errors in finishing, influence of part build orientation.

Allied Processes-Vacuum casting, surface digitizing, and surface generation from point cloud, surface modification, data transfer to solid models.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS:

1) Terry Wohlers, "Wohlers Report 2001", Wohlers Associates, 2008.

2) Pham D T and Dimov S S, "Rapid Manufacturing", Verlag, 2001.

3) Paul F Jacobs, "Stereo lithography and other RP&M Technologies", SME, 1996.

4) FDM Maxum User Guide.

5) FDM 1650 User Guide.

6) Sinterstation 2500 plus System User Guide.

7) MK-Technology GmbH. System User Guide.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 -No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

SPR1619	PRECISION ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

- On completion of the course, student will be able to
- CO1: Understand the concepts of measurements and instruments used for it
- CO2: Analyze the deformation and thermal stability during machining process
- CO3: Familiarize with dimensioning standards and tolerance limits
- CO4: Understand the principle of micro fabrication techniques
- CO5: Familiarize with smart materials and micro machining technique
- CO6: Get hands-on training with the related components of the technology

UNIT 1 CONCEPTS OF ACCURACY IN MACHINE TOOLS

10Hrs

Accuracy & Errors of machine tools, Spindle and Displacement Accuracies, Errors due to Numerical Interpolation Displacement Measurement System and Velocity Lags. Accuracy of N.C system, Errors in the NC machines feed stiffness zero stability. Setting errors - Location of rectangular prism, cylinder - Basic type of tests Measuring instruments used for testing machine tools. Alignment tests- Straightness, Flatness, Parallelism, Squareness, Circularity, Cylindricity.

UNIT 2 STIFFNESS, THERMAL EFFECTS AND FINISH MACHINING

9 Hrs.

Overall stiffness of Machine Tools compliance of work piece errors caused by cutting forces deformation in turning boring milling heat sources thermal effects Finish Turning, boring, grinding Surface roughness. -

UNIT 3 DIMENSIONING

8 Hrs.

Definition of terms Key dimension – Superfluous dimension dimensional stepped shaft assigning tolerances in the constituent dimensions dimensional chains.

UNIT 4 MICRO-MACHINING AND MICRO FABRICATION

9 Hrs.

Micro Machining Photo resist process Lithography LIGA-Process Optical processing of materials electron beam machining micro forming, diamond turning micro positioning devices etching physical vapour deposition Chemical vapour deposition

UNIT 5 SMART STRUCTURES, MATERIALS AND MICRO ACTUATORS

9 Hrs.

Smart structures Smart materials types and applications - smart sensors micro valves MEMS Micro motors Micropumps micro dynamometer micro machines micro optics micro nozzles. -

Max.45 Hrs.

TEXT / REFERENCE BOOKS: (Alignment and visibility)

1. Murthy R.L. "Precision Engineering in Manufacturing", New Age International Pvt. Limited.
2. Juliar W.Gardner. Vijay K. Varadan, 'Micro sensors, MEMS and Smart Devices, John Wiley and sons, 2001.
3. Stephen A.Campbell, "The Science and Engineering of Microelectronic Fabrication", Oxford University Press, 1996.
4. Raady Frank, "Understanding smart sensors", Artech House, Boston, 1996. 5. MEMS Hand Book, CRC Press, 2001
5. Nakazawa, H. Principles of Precision Engineering, Oxford University Press, 1994.
6. Institute of Physics Publishing, Bristol and Philadelphia, Bristol, BSI 6BE U.K.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 -No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying

16 marks

SPR1607	INDUSTRIAL SAFETY ENGINEERING	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OUTCOMES:

On completion of the course, student will be able to

- CO1: Understand the functions and activities of safety engineering department.
- CO2: Explain the important legislations related to health, Safety and Environment and for the requirements mentioned in factories act for the prevention of accidents.
- CO3: Understand the statutory requirements for an Industry on registration, license and its renewal.
- CO4: Illustrate the role of hazardous waste management and use of critical thinking to identify and assess environmental health risks.
- CO5: Analyze the accident indices, frequency rate, severity rate, frequency severity-incidence, incident rate, accident rate, safety "t" score, safety activity rate and problems.
- CO6: Evaluate the safety performance of an organization from accident records and identify various agencies, support institutions and government organizations involved in safety training and promotion.

UNIT 1 INTRODUCTION

9 hrs

Evaluation of modern safety concepts - Safety management functions - safety organization, safety department - safety committee, safety audit - performance measurements and motivation - employee participation in safety - safety and productivity.

UNIT 2 OPERATIONAL SAFETY

9 hrs

Hot metal operation safety in Cutting safety in welding safety in Boilers- Pressure vessels Furnace (all types) - Heat treatment processes shops electroplating grinding forming processes- rolling- forging - surface hardening casting Moulding coiling- Operational safety (cold metal operation); Safety in Machine shop - Cold bending and chamfering of pipes - metal cutting - shot blasting, grinding, painting - power press and other machines.

UNIT 3 SAFETY, HEALTH, WELFARE AND LAW

9hrs

Features of Factory Act explosive Act boiler Act ESI Act – workman's compensation Act industrial hygiene occupational safety diseases prevention ergonomics - Occupational diseases, stress, fatigue - Health, safety and the physical environment - History of legislations related to Safety-pressure vessel act-Indian boiler act - The environmental protection act - Electricity act - Explosive act.

UNIT 4 SAFETY PERFORMANCE MONITORING

9hrs

Permanent total disabilities, permanent partial disabilities, temporary total disabilities -Calculation of accident indices, frequency rate, severity rate, frequency severity-incidence, incident rate, accident rate, safety "t" score, safety activity rate problems.

UNIT 5 SAFETY MANAGEMENT

9hrs

Methods of promoting safe practice Safety organization- OSHA Safety controls. visible and latent hazards - human factors and safety - safety audit - Case study roll of management and roll of Govt. in industrial safety - safety analysis Industrial fatigue- role of industrial psychology- risk analysis - safety training - accident and near miss investigations- promotional measures to avoid accidents - human reliability - safety management characteristics-industrial safety policies and implementation

Max. 45 Hrs.

TEXT / REFERENCE BOOKS:

1. Deshmukh, Industrial Safety Management, Tata McGraw Hill, 2008.
2. Krishnan N.V., "Safety in Industry", Jaico Publisher House, 1996
3. Nair P M C, Industrial safety and the law" Attam Publisher's, 1994
4. Roland P.Blake, Industrial Safety, Prentice Hall, 1963
5. Rollin.H.Simonds, John V, Grimaldi, Technology and Engineering, 1989
6. Roy Asfatil C, David W Rieske, Industrial safety and Health Management, Prentice Hall, 2009.
7. Joseph F. Gustin, Safety Management: A Guide for facility Management, The Fairmont Press, Inc., 2008

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 -No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks 80 Marks

SMEA4003	INDUSTRY 4.0 FOR DESIGN AND MANUFACTURING	L	T	P	Credit s	Total Marks
		2	-	0	2	100

COURSE OUTCOMES

At the end of the course, the students will be able to:

CO1: Justify how the digitalization technologies are advantageous to the design and manufacturing industries.

CO2: Use the advanced CAD technologies to create the CAD models.

CO3: Use the smart manufacturing technologies to produce the components and products.

CO4: Recommend the enabling technologies to make various factory operations smarter.

CO5: Choose the suitable sensors and technologies to the future autonomous vehicles, drones and space crafts.

CO6: Prepare a report with the challenges faced currently, the enabling technologies to become smarter, and the steps needed for the effective implementation for the given case study.

UNIT 1 CONTRIBUTING TECHNOLOGIES

8 hrs

Brief introduction to the industrial revolutions. Contributing technologies to Industry 4.0: Additive manufacturing, Digital twin, Internet of things, Smart sensors, AR and VR, Artificial intelligence, Cloud computing, Block chain, Big data and analytics. Challenges and opportunities.

UNIT 2 ADVANCED CAD TECHNOLOGIES

8 hrs

Introduction to CAD. Enabling technologies: Digital twin, AR/VR, AI. Cloud computing, Touch/Voice/Motion enabled CAD, Customized CAD, Cloud based CAD, Digital twin and live simulation.

UNIT 3 SMART MANUFACTURING SYSTEMS

8 hrs

Enabling technologies: AI, Cloud computing, Robotics, IoT. Digital manufacturing: CNC, Cloud based manufacturing, IoT based manufacturing, Advanced CNC programming. Additive manufacturing. Micro electro mechanical systems. Robotics: Robotic automation, Collaborative robots, Autonomous robots, Swarm robots, and Modular robots.

UNIT 4 SMART FACTORY ENABLERS

8 hrs

Enabling technologies. Smart energy: Improving energy efficiency with data, Smart grids. Clean energy. Smart logistics. Smart Inspection. Smart decision making.

UNIT 5 AUTOMOMOUS VEHICLES

8 hrs

Introduction: Traditional mobility versus autonomous driving, Levels of automation, and challenges. Enabling technologies. Self-propelled vehicles, Drones, Unmanned aerial vehicles, Space crafts

UNIT 6 CASE STUDIES

5 hrs

Case studies related to Industry 4.0 applications, such as, transportation, energy, infrastructure, manufacturing, and product design sectors.

Max. 45 Hrs.

TEXT / REFERENCE BOOKS

1. Flavio Craveiro, Jose Pinto Duarte, Helena Bartolo and Paulo Jorge Bartolo, "Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0", Automation in Construction, Vol. 103, pp. 251- 267, 2019.
2. Klaus Schwab, "Fourth Industrial Revolution", Random House USA Inc, New York, USA, 2017.
3. Oliver Grunow, "Smart Factory and Industry 4.0. The current state of Application Technologies", Studylab Publications, 2016
4. Alasdair Gilchrist, "Industry 4.0: Industrial Internet of Things", Apress, 2016
5. Sang C. Suh, U. John Tanik, John N Carbone, Abdullah Eroglu, "Applied Cyber-Physical

Systems", Springer Publications, New York, 2013.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 11 Questions of 2 marks each - No choice

22 Marks

PART B: 2 Questions from each unit with internal choice, each carrying 13 marks

78 Marks

SMEA3021	QUALITY CONTROL AND RELIABILITYENGINEERING	L	T	P	Credit s	Total Marks
		3	0	0	3	100

(Use of approved statistical table permitted in the examination)

COURSE OBJECTIVES:

- To understand process control and acceptance sampling procedure and their application.
- To learn the concept of reliability.

UNIT I INTRODUCTION AND PROCESS CONTROL FOR VARIABLES

9Hrs

Introduction, definition of quality, basic concept of quality, definition of SQC, benefits and limitation of SQC, Quality assurance, Quality control: Quality cost-Variation in process causes of variation –Theory of control chart- uses of control chart – Control chart for variables – X chart, R chart and chart - process capability – process capability studies and simple problems. Six sigma concepts

UNIT II PROCESS CONTROL FOR ATTRIBUTES

9Hrs

Control chart for attributes –control chart for non conforming– p chart and np chart – control chart for nonconformities– C and U charts, State of control and process out of control identification in charts, pattern study.

UNIT III ACCEPTANCE SAMPLING

9hrs

Lot by lot sampling – types – probability of acceptance in single, double, multiple sampling techniques – O.C. curves – producer's Risk and consumer's Risk. AQL, LTPD, AOQL concepts-standard sampling plans for AQL and LTPD- uses of standard sampling plans.

UNIT IV LIFE TESTING – RELIABILITY

9Hrs

Life testing – Objective – failure data analysis, Mean failure rate, mean time to failure, mean time between failure, hazard rate – Weibull model, system reliability, series, parallel and mixed configuration – simple problems. Maintainability and availability – simple problems. Acceptance sampling based on reliability test – O.C Curves.

UNIT V QUALITY AND RELIABILITY

9Hrs

Reliability improvements – techniques- use of Pareto analysis – design for reliability – redundancy unit and standby redundancy – Optimization in reliability – Product design – Product analysis – Product development – Product life cycles.

Course Outcomes:

Max. 45 Hours

On completion of the course, student will be able to

CO1: Apply the concept of SQC in process control for reliable component production

CO2: Perform statistical analysis using control charts

CO3: Apply sampling techniques for non conformities

CO4: Evaluate the quality of components by failure analysis

CO5: Design for reliability of component parts

CO6: Develop product analysis for new product development

TEXT BOOKS/ REFERENCES

1. Douglas.C. Montgomery, " Introduction to Statistical quality control", 4th edition, John Wiley 2001.
2. Srinath. L.S., "Reliability Engineering", Affiliated East west press, 1991.
3. John.S. Oakland. "Statistical process control", 5th edition, Elsevier, 2005
4. Connor, P.D.T.O., "Practical Reliability Engineering", John Wiley, 1993
5. Grant, Eugene .L "Statistical Quality Control", McGraw-Hill, 1996
6. Monohar Mahajan, "Statistical Quality Control", Dhanpat Rai & Sons, 2001.
7. Sharma S.C., "Inspection Quality Control and Reliability", Khanna Publishers, 1998.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration : 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 16 marks

80 Marks

SMEA3020	DESIGN OF HEAT EXCHANGERS	L	T	P	Credits	Total Marks
		3	0	0	3	100

COURSE OBJECTIVE

- To learn the thermal and stress analysis on various parts of the heat exchangers
- To analyze the sizing and rating of the heat exchangers for various applications

UNIT I INTRODUCTION

9 Hrs.

Types of heat exchangers, shell and tube heat exchangers — regenerators and recuperators - Temperature distribution and its implications - Parts description, Classification as per Tubular Exchanger Manufacturers Association (TEMA)

UNIT II PROCESS DESIGN OF HEAT EXCHANGERS

9 Hrs.

Heat transfer correlations, Overall heat transfer coefficient, analysis of heat exchangers — LMTD and effectiveness method. Sizing of finned tube heat exchangers, U tube heat exchangers, Design of shell and tube heat exchangers, fouling factors, pressure drop calculations.

UNIT III STRESS ANALYSIS

9 Hrs.

Stress in tubes – header sheets and pressure vessels – thermal stresses, shear stresses - types offailures, buckling of tubes, flow induced vibration.

UNIT IV COMPACT AND PLATE HEAT EXCHANGER

9 Hrs.

Types- Merits and Demerits- Design of compact heat exchangers, plate heat exchangers, performance influencing parameters, limitations.

UNIT V CONDENSERS AND COOLING TOWERS

9 Hrs.

Design of surface and evaporative condensers — cooling tower — performance Characteristics.

Course Outcomes:

Max. 45 Hours On

completion of the course, student will be able to

CO1: Classify Heat Exchangers based on TEMA.

CO2:Perform Heat transfer analysis by LMTD and NTU Methods.

CO3: Calculate stresses in heat exchanger tubes.

CO4: Design compact heat exchangers according to applications

CO5:Evaluate the performance characteristics of heat exchanger types

CO6:Design condensers and cooling towers according to need and applications..

TEXT BOOKS/ REFERENCES BOOKS

1. SadikKakac and Hongtan Liu, "Heat Exchangers Selection", Rating and Thermal Design, CRCPress, 2002.
2. Shah,R. K., Dušan P. Sekulić, "Fundamentals of heat exchanger design", John Wiley & Sons,2003.
3. Robert W. Serth, "Process heat transfer principles and applications", Academic press,Elsevier, 2007.
4. Sarit Kumar Das, "Process heat transfer", Alpha Science International, 2005
5. John E. Hesselgreaves, "Compact heat exchangers: selection, design, and operation",Elsevier science Ltd, 2001.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration : 3 Hrs.

PART A: 10 questions of 2 marks each - No choice

20 Marks

PART B : 2 questions from each unit of internal choice; each carrying 16 marks

80 Marks

SAIC4003	UNIVERSAL HUMAN VALUES	L	T	P	Credits	Total Marks
		2	1	0	3	100

COURSE OBJECTIVES

- To develop a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence
- To understand (or developing clarity) the harmony in the human being, family, society and nature/existence
- To strengthen self-reflection
- To develop commitment and courage to act

MODULE 1 COURSE INTRODUCTION - NEED, BASIC GUIDELINES, CONTENT AND PROCESS FOR VALUE EDUCATION

1. Purpose and motivation for the course, recapitulation from Universal Human Values-I
2. Self-Exploration—what is it? - Its content and process; 'Natural Acceptance' and Experiential Validation- as the process for self-exploration
3. Continuous Happiness and Prosperity- A look at basic Human Aspirations
4. Right understanding, Relationship and Physical Facility- the basic requirements for fulfilment of aspirations of every human being with their correct priority
5. Understanding Happiness and Prosperity correctly- A critical appraisal of the current scenario
6. Method to fulfil the above human aspirations: understanding and living in harmony at various levels. Practice sessions to discuss natural acceptance in human being as the innate acceptance for living with responsibility (living in relationship, harmony and co-existence) rather than as arbitrariness in choice based on liking-disliking.

MODULE 2 UNDERSTANDING HARMONY IN THE HUMAN BEING - HARMONY IN MYSELF!

7. Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
 8. Understanding the needs of Self ('I') and 'Body' - happiness and physical facility
 9. Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
 10. Understanding the characteristics and activities of 'I' and harmony in 'I'
 11. Understanding the harmony of I with the Body: Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail
 12. Programs to ensure Sanyam and Health.
- Practice sessions to discuss the role others have played in making material goods available to me. Identifying from one's own life. Differentiate between prosperity and accumulation. Discuss program for ensuring health vs dealing with disease.

MODULE 3 UNDERSTANDING HARMONY IN THE FAMILY AND SOCIETY- HARMONY IN HUMAN-HUMAN RELATIONSHIP

13. Understanding values in human-human relationship; meaning of Justice (nine universal values in relationships) and program for its fulfilment to ensure mutual happiness; Trust and Respect as the foundational values of relationship
 14. Understanding the meaning of Trust; Difference between intention and competence
 15. Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
 16. Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
 17. Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.
- Practice sessions to reflect on relationships in family, hostel and institute as extended family, real life examples, teacher-student relationship, goal of education etc. Gratitude as a universal value in relationships. Discuss with scenarios. Elicit examples from students' lives.

MODULE 4 UNDERSTANDING HARMONY IN THE NATURE AND EXISTENCE - WHOLE EXISTENCE AS COEXISTENCE

18. Understanding the harmony in the Nature
19. Interconnectedness and mutual fulfilment among the four orders of nature- recyclability and self regulation in nature
20. Understanding Existence as Co-existence of mutually interacting units in all-pervasive space
21. Holistic perception of harmony at all levels of existence.

Practice sessions to discuss human being as cause of imbalance in nature (film "Home" can be used), pollution, depletion of resources and role of technology etc.

MODULE 5 IMPLICATIONS OF THE ABOVE HOLISTIC UNDERSTANDING OF HARMONY ON PROFESSIONAL ETHICS

22. Natural acceptance of human values
23. Definitiveness of Ethical Human Conduct
24. Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
25. Competence in professional ethics: a. Ability to utilize the professional competence for augmenting universal human order b. Ability to identify the scope and characteristics of people friendly and eco- friendly production systems, c. Ability to identify and develop appropriate technologies and management patterns for above production systems.
26. Case studies of typical holistic technologies, management models and production systems
27. Strategy for transition from the present state to Universal Human Order: a. At the level of individual: as socially and ecologically responsible engineers, technologists and managers b. At the level of society: as mutually enriching institutions and organizations
28. Sum up.

Practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg. To discuss the conduct as an engineer or scientist etc.

Total: 28 Lectures and 14 Practice Sessions

COURSE OUTCOMES

On completion of the course, the student are expected

- CO1: To become more aware of themselves, and their surroundings (family, society, nature)
- CO2: They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind
- CO3: To have better critical ability
- CO4: To become sensitive to their commitment towards what they have understood (human values, human relationship and human society)
- CO5: To apply what they have learnt to their own self in different day-to-day settings in real life, at least a beginning would be made in this direction

TEXT /REFERENCE BOOKS

1. Human Values and Professional Ethics by R R Gaur, R Sangal, G P Bagaria, Excel Books, New Delhi, 2010
2. Jeevan Vidya: Ek Parichaya, A Nagaraj, Jeevan Vidya Prakashan, Amarkantak, 1999.
3. Human Values, A.N. Tripathi, New Age Intl. Publishers, New Delhi, 2004.
4. The Story of Stuff (Book).
5. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
6. Small is Beautiful - E. F Schumacher.
7. Slow is Beautiful - Cecile Andrews
8. Economy of Permanence - J C Kumarappa
9. Bharat Mein Angreji Raj – Pandit Sunderlal
10. Rediscovering India - by Dharampal
11. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
12. India Wins Freedom - Maulana Abdul Kalam Azad
13. Vivekananda - Romain Rolland (English)
14. Gandhi - Romain Rolland (English)

ASSESSMENT:

Assessment by faculty mentor: 10 marks

by peers: 10 marks

Activities/Assignments: 20 marks Semester End Examination: 50 marks

Self-assessment: 10 marks

Socially relevant project/Group

SMEA3022	Lean Enterprises and Advanced Manufacturing Technology	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To make the students understand how the philosophy and core methods of lean manufacturing are applied to any business.
- To make the students understand the value chain and to map the current state of material and information flow through the value chain and to understand where the added value is for the customer.
- To help the students to identify waste and its root cause in the value stream.
- To help the students to develop a future state vision of lean systems

UNIT 1 INTRODUCTION TO LEAN MANUFACTURING 9 Hrs.

Definition and concept of lean manufacturing; Principles of lean manufacturing Just in time Types of pull systems - Toyota Production systems Benefits of lean manufacturing Theory of constraints Reduction of wastes.

UNIT 2 LEAN MANUFACTURING TOOLS-I 9 Hrs.

Basic tools of lean manufacturing: 5S, Total Productive Maintenance, Key Performance Indicator, Overall Equipment Effectiveness, Plan Do Check Act, Root Cause Analysis, Poka Yoke, Work Cell, Bottleneck analysis, continuous flow.

UNIT 3 LEAN MANUFACTURING TOOLS II 9 Hrs.

Secondary tools of lean manufacturing: Gemba, Heijunka, HoshinKanri, Jidoka, Load leveling, Mind maps, 5 whys, SMDE, Six Big Losses, Standardized work, Visual factory, Zero quality control.

UNIT 4 STRATEGIC ISSUES AND LEAN IMPLEMENTATION 9 Hrs.

Strategic issues: - Actions - Issues - Focus - Leadership - Management of teams Training. Focused factory concept Availability, Variability, Lean implementation strategies, causes for failures, sustaining lean, and constraint management.

UNIT 5 PROCESS MAPPING , VALUE STREAM MAPPING AND LEAN ACCOUNTING 9 Hrs.

Process mapping Need for process map- Types- Detailed instructions - common mistakes in mapping - limits facilitation; Value stream mapping: - Overview - Where to use When to use-Step by step approach How to use Present and future states - VSM symbols. Lean accounting definition, Need for lean accounting, benefits of lean accounting, volume adjusted costing, Target costing.

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Identify key requirements and concepts in lean manufacturing.
- CO2 - Apply the tools in lean manufacturing to analyze a manufacturing system and plan for its improvements.
- CO3 - Find the common pitfalls encountered during lean implementation and initiate a continuous improvement change program in a manufacturing organization.
- CO4 - Map the value chain and predict the value addition
- CO5 - Apply lean accounting principles towards financial management of all streamlined operations in a lean manufacturing setup..
- CO6 - Apply knowledge of facility planning, cellular manufacturing and group technology in a typical lean manufacturing setup.

TEXT / REFERENCE BOOKS

1. Golam Kibria, B. Bhattacharyya, J. Paulo Davim, Non-traditional micro machining processes: Fundamentals and applications, Springer International publishing, 2017.
2. V.K.Jain, Micro manufacturing processes, CRC press Taylor & Francis group, 2013. (ebook).
3. H. El-Hofy, Fundamentals of Machining Processes: conventional and non-conventional, 2nd edition, CRC press, Taylor & Francis group, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

PART A: 2 Questions each from CO1-CO4,1 question each from CO5 and CO6 – No choice

PART B: 4 Questions each with internal choice from CO1-CO4,1 question from CO5 and CO6 with internal choice , each carrying 16 marks

Exam Duration: 3 Hrs.

20 Marks

80 Marks

SMEA3023	Micro and Nano Machining	L	T	P	Credits	Total Marks
		3	*	0	3	100

COURSE OBJECTIVES

- To acquaint the basic concepts and applications of micro and nano machining processes
- To encourage the students for developing the models (experimental/theoretical) of micro and nano machining processes.

UNIT 1 INTRODUCTION

9 Hrs.

Classification and types of machining processes, Fundamentals of Micro and Nano machining processes, Nano materials and their applications in various industrial applications Advanced Mechanical Micro-Nano Machining processes.

UNIT 2 TRADITIONAL MICRO AND NANO MACHINING PROCESSES

9 Hrs.

Theory of micromachining, Operating principles and process parameters of Micro turning, Micromilling, Micro-grinding, Applications and Limitations of micro machining. Abrasive Flow Nano finishing, Magnetic Abrasive Nano finishing.

UNIT 3 ADVANCED MECHANICAL MICRO-NANO MACHINING PROCESSES

9 Hrs.

Introduction -Classification of advanced Mechanical Micro - Nano Machining processes, Operating principles and process parameters of Abrasive Jet Micromachining (AJM), Water jet micro machining (WJM), Abrasive Water Jet Machining (AWJM), Ultrasonic Micromachining.

UNIT 4 ADVANCED MICRO-NANO MACHINING PROCESSES

9 Hrs.

Operating principles and process parameters of Electric Discharge Micromachining, Electric Discharge Grinding and Electric Discharge Diamond Grinding, Wire Electric Discharge Micromachining. Operating principles and process parameters of Electrochemical Micromachining, Electrochemical Micro Grinding, Electro stream Micro drilling, Electro-chemical Micro deburring.

UNIT 5 HIGH ENERGY MICRO-NANO MACHINING PROCESSES

9 Hrs.

Operating principles and process parameters of Laser Beam Micromachining (LBM), Electron Beam Micromachining (EBM), Focused Ion Beam Machining (IBM).

Max. 45 Hrs.

COURSE OUTCOMES

On completion of the course, student will be able to

- CO1 - Classify the appropriate micro and nano machining process using material removal mechanism.
- CO2 - Recognize the traditional micro and nano machining process
- CO3 - Demonstrate the material removal mechanism of various Advanced Micro-Nano machining Processes
- CO4 - Extend the mechanism of High Energy c Micro-Nano machining Processes and their process
- CO5 - Select suitable Advanced Electro-chemical, Micro-Nano Machining Processes relevant to the desired product.
- CO6 - Utilize various micro and nano finishing processes.

TEXT / REFERENCE BOOKS

1. Golam Kibria, B. Bhattacharyya, J. Paulo Davim, Non-traditional micro machining processes: Fundamentals and applications, Springer International publishing, 2017.
2. V.K.Jain, Micro manufacturing processes, CRC press Taylor & Francis group, 2013. (ebook).
3. H. El-Hofy, Fundamentals of Machining Processes: conventional and non-conventional, 2nd edition, CRC press, Taylor & Francis group, 2014.

END SEMESTER EXAMINATION QUESTION PAPER PATTERN

Max. Marks: 100

Exam Duration: 3 Hrs.

PART A: 2 Questions each from CO1-CO4, 1 question each from CO5 and CO6 -No choice

20 Marks

PART B: 4 Questions each with internal choice from CO1-CO4, 1 question from CO5 and CO6 with internal choice, each carrying 16 marks

80 Marks