Deenbandhu Chhotu Ram University of Science & Technology, Murthal (Sonepat)

Scheme of Studies & Examinations under Choice Based Credit System

Programme: B. Tech. in Mechanical Engineering; Year – 4th (Semester – VIII); w.e.f. Session: 2021-22

A student can opt either Alternative-A or Alternative-B of the VIIIth semester scheme. In Alternative-A, students will undergo regular course work. Alternative-B includes one semester (minimum 16 weeks) internship/industrial training course. Students can opt Alternative-B only if he/she fulfills the pre-requisites as per guidelines given below the scheme.

Alternative - A

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1		**Professional Elective-IV**	3	0	0	25	75	-	100	3	3
2		**Professional Elective -V**	3	0	0	25	75	-	100	3	3
3		**Professional Elective -VI**	3	0	0	25	75	-	100	3	3
4		Open Elective-III	3	0	0	25	75	-	100	3	3
5	ME 402C	Major Project	0	0	16	25	-	75	100	8	3
	ME 406C	General Fitness for the Profession	-	-	-			100	100	-	-
Total			**12**	**0**	**16**	**125**	**300**	**175**	**600**	**20**	

Professional Elective – IV Courses (A Student has to select any one)		
S. No.	**Course Code**	**Course Title**
1	ME 422C	Industrial Engineering and Management
2	ME 424C	Energy Conservation and Management
3	ME 426C	Machine Tool Design

Professional Elective – V Courses (A Student has to select any one)		
S. No.	**Course Code**	**Course Title**
1	ME 432C	Computing Techniques
2	ME 434C	Finite Element Analysis
3	ME 436C	Modern Manufacturing and Materials

Professional Elective – VI Courses (A Student has to select any one)		
1	ME 442C	Automobile Engineering
2	ME 444C	Design of Transmission Systems
3	ME 446C	Principles of Management
4	ME448C	Process Planning and Cost Estimation

List of Open Elective-III (A Student has to select any one)					
S. No.	Course Code	Course Title	S. No.	Course Code	Course Title
1	CSE340C	Artificial Intelligence & Expert Systems	4	ME452C	Fundamentals of Sustainable Manufacturing
2	EE452C	Electrical and Hybrid Vehicles	5	CHE459C	Nano-Science and Nano-Technology
3	MGT401C	Entrepreneurship	6	EE454C	Smart Grid

Alternative – B

S. No.	Course Code	Course Title	Teaching Schedule			Marks of Class Work	Examination Marks		Total	Credit	Duration of Exam
			L	T	P		Theory	Practical			
1	ME 404C	Internship	-	-	-	250	-	250	500	20	3
2	ME 406C	General Fitness for the Profession	-	-	-			100	100	-	-
Total			-	-	-	**250**	-	**350**	**600**	**20**	

A) Guidelines for Internship

A student can opt for Internship (minimum 16 weeks) in 8th semester, in lieu of course work of 8th semester, in joint supervision of internal supervisor (allotted by the Department) and the supervisor/official of the organization under whom the candidate is associated for internship. A student can arrange the internship at his/her own and arranging internship for a student by the Department is never his/her right.

Pre-requisite conditions:

The student has got selected through on-campus/off-campus placement and the same employer is willing totake that student for the Internship.

The student has got offer of pursuing Internship from Government research organization/govt. sponsoredprojects IIT'S/IIIT'S/IIMs/CDAC.

The student has got offer of pursuing Internship from reputed private organization.

For pursuing Internship, student will require the prior approval of the Director/Principal of the institute or Chairperson of the University Department. While allowing Internship, the institute/department concerned must insure that the proposed Internship schedule does not disturb the academic calendar in force. The candidate should submit a synopsis of the proposed work to be done during Internship. This synopsis should be submitted to the Department before the start of the internship semester. The synopsis received will be examined/evaluated by the Departmental committee. The student will be allowed for internship only after approval of synopsis by the Departmental committee.

Intimation of commencement of internship shall be submitted to the Chairperson concerned before the commencement of the ongoing semester.

They will have to further deposit the 8th Semester fee. The internship will not be permitted through online mode If a student feels that the internship work is not of high quality/not-related to their field of interest, then he/ she should submit the application to the Department within two weeks and can re-join the institute to carry out the course work of 8th Semester.

The internal supervisor will monitor the student specific progress of the internship. The overall monitoring of industrial training has to be done by a Departmental Faculty Co-coordinator for Internship.

The Departmental Faculty Co-coordinator will be allotted total weekly teaching load of 2 periods, while each internal supervisor will be allotted total weekly teaching load of 1 period (supervising upto 4 students), and 2 periods , if supervising more than 4 students.

Evaluation Process:

Each student will submit 3 copies of the detailed internship report to the Department in prescribed format at theconclusion of training.

Internal assessment/ Sessional of Internship will be made jointly by the Departmental Faculty Co-coordinator for Internship, the concerned organization training supervisor/official and internal supervisor.

Assessment by the External supervisor/Mentor = 40% of Internal Assessment Marks

Assessment by the internal supervisor and Departmental Faculty Co-coordinator for Internship = 60% of Internal Assessment Marks

Practical Examination Assessment of Internship will be made by the committee consisting of the Chairperson of the Department, Departmental Faculty Co-coordinator for Internship and one external examiner appointed by the University.

ME 402C Major Project

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
0	0	16	8

Class Work	:	**25 Marks**
Examination (Practical)	:	**75 Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

This course is a group activity to be undertaken by a group of 4-5 students under the guidance of a faculty supervisor assigned by the department. The primary objective of this course is to develop in students the professional quality of synthesis employing technical knowledge obtained in the field of Engineering & Technology through a project work involving design, analysis augmented with creativity, innovation and ingenuity. Minor Project involving design/ fabrication/ testing/ computer simulation/ case studies etc. is to be undertaken in the VII Semester. In this semester thestudent is expected to complete the study/modeling/ design part of the project.

Course Outcomes: At the end of the course, the student will be able to: CO1: Apply academic knowledge to complete technical project as a team.

CO2: Design/Innovate/ creative product or solution using his/her professional capability.CO3: Prepare project reports.
CO4: Effectively communicate details of the project undertaken.

The assessment of the class work for Major Project will be evaluated through two presentations, with equalweightage, before the committee consisting of the following:

a. Chairman of the Department or his nominee
b. Major Project coordinator
c. The Project supervisor: Member

The assessment of practical/Examination component for Major Project will be evaluated through a panel of examinersconsisting of the following:

1. Chairman of Department: Chairperson
2. Major Project coordinator: Member Secretary
3. External Expert: To be appointed by the University

The student will be required to submit two copies of his/her project report to the department for record (one copy each for the department and participating teacher). The format of the cover page and the organization of the body of the report will be finalized and circulated by Project coordinator.

The Assessment will comprise of the following elements for evaluation:

- Quality of Modeling and Technical Detail: 40 Marks
- Adequacy and quality of Project: 20 Marks
- Quality of project reports: 20 Marks.
- Effectiveness of presentation/Communication skill and Team Work: 20 Marks

Project coordinator will be assigned the project load of maximum of 2 hours per week including his/her own guiding load of one hr. However, the guiding teacher will be assigned maximum of one period of teaching loadirrespective of number of students/groups under him/her.

ME 406C General Fitness For the Profession

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits (Audit Pass)			
0	0	0	0	Class Work	:	0 Marks
				Practical	:	100Marks
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

General Fitness for the Profession (ME 406C) is a compulsory & qualifying course (Audit Pass). The purpose of this course is to inculcate a sense of professionalism in a student along with personality development in terms of quality such as receiving, responding, temperament, attitude and outlook. The student efforts will be evaluated on the basis of his/ her performance / achievements in different walks of life.

Course Outcomes: This course is intended to evaluate the overall fitness of students as a result of 4 years ofengagement in the degree course. At the end of the course, the student will be able to:

CO1: Attain quality in professional competence.

CO2: Compete in the professional field on the basis of temperament, attitude and outlook. CO3: Participate on issues pertaining to society, community and nation at large.

CO4: Effectively communicate on technical and societal issues.

The evaluation for this course will assess the performance of student; at the end of 8th semester, in all types of programme activities like Academics, Cultural, Sports, NSS, organisation of camps, social activities etc., during the 8semester period.

The student will submit a written report and present the same before the evaluation committee orally for assessment.

The report and presentation should highlight the followings:

I. Academic Performance **(20 Marks)**
II. Extra-Curricular Activities / Community Service, Hostel Activities **(12 Marks)**
III. Technical Activities / Industrial, Educational tour **(12 Marks)**
IV. Sports/games **(16Marks)**
V. Written and oral communicative skill **(40 Marks)**

The evaluation of the General Fitness will be made by the committee of examiners constituted as under:

1. Chairperson of the Department : Chairperson
2. Final Year Coordinator of the Department : Member
3. External Examiner : Appointed by the University

ME 404C Internship

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
0	0	-	20

Class Work	:	**250 Marks**
Examination (Practical)	:	**250 Marks**
Total	:	**500 Marks**
Duration of Examination	:	**3 Hours**

Course Objectives: This course is intended to provide students the practical exposure to industrial setup. This is also intended to provide him/her the platform to explore his professional engagement with the training organization. This course is further expected to increase the employability of the graduate trainee.

Course Outcomes:

CO1: Capability to execute and report industrial projects as a team with moral and ethical standard.CO2: Ability to draft technical/ project reports.

CO3: Ability to use academic expertise in industrial/professional domain.CO4: Communicate effectively on professional issues.

Each student will undergo industrial training/Internship (minimum 16 weeks) in joint supervision of internal supervisor (allotted by the Department) and the supervisor/official of the organization under whom the candidate is associated for training/internship. The internal supervisor will monitor the student specific progress of the internship. The overall monitoring of industrial training has to be done by a departmental faculty co- coordinator.

Evaluation Process:

Each student will submit 3 copies of the detailed internship report to the Department in prescribed format at theconclusion of training.

(A) Internal assessment/ Sessional of Internship will be made jointly by the Departmental Faculty Co-coordinator for Internship, the concerned organization training supervisor/official and internal supervisor.

Assessment by the External supervisor/Mentor = 40% of Internal Assessment Marks

Assessment by the internal supervisor and Departmental Faculty Co-coordinator for Internship =60% of Internal Assessment Marks

(B) Practical Examination Assessment of Internship will be made by the committee consisting of the Chairperson of the Department, Departmental Faculty Co-coordinator for Internship and one external examiner appointed by the University.

The Following criteria are to be followed for evaluation in each of the Internal assessment/ Sessional as well aspractical assessments:

- Detail of training undergone: 40%
- Adequacy and quality of report: 20%
- Quality of learning through Training Project: 20 Marks
- Effectiveness of presentation/Communication skill and Team Work: 20%

ME422C Industrial Engineering and Management

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75 Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

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

CO1: Describe the different types of production systems, the related decision variables, and methods forimproving operations and worker safety.
CO2: Perform cost and breakeven analysis and appreciate the strategic role of materials management.
CO3: Explain the product design and development process and associate product design with process designand process selection.
CO4: Appreciate manufacturing strategy and Supply Chain as pathways for competitive advantages.

UNIT I

Introduction: Brief history and Definition of Industrial Engineering, Objectives, relevance of industrial engineering for achieving excellence in industry, types of decisions in industrial engineering.
Production System and Productivity: Value addition process, Production system, types of production system, conceptual model of a production system, Productivity-definition, measurement, factors effecting productivity, ways and strategies to improve productivity.
Work Study- Introduction, Method study- basic procedure of method study, recording techniques, various charts, therbligs etc. Work measurement- basic procedure, various techniques like time study, work sampling, PMTS etc.
Workforce management:- Introduction, recruitment, selection**,** employees empowerment, quality circles, teamwork etc., **Job design**- Job specialization, job enlargement, job rotation, job enrichment, training etc

UNIT II

Manufacturing cost analysis- fixed & variable cost, direct & indirect cost, Estimation of overheads, Break even analysis.

Materials management- strategic importance, need for integrated approach to materials management- role of value analysis and purchase price analysis, materials handling, inventory control, stores management, waste management. Relevant costs, Overview of inventory models and inventory control models, selective inventory control, JIT- materials management approach.

UNIT III

Product development and design: product development approaches, product development process, Product life cycle (PLC) concept. Product design- Various approaches: concurrent engineering, designing for customer- quality function deployment (QFD), design for manufacture and assembly (DFMA), rapid prototyping, design for environment, Role of 3S- standardization, simplification, specialization, role of ergonomics in product design, introduction to value engineering.

Process planning: Introduction, forms of transformation process**,** selection of process, use of break-evenanalysis.

UNIT IV

Manufacturing strategy and competitiveness

Brief review of manufacturing strategy, measures of manufacturing performance, internal and external aspects of performance measures, order wining and order qualifying criteria, SWOT analysis, five force model, linkage between manufacturing and corporate strategy.
Elements , benefits, and implementation aspects of various approaches: JIT, TQC, TPM

Management of Supply Chains and Service Systems

Overview of supply chain management, Introduction to simulation, Monte Carlo simulation, applications in IE. Management Information System: meaning, importance and role in decision making, Service processes: Introduction, difference between manufacturing and service operations, a conceptual model of service quality

Textbooks:-

1. Industrial engineering & Management by Dr. Ravi Shankar - Galgotia publication
2. Industrial engineering & Management by Dr. B. Kumar – Khanna publication
3. Industrial Engineering by A P Verma - S. K. Kataria and sons
4. Production and Operations Management by Charry- TMH publication

Reference books:-

1. Operations Management by Chase, Jacobs and Aquilano - TMH publication

ME424C Energy Conservation And Management

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits			
3	0	0	3	**Class Work**	:	**25 Marks**
				Examination	:	**75 Marks**
				Total	:	**100 Marks**
				Duration of Examination	:	**3 Hours**

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

CO1: Explain the principles of energy conservation, Energy audit, Energy Management and relatedenvironmental issues.
CO2: Evaluate the energy saving & conservation in different utilities.
CO3: Explain Energy audit process and methods and the instruments for energy audit for thermal system.CO4: Perform economic evaluation life cycle cost analysis of thermals systems.

UNIT I

Energy conservation: Introduction, Principles of energy conservation, Energy consumption pattern, Resource availability, Energy pricing, Energy Security, Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall
- Standards for thermal performance of building envelope, Evaluation of overall thermal transfer

UNIT II

Energy conservation in utilities: Energy efficiency in boilers, furnaces, steam systems, cogeneration utilities, waste heat recovery, compressed air systems, HVAC & R systems, I.C. Engine, fans and blowers, pumps, cooling tower, DG Sets. Energy conservation in electrical utilities: power factor improvement, electric motor, illumination, scope of energy conservation in lightening.

UNIT III

Energy Audit: Definition, objective and principles of Energy Management, Need of Energy Audit and Management, types of energy audit, audit process, Guidelines for writing energy audit report, data presentation in report, findings recommendations, impact of renewable energy on energy audit recommendations and energy audit report, energy audit of building system, lighting system, HVAC system, Water heating system, heat recovery opportunities during energy audit, Industrial audit opportunities, Instruments for Audit and Monitoring Energy and Energy Savings

UNIT IV

Energy Economics: Simple Payback Period, Time Value of Money, Internal Rate of Return, Net Present Value, Life Cycle Costing, Equivalent uniform annual cost (EUAC), Life cycle cost, Discounting factor, Capital recovery, Depreciation, taxes and tax credit, Impact of fuel inflation on life cycle cost, Cost of saved energy, cost of energy generated, Energy performance contracts and role of Energy Service Companies (ESCOs).

Energy Management and Environment: Importance and role of Energy management, Kyoto protocol, Clean development mechanism (CDM), Geopolitics of GHG control; Carbon Market

Textbooks:-

1. Energy Conservation Guidebook, Dale R Patrick, Stephen W Fardo, Latest Edition, CRC Press
2. Handbook of Energy Audits, Albert Thumann, Latest Edition, The Fairmont Press
3. Energy Management Handbook, W.C. Turner, John Wiley and Sons, A Wiley Interscience publication
4. Heating and Cooling of Buildings - Design for Efficiency, J. Krieder and A. Rabl, McGraw HillPublication, latest edition.
5. Carbon Capture and Sequestration: Integrating Technology, Monitoring, and Regulation, E J Wilson andD Gerard, Blackwell Publishing

Reference books:-

1. Energy Management, Commonwealth Publication, New Delhi, P.R. Trivedi, K.R. Jolka, Latest Edition,CRC Press
2. Economics of Solar Energy and Conservation System by Kreith, Volume 3.
3. Bureau of Energy Efficiency Reference book: No.1, 2, 3 4

ME 426C Machine Tool Design

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

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

CO1: Evaluate motion, forces and power and machining accuracy in different machine tools.CO2: Design machine tool structures and drives.
CO3: Design speed and feed boxes of machine tool structures.
CO4: Design slide Ways, Guide Ways and Spindles of machine tools

UNIT-I

Analysis of Forces, Velocities and Power Requirements during metal cutting: Turning, Drilling, Milling,Grinding, Planning, Shaping and Broaching.

General Requirements of the Machine Tool: Accuracy of Shape, Dimensional accuracy and surface finish of thecomponents produced. Productivity and Efficiency of Machine tools

UNIT-II

Design Principles: Stiffness and Rigidity of Constructional Elements and Machine Tools under Load, Static Rigidity, Dynamic Rigidity, Brief discussion of Natural frequencies, Damping, Mode of Vibration in Machine Tools.

Standardization of Spindle Speeds and Feed Rates: Layout of Speed Change Gears. Saw Diagrams of Mechanical Stepped Drives in Machine Tools for different series, Layout of the Intermediate Reduction Gears, Calculation of Transmission Ratios, Pulley Diameter, Gear Wheel Diameters and Number of Teeth, Ray Diagram, Speed Diagram.

UNIT-III

Electrical, Mechanical and Hydraulic Drives for the Operational Movements: Electric Drive and Control Equipment, Mechanical and Hydraulic Drives, Drives for Producing Rotational Movements, Stepped Drives, Step less Drives. Drives for Producing Rectilinear Movements, Backlash Eliminator in the Feed Drive Nut.

Design of Constructional Elements: Machine Tool Structures, Structural Elements Design for Centre Lathe, Drilling Machine, Knee Type Milling Machine, Planning Machine, Boring Machine, and Grinding Machines.

UNIT-IV

Design of Slide Ways: Design of Slide ways for Tables, Saddles and Cross-slides, Antifriction Bearings forslide ways, Hydrostatically Lubricated Slide ways.

Design of Spindles and Spindle Bearings: Design of Spindles for Strength and Stiffness, Design of Spindles for Balancing, General Layout and Design of the Driving Elements and the Spindle

Bearings, Selection and General Layout of Ball and Roller Bearings for Supporting Spindles. Brief discussion on Design of Secondary Drives for Machine Tools

Text Books:

1. Machine Tool Design by N. K. Mehta, 3e, McGraw Hill Publishing
2. Machine tool design by Sen and Bhattacharya, CBS Publications Oxford and IBH Publishing

ME 432C Computing Techniques

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits			
3	0	0	3	Class Work	:	25 Marks
				Examination	:	75Marks
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

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

CO1: Understand and appreciate the importance of errors associated with scientific computing and accuracyrequirements.
CO2: Understand the computing techniques and the inherent limitations of the techniques. CO3: Understand the significance of computing methods, their strengths and application areas. CO4: Perform the computations on various data using appropriate computation tools.
CO5: Understand and implement Discrete Fourier Transform, Fast Fourier Transform.

Unit-I

Chapter-1

Introduction to numerical computing: Numeric data, analog computing, digital computing, process of numerical computing and characteristics, Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy; Computer arithmetic -Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Error propagation, Minimizing the total error.

Chapter-2

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss- Jordan, Norms and Condition Numbers, Iterative Methods for Linear Systems Linear least squares: Data Fitting, Linear Least Squares, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization.

Unit-II

Chapter-3

Eigen values and singular values: Eigen values and Eigenvectors, Methods for Computing All Eigen values,Jacobi Method, Methods for Computing Selected Eigen values,

Chapter-4

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

Unit-III

Chapter-5

Numerical Integration and Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule,Finite Difference Approximation,

Chapter-6

Initial Value Problems for ODEs, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems for ODEs, Finite Difference Methods, introduction to Finite Element Method.

Unit-IV

Chapter-7

Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for SparseLinear Systems, Iterative Methods,

Chapter-8

Continuous Fourier Series, Frequency and Time Domains, Fourier Integral and Transform, Discrete Fourier Transform (DFT),Fast Fourier Transform (FFT), The Power Spectrum, Introduction to Curve Fitting with Software Packages.

Text/ Reference Books:

1. Computational Methods in Engineering, S.P. Venkateshan and Prasanna Swaminathan, Ane Books Pvt. Ltd
2. Numerical Methods, E. Balagurusamy, Tata McGraw-Hill Education
3. Numerical Methods for Engineers, Steven C. Chapra Raymond P. Canale, McGraw Hills, 6th edition
4. Computational Science, Kiryanov D. and Kiryanova E., Infinity Science Press, 1st Ed., 2006
5. Scientific Computing With MATLAB and Octave, Quarteroni, Alfio, Saleri, Fausto, Gervasio and Paola,Springer, 3rd Ed., 2010

ME 426C Machine Tool Design

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

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

CO1: Evaluate motion, forces and power and machining accuracy in different machine tools.CO2: Design machine tool structures and drives.
CO3: Design speed and feed boxes of machine tool structures.
CO4: Design slide Ways, Guide Ways and Spindles of machine tools

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Standardization of Spindle Speeds and Feed Rates: Layout of Speed Change Gears. Saw Diagrams of Mechanical Stepped Drives in Machine Tools for different series, Layout of the Intermediate Reduction Gears, Calculation of Transmission Ratios, Pulley Diameter, Gear Wheel Diameters and Number of Teeth, Ray Diagram, Speed Diagram.

UNIT-III

Electrical, Mechanical and Hydraulic Drives for the Operational Movements: Electric Drive and Control Equipment, Mechanical and Hydraulic Drives, Drives for Producing Rotational Movements, Stepped Drives, Step less Drives. Drives for Producing Rectilinear Movements, Backlash Eliminator in the Feed Drive Nut.

Design of Constructional Elements: Machine Tool Structures, Structural Elements Design for Centre Lathe, Drilling Machine, Knee Type Milling Machine, Planning Machine, Boring Machine, and Grinding Machines.

UNIT-IV

Design of Slide Ways: Design of Slide ways for Tables, Saddles and Cross-slides, Antifriction Bearings forslide ways, Hydrostatically Lubricated Slide ways.

Design of Spindles and Spindle Bearings: Design of Spindles for Strength and Stiffness, Design of Spindles for Balancing, General Layout and Design of the Driving Elements and the Spindle

Bearings, Selection and General Layout of Ball and Roller Bearings for Supporting Spindles. Brief discussion on Design of Secondary Drives for Machine Tools

Text Books:

1. Machine Tool Design by N. K. Mehta, 3e, McGraw Hill Publishing
2. Machine tool design by Sen and Bhattacharya, CBS Publications Oxford and IBH Publishing

ME 432C Computing Techniques

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits			
3	0	0	3	Class Work	:	25 Marks
				Examination	:	75Marks
				Total	:	100 Marks
				Duration of Examination	:	3 Hours

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

CO1: Understand and appreciate the importance of errors associated with scientific computing and accuracyrequirements.
CO2: Understand the computing techniques and the inherent limitations of the techniques. CO3: Understand the significance of computing methods, their strengths and application areas. CO4: Perform the computations on various data using appropriate computation tools.
CO5: Understand and implement Discrete Fourier Transform, Fast Fourier Transform.

Unit-I

Chapter-1

Introduction to numerical computing: Numeric data, analog computing, digital computing, process of numerical computing and characteristics, Sources of Approximations, Data Error and Computational, Truncation Error and Rounding Error, Absolute Error and Relative Error, Sensitivity and Conditioning, Backward Error Analysis, Stability and Accuracy; Computer arithmetic -Floating Point Numbers, Normalization, Properties of Floating Point System, Rounding, Machine Precision, Error propagation, Minimizing the total error.

Chapter-2

System of liner equations: Linear Systems, Solving Linear Systems, Gaussian elimination, Pivoting, Gauss- Jordan, Norms and Condition Numbers, Iterative Methods for Linear Systems Linear least squares: Data Fitting, Linear Least Squares, Orthogonalization Methods, QR factorization, Gram-Schmidt Orthogonalization.

Unit-II

Chapter-3

Eigen values and singular values: Eigen values and Eigenvectors, Methods for Computing All Eigen values,Jacobi Method, Methods for Computing Selected Eigen values,

Chapter-4

Nonlinear equations: Fixed Point Iteration, Newton's Method, Inverse Interpolation Method Interpolation: Purpose for Interpolation, Choice of Interpolating, Function, Polynomial Interpolation, Piecewise Polynomial Interpolation

Unit-III

Chapter-5

Numerical Integration and Differentiation: Quadrature Rule, Newton-Cotes Rule, Gaussian Quadrature Rule,Finite Difference Approximation,

Chapter-6

Initial Value Problems for ODEs, Euler's Method, Taylor Series Method, Runga-Kutta Method, Extrapolation Methods, Boundary Value Problems for ODEs, Finite Difference Methods, introduction to Finite Element Method.

Unit-IV

Chapter-7

Partial Differential Equations, Time Dependent Problems, Time Independent Problems, Solution for SparseLinear Systems, Iterative Methods,

Chapter-8

Continuous Fourier Series, Frequency and Time Domains, Fourier Integral and Transform, Discrete Fourier Transform (DFT),Fast Fourier Transform (FFT), The Power Spectrum, Introduction to Curve Fitting with Software Packages.

Text/ Reference Books:

6. Computational Methods in Engineering, S.P. Venkateshan and Prasanna Swaminathan, Ane Books Pvt. Ltd
7. Numerical Methods, E. Balagurusamy, Tata McGraw-Hill Education
8. Numerical Methods for Engineers, Steven C. Chapra Raymond P. Canale, McGraw Hills, 6th edition
9. Computational Science, Kiryanov D. and Kiryanova E., Infinity Science Press, 1st Ed., 2006

ME 434C Finite Element Analysis

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Objectives:

1. To illustrate the principle of mathematical modeling of engineering problems
2. To introduce the basics and application of Finite Element Method

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

CO1: Perform finite element formulations for simple engineering problems

CO2: Understand the concepts of discretization and various types of finite elements CO3: Understand use of finite element in structural and thermal problems

CO4: Use commercial finite element software and understand its structure.

CO5: Write formal technical report based on the finite element analysis of engineering problem

Unit-I

Chapter-1

Historical Background, Mathematical modeling of field problems in engineering, governing equations, discreteand continuous models, boundary and initial value problems,

Chapter-2

Weighted Residual Methods, Variational formulation of boundary value problems, Ritz technique, Basicconcept of Finite Element Method.

Unit-II

Chapter-3

One dimensional second order equation, discretization, linear and higher order elements, derivation of shape functions, Stiffness matrix and force vectors, assembly of elemental matrices, Solution of problems from solid mechanics and heat transfer,

Chapter-4

Solution of problems from longitudinal vibration and mode shapes, fourth order beam equation, transversedeflections and natural frequencies.

Unit-III

Chapter-5

Two dimensional equations, variational formulation, finite element formulation, triangular elements-shapefunctions, elemental matrices and RHS vectors; Application to thermal problems,

Chapter-6

Application to torsion of non-circular shafts, quadrilateral and higher order elements; Plane stresses and planestrain problems, body forces and thermal loads, plate and shell elements.

Unit-IV

Chapter-7

Natural coordinate systems, isoparametric elements and shape functions, numerical integration and applicationto plane stress problems, matrix solution techniques,

Chapter-8

Solution of dynamic problems, introduction to FE software.

Text Books:

1. Reddy J.N., An Introduction to Finite Element Method, 3rd ed., Tata McGraw Hill, 2005.
2. Seshu P., Text Book of Finite Element Analysis, Prentice Hall, New Delhi, 2007.
Rao S.S., The Finite Element Method in Engineering, 3rd ed., Butterworth Heinemann

ME 436C Modern Manufacturing and Materials

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Objectives:

1. To illustrate the principle of mathematical modeling of engineering problems
2. To introduce the basics and application of Finite Element Method

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

CO1: Discuss Additive Manufacturing, Rapid prototyping and their applications .
CO2: Describe Micro-machining/Powder Metallurgy and Surface Treatment processes. CO3: Illustrate the types and Applications of different ceramic and smart materials.
CO4: Describe the types and Applications of different composite materials.

UNIT - I

Additive Manufacturing (AM): Introduction and Classification of AM process, Need for Additive Manufacturing, Fundamentals of Additive Manufacturing and Prototyping, methods of Additive Manufacturing, Applications of AM in rapid prototyping, rapid manufacturing, rapid tooling, repairing and coating, Pre and postProcessing in Additive Manufacturing

UNIT – II

Micromachining – definition - principle of mechanical micromachining - Classification of Micro-machining processes and methods

Powder Metallurgy: Introduction to Powder Metallurgy process, preparation of powders, types & function of binders, advantages disadvantages and application of powder metallurgy products

Surface Treatment: Scope, Cleaners, Methods of cleaning, Surface coating types, methods of coating, economics of coating. Electro forming, Chemical vapour deposition, thermal spraying.

UNIT III

Ceramic material: Structural ceramics, Applications, characteristics, classification ,properties, Processing of particulate ceramics, WC, TiC, TaC, Al2O3, SiC, Si3N4, CBN and diamond - properties, processing andapplication

Smart Material: Classification, types of smart material, carbon nanotechnology tubes and applications.

UNIT IV

Composite material: Definition- Rule of mixtures, methods of manufacturing, Matrix materials-polymers- metals-ceramics, Reinforcements: Particles, whiskers, inorganic fibres, metal filaments-

ceramic fibres- natural composite, Advantages and drawbacks of composites over monolithic materials. Properties and applications of composites

Text Books:

1. M. P. Groover, "Principles of Modern Manufacturing," 5 th Edition, Wiley, India, 2014.
2. James A. Murphy- Surface Preparation and Finishes for Metal, McGraw-Hill, New York 1971
3. Manufacturing Engineering and Technology IKalpakijian / Adisson Wesley, 1995
4. Process and Materials of Manufacturing / R. A. Lindburg / 1th edition, PHI 1990.
5. Jain V. K. - 'Introduction to Micromachining' - Narosa Publishing House – 2010

Reference Book:

1. Madou M. J. - 'Fundamentals of Microfabrication' - CRC Press - 2009 - 2nd Edition
2. I. Gibson, D. W. Rosen, and B. Stucker, "Additive manufacturing technologies," New York: Springer.2010

ME 442C Automobile Engineering

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits			
3	**0**	**0**	**3**	Class Work	:	25 Marks
				Examination	:	**75Marks Total**
					:	**100 Marks**

Duration of Examination: 3 Hours

Course Objectives:

To understand the construction and working principle of various parts of an automobile

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

CO1: Describe the details, constituents and technologies of Automobiles. CO2: Discuss the details of the transmission system of an Automobile.
CO3: Explain the types and operation of Steering, suspension and braking system in Automobiles.CO4: Discuss different alternative energy sources/ fuels in for Automobiles.

Unit-I

Types of automobiles, vehicle construction and layouts, chassis, frame and body, vehicle aerodynamics, IC engines-components, function and materials, variable valve timing (VVT), Engine auxiliary systems, electronic injection for SI and CI engines, unit injector system, rotary distributor type and common rail direct injection system, transistor based coil ignition & capacitive discharge ignition systems, turbo chargers (WGT, VGT), engine emission control by 3-way catalytic converter system, Emission norms (Euro & BS).

Unit-II

Transmission systems, clutch types & construction, gear boxes-manual and automatic gear shift mechanisms, Over drive, transfer box, flywheel, torque converter, propeller shaft, slip joints, universal joints, differential and rear axle, Hotchkiss drive and Torque tube drive.

Unit-III

Steering geometry and types of steering gear box, power steering, types of front axle, types of suspension systems, pneumatic and hydraulic braking systems, antilock braking system (ABS), electronic brake force distribution (EBD) and traction control.

Unit-IV

Alternative energy sources, natural gas, LPG, biodiesel, bio-ethanol, gasohol and hydrogen fuels in automobiles, modifications needed, performance, combustion & emission characteristics of alternative fuels in SI and CI engines, Electric and Hybrid vehicles, application of Fuel Cells

ME 444C Design of Transmission Systems

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits			
3	**0**	**0**	**3**	Class Work	:	25 Marks
				Examination	:	**75Marks Total**
					:	**100 Marks**

Duration of Examination: 3 Hours

Objectives:

To learn about the design procedures for mechanical power transmission components

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

CO1: Inculcate an ability to design belt drives and selection of belt, rope and chain drives. CO2: Understand and apply principles of gear design to spur gears and spur gear boxes. CO3: Become proficient in design of helical, bevel gear and worm gear box.
CO4: Learn a skill to design multi-speed gear box for various applications. CO5: Inculcate an ability to design clutches brakes and cams.

Unit-I

Chapter-1

Flexible transmission elements- design of flat belts & pulleys, selection of V-belts and pulleys, selection ofhoisting wire ropes and pulleys, design of chains and sprockets

Chapter-2

Gear transmission- speed ratios and number of teeth, force analysis, tooth stresses, dynamic effects, fatigue strength, factor safety, gear materials; Design of straight tooth spur gear and parallel axis helical gears based on strength and wear considerations, pressure angle in the normal and transverse plane; equivalent number of teeth and forces for helical gears.

Unit-II

Chapter-3

Straight bevel gear- tooth terminology, tooth forces and stresses, equivalent number of teeth. Estimating thedimensions of a pair of straight bevel gears;

Chapter-4

Worm gear, merits & demerits, terminology, thermal capacity, materials, forces & stresses, efficiency, estimating the size of worm gear pair. Cross helical gears, terminology, helix angles, sizing of a pair of helical gears.

Unit-III

Chapter-5

Gear box- geometric progression, standard step ratio; Ray diagram, kinematics layout; Design of sliding mesh gear box- Design of multi-seed gear box for machine tool applications; constant mesh gear box, speed reducer unit; problems,

Chapter-6

Variable speed gear box; Fluid couplings, Torque converters for automotive applications, problems,

Unit-IV

Chapter-7

Cam design, types: pressure angle and undercutting base circle determination, forces and surface stresses; Design of plate clutches, axial clutches, cone clutches, internal expanding rim clutches; Electromagnetic clutches;

Chapter-8

Band and Block brakes, external shoe brakes, internal expanding shoe brake, problems

Text Books:

1. Shigley J., Mischke C., Budynas R. and Nisbett K., Mechanical Engineering Design, 8th ed., Tata McGrawHill, 2010.

ME 446C Principles of Management

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Objectives:

Broad objective of course is to understand the principles of management and their application to thefunctioning of an organization.

CO1: Describe the types of business organization its management, roles of manager and entrepreneurs.

CO2: Distinguish between strategic, tactical, and operational planning and explain the benefits, tools andtechniques of planning.

CO3: Understand organizational structure and describe the major considerations in organizing an enterprise's resources, including human resources, and role of IT systems in management.

CO4: Describe the effective management skills needed to maximize individual and organizational productivity related to the internal and external environment and issues of ethics and social responsibility.

UNIT I

Definition of management, science or art, manager vs. entrepreneur; Types of managers managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management

UNIT II

Nature and purpose of Planning, types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes

UNIT III

Nature and purpose of Organizing, formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management.

UNIT IV

Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication. Controlling, system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.

Text Books:

1. Robins S.P. and Couiter M., Management, Prentice Hall India, 10th ed., 2009.

ME448C Process Planning and Cost Estimation

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Objectives:

To introduce process planning concepts to make cost estimation for various products

Course Outcomes:

Upon completion of this course, the students will be able to use the concepts of process planning and costestimation for various products

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

CO1: Explain Process planning, select material, production machine, equipments and tools using partsdrawing; and calculate process parameters for production activity.
CO2: Comprehend the different elements of cost in manufacturing and their estimation procedure.CO3: Calculate process times for metal cutting jobs on different machines.
CO4: Estimate cost of Production for different jobs in forging, welding, foundry and machining.

UNIT I

Introduction of Process Planning- methods of process planning, drawing interpretation, material evaluation, steps in process selection, production equipment and tooling selection Process planning activities- process parameter calculation for various production processes,

Selection of jigs and fixtures, selection of quality assurance methods, documents for process planning, economics of process planning, case studies

UNIT II

Introduction to cost estimation- importance of costing and estimation, methods of costing, elements of cost estimation, types of estimates, estimating procedure, estimation of labor cost, material cost, allocation of overhead charges, calculation of depreciation cost

UNIT III

Machining time estimation- importance of machine time calculation, machining time for different lathe operations, drilling and boring time calculations, Machining time calculation for Milling, Shaping, Planning and Grinding

UNIT IV

Production costs- Different production processes for different jobs, estimation of forging cost, estimation ofwelding cost, estimation of foundry cost, estimation of machining cost

Text Books:

1. Peter Scallan, Process Planning, Design/ Manufacture Interface, Elsevier Sci.&Tech. 2002.
2. Ostwald P.F. and Munoz J., Manufacturing Processes and Systems, 9th ed., John Wiley, 1998.

Open Elective –III: CSE340C Artificial Intelligence & Expert Systems

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Unit 1(10 Lectures)

Introduction: The AI problems; what is an AI technique; Characteristics of AI applications Problem Solving, Search and Control Strategies General Problem solving; Production systems; Control strategies: forward and backward chaining Exhaustive searches: Depth first Breadth first search.

Unit 2(10 Lectures)

Heuristic Search Techniques: Hill climbing; Branch and Bound technique; Best first search and A* algorithm; AND/OR Graphs; Problem reduction and AO* algorithm; Constraint Satisfaction problems Game Playing Minmax search procedure; Alpha-Beta cutoffs; Additional Refinements.

Unit 3(12 Lectures)

Knowledge Representation & Reasoning:- Propositional logic, First order predicate logic, Inference in FOPL, Skolemnisation; Resolution Principle and Unification; Forward & Backward chaining, Inference Mechanisms Horn's Clauses; Semantic Networks; Frame Systems and Value Inheritance; Conceptual Dependency**.**

Learning Techniques: - Supervised and unsupervised learning, Decision trees, Statistical learning models, Reinforcementlearning.

Expert Systems: Introduction to Expert Systems, Architecture of Expert Systems; Expert System Shells; KnowledgeAcquisition; Case Studies: MYCIN, Learning, Rote Learning; Learning by Induction; Explanation based learning.

Text Books/Reference Books:

1. Elaine Rich and Kevin Knight: Artificial Intelligence- Tata McGraw Hill.
2. Dan W.Patterson, Introduction to Artificial Intelligence and Expert Systems- Prentice Hall of India.
3. Nils J.Nilsson: Principles of Artificial Intelligence- Narosa Publishing house.
4. Artificial Intelligence : A Modern Approach, Stuart Rusell, Peter Norvig, Pearson Education.
5. Artificial Intelligence, Winston, Patrick, Henry, Pearson Education.

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

1. Analyze and formalize problem and solve them using AI techniques
2. Use Heuristic search techniques for game playing and other problems
3. Represent diverse knowledge using AI and analyze
4. Understand and design an expert system

Open Elective –III: EE452C Electrical and Hybrid Vehicles

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Unit 1(10 Lectures)

Introduction: History of hybrid and electric vehicles, social and environmental importance of hybrid and electric vehicles, impact of modern electric vehicles on energy supplies.

Electric Vehicle Composition and Configurations, Basic concept of hybrid Electric vehicle, HEV configuration types – series, parallel, series-parallel and complex hybrid, Power flow control.

Unit 2(10 Lectures)

Electric Propulsion: major requirements of EV motor drive, characteristics and control ofDC motor, Induction motor, Switched Reluctance motor and Permanent Magnet motor, power converters devices/topology, control hardware, software and strategy vehicle, power source characterization, transmission characteristics.

Unit 3(12 Lectures)

Energy Storage: Introduction to energy storage requirements in Hybrid and Electric Vehicles, Energy sources, Battery based energy storage and its analysis, Fuel fell based energy storage and its analysis, super capacitor based energy storage and its analysis, Flywheel based energy storage and its analysis.

Unit 4(12 Lectures)

Energy Management Strategies: Introduction to energy management strategies used in hybrid and electric vehicles, classification of different energy management strategies, comparison of different energy management strategies, implementation issues of energy management strategies. Plug-in electric vehicles, Vehicle to grid (V2G) and Grid to vehicle (G2V) fundamentals.

Text/ Reference Books:

1. C. Mi, M. A. Masrur and D. W. Gao, “Hybrid Electric Vehicles: Principles and Applications with PracticalPerspectives”, John Wiley & Sons, 2011.
2. S. Onori, L. Serrao and G. Rizzoni, “Hybrid Electric Vehicles: Energy Management Strategies”, Springer, 2015.
3. M. Ehsani, Y. Gao, S. E. Gay and A. Emadi, “Modern Electric, Hybrid Electric, and Fuel Cell Vehicles:Fundamentals, Theory, and Design”, CRC Press, 2004.
4. T. Denton, “Electric and Hybrid Vehicles”, Routledge, 2016.

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

1. Understand the basic concept and history of EV and HEV.
2. Understand the models to describe hybrid vehicles and their performance.
3. Understand the different possible ways of energy storage.
4. Understand the different strategies related to energy management systems.

Open Elective –III: MGT401C Entrepreneurship

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Unit 1 (9 Lectures)

Entrepreneurship: Concept and Definitions of Entrepreneur & Entrepreneurship; Classification and Types of Entrepreneurs; Traits/Qualities of an Entrepreneurs; Entrepreneurship's Challenges; Factor affecting Entrepreneurial Growth

– Economic &Non-Economic Factors; Entrepreneur Vs. Intrapreneur .EDP Programmes.

Unit 2 (10 Lectures)

Innovation Technology Management: Entrepreneurial Opportunity Search and Identification; recognition of a good business opportunity; Conducting Feasibility Studies. Business Plan: Purpose of Business Plan; Contents of Business Plan; Presenting of Business Plan; Why Business plan Fails.

Unit 3 (10 Lectures)

Indian Models in Entrepreneurship: Social Entrepreneur: Introduction; Characteristics, Need, Types and Motivations of Social Entrepreneur. Women Entrepreneurship: Role & Importance, Profile of Women Entrepreneur, Problems of Women Entrepreneurs, Women Entrepreneurship Development in India.

Unit 4 (9 Lectures)

Developments of Entrepreneur: Micro, Small and Medium Enterprises: Concept & definitions; Role & Importance;MSMED Act 2006, Current Scheme of MSME- Technology Up-gradation Scheme ,Marketing Assistance Scheme

,Certification Scheme, Credit- rating scheme , Problems facing MSME.

Financing the venture: Introduction, features and process of Venture Capital, Funding from Banks.

Text Books:

1. Roy Rajeev, Entrepreneurship 2/e, Oxford University Press.
2. Charantimath, Poornima, "Entrepreneurship Development and Small Business Enterprises", Pearson Education, NewDelhi.

Reference Books:

1. Roy Rajeev, Entrepreneurship 2/e, Oxford University Press.
2. Charantimath, Poornima, "Entrepreneurship Development and Small Business Enterprises", Pearson Education, NewDelhi.
3. Norman M. Scarborough, "Essentials of Entrepreneurship & Small Business Management", PHI, New Delhi.
4. Vasant Desai, "Entrepreneurial Development and Management", Himalaya Publishing House, New Delhi.
5. Kumar Arya, "Entrepreneurship: creating and leading an entrepreneurial organization", Seventh Impression, Pearson Education.
6. Holt, "Entrepreneurship: New Venture Creation", Prentice Hall, New Delhi.
7. Hisrich, Robert D., Michael Peters and Dean Shephered, "Entrepreneurship", Tata McGraw Hill, New Delhi.
8. Bridge, S et al., "Understanding Enterprise: Entrepreneurship and Small Business", Palgrave Publication.
9. Donald F. Kuratko, "Entrepreneurship: Theory, Process, and Practice", South Western College Publications.

Open Elective –III: ME452C Fundamentals Of Sustainable Manufacturing

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Unit 1 (9 Lectures)

Introduction: Introduction to sustainability and drivers for sustainable development and Sustainable Manufacturing - Concept of Triple bottom line, Environmental, Economic and Social Dimensions of Sustainability, Sustainable Product Development – Various Phases.

Unit 2 (10 Lectures)

Tools and Techniques: Environmental Conscious Quality Function Deployment, Life cycle assessment, Design for Environment, R3 and R6 cycles, loop production systems, Reverse supply chain, product acquisition management Design for Disassembly.

Unit 3 (10 Lectures)

EIA Standards: CML, EI 95 and 99, ISO 14001 EMS and PAS 2050 standards, Environmental Impact parameters, Energy in manufacturing (assessment and minimization)

Design for recycling: Eco friendly product design methods – Methods to infuse sustainability in early product design phases

Unit 4 (9 Lectures)

Sustainability Assessment: Concept, Models and Various Approaches, Toxic substances in industry, Product Sustainability and Risk/Benefit assessment– Corporate Social Responsibility, Industry cooperation for reducing Carbon footprint

Green Manufacturing: Dry and near-dry machining, edible oil-based cutting fluids, cryogenic machining, improving work environment, of lean manufacturing, Lean techniques for green manufacturing and strategies for waste reduction in green manufacturing.

Text Books:

1. G. Atkinson, S. Dietz, E. Neumayer —Handbook of Sustainable Manufacturing¦. Edward Elgar Publishing Limited,2007.
2. D. Rodick, Industrial Development for the 21st Century: Sustainable Development Perspectives, UN New York, 2007.

Reference Books:

1. P. Lawn, Sustainable Development Indicators in Ecological Economics, Edward Elgar Publishing Limited.
2. S. Asefa, The Economics of Sustainable Development, W.E. Upjohn Institute for Employment Research, 2005.

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

1. Summarize sustainability issuesand drivers of sustainability.
2. Understand various standards for Environmental Impact Assessment.
3. Apply various tools and technique to access manufacturing sustainability.
4. Comprehend sustainability advantages associated with various manufacturing initiatives.

Open Elective –III: CHE459C Nanoscience and Nanotechnology

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Unit 1 (9 Lectures)

Types of materials; bonding in materials; crystal structures and defects; amorphous materials; origins of properties ofmaterials; Effect of nanostructures on properties of materials.

The science of materials – materials science; Historical use of nanoparticles; discovery of the carbon nanotubes; fullerenes; nanostructured materials.

Unit 2 (10 Lectures)

Particle-wave duality; de-Broglie waves; Schrodinger equation in 1-Dimension; Superposition; Energy eigenstates; Interpretation of wave function; Fermions and Bosons; Electron density of states; Energy bandgaps; Fermi energy; Excitons and Bohr radius.

Unit 3 (10 Lectures)

AFM; STM; Transport in nanostructures; 0,1 and 2 dimensional nanostructures; Bandgap engineering; Molecular motors; MEMS and NEMS devices. Biomaterials and nano-biotechnology.

Unit 4 (9 Lectures)

Synthesis of Nanomaterials – ZnO and Fe3O4. Characterization of phases and quantification of phases. Applications of Nanomaterials: In textile industry, in catalytic operations, in energy generation, in energy storage, in environmental remediation and in sensors and devices.

Text Books:

1. NANO:The Essentials Understanding Nanoscience and Nanotechnology, T. Pradeep, Tata McGraw Hill PublishingCompany Limited, 2007, 0-07-154830-0.
2. Material Science and Engineering, 7th ed. , William D. Callister, Johan Wiley & Sons, Inc.
3. Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press, 2002.
4. Nanostructures and Nanomaterials, synthesis, properties and applications., Guozhong Cao, Imperial College Press,2004.

Reference Books:

1. Introduction to Nanoscience, S.M. Lindsay, Oxford University Press, 2010, ISBN: 978–019–954421–9 (Pbk).
2. Nanoscience, Hans-Eckhardt Schaefer, Springer, 2010, ISBN 978-3-642-10558-6.
3. Chemistry of nanomaterials: Synthesis, Properties and applications. C.N.R. Rao, Achim Muller, A.K. Cheetham,Wiley-VCH, 2004.

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

1. Learn about the background on nanoscience and give a general introduction to different classes of nanomaterials.
2. Develop an understanding of the science behind the nanomaterial properties.
3. Apply their learned knowledge to study and characterize nanomaterials.
4. Familiarize themselves with the variety of nanotechnology applications, and know how to approach the synthesis of nanomaterials with a set of desirable properties.

Open Elective –III: EE454C Smart Grid

B. Tech. Semester – VIII (Mechanical Engineering)

L	T	P	Credits
3	0	0	3

Class Work	:	**25 Marks**
Examination	:	**75Marks**
Total	:	**100 Marks**
Duration of Examination	:	**3 Hours**

Unit 1(10 Lectures)

Introduction: Concept of smart grid, smart grid control, Communications and Sensing in a Smart Grid, Hardware Architecture, Software architecture, Protocol detail, application & benefits, PLCs Vs RTUs, IED's, RTU Block diagram, PMU communication interface.

Unit 2(10 Lectures)

Cyber Security of the Smart Grid: Smart Grid Threats, Vulnerabilities and Cyber Security Strategies, Cyber SecurityEnvironment, False Data Injection and Attacks in Electric Power Grids Cyber-Physical System Security.

Unit 3(12 Lectures)

Smart Grid Technologies: Energy Management System, Demand side management: peak clipping, valley filling, loadshifting etc., state estimation, load forecasting. Time of the day pricing(TOD), Time of use pricing(TOU).

Unit 4(12 Lectures)

Distributed Generation & Control: Concept of distributed generation, Introduction of various distributed generationsources like wind, solar, fuel-cell, micro-hydro, PHEV's etc., Grid integration and control of distributed generation sources.

Text Books:

1. T. Gönen, Electric Power Distribution System Engineering, McGraw-Hill, 1986. ISBN: 0-8493- 5806-X.
2. Distribution System Protection Manual, McGraw-Edison Power Systems, 1990.
3. Westinghouse Electric Utility Ref. Book, Vol.3, Distribution Systems, 1965.
4. R. E. Brown, Electric Power Distribution Reliability, Marcel Dekker Inc., 2002.

Reference Books:

1. IEEE Power and Energy Magazine, July/August 2007 Issue
2. James Burke, Power Distribution Engineering, Mercel Dekker, 1994.
3. A.J. Pansini, Electrical Distribution Engineering McGrawHill, 1983.
4. E. Lakervi, E.J.Holmes, Electricity Distribution Network Design, IEE series, 1989.
5. J. Gers and E. J. Holmes Protection of Electricity Distribution Networks 2nd Edition.

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

1. Understand the features of Smart Grid.
2. Understand to make conventional grid more smart, reliable, and efficient.
3. Understand the technical expertise in the emerging area of smart grid.
4. Understand the concepts of distributed generation.