SCHOOL OF ENGINEERING AND TECHNOLOGY
SRI PADMAVATI MAHILA VISVAVIDYALAYAM
(WOMEN'S UNIVERSITY)

Department of Mechanical Engineering
B.TECH Scheme and Syllabus – R20
(In accordance with AICTE Model Curriculum)

Accredited by NACC with "A" Grade

Board of Studies

SCHOOL OF ENGINEERING AND TECHNOLOGY
SRI PADMAVATI MAHILA VISVAVIDYALAYAM
(WOMEN'S UNIVERSITY)

S.No	Contents
1	Vision & Mission of the Institution
2	Vision & Mission of the department
3	Objectives of the Institution
4	Program Educational Objectives (PEOs) of the Department
5	Program Outcomes (POs) of the Department
6	Scheme of Instruction and Evaluation for B.TECH (ME)

SCHOOL OF ENGINEERING AND TECHNOLOGY

SRI PADMAVATI MAHILA VISVAVIDYALAYAM, TIRUPATI

(WOMEN'S UNIVERSITY)

VISION OF THE INSTITUTION

To be a premier centre of education for women in Engineering and Technology that empowers them to be globally competitive and socially responsible.

MISSION OF THE INSTITUTION

- Empowerment and Emancipation of Women through acquisition of knowledge and skill up-gradation.
- Create an ambience that promotes innovation, research and patenting in cutting edge technologies and enhance leadership qualities.
- Collaborate with industry, academic and research institutes to bring a synergetic relationship between Industry and Institute.
- Promote sense of commitment among students and faculty in applying engineering knowledge to solve the societal problems.

SCHOOL OF ENGINEERING AND TECHNOLOGY
SRI PADMAVATI MAHILA VISVAVIDYALAYAM, TIRUPATI
(WOMEN'S UNIVERSITY)

DEPARTMENT OF MECHANICAL ENGINEERING

VISION OF THE DEPARTMENT

The Department endeavors to be recognized globally for outstanding education and research leading to well qualified and empowered woman engineers who are innovative, research and entrepreneurial in advanced fields of mechanical engineering catering to the ever changing industrial and societal needs.

MISSION OF THE DEPARTMENT

- Impart quality and outcome based education to make the students globally competitive Mechanical Engineers.
- Access to modern tools technology and advanced software's of Mechanical Engineering.
- Fostering Innovation and Entrepreneurial skills through incubation and design thinking practicum.
- Promote Social Engineering.

SCHOOL OF ENGINEERING AND TECHNOLOGY
SRI PADMAVATI MAHILA VISVAVIDYALAYAM, TIRUPATI
(WOMEN'S UNIVERSITY)

DEPARTMENT OF MECHANICAL ENGINEERING

OBJECTIVES OF THE INSTITUTION

- To create a conducive and competitive environment for students through curricular, co-curricular and extra-curricular activities.
- To promote the culture of innovation and research among the stake holders.
- To promote synergetic alliances with premier institutions, industries and various related government organizations for collaborative research projects.
- To promote economic and social enrichment of the society through skill development programs, entrepreneurship and extension activities.
- To introduce demand driven new UG and PG programs.
- To ensure quality in terms of providing infra-structure and research ambience.

SCHOOL OF ENGINEERING AND TECHNOLOGY

SRI PADMAVATI MAHILA VISVAVIDYALAYAM, TIRUPATI (WOMEN'S UNIVERSITY)

DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM OUTCOMES – B.TECH (ME)

Engineering Graduates will be able to

PO1:Engineering Knowledge: Apply knowledge of mathematics, science and engineering fundamentals and Production and Industrial Engineering specialization to the solution of complex Production and Industrial Engineering problems.

PO2:Problem Analysis: Identify, formulate, research literature and analyze complex Production and Industrial Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.

PO3: Design/Development of Solutions: Design solutions for complex Production and Industrial Engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.

PO4: Conduct investigations of complex Production and Industrial Engineering problems: using research-based knowledge and research methods including analysis, interpretation of data and synthesis of information to provide valid conclusion.

PO5: Modern Tool Usage: To apply appropriate techniques, resources and engineering and IT tools for modeling of different Production and Industrial Engineering problems with an understanding of the limitations.

PO6: The Engineer and Society: Apply contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.

PO7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

SCHOOL OF ENGINEERING AND TECHNOLOGY

SRI PADMAVATI MAHILA VISVAVIDYALAYAM, TIRUPATI
(WOMEN'S UNIVERSITY)
DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM EDUCATIONAL OBJECTIVES – B.TECH (ME)

PEO1: To provide a quality education for students of Mechanical Engineering profession through outcome based education.

PEO2: To equip students with Robotics, Mechatronics, CFD, Siemens and Dassault 3D experience technologies for deliberating engineering solutions.

PEO3: To promote research leading to innovation, incubation & patenting of research outcomes for stake holders.

PEO4: To disseminate technical information through scholarly publication, conferences and continuing education.

PEO5: To acquire knowledge of relevant technologies in multidisciplinary field of social engineering.

PROGRAMME SPECIFIC OUTCOMES – B.TECH (ME)

Engineering Graduates will be able to

PSO 1: Graduate engineers will be equipped with all the basic principles of Mechanical Engineering.

PSO 2: Apply Engineering knowledge, analysis and design tools to solve problems in the domains of Thermal, Manufacturing and Design.

PSO 3: Engage professionally in industries or as an Entrepreneur by applying Manufacturing, Industrial Engineering and Management practices.

SCHOOL OF ENGINEERING AND TECHNOLOGY

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DEPARTMENT OF MECHANICAL ENGINEERING

B.TECH (ME)

H – HIGH M – MODERATE L– LOW

1. PROGRAM EDUCATIONAL OBJECTIVES (PEOs) – PROGRAMOUTCOMES (POs) MAPPING

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
PEO1	H	H	H	M	M	L	L	-	M	L	L	-
PEO2	-	-	-	-	-	-	-	L	H	H	-	-
PEO3	H	-	M	L	M	H	M	H	L	-	-	-
PEO4	H	H	H	H	M	M	M	H	H	M	M	H
PEO5	H	H	M	H	L	H	L	H	M	M	M	H

2. PROGRAM EDUCATIONAL OBJECTIVES (PEOs) –PROGRAM SPECIFIC OUTCOMES (PSOs) MAPPING

	PSO1	PSO2	PSO3	PSO4
PEO1	H	M	M	-
PEO2	-	L	H	-
PEO3	-	M	H	-
PEO4	M	M	M	H
PEO5	L	M	-	H

3. PROGRAM EDUCATIONAL OBJECTIVES (PEOs) – MISSIONSTATEMENTS MAPPING

	M1	M2	M3	M4
PEO1	M	H	-	-
PEO2	L	-	H	-
PEO3	M	-	-	H
PEO4	H	M	-	-
PEO5	M	-	-	H

R20 SYLLABUS

B.Tech
I Year I Semester

S.No	Course Code	Course Title
1	20BST04	Engineering Mathematics – 1
2	20BST03	Engineering Physics
3	20BST01	Functional English
4	20ECT01	Basic Electronics Engineering
5	20BSP03	Engineering Physics Lab
6	20BSP01	Communicative English Lab
7	20MEP03	Workshop and Manufacturing Practices
8	20ECP01	Basic Electronics Engineering Lab

B.Tech I Year I Semester

20BST04: ENGINEERING MATHEMATICS – I

Credits - 4 **Sessional Marks: 30**
L: T: P:: 3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. To introduce the mean value theorems and the fallouts of Rolle's Theorem that is fundamental to application of analysis to engineering problems.
2. To familiarize the students with techniques in integral calculus and introduce the idea of applying integral calculus to notations of curvature.
3. To acquaint the student with different effective mathematical tools for the solutions of differential equations that model physical processes.
4. To equip the students with standard concepts in vector calculus and its applications.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Identify the extrema of a function on an interval and classify them as maxima, minima or saddle using the first derivative test.

CO2. Calculate double and triple integrals and apply to measure the area of a plane and volume of a solid.

CO3. Use the tools of Calculus to sketch the graphs of functions, Critical points, intercepts, Asymptotes etc.

CO4. Solve second and higher order linear differential equations with constant coefficients.

CO5. Analyze the methods for finding the solutions of linear differential equations.

CO6. Memorize definitions of Curl, Gradient and Divergence of vector field and compute them.

CO7. Understand the statements of Stoke's, Green's and Divergence theorem and apply them in solving Engineering problems.

UNIT I

Calculus: Roll's and Mean value theorems, Taylor's theorem, Maclaurins theorem - Maxima & minima for functions of two variables – Curve tracing.

UNIT II

Multiple integrals: Double and triple integrals, Change of order of integration, Change of variables – Simple applications – areas & volumes.

UNIT III

Differential Equations-I: Exact, Linear and Bernoulli's equations, orthogonal trajectories; Homogeneous and Non-Homogeneous linear differential equations of second and higher order with constant coefficients.

UNIT IV

Differential Equations-II: Linear equations with variable coefficients-Euler equations, Method of variation of parameters, Simultaneous equations.

UNIT V

Vector Calculus: Gradient, Divergence, Curl and related properties; Line, surface and volume integrals; Stokes, Greens and Gauss-Divergence theorems.

Text books

1. Grewal, B.S. "Higher Engineering Mathematics", Khanna Publishers, 42nd Edition.

Reference Books

1. T.K.V.Iyengar & B.Krishna Gandhi et., "Engineering Mathematics – I, II ";S. Chand & Company.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	M	H		L								
CO2	H	M		L								
CO3	H	H	M	L								
CO4	H	M	L									
CO5	H	M			L							
CO6	M	H			L							
CO7	M	H			L							

20BST03: ENGINEERING PHYSICS

Credits – 4 **Sessional Marks: 30**
L: T: P::3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. To understand this course is at the end of the course the students would be exposed to fundamental knowledge in various engineering subjects and applications.
2. To know the acquaintance of basic physics principles would help engineers to understand the vital role played by science and engineering in the development of new technologies.
3. To Familiarize basic concepts of quantum mechanics, semiconductors and superconductors will lead the students to solve some basic problems in the higher levels of their respective courses.
4. To Gain Knowledge of upcoming technologies like laser technology, fiber optics and Nanotechnology.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Explain the basic concepts of Quantum Mechanics and the band theory of solids.

CO2. Learn and to apply the basic concepts of properties of matter in day to day life.

CO3. Learn the types of Semiconductors and the role of carrier concentrations in conductivity. Understand the behaviour of materials at low temperatures and the applications of Super conductivity.

CO4. Understand the use of lasers in Engineering Science, Medicines & apply the concepts of optical fibre in communication systems.

CO5. Get a basic understanding of Nanotechnology. The course willgive idea of synthesis, characterisation of Nano materials and electrical & optical properties, applications of Nano systems.

UNIT I

Quantum Mechanics and Conducting Material: Introduction-wave nature of particles-De-Broglie Hypothesis-Time dependent and independent Schrodinger wave equation-Physical signification of wave function-particle in one dimensional infinite potential well-Heisenberg Uncertainty principle-Classical free electron theory-quantum free electron theory-Fermi Dirac Distribution.

UNIT II

Properties of Matter: Elasticity– Stress-strain diagram and its uses - factors affecting elastic Modulus and tensile strength – Torsion stress and deformations– twisting couple - torsion pendulum :theory and experiment -bending of beams- bending moment – cantilever: theory and experiment – uniform and non-uniform bending: theory and experiment - I-shaped girders - stress due to bending in beams.

UNIT III

Semiconductors and Superconductors: Semiconductors: Semiconducting materials: Intrinsic and extrinsic semiconductors – carrier concentration derivation – Fermi level – variation of Fermi level with temperature in intrinsic – electrical conductivity for intrinsic semiconductor –Hall Effect.

Superconductivity: Introduction - effect of magnetic field- Meissner effect- Types of superconductors - Flux quantization - Magnetic Levitation - BCS theory - Josephson Effect - Application of superconductors.

UNIT IV

Laser& Fiber Optics: Lasers: Einstein's theory of matter radiation interaction and A and B coefficients; Amplification of light by population inversion, different types of lasers: He-Ne Gas Laser, Ruby Laser - Coherence -applications in engineering science and medicine.

Fiber Optics: Light propagation through fibers –Acceptance angle – numerical aperture – types of fibers – step index, graded index – single mode, multimode – attenuation – dispersion– LED-Detector- application of fiber optics in communication

UNIT V

Nanotechnology: Origin of Nanotechnology, Nano Scale, Surface to Volume Ratio, Quantum Confinement, Bottom-up Fabrication: Sol-gel, Precipitation, Combustion Methods; Top-down Fabrication:

Chemical Vapour Deposition, Physical Vapour Deposition, Pulsed Laser Vapour Deposition Methods, Characterization(TEM)-Carbon Nan tubes (OD,1D,2D and 3D) – Applications.

Text Books

1. Avadhanulu M. N., "Engineering Physics", S. Chand & Co., 2007
2. K.Thiyagarajan,"Engineering Physics" McGraw Hill Education (India) Private Limited.

Reference Books

1. Gaur R K, Gupta S L, "Engineering Physics", Dhanpat Rai Publications, 2013.
2. R.Murugesan, Kiruthiga Sivaprasath,"Modern Physics"S.Chand&Company Pvt.Ltd, 2014.
3. Pillai, S.O., "Solid State Physics", New Age International Publication, New Delhi, Seventh Edition, 2015.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**H**	**M**										
CO2			**H**		**M**							
CO3			**M**			**H**	**L**					
CO4					**H**					**H**		
CO5				**H**			**M**				**H**	

20BST01: FUNCTIONAL ENGLISH

Credits – 3 **Sessional Marks: 30**
L: T: P::3: 0: 0 **University Exam Marks: 70**

Course Objectives

1. To develop the knowledge of communicative grammar, enhance lexical capabilities by extensive practice exercises, build the vocabulary, and develop skimming and scanning skills using reading materials on different topics.
2. To enhance professional competence in reading, writing, listening and speaking.
3. To switch the approach from providing information about the language to use the language.
4. To minimize the Grammar Translation Method of ELT while trying to replace it with Direct Method.
5. To introduce Communicative Method of ELT and focusing the teaching pedagogy on the student-centered learning rather than on the teacher-centered learning.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Analyze the usage of English words in different contexts and acquire considerable flair in using broad range of vocabulary.

CO2. Upgrade comprehension of technical and academic articles and recognize writings as a process rather than a product.

CO3. Identify common errors in various parts of English and give effective expression in oral and written communication.

CO4. Explore various grammatical units of English and design a language component critically and coherently to meet desired needs within the realistic constraints.

UNIT I

The Secret of Work by Swami Vivekananda: Vocabulary Building: Root words from foreign languages and their use in English;Writing: Tenses; Identifying Common Errors: Subject-Verb agreement; Reading Comprehension.

UNIT II

Reaching for the Stars: Kalpana Chawla: Vocabulary Building: Word Formation; Writing: Sentence Structures, Use of phrases and clauses in sentences; Identifying Common Errors: Noun-Pronoun Agreement; Reading Comprehension.

UNIT III

A Retrieved Reformation by O. Henry: Vocabulary Building: Acquaintance with prefix and suffix from foreign languages in English to form derivatives; Writing: Importance of proper punctuation, Creating Coherence, Describing; Identifying Common Errors: Misplaced Modifiers; Reading Comprehension.

UNIT IV

Water: The Elixir of Life by C.V. Raman: Vocabulary Building: Synonyms and antonyms; Writing: Paragraph writing, Précis Writing;Identifying Common Errors: Articles, Prepositions; Reading Comprehension.

UNIT V

The Post Office by Rabindranath Tagore: Vocabulary Building: Standard Abbreviations; Writing: Letter Writing; Identifying Common Errors: Use of Adjectives; Reading Comprehension.

Reference Books

1. Michael Swan, “Practical English Usage”, OUP. 1995.
2. F.T. Wood, “Remedial English Grammar”, Macmillan. 2007.
3. William Zinsser, “On Writing Well”, Harper Resource Book. 2001.
4. Liz Hamp-Lyons and Ben Heasly. “Study Writing”, Cambridge University Press. 2006.

5. Sanjay Kumar and Pushplata. “Communication Skills”, Oxford University Press. 2011.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO12
CO1		H								M		L
CO2				M						H		M
CO3									M	H		L
CO4				M						H		M

20ECT01: BASIC ELECTRONICS ENGINEERING

Credits–3 **Sessional Marks: 30**

L:T:P::2:1:0 **University Exam Marks:70**

Course Objectives

1. To Know the volt-Ampere characteristics of semiconductor devices.
2. To Gain knowledge on various Transistor Amplifiers.
3. To Know the principle of operation of FET biasing schemes and Amplifiers.
4. To Familiarize with negative feedback Amplifiers and oscillators.
5. To Implement different op-Amp circuits.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Learn PN-Diode, Transistor, FET, Amplifiers, Oscillators, IC's.

CO2. Solve problems related to Rectifiers, Transistor Amplifiers, negative feedback amplifiers, Inverting and non-inverting Op-Ampcircuits.

CO3. Classify Rectifiers, BJT and FET Amplifiers, Oscillators.

CO4. Analyze the biasing schemes of Transistors, FET's, rectifiers and Amplifiers.

CO5.Apply rectifiers, BJT Amplifiers, FET amplifier, negative Feedback Amplifiers,oscillators, OP-Amps for electronic systems.

UNIT I

PN Junction Diode: Semiconductor materials, PN junction diode, Volt-ampere characteristic and applications,Half wave rectifier, Full wave rectifier, Bridge rectifier, Filters.

UNIT II

Bipolar Junction Transistor: Construction, characteristics and parameters, Transistor as amplifier, Biasing, CB,CE,CC amplifiers and their comparison.

UNIT III

Field Effect Transistor: Construction, characteristics and parameters of JFET,depletion and enhancement type MOSFETS, Biasing, JFET amplifiers, CS,CD and CG amplifiers and their comparison.

UNIT IV

Feedback Amplifiers and Oscillators: Concept of Feedback, advantages of Negative Feedback, types of feedback circuits, BarkHausen criterion, RC phase shift and wein bridge oscillators, Hartley andColpitts oscillators.

UNIT V

Integrated Circuit Applications: Op-Amp applications, inverting and Non-inverting amplifiers, comparator, Summer, Integrator, Astable and MonostableMulti-vibrators.

Text Books

1. J.Milliman and C.C.Halkias, Satyabratajit, "Integrated Electronics", 2nd edition, TMH,1998.
2. Allen Mottershead, "Electronic Devices and Circuits", PHI Private Limited,1979.

Reference Books

1. RobertL.Boylestad,LouisNashelsky-"ElectronicDevicesandCircuitTheory",9th Edition,2008.
2. S.Salivahana, N.Suresh Kumar, A.Vallavaraj- "Electronic Devices and Circuits",2nd Edition,2008,TM

Course Outcomes – Program Outcomes – Program Specific Outcomes(CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	-										H		
CO2		H	M	L					L	L	L		H	M	
CO3	H	M											H		
CO4	H	M	L	L										L	H
CO5			H	M		M	L		L	L	L	L		L	H

20BSP03: ENGINEERING PHYSICS LAB

Credits - 1 **Sessional Marks: 40**
L: T: P::0: 0: 2 **University Exam Marks: 60**

Course Objective

1. To impart practical knowledge about some practical phenomena they have studied in the engineering physics course.
2. To develop the experimental skills of the students.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Apply knowledge of mathematics and physics fundamentals and an Instrumentation to arrive solution for various problems.

CO2. Understand the usage of basic laws and theories to determine various properties of the materials given.

CO3. Apply the theories learnt and the skills acquired to solve real time problems.

CO4. Carryout experiments to understand the laws and concepts of physics.

LIST OF EXPERIMENTS
(Minimum Six are mandatory)

1. Determination of Numerical aperture and bending losses of fibers of an optical fiber.
2. Young's modulus - non uniform bending – Pin and microscope
3. Calibration of voltmeter / ammeter using potentiometer
4. Spectrometer-Dispersive power of prism /grating.
5. Spectrometer- Determination of refractive index of given liquid using Hollow Prism.
6. Laser-Determination of wavelength.
7. Air Wedge- Determination of thickness of given thin wire.
8. V-I Characteristics of PN Junction diode.
9. Energy Gap Determination of a PN Junction Diode
10. Determination of surface tension of the given liquid-drop weight method.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H											
CO2		H										
CO3			H									
CO4	H				H					H		

20BSP01: COMMUNICATIVE ENGLISH LAB

Credits -1 **Sessional Marks: 40**
L: T: P::0: 0: 2 **University Exam Marks: 60**

Course Objectives

1. To enhance communicative skills of the students with emphasis on Listening, Speaking, Reading and Writing skills.
2. To develop oral communication and fluency in Group Discussions, Just a Minute and Debates.
3. To enable the student to acquire the structure of written expressions required for their profession.
4. To enable the student to communicate in English for Academic and Social purpose.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Learn English speech sounds, analyze phonetic transcriptions
CO2. Understand the stress on word accent, intonation, and rhythm to acquire better pronunciation.
CO3. Acquire fluency in spoken English and neutralize mother tongue influence.
CO4. Upgrade listening skills and receive and interpret messages in the communication process.
CO5. Become active participants in the learning process and acquire proficiency in both ways of communication

UNIT I

Phonetics

i) Phonetics: Importance ii) Speech Sounds - Vowels and Consonants
iii) Phonetic Transcriptions

UNIT II

Pronunciation: i) Word Stress and Rhythm ii) Intonation: Rising tone, Falling tone.

UNIT III

Oral Communication: i) Group Discussions ii) Just a minute (JAM) iii) Debate iv) Situational Dialogues v) Oral Presentations

UNIT IV

Listening Skills

UNIT V

Resume Writing, Interview Skills

Reference Books

1. Nira Konar, "English Language Laboratories: A Comprehensive Manual". PHI Learning Pvt. Ltd., 2011.
2. Michael Swan, "Practical English Usage", OUP. 1995.
3. William Zinsser, "On Writing Well", Harper Resource Book. 2001.
4. Liz Hamp-Lyons and Ben Heasly. "Study Writing, Cambridge University Press. 2006.
5. Sanjay Kumar and Pushp Lata. "Communication Skills", Oxford University Press. 2011.
6. Central institute of English & Foreign Languages. "Exercises in Spoken English. Parts. I-III", Hyderabad. Oxford University Press.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1		H		M						L		
CO2		L		M						H		
CO3				M						H		
CO4		M								H		
CO5				L						H		M

20MEP03: WORKSHOP AND MANUFACTURING PRACTICES
(Common for all Branches)

Credits – 2 **Sessional Marks: 40**
L:T:P ::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Understand the basic knowledge of Workshop Practice and Safety.
2. Identify and use of different hand tools and other instruments like Hand Saw, Jack Plane, Chisels etc and operations like such as Marking, Cutting etc used in manufacturing processes.
3. Get hands on practice in various machining metal joining processes such as turning, facing, fitting , Soldering, etc.
4. Gain basic knowledge on Computer hardware and Software.

Course Outcomes

After successful completion of course the student should be able to

CO1. Gain basic knowledge of Workshop Practice and Safety useful for our daily living.
CO2.Identify Instruments of a pattern shop like Hand Saw, Jack Plain, Chisels etc and Performing Operations such as Marking, Cutting etc used in manufacturing.
CO3.Gain knowledge of the various operations in the Fitting Shop using Hack Saw, various files, Scriber etc., to understand the concept of tolerances applicable in all kind of manufacturing.
CO4.Known and identify the computer hardware, assembly and disassemble the CPU.
CO5.Obtain the knowledge to installation of software's for different applications.

TRADE 1: CARPENTARY

Wood sizing exercise in planning, marking, sawing, chiseling and grooving to prepare

1. Cross Lap Joint.
2. Bridle Tee Joint.

TRADE 2: FITTING

Marking, cutting and filing to practice

1. Square Fitting.
2. V Fitting.

TRADE 3: ELECTRICAL & ELECTRONICS

Safety rules and practices in wiring, basic circuits common house wiring connections such as

1. Identification of basic electrical and electronic components.
2. (a) Two-switches, two-bulbsinparallel connection.
   (b)Staircase connection.
3. Soldering process.

TRADE 4: MANUFACTURING PRACTICE ON LATHE

1. Facing operation
2. Straight turning and Chamfering.

TRADE 5: INFORMATION TECHNOLOGY

1. Assembly and disassembly of CPU and component identification.
2. Software installation.

Reference Books

1. K. Venkat Reddy, Workshop Manual, BS Publications
2. P.Kannaiah, K.L.Narayana -Work shop Manual -SciTech Publishers.
3. Jeyapoovan, SaravanaPandian-Engineering Practices Lab Manual -Vikas publishers

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H				M			L		M			H	M	
CO2	H	H	L							M			H	M	
CO3	H					M				M		L	M	M	
CO4	L	M			H					M			H	M	
CO5	H				L	M				M			H	M	

20ECP01: BASIC ELECTRONICS ENGINEERING LAB

Credits–1 **Sessional Marks:40**
L: T:P::0:0:2 **University ExamMarks:60**

Course Objectives

1. To provide Engineering skills by way of breadboard circuits with electronic devices and components.
2. To test and experimentally determine characteristics of electronic devices such as FET, PN diode, BJT &JFET.
3. To construct and measure different parameters of Rectifiers, Amplifiers and OP Amps.

Course Outcomes

After successful completion of the course the student should be able to
CO1. Plot the characteristics of electronic devices and determine their parameters.
CO2. Construct and test amplifiers, Rectifiers and oscillators.
CO3. Operate electronic test equipment.
CO4. Verify experimentally determined values with theoretical values.
CO5. Identify the applications of different Electronic Devices.

LIST OF EXPERIMENTS

1. Study ofCRO.
2. PN Junction DiodeCharacteristics
3. Half Wave Rectifier with and without Cfilter
4. Full Wave Rectifier with and without LCfilter
5. Bridge Rectifier with and without πfilter
6. Input and output Characteristics of BJT in CEconfiguration
7. CEamplifier
8. FETcharacteristics
9. FeedbackAmplifiers
10. RC phase shiftOscillator
11. OP-Ampapplications
12. OP Amp Comparator and AstableMultivibrator.

Note: A Minimum of 10 experiments have to be conducted.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H							L	L	L		H		
CO2			H	M					L	L	L			H	L
CO3		L	H	M					L	L	L		H	M	L
CO4		M	H						L	L	L		H		M
CO5		H	M	M					L	L	L	L	L		H

B.Tech
I Year II Semester

B.Tech I Year II Semester

S.No	Course Code	Course Title
1	20BST05	Engineering Mathematics – II
2	20BST02	Engineering Chemistry
3	20CST01	Programming for Problem Solving
4	20EET01	Basic Electrical Engineering
5	20BST13	Essence of Indian Knowledge Tradition
6	20BSP02	Engineering Chemistry Lab
7	20CSP01	Programming for Problem Solving Lab
8	20EEP01	Basic Electrical Engineering Lab
9	20MEP01	Engineering Graphics

20BST05: ENGINEERING MATHEMATICS – II

Credits - 4 **Sessional Marks: 30**
L: T: P :: 3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. Provides an introduction to Laplace Transforms
2. To Gain knowledge of matrices in a comprehensive manner and the convergence of series.
3. To Familiarize numerical methods for solving first-order IVPs
4. To introduce partial differential equations and make the student get acquainted with the basics of PDE.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define Laplace transforms, Rank, Eigen Values and Eigen vectors, absolute and Conditional convergence

CO2. Understand Convolution theorem, Linear Dependence and Independence, Convergence and Divergence of sequences and series, Basic concepts of formation of Partial differential equations.

CO3. Apply Laplace transforms to solve ordinary differential equations and use appropriate numerical method to solve algebraic, Transcendental equations, ordinary differential equations.

CO4. Determine the Laplace transforms of standard functions and evaluate a definite integral numerically and demonstrate that any square matrix satisfy its characteristic polynomial and evaluate its minimal polynomial

CO5. Derive one – dimensional wave equation, Heat equation and Laplace equation

UNIT I

Laplace Transforms: Laplace transforms of standard functions, Transform of Periodic functions, Step function, Inverse transforms of derivatives and integrals, Convolution theorem, applications to solutions of ordinary differential equations.

UNIT II

Matrices: Rank, solution of system of linear equations, Eigen values, Eigen vectors, Cayley Hamilton theorem, Quadratic forms – Diagonalization.

Sequences and Series: Convergence and Divergence, Ratio test, Comparison test, Absolute and Conditional Convergence.

UNIT III

Partial Differential Equations: Formation of PDEs by elimination of arbitrary constants and arbitrary functions, Method of separation of variables, one dimensional wave equation, heat equation, Laplace equation.

UNIT IV

Solution of Algebraic and Transcendental Equations: The Bisection Method – The Method of False Position– Newton-Raphson Method, Solution of linear simultaneous equation by Gauss elimination method, Gauss matrix and Gauss – Seidal iteration method.

Interpolation: Newton's forward and backward interpolation formulae – Lagrange's formulae.

UNIT V

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule.

Numerical solution of Ordinary Differential equations

Solution by Taylor's series-Picard's Method of successive Approximations-Euler's Method, Runge-Kutta Methods, Predictor-Corrector Method-Milne's Method.

Text books

1. Grewal, B.S. Higher Engineering Mathematics, Khanna Publishers, 42nd Edition.

Reference Books

1. T.K.V.Iyengar & B.Krishna Gandhi et., "Engineering Mathematics –I, II"; S. Chand & Company.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M			L							
CO2	M	H			L							
CO3	H	L			M							
CO4	H	M			M							
CO5	M	H			L							

20BST02: ENGINEERING CHEMISTRY

Credits – 4 **Sessional Marks: 30**
L: T: P::3: 1: 0 **University Exam Marks: 70**

Course Objectives

1. To impart in-depth knowledge of the subject and highlight the role of chemistry in the field of engineering.
2. To strengthen the fundamentals of chemistry in Atomic Structure and then build an interface of theoretical concepts with the engineering applications.
3. To help students understand the fundamental concepts and achieve Advanced Knowledge about the interactions of Spectroscopy and solve problems related to them. An attempt has been made to logically correlate the topic with its application.
4. To Implement the concepts of chemistry in respect of Electrochemical cells, Thermodynamic process, mechanism of corrosion and factors to influence, polymers with their applications and analytical methods.
5. To understand the upcoming technologies like Fullerenes, carbonnanotubes, applications of Telecommunications in Nano materials.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Explain the basic concepts of Atomic and Molecular structures and the band theory of solids.
CO2. Solve problems related to the structure , purity and to study Molecular interactions by Spectroscopic methods
CO3. Apply knowledge of Substitute metals with Conducting polymers and also produce Bio-degradable polymers to reduce Environmental Pollution
CO4. Understand the mechanism of Electro Chemical corrosion of metals ,use of appropriate design criteria and apply corrosion protection techniques.
CO5. Give idea of synthesis, characterisation of Nanomaterials and applications of latest technology on Carbon Nano wires and medicinal applications.

UNIT I

Atomic and molecular structure: Schrodinger equation. Particle in a box solutions and their applications for conjugatedmolecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots ofthese functions to explore their spatial variations.Molecular orbitals of diatomic moleculesand plots of the multicentre orbitals.Equations for atomic and molecular orbitals. Energylevel diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity.Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties.Band structure of solids and the role of doping on band structures.

UNIT II

Spectroscopic techniques, applications and Organic reactions and synthesis of a drug molecule: Principles of spectroscopy and selection rules. Electronic spectroscopy.Fluorescence and itsapplications in medicine.Vibrational and rotational spectroscopy of diatomic molecules.Applications.Nuclear magnetic resonance and magnetic resonance imaging, surfacecharacterization techniques.Diffraction and scattering. Introduction to reactions involving substitution, addition, elimination, oxidation, reduction,cyclization and ring openings. Synthesis of a commonly used drug molecule.

UNIT III

Polymers: Mechanism of polymerization and synthesis of polymers. Molecular weight, shape and conformation of polymers. Crystallinity, melting point and glass transition. Copolymerization. Viscoelasticity. Elastomers-structure, applications and curing. Conducting polymers and applications.Dendrimers.Solubility of polymers. Fabrication and moulding of polymers. Synthesis, properties and uses of PE, PVC, PMMA, formaldehyde resins, melamine-formaldehyde-urea resins. Adhesives, adhesive mechanism and applications. Composites: characteristics, types and applications. Nanocomposites.Metallic and nonmetallic fillers.

UNIT IV

Surfactants and Lubricants and Corrosion: Methods of preparation, cleaning mechanism. Critical micelle concentration and itsdetermination.Hydrophobic and hydrophilic interactions. Micelles and reverse micelles.Detergents. Fricohesity of surfactants.Lubricants-physical and chemical properties, typesand mechanism of lubrication.Additives of lubricants and freezing points of lubricants.Thermodynamic overview of electrochemical processes. Reversible and irreversible cells.Chemical and electrochemical corrosion and mechanism of corrosion. Factors affecting corrosion.Protection of corrosion and practical problems of corrosion.

UNIT V

New Materials/Nanomaterials: Nanomaterials. Properties and application of fullerenes, fullerols, carbon nanotubes andnanowires.Synthesis-top down and bottom up approaches.Nanoelectronics.Applications ofnanomaterials in catalysis, telecommunication and medicine.

Text Books

1. Jain and Jain "Engineering Chemistry",15th Edition, Dhanapat rai publishing company.
2. K.N.Jayaveera, G.V.Subba Reddy, C.Ramachandraiah."Engineering Chemistry", 1st Edition, McGraw Hill Education (India) Private Limited,2013.

Reference Books

1. Jag Mohan, "Organic Spectroscopy",2nd Edition ,Narosa Publishing house,2007.
2. V.K.Ahluwalia and Rakesh kumar Parashar."Organic Reaction Mechanisms",3rd Edition,Narosa Publishing House,2007.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M										
CO2		H	L		H							
CO3					M	H	H					
CO4			H			H	L					
CO5					H		M			H		

20CST01: PROGRAMMING FOR PROBLEM SOLVING

Credits–3 **Sessional Marks: 30**
L:T:P::2:1:0 **University Exam Marks:70**

Course Objectives

To expose the students to the following:

1. Basic concepts of computer.
2. Variables, C-Tokens and operators, functions, arrays and strings.
3. Pointers, structures, unions andfiles.
4. Write algorithms for solving problems with help of C programmingconcepts.

Course Outcomes

After successful completion of course the student should be able to

CO1. Analyse the real time problems, develop algorithms to solve it

CO2. Use conditional branching, iteration, recursion, arrays, pointers and structures to formulate algorithms and programs in C.

CO3. Design and implement the complex problems using functions

CO4. Understanding Pointers and dynamic memory allocation

CO5. Apply the knowledge of files in different applications

UNIT I

Introduction to Problem Solving: Introduction to Computer Systems, Computer Environments, Computer Languages, Problem Solving Aspects, Top-Down Design, Bottom-Up Design, Development of Algorithms, Representation of Algorithm, Flow Chart, Pseudo Code, Coding, Testing and Debugging.

UNIT II

Introduction to C: History of C programming Language, Structure of a C program - Comments, pre-processor statements, function header statements, variable declaration statements and executable statements. C character set, C tokens-constants, identifiers, operators, punctuations and keywords. Basic data types, modifiers, identifiers, variables, C Scopes, Type qualifiers, Storage Class Specifiers, variable initializations and constants. Console I/O: Reading and writing characters, Formatted console I/O. Operators: Assignment, Arithmetic, Relational, Logical, Bitwise, Ternary, Address, Increment/Decrement, special Operators. Expressions: Precedence of operators and associativity. Category of Statements: Decision Making, Branching and Looping statements.

UNITIII

Functions: Declaration, Prototype definition, calling by value and address, Standard Library Functions, User Defined functions, RecursiveFunctions.

Arrays and strings: Declaration, Initialization, Reading and Writing, Accessing, and Passing as a parameter to functions, Types of arrays, String functions.

UNIT IV

Pointers: Pointer expressions, pointer and arrays, multiple indirection, initializing pointers, pointers to functions, Dynamic memory allocation functions.

Structures: Declaration, initialization, accessing, array of structures and passing structures to functions, structure pointers, arrays and structures within structures, Unions, Bit-fields, typedef, and enumerations.

UNIT V

Files: I/O and processing operations on Text and binary files, Pre-processor directives and Command Line Arguments.

Text Books

1. Brian W.Kernighan and Dennis M. Ritchie, "The C Programming Language", 2nd Edition, Prentice Hall of India, 2018.

Reference Books

1. Herbert Schildt, "C: The Complete Reference", 4th Edition, Tata McGraw-Hill,2000.
2. E Balagurusamy, "Programming in ANSI C", 7th Edition, Tata McGraw-Hill,2016.
3. YeswanthKanitkar, "Let us C", 9th Edition, BPB Publications,2012.

Web References

1. https://nptel.ac.in/courses/106/105/106105171/

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	-	H	H	M	-	-	-	-	-	-	-	-	H	H	-
CO2	H	M	M	-	M	-	-	-	-	-	-	-	H	H	-
CO3	-	M	H	M	M	-	-	-	-	-	-	-	H	H	-
CO4	H	L	-	-	-	-	-	-	-	-	-	-	H	L	-
CO5	H	-	-	L	M	-	-	-	-	-	-	-	H	H	-

20EET01: BASIC ELECTRICAL ENGINEERING
(Common for CSE, ME & ECE Branches)

Credits - 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To impart basic knowledge of electrical quantities such as current, voltage, power and energy and analysis
Techniques in electrical engineering.
2. To provide knowledge on magnetic circuits.
3. To familiarize with the ac circuits.
4. To introduce Network theorems to determine circuit response.
5. To Know the Construction and Principle of Operation of DC Generators, DC Motors, Transformers, single phase and three phase Induction motors.

Course Outcomes

After completion of the course the student will be able to

CO1. Apply the concepts of basic laws and calculate the fundamental quantities in DC circuits.
CO2. Explain the basic concepts of electromagnetism, types of induced emf, self and mutual Inductances.
CO3. Understand the basic definitions, Analyze and apply the phasor algebra approach in R, L, C series and parallel AC circuits.
CO4. Analyze the various Network theorems to determine circuit response
CO5. Describe the principle of operation, Types and construction of DC generators, DC motors, Transformers, Single & three phase induction motors.

UNIT I

DC Circuits: Active and passive elements – Ideal and practical sources –V –I Characteristics of R.L and C elements – Kirchhoff's laws, Mesh and nodal analysis – Concept of super mesh and super node.
Magnetic Circuits: Basic definitions, Analogy between electric and magnetic circuits, magnetization characteristics of ferromagnetic materials, self inductance, mutual inductance, energy in linear magnetic systems, coils connected in series attracting force of electro magnets. Concept of coupling and dot convention.

UNIT II

AC Circuits: Principle of AC voltages, wave forms and basic definitions, relationship between frequency, speed and number of poles, root mean square and average values of alternating current and voltage, form factor and peak factor, phasor representation of Alternating Quantities, the j operator and phasor algebra, analysis of AC circuits with single basic network element, single phase series circuits, single phase parallel circuits, single phase series parallel circuits, power in AC circuits.

UNIT III

Network Theorems: Super position theorem, Thevenin's& Norton's theorem, Maximum power transfer theorems, Tellegan's Theorem, Millman's Theorem and problems.

UNIT IV

Transformers:
Principle of operation, constructional details, ideal transformer, and practical transformer, losses, transformer testing, efficiency, and regulation calculations (all the above topics are elementary treatment and simple problems).

Direct Current Machines: principle of operation of DC machines, armature windings, EMF equation in DC machines, torque production in a DC machine, operation of a DC machine as a generator, operation of a DC machine as a motor , losses and efficiency.

UNIT-V

A.C Machines

Single Phase Induction Motor: principle of operation, types of single phase induction motor and working.

Three Phase Induction Motor: principle of operation, production of rotating magnetic field, slip and rotor frequency, torque (simple problems), losses and efficiency.

Text Books

1. M.S Naidu and S.Kamakshaiah, "Basic Electrical Engineering", 2nd Edition, Tata McGraw – Hill, 2008
2. T.K.Nagsarkar and M.S.Sukhija, "Basic Electrical Engineering", 2nd Edition, Oxford University press, 2017.

Reference Books

1. D.P.Kothari & I.J.Nagrath,"Theory and Problems of Basic Electrical Engineering", 2nd Edition, PHI, 2017.
2. V.K.Mehta, "Principles of Electrical Engineering" Revised Edition, S.Chand publications, 2010
3. David V.Kems, JRJ.David "Essentials of Electrical and computer engineering", United States Edition, Irwin Pearson, 2004

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2	PSO 3
CO 1	H	-	-	-	M	-	-	-	-	M	-	-	L	H	-
CO 2	H	-	-	-	-	-	-	-	-	M	-	-	L	M	-
CO 3	M	H	-	-	L	-	-	-	-	M	-	-	L	M	-
CO 4	M	-	-	-	H	-	-	-	-	M	-	-	L	M	-
CO 5	H	L	H	-	-	-	-	-	-	M	-	-	L	M	-

20BST13: ESSENCE OF INDIAN KNOWLEDGE TRADITION

Credits – No credits
L:T:P::3:0:0

Course Objectives

1. To impart basic principles of thought process, reasoning and inferencing. Sustainability is at the core of Indian Traditional knowledge systems connecting society and nature.
2. To impart holistic life style of Yogic-science and wisdom capsules in Sanskrit literature are also important in modern society with rapid technological advancements and societal disruptions.
3. To focus on introduction to Indian knowledge System, Indian perspective of modern scientific world-view and basic principles of Yoga and holistic health care system.
4. To focuses on Indian Philosophical traditions, Indian linguistic Tradition and Indian artistic tradition.

Course Outcomes

After successful completion of course the student should be able to

CO1. The student will be able to understand, connect up and explain basics of Indian Traditional knowledge in modern scientific perspective.

UNIT I

The basic structures of Indian knowledge system: Vedas – vedangas, Upavedas – Ayurveda, Dhanurveda, Gandharvaveda, Vedic gods – Agni, Indra, Varuna, Vishnu, Importance of the study of the vedic hymns.

UNIT II

Modern sciences and Indian knowledge system: Vedic cosmology, Indian atomic theory, Matter life and Mind –Sri Aurobindo .

UNIT III

Yoga and Holistic Health Care: Mind and its Modes, Afflictions, Threefold pain, Dispositions, Levels of Attention ,
Astanga Yoga.

UNIT IV

Indian Philosophical Tradition: Asatika darshanas - Nyaya, Vaisesika, Sankhya, Yoga, Mimamsa, Vendanta. Nastika darshanas – Carvaka, Jaina Buddhism

UNIT V

Indian Linguistic and Aristic Tradition: Phonology - (sabda), Morphology (pada), syntax (vakya), Semantics,Vakhyartha, Chitrakala, Murthikala, vasthukala

Reference Books

1. S. Radha Krishna , Indian Philosophy ,Oxford Indian Paper backs, New Delhi.
2. V.SivaramaKrishnan (Ed.), Cultural Heritage of Indian - course material , Bharatiya Vidya Bhavan ,Mumbai. 5th Edition, 2014
3. Smami Jitatmanand , Modern Physics and Vedant , Bhartiya Vidya Bhavan.
4. Smami Jitatamanad , Holistic Science and Vedant , Bhartiya Vidya Bhavan.
5. Fritz of capra ,Tao of Physics.
6. Fritz of capra ,The Wave of Life
7. VN Jha (Eng. Trans.), Tarkasangraha of Annam Bhatta , International Chinmay Foundation ,Velliarnad,Arnakulam .
8. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkata .
9. GN Jha (Eng. Trans.), Ed. RN Jha , Yoga-darshanam with Vyasa Bhashya, Vidyanidhi Prakashan , Delhi 2016.
10. RN Jha, Science of Consciousness Psychotherapyand Yoga Practices, Vidyanidhi Prakashan ,Delhi 2016
11. PB Sharma (English translation), Shodashang Hridayan .

20BSP02: ENGINEERING CHEMISTRY LAB

Credits – 1 **Sessional Mark: 40**
L: T: P::0: 0: 2 **University Exam Marks: 60**

Course Objectives

1. To impart practical knowledge about some practical phenomena they have studied in the engineering Chemistry course.
2. To develop the experimental skills of the students.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Understand the estimation of the acidity of water ,Dissolved Oxygen in different water samples, estimation of chloride content of water and some ions etc.

CO2.Analyse and to measure the conductance and redox potentials of different solutions.

CO3.Develop knowledge pertaining to the appropriate selection of instruments for the successful analysis of complex mixture.

CO4.Apply the knowledge of various aspects of synthesis of drug

LIST OF EXPERIMENTS
(Minimum Seven are mandatory)

1. To determine the strength of KMnO4 solution by titrating it against a standard solution of Oxalic acid.
2. Determination of hardness of water by EDTA method.
3. Estimation of acidity of Water.
4. Estimation of Dissolved oxygen in water sample.
5. Determination of Iron by using potassium dichromate.
6. Estimation of copper by EDTA method.
7. Estimation of chloride in water sample.
8. Conductometric titration of strong acid with strong base.
9. Potentiometric titration of Iron by dichrometry method.
10. Colorimetric estimation of manganese
11. Synthesis of a polymer/ drug.
12. Thin layer chromatography.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H											
CO2		H										
CO3					H							
CO4						H						

20CSP01: PROGRAMMING FOR PROBLEM SOLVING LAB

Credits – 2 **Sessional Marks: 30**
L:T:P::0:0:4 **University Exam Marks: 70**

List of Experiments

1. Write a C program to display "Hello Computer" on the screen.
2. Write a C program to display Your Name, Address and City in different lines.
3. Write a C program to find the area of a circle
4. Write a C program to convert centigrade into Fahrenheit. Formula: C= (F*32)/1.8.
5. Write a C program to read in a three-digit number produce following output (assuming that the input is 347) 3 hundreds 4 tens 7 units
6. Write a C program to read in two integers and display one as a percentage of the other. Typically, your output should look like 20 is 50.00% of 40 assuming that the input numbers were 20 and 40. Display the percentage correct to 2 decimal places.
7. Write a C program to swap variable values of i and j.
8. Write the program for the simple, compound interest.
9. Write a C program to find the maximum from given three nos.
10. Write a C program to find that the accepted no is Negative, Positive or Zero.
11. Write a program which reads two integer values. If the first is lesser print the message up. If the second is lesser, print the message down if they are equal, print the message equal if there is an error reading the data, print a message containing the word Error
12. Given as input three integers representing a date as day, month, year, print the number day, month and year for the next day's date. Typical input: “28 2 1992” Typical output: “Date following 28:02:1992 is 01:03:1992”
13. Write program for students marks grading.
14. Take three coefficients (a, b, and c) of a Quadratic equation ($ax^2+bx+c=0$) as input and compute all possible roots. Implement a C program to output the possible roots for a given set of coefficients with appropriate messages.
15. Implement a C program that takes an integer number as input, check whether it is PALINDROME or NOT and output the reverse of the same with suitable messages. Ex: Num: 2014, Reverse: 4102, Not a Palindrome.
16. Implement a C program to find the square root of a given number N and execute for all possible inputs with appropriate messages. Note: Don’t use library function sqrt(n).
17. Design and develop a C program to read a year as an input and find whether it is leap year or not. Also consider end of the centuries.
18. Design and develop a C function RightShift(x, n) that takes two integers x and n as input and returns value of the integer x rotated to the right by n positions. Assume the integers are unsigned. Write a C program that invokes this function with different values for x and n and tabulate the results with suitable headings.
19. Design and develop a C function isprime (num) that accepts an integer argument and returns 1 if the argument is prime, a 0 otherwise. Write a C program that invokes this function to generate prime numbers between the given range.
20. Write a C program for the problem given below: Assume that the United States of America uses the following income tax code formula for their annual income: First US$ 5000 of income: 0% tax Next US$ 10,000 of income: 10% tax Next US$ 20,000 of income: 15% tax. An amount above US$ 35,000: 20% tax. For example, somebody earning US$ 38,000 annually would owe US$ 5000 X 0.00 + 10,000 X 0.10 + 20,000 X 0.15 + 3,000 X 0.20, which comes to US$ 4600. Write a program that uses a loop to input the income and calculate and report the owed tax amount. Make sure that your calculation is mathematically accurate and that truncation errors are eliminated.
21. Write a C program to convert decimal to binary.
22. Write a C program to convert decimal to octal.

23. Write a C program to convert decimal to hexadecimal.
24. Write a C program that reads in integers until a 0 is entered. If it encounters 0 as input, then it should display:
    a. The total number of even and odd integers
    b. Average value of even integers
    c. Average value of odd integers.

Note: Use switch statement for selection.

25. Write an interactive program to generate the divisors of a given integer.
26. Write a program to find all Armstrong number in the range of 0 and 999 Hint: An Armstrong number of three digits is an integer such that the sum of the cubes of its digits is equal to the number itself. For example, 371 is an Armstrong number since 3**3 + 7**3 + 1**3 = 371.
27. Write a program to check whether a given number is a perfect number or not. Hint: A positive integer n is called a perfect number if it is equal to the sum of all of its positive divisors, excluding n itself. For example, 6 is a perfect number, because 1, 2 and 3 are its proper positive divisors and 1 + 2 + 3 = 6. The next perfect number is 28 = 1 + 2 + 4 + 7 + 14. The next perfect numbers are 496 and 8128.
28. Write a program to check whether given two numbers are amicable numbers or not. Hint: Amicable numbers are two numbers so related that the sum of the proper divisors of the one is equal to the other, unity being considered as a proper divisor but not the number itself. Such a pair is (220,284); for the proper divisors of 220 are 1, 2, 4, 5, 10, 11, 20, 22, 44, 55 and 110, of which the sum is 284; and the proper divisors of 284 are 1, 2, 4, 71, and 142, of which the sum is 220.
29. Write a program that will take as input a set of integers and find and display the largest and the smallest values within the input data values.
30. Write a C program that uses functions to perform the following operations: i. To insert a sub-string in to a given main string from a given position. ii. To delete n Characters from a given position in a given string.
31. Write a C program to do the following computation by providing the option using the switch statement:
    a. Add two matrices
    b. Subtract two matrices
    c. Multiply two matrices
32. Write a program to check if the given matrix is magic square or not.
33. Write a program print the upper and lower triangle of the matrix.
34. Write a program to compute transpose of a matrix.
35. Write a program to find the inverse of a matrix.
36. Using recursion, (i) Find the factorial of a number (ii) Find Greatest Common Divisor (GCD) of two numbers (iii) To generate Fibonacci sequence (iv) Reverse ‘n’ characters.
37. Write a C program to convert a Roman numeral to its decimal equivalent.
38. Write a program to convert a given lowercase string to upper case string without using the inbuilt string function.
39. Write a program to count number of vowels, consonants and spaces in a given string.
40. Define a structure that will hold the data for a complex number. Using this structure, please write a program that will input two complex numbers and output the multiple of the two complex numbers. Use double variables to represent complex number components. Note: A complex number z is a number of the form z = a + bi where a and b are real numbers. The term a is called the real part of z and b is called the imaginary part of z. The multiplication operation on complex numbers is defined as: (a + bi) * (c + di) = (ac - bd) + (ad + bc)i
41. Write a function that will return the length of a character string. You are not allowed to use the strlen C library function. Note: Use “Pointers” concept
42. Write a function that returns the minimum and the maximum value in an array of integers.
43. Write a C program to merge two files into a third file (i.e., the contents of the first file followed by those of the second are put in the third file)
44. Write a program that prompts the user the name of a file and then counts and displays the number of bytes in the file. And create a duplicate file with the word ‘.backup’ appended to the file name.

Please check whether file was successfully opened, and display an error message, if not.

45. Write a program to create a file, open it, type-in some characters and count the number of characters in a file.
46. Write a program that will input a person's first name, last name, SSN number and age and write the information to a data file. One person's information should be in a single line. Use the function fprintf to write to the data file. Accept the information and write the data within a loop. Your program should exit the loop when the word 'EXIT' is entered for the first name. Remember to close the file before terminating the program. Hint: Use the function strcmp() to compare two strings.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H	H	L	M	-	-	L	-	-	-	-	M	H	L
CO2	H	L	L	-	-	-	-	L	-	-	-	-	M	H	L
CO3	M	L	-	M	L	-	-	L	-	L	-	-	M	H	L
CO4	-	H	L	-	L	-	-	L	-	-	-	-	M	H	L
CO5	-	-	M	-	L	-	-	L	-	-	-	-	M	H	L

20EEP01: BASIC ELECTRICAL ENGINEERING LAB

Credits – 1 **Sessional Mark: 40**
(L: T: P: 0:0:2) **University Practical Exam Marks: 60**

Course Objectives:
1. To provide hands on experience to the students so that they are able to put theoretical concepts to practice.
2. To find the circuit response using KVL, KCL and various network theorems.
3. To conduct OC and SC test on single phase transformer.
4. To learn about various test conditions on DC shunt motor

Course Outcomes:
After completion of the course the student will able to
CO1. Apply suitable theorems for circuit analysis and verify the results theoretically.
CO2. Experimentally determine self inductance, mutual inductance and coefficient of coupling
CO3. Analyze the performance of DC shunt motor, single phase transformer.
CO4. Verify KVL and KCL in a series and parallel resistive network.
CO5. Draw current locus diagrams

LIST OF EXPERIMENTS

1. Verification of KVL and KCL in a series and parallel resistive network.
2. Determination of coefficient of coupling of a coupled circuit.
3. Verification of Superposition Theorem.
4. Verification of Thevenin's Theorem.
5. Verification Norton's Theorem.
6. Verification of Maximum power transfer theorem with DC source.
7. Verification of Millman's Theorem
8. OC and SC test on single phase transformer.
9. Brake test on DC shunt motor.
10. Swinburne's tests on DC shunt motor.

Course Outcome-Program Outcome- Program Specific Outcomes (CO-PO-PSO) Mapping:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	PSO1	PSO 2	PSO 3
CO 1	M	H	M	-	-	-	-	-	-	M	-	L	H	M	-
CO 2	M	H	M	M	-	-	-	-	-	M	-	-	M	H	-
CO 3	M	H	M	M	-	-	-	-	-	M	-	-	M	H	-
CO 4	H	M	M	M	-	-	-	-	-	M	-	-	H	H	-
CO 5	H	H	M	-	-	-	-	-	-	M	-	-	-	H	-

20MEP01: ENGINEERING GRAPHICS
(Common to all branches)

Credits – 3 **Sessional Marks: 40**
L: T: P:: 0:0:6 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Develop the graphic skills for communication of concepts, ideas and design of engineering products.
2. Expose them to existing national standards related to technical drawings.
3. Develop skills in three-dimensional visualization of engineering component.
4. Learn sketching and taking field dimensions.
5. Take data and transform it into graphic drawings.
6. Learn basic engineering drawing formats, basic AutoCAD skills & draw 2D drawings in Auto CAD.

Course Outcomes

After successful completion of course the student should be able to

CO1. Prepare drawings as per standards.
CO2. Solve specific geometrical problems in plane geometry involving lines, plane figures and special Curves.
CO3. Produce orthographic projection of engineering components working from pictorial drawings.
CO4. Student's ability to perform basic sketching techniques will improve.
CO5. Students will be able to draw projections and sections, ability to produce engineered drawings will improve, will become familiar with Auto-CAD two-dimensional practice and standards.
CO6. Students will develop good communication skills and teamwork.

Part A

Introduction to Engineering Drawing: Principles of Engineering Graphics and their Significance, Dimensioning principles, Conventions in Drawing.
Conics Sections: Ellipse - Eccentricity method, Arcs of circles Method, Oblong method and Four Center Method;
Parabola - Eccentricity method, Rectangular method, Tangent method.
Hyperbola - Eccentricity method, Rectangular Hyperbola.

Principles of Projections: Principles of Orthographic Projections and Conventions.
Projection of Points, Projection of Lines (first angle projection only) inclined to both planes.

Projections of Planes: Projections of regular Planes (Triangle, Square, Rectangle, Pentagon, Hexagon and Circle) in simple position, inclined to both the planes.

Part B (Using AutoCAD)

Projections of Solids: Projections of right regular solids (Cube, Prism, Pyramid) in simple position, inclined to both the planes.
Isometric Projections: Isometric projection of right regular solids (Cube, Prism, Pyramid, Sphere). Conversion of given isometric views to orthographic views of simple objects.

Text Books

1. N.D. Bhat / Charotar, “Engineering Drawing”, New edition.
2. K.L. Narayana and Kannaiah, “Engineering Drawing”, Scitech Publishers.

Reference Books

1. Venugopal K, “Engineering Drawing and Graphics”, New Age International.
2. P.J. Shah, “Engineering drawing’, S. Chand.
3. Johle, “Engineering Drawing’, Tata McGraw Hill.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H									M			H		
CO2		H	L							M			H	M	
CO3		L	M	H						M				H	
CO4	H									M			H	M	
CO5			M	H	L					M				M	
CO6					L				H	M			H		

B.Tech
II Year I Semester

B.Tech II Year I Semester

S.No	Course Code	Course Title
1	20BST08	Economics & Accountancy
2	20MET02	Engineering Mechanics
3	20MET01	Basic Thermodynamics
4	20MET03	Material Science and Metallurgy
5	20MET04	Machine Tools & Manufacturing Technology
6	20BST16	Universal Human values & Ethics
7	20MEP02	Advanced Engineering Graphics
8	20MEP04	Manufacturing Technology lab
9	20MES01	Skill Oriented Course 1

20BST08: ECONOMICS & ACCOUNTANCY

Credits – 4 **Sessional Marks: 30**
L:T:P::3:1:0 **University Exam Marks: 70**

Course Objectives

1. To impart in-depth knowledge of the subject and highlights the role of the economics, finance & accountancy in the field of engineering.
2. To strengthen the fundamentals of demand analysis & production function.
3. To estimate demand, price-output in different market structures.
4. To select the different investment alternatives
5. To know the financial position of the companies

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define law of demand, assumption, production function & different types of costs
CO2. Apply demand forecasting techniques & BEP for estimation of demand & production
CO3. Identify the price-output in different competitions
CO4. Determine the feasible investment alternative.
CO5. Analyse the financial position of the company through ratio analysis.

UNIT I

Introduction to Economics: Economics – Micro & Macro Economics – Definitions - Significance & Limitations. Demand Analysis: Law of Demand, Demand Determinants. Elasticity of Demand: Definition, Types and Demand Forecasting methods.

UNIT II

Theory of Production: Firm and Industry – Production Function – Cobb Douglas Production function – Laws of returns – internal and external economies of scale. Break-Even Analysis: Concept of Break-even point (BEP) – Significance of BEP – Limitation - Assumptions - Break-even chart – Determination of BEP in volume and value (Simple problems).

UNIT III

Cost Analysis: Cost concepts, Fixed Vs Variable costs, explicit Vs implicit costs, Out-of-pocket costs Vs imputed costs and Opportunity cost. Introduction to Markets, Market structure, types of competition, features of Perfect competition, Monopoly, Monopolistic competition – Price output determination.

UNIT IV

Fundamentals of finance and Capital Budgeting: Capital and its significance – Types of Capital, Estimation of Fixed and Working Capital, requirements and methods of raising capital. Capital Budgeting Methods: Pay back method, Accounting Rate of Return (ARR) and Net Present Value (NPV) and IRR methods (Simple Problems).

UNIT V

Introduction to Financial Accounting and Financial Analysis: Double Entry Book Keeping – Journal, Ledger, Trial Balance, Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments. Ratio Analysis: Computation of Liquidity ratios (Current ratio and quick ratio), Activity Ratios (Inventory Turnover ratio, Debtors Turnover ratio) Capital Structure Ratios (Debt-equity Ratio and Interest Coverage ratio) and Profitability Ratios (Gross Profit ratio, Net Profit Ratio, Operating Ratio, P/E Ratio and EPS) Analysis and interpretation.

Text Books

1. Joel Dean, Managerial Economics, PHI 2001
2. James C. Van Home, Financial Management Policy
3. I.M. Pandy, Financial Management, PHI

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1			**H**								**M**	**L**
CO2				**M**	**H**							**L**
CO3			**L**								**M**	
CO4				**L**	**M**						**H**	**L**
CO5				**M**							**H**	**L**

20MET02: ENGINEERING MECHANICS

Credits – 4 **Sessional Marks: 30**
L:T:P :: 3:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the basic knowledge in mechanics in the areas of applied engineering.
2. Develop the skills in the areas of forces and their effects, concept of free body diagram.
3. They will be able to analyze forces in various systems such as frames, trusses and beams.

Course Outcomes

After successful completion of course the student should be able to

CO1. Determine the resultant force and moment for a given system of forces.
CO2. Comprehend the effect of friction on general plane motion.
CO3. Analyze planar and spatial systems to determine the forces in members of trusses, frames and problems related to friction.
CO4. Illustrate the laws of motion kinematics of motion and their relationship.
CO5. Determine the centroid and second moment of inertia.

UNIT I

Introduction to Engineering Mechanics – Basic concepts - System of Forces – Moment of Forces and its Application – Couples and Resultant of Force System – Equilibrium of System of Forces - Degrees of Freedom – Free body diagrams –Types of Supports – Support reactions for beams with different types of loading – concentrated, uniformly distributed and uniformly varying loading.

UNIT II

Friction : Types of friction– laws of Friction – Limiting friction- Cone of limiting friction– static and Dynamic Frictions – Motion of bodies – Wedge and Screw jack

UNITIII

Centroid and Center of Gravity: Centroids of simple figures – Centroids of Composite figures – Centre of Gravity of bodies – Area moment of Inertia - Parallel axis and perpendicular axis theorems - Moments of Inertia of Composite Figures.

Mass Moment of Inertia: Moment of Inertia of Simple solids – Moment of Inertia of composite masses. (Simple problems only)

UNIT IV

Analysis of Perfect Frames: Types of frames – cantilever frames and simply supported frames – Analysis of frames using method of joints, method of sections for vertical loads, horizontal loads and inclined loads.

UNIT V

Kinematics: Rectilinear and Curvilinear motion – Velocity and Acceleration – Motion of a RigidBody – Types and their Analysis in Planar Motion.

Kinetics: Analysis as a particle and Analysis as a Rigid Body in Translation – Central Forces of motion – Equations of Plane Motion – Fixed Axis Rotation – Rolling Bodies

Text Books

1. Vijay Kumar Reddy, Suresh Kumar, Singer's, "Engineering Mechanics Statics and Dynamics", BS Publications 2015
2. B. Bhattacharyya, "Engineering Mechanics",Oxford University Publications, 2015

References Books

1. Jayakumar, “Engineering Mechanics” Kumar, PHI, 2014
2. D.S. Kumar, “Engineering Mechanics”, 3rd Edition, S.K. KATARIA & SONS.
3. J L Meriam, L G Kraige, “Engineering Mechanics: Statics”, 6th Edition, Wiley India Pvt. Ltd, 2010.
4. Bhavikatti .S .S,“A Textbook of Engineering Mechanics” 3rd Edition, New Age International, 2016.
5. Dr. R. K. Bansal, “Engineering Mechanics”, 4th Edition, Laxmi Publications, 2011.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	L	H				L			M			H	M	
CO2	M	H	L				M			M		L	M	H	M
CO3	H	L	M				M			M		L	M	L	L
CO4	M	L	M	H			L			M		L	L	H	
CO5	M	H	L	L			M			M		L	M	H	M

20MET01: BASIC THERMODYNAMICS

Credits – 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Principles of classical thermodynamics and develops understanding of mass, energy, heat, work, efficiency, ideal and real thermodynamic cycles and processes.
2. Demonstrate first and second laws of thermodynamics, perfect gas law, properties of real gases, and the general energy equation for closed and open systems.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand fundamental thermodynamic properties.
CO2. Derive and discuss the first and second laws of thermodynamics.
CO3. Solve problems for flow & non-flow processes using the properties and relationships of thermodynamics.
CO4. Know the new concept of Entropy and its importance.
CO5. Analyze basic thermodynamic cycles.

UNIT I

Basic Concepts: Scope of Thermodynamics – Macroscopic and Microscopic properties thermodynamic system – Control Volume – Thermodynamic Properties – Processes and cycles – Thermodynamic Equilibrium – Quasi static process – Zeroth Law of Thermo dynamics –Work transfer – pdv work.

First Law of Thermodynamics: Energy – Different forms of stored energy – closed systems and steady flow systems – First law applied to flow process.

UNIT II

Properties of pure substances: Thermodynamic properties of pure substances in solid, liquid and vapor phases; P-V-T behavior of simple compressible substances – Equations of state- Laws of real gases- Boyle's Law – Charles Law –Avogadro's Law – Joule's Law –Vander Waal's equation-Gibbs phase rule – generalized compressibility factor-Throttling-Joule-Thomson coefficient.

UNIT III

First Law applied to non-flow Processes: Constant volume – Constant Pressure – Isothermal-Hyperbolic – Adiabatic – free expansion and polytrophic processes.

Second Law of Thermodynamics: Limitations of first law – Heat engines– Kelvin Planks statement of second law – Clausius inequality – refrigeration and heat pump reversibility and irreversibility – Carnot cycle – Reversible heat engine – Carnot Theorem.

UNIT IV

Entropy and availability: Claussiu's theorem – The property of entropy –Principle of increase of entropy – Entropy changes in various thermodynamic processes.

Availability: Availability energy referred to a cycle – The Helmholtz function and Gibb's functions – Tds equations –Joule's Kelvin effect – Claussius –Clapeyron equation.

UNIT V

Air standard cycles: Carnot cycle – Stirling cycle – Eriksson cycle – Otto cycle – Diesel cycle – Duel cycle – Comparison of cycles – Brayton cycle-problems.

Text Books

1. P.K Nag, “Engineering Thermodynamics”, Tata McGraw Hill Publishers.
2. P. Chattopadhya, “Engineering Thermodynamics”, Oxford.

Reference Books

1. YunusCengel& Boles, “Thermodynamics, An Engineering Approach”, Tata McGraw Hill.
2. J.P.Holman, “Thermodynamics”, 2nd Edition, Mc Graw Hill Company New York 1975.
3. YVC Rao, “An introduction to Thermodynamics”, 2009 Revised Edition, Universities press.
4. J.B. Jones &R.E.Dugan, “Engineering Thermodynamics”, 1st Edition, PHI-2009.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M				L				M			H	M	
CO2	M	H	L							M			M	H	L
CO3		H	M							M			H	M	
CO4	H	M								M			H	M	
CO5	M	H								M			M	H	

20MET03: MATERIAL SCIENCE & METALLURGY

Credits – 3 **Sessional Marks: 30**
L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the basic fundamentals of Material science and Physical metallurgy
2. Know the basic concepts of bonds in metals and alloys, proper selection and effective utilization of materials to satisfy the ever increasing demands of the society.
3. Understand the regions of stability of the phases that can occur in an alloy system in order to solve the problems in practical metallurgy
4. Study the basic differences between cast irons and steels, non-ferrous metals and alloys their properties and practical applications.
5. Understand the various heat treatment and strengthening processes used in practical applications

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the crystal structure and classification of materials.

CO2. Interpret the phase diagrams of materials.

CO3. Classify cast irons and study their applications and Understand methods of determining Mechanical properties and their suitability for applications.

CO4. Select suitable heat-treatment process to achieve desired properties of metals and alloys.

CO5. Understand the new developments such as nanotechnology continue to propel materials Science and engineering to the forefront of the studies around the world.

UNIT I

Structure of Metals and Constitution of alloys: Bonds in Solids – Metallic bond crystallization of metals, grain and grain boundaries, effect of grain boundaries on the properties of metal/alloys – determination of grain size. Necessity of alloying, types of solid solutions, Hume Rotherys rules, intermediate alloy phases, and electron compounds.

UNIT II

Equilibrium Diagrams : Experimental methods of construction of equilibrium diagrams, Isomorphous alloy systems, equilibrium cooling and heating of alloys, Lever rule, coring miscibility gaps, eutectic systems, congruent melting intermediate phases, peritectic reaction. Transformations in the solid state – allotropy, eutectoid, peritectoid reactions, phase rule, relationship between equilibrium diagrams and properties of alloys. Study of important binary phase diagrams of Cu-Ni-, Al-Cu, Bi-Cd, Cu-An, Cus-Sn and Fe-Fe3C.

UNIT III

Cast Irons and Steels: Structure and properties of White Cast iron, Malleable Cast iron, greycast iron, Spheriodal graphite cast iron, Alloy cast irons. Classification of steels, structureand properties of plain carbon steels, Low alloy steels.

Non-ferrous Metals and Alloys: Structure and properties of copper and its alloys,Aluminium and its alloys, Titanium and its alloys.

UNIT IV

Heat Treatment of Alloys: Effect of alloying elements on Fe-Fe3C system, Annealing,normalizing, Hardening, TTT diagrams, tempering, Hardenability, surface – hardeningmethods, Age hardening treatment, Cryogenic treatment of alloys.

UNIT V

Ceramic and Composite Materials: Crystalline ceramics, glasses, cermaets, abrasivematerials, nanomaterials – definition, properties and applications of the above.Classification of composites,

various methods of component manufacture of composites,particle – reinforced materials, fiber reinforced materials, metal ceramic mixtures, metal –matrix composites and C – C composites.

Text Books

1. Sidney H. Avener, "Introduction to Physical Metallurgy", McGrawHill.
2. Donald R.Askeland, ". Essential of Materials science and engineering", Thomson

Reference Books

1. Dr. V.D.kodgire, "Material Science and Metallurgy", TMG Edition, Tata Mcgraw-Hill, 2001.
2. Callister&Baalasubrahmanyam, ".Materials Science and engineering", 4th edition, Wadsworth Publishing Co. Inc, 2010.
3. Fischer, "Material Science for Engineering students", Elsevier Publishers.
4. V. Rahghavan,Material science and Engineering
5. Yip, "Introduction to Material Science and Engineering", Wah Chung CRC Press.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**M**	**H**		**M**				**M**				**L**	**M**	**L**	
CO2			**H**	**M**	**L**			**M**				**L**			**L**
CO3	**H**	**H**			**M**							**L**	**M**	**L**	**L**
CO4	**M**	**M**	**H**		**M**			**L**					**M**		**L**
CO5	**H**	**M**						**M**				**M**	**M**	**L**	

20MET04: MACHINE TOOLS & MANUFACTURING TECHNOLOGY

Credits - 3 **Sessional Marks: 30**
L: T: P: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the fundamental knowledge and principles in machining processes and machine tools.
2. Provide the fundamentals and principles of metal cutting on lathes, milling machines, grinding machines, etc.
3. Important effects that manufacturing processes may have on the material properties of the processed part with a focus on the most common processes.
4. Provide a technical understanding of common processes to aid in appropriate process selection for the material and required tolerances.

Course Outcomes

After successful completion of course the student should be able to

CO1. To explain the constructional details and functions of basic components of lathe, shaper, planer, drilling, milling and grinding machines and estimate machining times.
CO2. Suggest appropriate cutting fluids, cutting tool materials and tool geometry for given operating conditions
CO3. To develop in-depth understanding on manufacturing processes namely casting, forming and welding
CO4. Learn the types of defects and remedies
CO5. Study the Applications of Manufacturing processes.

UNIT I

Machine Tools: Types, parts, working, machining time estimation; Principles of machining: Tool geometry, orthogonal and oblique cutting, mechanics of chip formation, Merchant's analysis, dynamometry, effect of tool geometry on cutting forces and surface finish, tool materials, thermal aspects in machining, cutting fluids, tool wear and tool life, Machinability.

UNIT II

Constructional features of various Machine Tools- Turning: Lathe and its Parts, Classification of Lathes, Types of Operations performed on lathe, Cutting tools for lathe operations, Feed drive, Taper and Thread cutting on lathe, Tool holding and work holding devices on lathe.

UNIT III

Shaping: Constructional Details, Quick Return Mechanisms, Estimation of Machining time, Slotter, planer.

Drilling & Boring: Classification, Constructional Details, Operations performed on them. Twist Drill-Elements, Boring machines-Types-constructional details.

UNIT IV

Methods of manufacturing – **Metal Casting Processes** -Sand Casting – Sand Mould – Type of patterns – Pattern Materials – Pattern allowances – Molding sand, Properties and testing – Cores: Types and applications – Molding machines – Types and applications– Melting furnaces. Principle of special casting processes- Shell, Investment – Ceramic mould – Pressure die casting –Centrifugal Casting – CO_2 process – Stir casting - Defects in casting.

UNIT V

Joining Processes - Basic principles, classification, equipment, process variables, defects in manufactured components, and applications

Metal Forming Processes- Basic principles, classification, equipment, process variables, defects in manufactured components, and applications.

Text Books

1. S.K Hajra Choudhary and AK Hajra Choudhary, "Elements of workshop Technology", Volume I, Media promoters and Publishers Private Limited, Mumbai, 1997.
2. P.N. Rao, "Manufacturing Technology Foundry, Forming and Welding", 4th Edition, Tata McGraw Hill, 2003

Reference Books

1. R.K. Jain, "Production Technology", Khanna Publishers, 17th edition, 2012.
2. Paul Degarma E, Black J.T and Ronald A. Kosher, "Materials and Process in Manufacturing", 8th Edition, Prentice – Hall of India, 1997.
3. Rosenthal, "Principles of Metal Castings", 2nd Edition, Tata McGraw Hill, 2001.
4. R.K. Rajput, "Manufacturing Technology", 1st Edition, Laxmi Publishers, 2007.
5. Kalpakjian, "Manufacturing Technology", Pearson Education India Edition, 2006.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H	M	M
CO2	H	M		M						M			H	M	M
CO3	M	H	M							M			H	M	L
CO4	H	H	L	M						M			H		M
CO5	H	L	L	M	L					M			H	L	L

20BST16: UNIVERSAL HUMAN VALUES AND ETHICS

Credits – 3 **Sessional Marks: 30**
L:T:P ::3:0:0 **University Exam Marks: 70**

Course Objectives

The objective of the course is four fold:

- Development of a holistic perspective based on self-exploration about themselves (human being), family, society and nature/existence.
- Understanding (or developing clarity) of the harmony in the human being, family, society and nature/existence
- Strengthening of self-reflection.
- Development of commitment and courage to act.

Course Outcomes:

By the end of the course,

- Students are expected to become more aware of themselves, and their surroundings (family, society, nature)
- They would become more responsible in life, and in handling problems with sustainable solutions, while keeping human relationships and human nature in mind.
- They would have better critical ability.
- They would also become sensitive to their commitment towards what they have understood (human values, human relationship and human society).
- It is hoped that they would be able 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.

UNIT I

Course Introduction – Need, Basic Guidelines, Content and Process for Value Education

- Purpose and motivation for the course, recapitulation from Universal Human Values--I
- Self-Exploration-what is it? – Its content and process; 'Natural Acceptance' and Experiential Validation – as the process for self-exploration
- Continuous Happiness and Prosperity – A look at basic Human Aspirations
- Right understanding, Relationship and Physical Facility – the basic requirements for fulfilment of aspirations of every human being with their correct priority
- Understanding Happiness and Prosperity correctly - A critical appraisal of the current scenario
- Method to fulfil the above human aspirations: understanding and living in harmony at various levels.

Include 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

UNIT II

Understanding Harmony in the Human Being – Harmony in Myself!

- Understanding human being as a co-existence of the sentient 'I' and the material 'Body'
- Understanding the needs of Self ('I') and 'Body' – happiness and physical facility
- Understanding the Body as an instrument of 'I' (I being the doer, seer and enjoyer)
- Understanding the characteristics and activities of 'I' and harmony in 'I'
- Understanding the harmony of I with the Body : Sanyam and Health; correct appraisal of Physical needs, meaning of Prosperity in detail

- Programs to ensure Sanyam and Health.

Include 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

UNIT III

Understanding Harmony in the Family and Society- Harmony in Human- Human Relationship

- 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
- Understanding the meaning of Trust; Difference between intention and competence
- Understanding the meaning of Respect, Difference between respect and differentiation; the other salient values in relationship
- Understanding the harmony in the society (society being an extension of family): Resolution, Prosperity, fearlessness (trust) and co-existence as comprehensive Human Goals
- Visualizing a universal harmonious order in society- Undivided Society, Universal Order- from family to world family.

Include 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

UNIT IV

Understanding Harmony in the Nature and Existence - Whole existence as Coexistence

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

Include 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.

UNIT V

Implications of the above Holistic Understanding of Harmony on Professional Ethics

- Natural acceptance of human values
- Definitiveness of Ethical Human Conduct
- Basis for Humanistic Education, Humanistic Constitution and Humanistic Universal Order
- 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.
- Case studies of typical holistic technologies, management models and production systems
- 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
- Sum up.

Include practice Exercises and Case Studies will be taken up in Practice (tutorial) Sessions eg.

To discuss the conduct as an engineer or scientist etc.

Text Book

1. R R Gaur, R Asthana, G P Bagaria, "A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93- 87034-47-1
2. R R Gaur, R Asthana, G P Bagaria, "Teachers' Manual for A Foundation Course in Human Values and Professional Ethics", 2nd Revised Edition, Excel Books, New Delhi, 2019. ISBN 978-93-87034-53-2

Reference Books

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

20MEP02: ADVANCED ENGINEERING GRAPHICS
Prerequisite: 20MET01: Engineering Graphics

Credits – 3 **Sessional Marks: 40**
L: T: P:: 0:0:6 **University Exam Marks: 60**

Course Objectives
To expose the students to the following
1. Draw sectional views of solids.
2. Develop surfaces and estimate the sheet metal requirement.
3. Impart skills in three-dimensional visualization of engineering components.
4. Provide the basic knowledge and skills in producing Engineering Graphics.
5. Familiarize the drafting standard software.

Course Outcomes
After successful completion of course the student should be able to
CO1. Prepare sectional views of solids.
CO2. Estimate the sheet metal requirement for fabrication.
CO3. Draw orthographic and isometric views of combined solids and simple components.
CO4. Do basic exercises on a standard drafting software.

Part A

Sections and Sectional Views: Right Regular Solids- Prism, Cylinder, Pyramid and Cone, Section plane inclined to one plane, Auxiliary views for true shape of sections.
Development of Surfaces of Solids: Right Regular Solids - Prisms, Cylinder, Pyramid, Cone.
Interpenetration of Solids: Projection of interpretation of solids with axes perpendicular and intersecting, non-intersecting (off-set) Cylinder Vs. Cylinder, Cylinder Vs. Prism, Cylinder Vs. Cone, Square prism Vs. Square prism.
Transformation of Projections: Conversion of Isometric Views to Orthographic views, Conventions.

Part B (Using Auto CAD)

Drawing Standards: Code of Practice for Engineering Drawing - BIS specifications - Conventional representation – Welding symbols - riveted joints - keys - fasteners - Reference to hand book for the selection of standard components like bolts, nuts, screws, keys etc.
Joints: Cotter joint (socket and spigot), Knuckle joint (pin joint) for two rods.
Riveted Joints: Single and double riveted lap joints, butt joints with single / double cover straps (Chain and Zigzag, using snap head rivets).

Text Books

1. K.L. Narayana and Kannaiah, "Engineering Drawing", Scitech Publishers.
2. N.D. Bhat, "Engineering Drawing", Charotar.
3. K.L.Narayana, P.Kannaiah, K. Venkata Reddy, "Machine Drawing", New Age Publishers.
4. N. D. Bhatt, V.M. Panchal, "Machine Drawing", Charotar.

Reference Books

1. Venugopal K, "Engineering Drawing and Graphics", New Age International.
2. P.J. Shah, "Engineering Drawing", S. Chand.
3. Johle, "Engineering Drawing", Tata Mc Graw Hill.
4. Basant Agarwal and Agarwal C.M, "Engineering Drawing", Tata McGraw Hill Publishing.
5. K.L. Narayana and Kannaiah, "Engineering Drawing", Scitech Publishers.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L								M			H		
CO2	M	H								M				H	L
CO3			H	M						M				H	
CO4	H		H	L		M				M			H		

20MEP04: MANUFACTURING TECHNOLOGY LAB

Credits – 1 **Sessional Marks: 40**
L:T:P :: 0:0:2 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. To enable the students understand the basic concepts of molding and the sequence of processes involved in the preparation of green sand mold.
2. To teach students how to determine permeability number, grain fineness number, compressive and shear strength of molding sand etc.
3. To teach students how to perform simple welding operations using Arc, Gas, TIG / MIG welding machines.
4. To explain the plastic molding process.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire knowledge about green sand molding process, gates and risers.
CO2. Determine the strength and permeability of the molding sand.
CO3. Demonstrate the welding procedure using Arc, Gas, TIG / MIG welding machines.
CO4. Acquire the knowledge about the process of making the plastic moulds.

List of Experiments

I. METAL CASTING

1. Pattern Design and making - for one casting drawing.
2. Sand properties testing - for strength and permeability
3. Mould preparation, Melting and Casting
4. Study experiment of casting process analysis software's.

II. WELDING

1. Gas welding & Gas cutting
2. Manual metal arc welding - Lap & Butt Joints
3. TIG / MIG Welding
4. Resistance Spot Welding

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**H**									**M**			**H**		
CO2	**M**	**H**	**M**							**M**				**M**	
CO3	**M**	**H**	**M**		**M**					**M**			**M**	**H**	**M**
CO4	**H**	**M**	**M**	**L**	**L**					**M**			**M**	**L**	
CO5	**M**	**H**	**L**	**L**	**L**					**M**				**H**	**L**

20MES01– AUTOCAD 2D&3D Design

Credits – 2 **Sessional Marks: 40**
L:T:P :: 0:1:2 **University Exam Marks: 60**

COURSE OBJECTIVES:

1. To gain practical experience in handling 2D drafting modeling software system.
2. Familiarize the usage of AUTOCAD software packages.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1 Develop 2D models using AUTOCAD software.

CO2 Develop and model mechanical system using AUTOCAD Software.

CO3 To impart knowledge on the use of AUTOCAD software to solve various field problems in mechanical engineering to optimize and verify the design of machine elements.

Description

AUTOCAD Essentials will provide a user of any proficiency the skill set to use Edge as their primary tool for design and change. This course will build on Part, Assembly and Draft workflows as they assist the user's daily tasks.

Content

- To understand how to create a 2D parametrically constrained sketch
- To create a 3D model using sketch driven features
- Create a 3D model using Synchronous driven features
- Combine individual parts into assemblies and build a BOM
- Createa2Ddraftfiledrivenfrompartandassemblyfiles

Part Design:

- Part break down
  - Where to start? Construction geometry?
  - Ordered or Synchronous design approach?
  - Which features to model first?
- Profile/Sketch
  - **2D&3D designs that will improve your use of Intellisketch. Tips to faster and more reliable sketching. You'll learn to build predictable and reliable profiles that will not blow up**
- Optimize Design
  - What features to draw? Which to model? Learn to model the part, not draw it out. How detailed should profiles be? Learn to combine treatment features to reduce file overhead.
- Part design
  - Machined, Plastic (process for plastics design), cast and Sheet metal parts, Feature Libraries – grouping features to optimize the design.

References:

User manuals of AUTOCAD package Version 19.0

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H		
CO2		H	M							M			H	M	
CO3			H		L					M				H	L

B.Tech
II Year II Semester

II B.Tech II Semester

S.No	Course Code	Course Title
1	20BST07	Probability and Statistics
2	20MET05	Design of Machine Members -I
3	20MET06	Applied Thermodynamics
4	20MET07	Strength of Materials
5	20MET08	Fluid Mechanics & Hydraulic Machinery
MAN	20BST12	Environmental studies
6	20MEP06	Thermal Engineering Lab
7	20MEP07	Strength of Materials& Material Science Lab
8	20MES02	Skill Oriented Course 2

20BST07: PROBABILITY AND STATISTICS

Credits - 3 **Sessional Marks: 30**
L: T: P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

1. To study the fundamental concepts like random variables, probability, probability distributions, sampling.
2. To understand the statistical concepts of estimation, hypothesis testing, regression, correlation analysis and multiple regression.
3. To equip students with essential tools for statistical analyses at the graduate level.
4. To familiarize the techniques of ANOVA designs and reliability most frequently used in engineering and applied research.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Find probabilities of single events, complementary events and the unions and intersections of collections of events.
CO2. Derive the probability density function of random variables and use these techniques to generate data for various distributions.
CO3. Calculate the mean and variance of continuous and discrete random variable.
CO4. Describes the Sampling distribution of mean when σ- known or unknown.
CO5. Differentiate between a population and a sample
CO6. Identify features that determine the width of a confidence interval.
CO7. State and apply the definitions of the t, F and χ 2 distributions in terms of the standard Normal.
CO8. Define the concept of least squares estimation in linear regression.
CO9. State the modelling assumptions underlying ANOVA.

UNIT I

Probability & Random Variables: Probability- Axioms of Probability-some elementary Theorems-Conditional probability-Baye's theorem. Random Variables: Discrete and Continuous random variables, Distribution function of random variable, Properties, Probability mass function, Probability density function, Mathematical expectation, Properties of Mathematical expectations, Mean and Variance.

UNIT II

Probability Distributions: Binomial Distribution, Mean and StandardDeviations of Binomial Distribution, Poisson distribution, Mean andStandard Deviations of Poisson Distribution. Continuous Distributions: Normal Distribution, Mean, Variance andarea properties.

UNIT III

Sampling Distributions, Inferences concerning means, Inferences concerning variances

Populations and Samples, The Sampling Distribution of the Mean (σ Known), The Sampling Distribution of the Mean (σ Unknown), The Sampling Distribution of the Variance. Point Estimation, Interval Estimation, Bayesian Estimation, Tests of Hypotheses, Null Hypotheses and Significance Tests, Hypotheses Concerning One Mean, Operating Characteristic Curves, Hypotheses Concerning Two Means, The Estimation of Variances, Hypotheses Concerning One Variance, Hypotheses Concerning Two Variances.

UNIT IV

Test of Significance (small samples): Student's t – test, test for ratio of variance (or) F – test, Chi – square test for Goodness of fit and independence of attributes - The method of least squares-fitting a straight line, second degree parabolas and more general curves - Curvilinear Regression –Multiple Regressions, Correlation.

UNIT V

Anova: Analysis of variance - one way classification, two way classification, Completely Randomized Designs. Reliability – Failure –Time Distributions-The exponential Model Reliability – The Weibull Model in Life Testing.

Text books

1. T.K.V.Iyengar & B.Krishna Gandhi et. al, "Probability and Statistics", S. Chand & Company, Vol.III.
2. Irwin Miller, John E.Freund, "Probability and Statistics for Engineers", Pearson Global edition, 9th edition.
3. S C Gupta and V.K.Kapoor,"Fundamentals of Mathematical Statistics", S. Chand & Son's, 10th edition 2000.
4. Shahnaz Bathul,"A text book of Probability and Statistics", Ridge Publications, 2nd edition.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	H	M										
CO2	H	L			M							
CO3	H	M										
CO4	H	L					M					
CO5	M	H					L					
CO6	M	H										
CO7	H	M										
CO8	H	M										
CO9	H	M										

20MET05: DESIGN OF MACHINE MEMBERS – I

Credits – 3 **Sessional Marks: 30**
L:T:P :: 3:0:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Apply knowledge of mathematicsin design engineering
2. Design a system, component, or process to meet desired needs within realistic constraints.
3. Identify, formulate, and solve engineering problems
4. Use the techniques, skills, and modern engineering tools necessary for engineering practice.

Course Outcomes

After successful completion of course the student should be able to

CO1. Knowledge on basic machine elements used in machine design
CO2. Analyze the stress and strain on mechanical components and understand, identify and quantify failure modes for mechanical parts.
CO3. Design machine elements to withstand the loads and deformations for a given application, while considering additional specifications.
CO4. Approach a design problem successfully, taking decisions when there is not a unique answer.
CO5. Proficient indesigning with analytical knowledge.

UNIT I

Mechanical Engineering design:: Introduction to Design; What is design, Basic procedure of Design, Traditional Design methods; Design Synthesis; design considerations(thermal and wear) and standards; Engineering classification and selection; Material selection in machine design, BIS designation of steels, Preferred numbers, Mechanical Properties of Engineering Materials, Selection of material, Selection of Manufacturing method.

UNIT II

Design against static load: Factor of safety; Stress-strain relationships; shear stress and shear strain relationships; Axial, Bending, Torsional stresses; principle stresses; Theories of failure.

Design against Fluctuating loads: Stress Concentration factors; Reduction of stress concentration effects; Fluctuating stresses; fatigue Failure; Endurance limit; Notch sensitivity; Soderberg and Goodman Diagrams, Gerber Equation, Fatigue design under combined stresses, Design for finite and infinite life.

UNIT III

Design of Shafts: Terminology, types of shafts, Transmission shafts, Shaft Design on Strength basis, Shaft design on Torsional Rigidity basis, Design of hollow shaft on strength basis, Design of hollow shaft on Torsional Rigidity basis, Flexible shafts.

UNIT IV

Design of fasters: Threaded joints-Thread joints; ISO metric screw threads, Bolted joint in tension; Torque requirement for bolt tightening; bolted joint under fluctuating load; eccentricity loaded bolted joints in shear; bolted joints with combined stresses; Bolt of uniform strength.

Welded joints: types of welded joints; stresses in butt and fillet welds; strength of welded joints; eccentric welded joint; weld joint subject to bending moment and fluctuating forces; welding symbols; weld inspection.

UNIT V

Mechanical springs: Helical springs-stress equation and deflection equation; spring materials; spring end formation; design against-static and fluctuating loads; Design of helical springs;

Compound springs leaf springs, ; equalized stress in spring leaves ,nipping

Text Books

1. V.B. Bhandari , “Design of Machine Elements”, TMH Publishers, New Delhi, 2 edition, 2013.
2. R.S. Khurmi and J.K. Gupta, “Machine Design”, S. Chand Publishers, New Delhi.
3. Pandya and Shah, “Machine Design”, Charotar Publishers, Anand, 17th edition, 2009.

Reference Books

1. Joseph E. Shigely, “Mechanical Engineering Design”, TMH Publishers, New Delhi, 9th edition, 2011.
2. Sadhu Singh, “Machine Design”, Khanna Publishers, New Delhi.
3. Spotts. M.F, “Design of Machine Elements”, PHI Publishers, New Delhi.
4. Norton .R.L, “Machine Design”, Tata Mc Graw Hill Publishers, 2nd edition, 2002.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M				L			M			H	M	
CO2	H	H	H				M			M		L	M	H	H
CO3	H	H	H				M			M		L	M	H	M
CO4	H	H	M	M			M			M		L	M	H	M
CO5	H	H	H	L			M			M		L	M	H	

20MET06: APPLIED THERMODYNAMICS

Credits: 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize with the engine components.
2. Understand analytical techniques of internal combustion engines performance.
3. Know environmental and fuel economy challenges of internal combustion engines.

Course Outcomes

After successful completion of course the student should be able to

CO1. Demonstrate the principles of thermal engineering in power producing fields.
CO2. Differentiate internal combustion engine designs.
CO3. Recognize operating characteristics of different engine types and designs.
CO4. Analyze engineering systems performance in controlled laboratory environments.
CO5. Compare and contrast measurement errors or modeling limitations of internal combustion engines.

Points Applicable to University Examinations

- Steam tables book is allowed

UNIT I

Steam Generators: classification of fire tube and water tube boilers–introduction to high pressure boilers–boiler performance–boiler draught.

Steam Nozzles: types–isentropic flow of steam through nozzles–velocity and enthalpy drop–variation of velocity–area–specific volume–critical pressure ratio for maximum discharge of effect.

UNIT II

Steam Turbines: impulse turbine–compounding–velocity diagrams–work done–diagram efficiency–stage efficiency–reaction turbines–velocity diagrams–degree of freedom–governing of turbines.

UNITIII

Compressors: positive displacement: reciprocating-single stage and multi stage compressors–isothermal efficiency–rotary-helical screw, scroll, sliding vane, lobe and liquid ring–non-positive displacement compressors: centrifugal compressors and axial flow compressors–velocity diagrams–isentropic efficiency.

UNIT IV

Gas Turbines: Open and closed cycle arrangements–ideal and actual cycles and their analysis–methods to improve the efficiency.

Jet Propulsion: Air breathing engines–turbo jet, turbo prop and ram jet–rocket engines–liquid and solid propellant

UNIT V

I.C. Engines: classification–working principles–valve and port timing diagrams–carburetor– fuel injection system–ignition system–cooling and lubrication–stages of combustion in S I Engines–stages of combustion in C I Engines–detonation–knock–fuel ratings.

Performance and Emission of I C Engines: performance parameters–engine power, engine efficiencies–problems–engine emissions and controlling methods.

Text Books

1. R K Rajput, “Thermal Engineering”, Seventh edition, Laxmi Publications (P) Limited.
2. V Ganesan, “Internal Combustion Engines”, Third edition, Tata McGraw Hill.

Reference Books

1. R S Khurmi and J K Gupta, “Thermal Engineering”, S. Chand & Company Limited.
2. R S Khurmi and N Khurmi, “Steam Tables with Mollier Diagram in SI units”, S.Chand & Company Limited.
3. V M Domkundwar, “Internal Combustion Engines”, Dhanpat Rai & Co. (P) Limited.
4. Eastop & Mc Conkey, “Applied Thermodynamics for Engineering Technologies”, Pearson.
5. R K Rajput, “Steam Tables with Mollier Diagram (SI Units)”, Laxmi Publications (P) Limited.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M				L				M			H	L	
CO2		M	H							M			M	H	L
CO3	L	M	H							M			H	M	L
CO4		H	L	M			M			M				H	M
CO5	H	M	M							M	L		M	H	

20MET07: STRENGTH OF MATERIALS

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Learn the concepts of stress, strain, principal stresses and principal planes.
2. Study the concept of shearing force and bending moment.
3. Determine stresses and deformation in circular shafts and helical spring due to torsion.
4. Compute slopes and deflections in beams.
5. Study the stresses and deformations induced in thin and thick shells.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the concepts of stress and strain in simple, compound bars and principle planes.
CO2. Understand the load transferring mechanism in beams.
CO3. Calculate the slope and deflection in beams.
CO4. Apply equation of simple torsion in designing of shafts.
CO5. Analyze and design thin and thick cylindrical shells for the applied internal and external pressures.

UNITI

Stress and Strain: Concept of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, elongation of tapering bars of circular and rectangular cross sections, elongation due to selfweight, thermal stress, complex stresses: stresses on an inclined plane under different uniaxial, biaxial and tri-axial stress conditions, principal planes and principal stresses, mohr's circle.

UNITII

Shear Force and Bending Moment in Beams: Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads.

0UNIT III

Bending Stress in beams: Theory of simple bending, assumptions, derivation of bending equation. Moment of resistance of rectangular section, I Section and triangular section, T section.

Shear stress: Equation for shear stress distribution across any cross section of beam,shear stress distribution across rectangular, circular, triangular, I-Sections, T-Section.

UNITIV

Deflections of Beams: Relation between curvature, slope and defection, double Integration method, macaulay's method, moment area method.

Torsional Stresses in shafts: Analysis of torsional stresses, power transmitted, combined bending and torsion.

UNITV

Pressure Vessels: Introduction, stresses in a thin cylindrical vessel subjected to internal pressure, expression for circumferential and longitudinal stress, efficiency of joints, effect of internal pressure on the dimensions of a thin cylindrical shell, stresses in a thick cylindrical shell, Lamies equation, stress in compound thick cylinders.

Text Books

1. S. Ramamrutham,"Strength of Materials", Dhanpat Rai Publishers.
2. S.S. Rattan, "Strength of Materials", 2nd Edition , Mc Graw Hill Education (India) Pvt. Ltd.
3. Dr. Sadhu Singh, "Strength of Materials", 10th Edition, Khanna Publishers,2013.

Reference Books

1. Stephen P.Timoshenko, "Strength of Materials", volume-I,2nd Edition.
2. S.S. Bhavikatti, "Strength of Materials",4th Edition, vikas publishing.

Course Outcomes – Program Outcomes – Program Specific Outcome (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H		H
CO2	H	M								M			H		H
CO3		M	H							M			M	H	
CO4			H							M			H		
CO5			H	M						M			M	H	

20MET08: FLUID MECHANICS & HYDRAULIC MACHINERY

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Learn the basic fluid properties, Hydrostatic laws and applications.
2. Notice the types of fluid flows.
3. Recognize the principles of Kinematics and Hydro-Dynamics.
4. View the importance of various types of flow in pumps and turbines.
5. Design the applications of the conservation laws to flow through pipes and hydraulic machines

Course Outcomes

After successful completion of course the student should be able to

CO1. Possess the knowledge of fundamental properties of fluids, compute and solve problems on hydrostatics.
CO2. Apply principles of mathematics to represent kinematic concepts related to fluid flow and the Bernoulli's principle applications.
CO3. Compute flow and its losses in the discharge through pipe networks.
CO4. Understand the hydrodynamic forces of jets on stationary and moving vanes.
CO5. Analyze the performance of pumps and turbines.

UNIT I

Fluid properties: Mass density, weight density, specific volume, relative density, viscosity, compressibility, surface tension and capillarity and standard atmosphere pressure, vapour pressure. Pressure Measurements: piezometer, manometer, differential manometers, micro manometers.

Fluid statics: Fluid pressure pascal's law, absolute and gauge pressure, hydrostatic force on surfaces- total pressure and centre of pressure on plane surfaces.

UNIT II

Fluid kinematics**:** Type of fluid flow, type of flow lines, rate of flow, velocity potential and stream function ,continuity equation.

Fluid dynamics: Euler's equation-Bernoulli's equation and its application- venturi meter, orifice meter, pitot tube. Momentum equation and moment of momentum equation.

UNIT III

Laminar flow: Relationship between shear stress and pressure gradients- laminar flow through circular pipes- Hagen poisulle law, loss of head due to friction.Turbulent flow: Loss of head due to friction in pipe- Darcy- Weisbach equation, minor head losses, pipes in series.

Boundary layer concept: Boundary layer growth over a flat plate, boundary layer thickness, displacement thickness, momentum thickness and energy thickness-separation of boundary layer.

UNIT IV

Hydraulic turbines: Impact of water jets Hydrodynamic forces of jets on stationary and moving flat, inclined and curved vanes ,jet striking centrally and at tip, velocity triangle at inlet and outlet , work done and efficiency. Turbines: Classification of Hydraulic turbines, Pelton Wheel, Francis turbine, Kaplan working principle, work done and efficiency of Pelton wheel, Francis, Kaplan turbine. Draft tube, specific speed unit quantities, specific speed, performance characteristics, model testing.

UNIT V

Centrifugal pumps : Classification of pumps ,working of a centrifugal pump work done by the impeller on liquid, heads and efficiencies, multistage centrifugal pumps, specific speed, performance characteristics, model testing.

Reciprocating Pumps: Classification of reciprocating Pumps, working of a reciprocating pump, coefficient of discharge and slip, Single acting and double acting reciprocating pumps.

Text Books

1. P N Modi and S M Seth,"Hydraulics and Fluid Mechanics" 20th edition, Book House, New Delhi.
2. R.K.Bansal, "Fluid Mechanics and Hydraulic Machines",10th edition, Laxmi Publications.

Reference Books

1. Frank M. White,Fluid Mechanics,4th edition, Mc Graw Hill Education.
2. yunus A. Cengel& John M Cimbala,Fluid Mechanics and Applications,3rd edition, Mc Graw Hill Education, 2013.
3. S K SOM and G Biswas, "Introduction to Fluid Mechanics and Fluid Machines", TataMcGrawHill, New Delhi.

Course Outcomes – Program Outcomes – Program Specific Outcome (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H								M			H	M	
CO2	M	H								M			H	H	
CO3		H					M			M			M	H	
CO4	H	M								M			M	H	
CO5		H		M			M			M			M	H	L

20BST12: ENVIRONMENTAL STUDIES

Credits – No credits
L:T:P::3:0:0

Course Objectives

1. To reflect on how the natural and built environments shape and are shaped by multiple socio-cultural and political factors.
2. To think across and beyond existing disciplinary boundaries, mindful of the diverse forms of knowledge and experience that arises from human interactions with the world around them.
3. To live responsibly and appreciate the environmental and cultural histories of the places they inhabit.
4. To nurture knowledge, respect, and love for the natural and human communities of central Maine, the place where they spend four formative years of their lives.
5. To develop skills of analysis and communication, bearing in mind disciplinary traditions and diverse publics.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand key concepts from economic, political, and social analysis as they pertain to the design and evaluation of environmental policies and institutions.
CO2. Appreciate concepts and methods from ecological and physical sciences and their application in environmental problem solving.
CO3. Appreciate the ethical, cross-cultural, and historical context of environmental issues and the links between human and natural systems.
CO4. Appreciate that one can apply systems concepts and methodologies to analyze and understand interactions between social and environmental processes.
CO5. Reflect critically about their roles and identities as citizens, consumers and environmental actors in a complex, interconnected world.

UNIT I

Environmental studies and Natural resources-Definition of environment, scope and importance of environment, environmental studies, need for public awareness.

Renewable and **Non Renewable Resources and associated problems and case studies-** Uses, consequences of exploitation and remedies- (i) Water resources,(ii) Forest resources, (iii) Land resources, (iv) Mineral resources, (v) Food resources, (vi) Energy resources. Role of individual in conservation of natural resources.Equitable use of resources for sustainable life styles.

UNIT II

Environmental Pollution and Global Effects - Definition, Causes, Effects and Control measures of: Air pollution, Water pollution, Soil pollution, Marine pollution and Noise pollution .Case studies.Role of an individual in prevention of pollution.

Solid waste Management- Causes, effects, disposal methods, and control of urban and industrial wastes.

Climate change- Global warming, Acid rain and Ozone layer depletion, Nuclear accidents and holocaust-case studies.

UNIT III

Disaster Management – Floods, earth quake, cyclone, avalanches, landslides and Tsunami.

Environment and Human health – Epidemic diseases, and pathology of Hepatitis –b, HIV/AIDs Malaria, Typhoid, Chikungunya, Avian flu and anthrax *etc.* Role of information technology in environment and human health, Case studies

Water conservation- Rain water harvesting – Water shed management.

Waste land reclamation

UNIT IV

Ecosystem- Concept of an ecosystem,Structure and functions of an ecosystem; types of ecosystems, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids. Types of ecosystems- characteristic feature, structure and functions.

Biodivesity and its conservation –Introduction; Definition; genetic, species and ecosystem diversity; Endangered and endemic species of India; Value of biodiversity- consumptive use, productive use, social, ethical, aesthetic and option values; Biodiversity at global, national and local level; Importance of biodiversity; Biodiversity hot-spots; India as a mega-diversity nation. Threats to biodiversity: habitats loss, poaching of wild life man wild life conflicts. Conservation of biodiversity: in-situ and ex-situ conservation of biodiversity.

UNIT V

Human population and the environment-Population growth and variation among nations, Population explosion - Family welfare program in specific to women and child, Human rights, Value education.

Environment Impact Assessment; Environmental risk assessment (ERA); Clean production and Life cycle assessment.

Environmental Legislation - Forest Act, Water Act, Air act, Wild life protection Act, Environmental protection Act. Issues involved in enforcement of environmental legislation and public awareness.

Reference Books

1. Kaushik & Kaushik, Environmental Studies, New age international Publishers, 4th Edition,
2. B.R. Shah and Snehal Popli, Environmental Studies, Mahajan Publishing House. 9th Edition,
3. C.S. Rao, Environmental Pollution Control Engineering, 2ndEdition, New age International Publishers.
4. Canter, L.W., Handbook of Environmental Impact Assessment, Vol. I and II', The World Bank, Washington, 1991.
5. Pelczer, Jr., M.J., Chan, E.C.S., Krieg, R. Noel., and Pelczer Maerna Foss, 'Microbiology'. 5th Edition Tata Mc Graw Hill Publishing Company Limited, New Delhi-1996.
6. Metcalf & Eddy, Inc. "Wastewater Engineering Treatment Disposal and Reuse", Third Edition, Tata McGraw Hill Publishing Company Limited, New Delhi-1995.
7. Casey.I.J., 'Unit Treatment processes in Waste water engineering', John Wiley & Sons England, 1993.
8. Erach Bharucha, "Text book of Environmental Studies, UGC
9. DD Mishra,"Fundamental concepts in Environmental Studies", S Chand & Co Ltd

20MEP06: THERMAL ENGINEERING LAB

Credits – 1 **Sessional Marks: 40**
L: T: P:: 0:0:2 **University Exam Marks: 60**

Course objectives

To expose the students to the following

1. Measure performance of internal combustion engines.
2. Study the fuel properties, combustion, heat transfer, friction and other factors affecting engine efficiency and emissions.
3. Understand the environmental and fuel economy challenges faced by the internal combustion engines.

Course Outcomes

After successful completion of course the student should be able to

CO1. Recognize the reasons for different operating characteristics of various fuels used in engines.
CO2. Predict performance and fuel economy trends for the engines.
CO3. Do in-depth analysis of the combustion process.
CO4. Compare and contrast measurement error or modeling limitations.
CO5. Develop theoretical and practical limits to engine performance.

PART A: FUELS LAB

1. Viscosity measurement (Saybolt Viscometer, Engler's Viscometer, Redwood viscometer)
2. Flash and fire points (Abel's flash and fire point testing, Pensky Marten's flash and fire point apparatus)
3. Determination of Calorific value (Bomb Calorimeter, Junker's Calorimeter)
4. Carbon Residue Test
5. Grease Penetration Method

Note: Perform any <u>THREE</u> out of 5 experiments.

PART B: I.C ENGINES LAB

1. Valve Timing Diagrams
2. Port Timing Diagrams
3. Performance Test on 4-Stroke Single Cylinder Water Cooled Diesel Engine
4. Morse Test.
5. Retardation Test On 4-Stroke Single Cylinder Water Cooled Diesel Engine
6. Performance Test on Air Cooled Petrol Engine
7. Performance Test on Air Compressor
8. Preparation of Heat Balance Sheet

Note: Perform any <u>FIVE</u> out of 8 experiments.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H				L				M			M	H	L
CO2		H	M				L			M			H	M	
CO3			M	H			L			M				H	M
CO4	M	H								M	L		H	M	
CO5		M	H	L						M				H	M

20MEP07: Strength of Materials & Material Science Lab

Credits – 1 **Sessional Mark: 40**
L:T:P :: 0:0:2 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Impart practical exposure on the microstructures of various materials and their hardness evaluation.
2. Practical knowledge on the evaluation of material properties through various destructive testing procedures.

Course Outcomes

After successful completion of course the student should be able to

CO1. Conduct tension test on steel.
CO2. Perform compression tests on wood.
CO3. Determine elastic constants using flexural and torsion tests.
CO4. Understand hardness and strength of metals.
CO5. Draw the microstructure of various metals.
CO6. Know the concept of hardenability & demonstrate the test.

PART A: STRENGTH OF MATERIALS LAB

1. Direct tension test
2. Compression Test
3. Bending test on a) Simply supported beam b) Cantilever beam
4. Torsion test
5. Brinells hardness test
6. Rockwell hardness test
7. Impact test

PART B: MATERIAL SCIENCE LAB

1. Preparation and study of the Micro Structure of pure metals like Iron, Cu and Al.
2. Preparation and study of the Microstructure of Mild steels, low &high carbon steels
3. Study of the Micro Structures of Cast Irons.
4. Study of the Micro Structures of Non-Ferrous alloys.
5. Study of the Micro structures of Heat treated steels.
6. Hardenability of steels by Jominy End Quench Test.
7. To find out the hardness of various treated and untreated steels.
8. Study of the corrosion of steels.

Course Outcomes-Program Outcomes - Program Outcome System (CO-PO-POS)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H								M			H		
CO2	M	H								M			H		
CO3		M								M			H		
CO4		H	M							M			H		
CO5		M		H						M			H		
CO6	H	M								M			H		

20MES02– MATLAB

Credits – 2 **Sessional Marks: 40**
L:T:P :: 0:1:2 **University Exam Marks: 60**

COURSE OBJECTIVE:

1. To gain practical experience in handling 2D drafting and 3D modeling software system.
2. Familiarize the usage of MATLAB software packages.

COURSE OUTCOMES:

On completion of this course, students will be able to

CO1 Develop 2D & 3D plotmodels using MATLAB software.

CO2 Develop and model mechanical system using MATLAB Software.

CO3 To impart knowledge on the use of MATLAB software to solve various field problems in mechanical engineering to optimize and verify the design of machine elements.

Introduction

- Basic of Matlab
- Types of window
- Types of file
- Basic operations

Matrix(Array Design)

- Matrix operation
- Array Design
- Array Operations
- Multidimensional Array

Graphics

- Plotting
- Multiple plot
- 2-D Plot
- 3-D Plot
- Subplot
- Handle Graphics
- Animation
- Examples

Symbolic Calculation

- Symbols
- Design Formula
- Differentiation
- Integration
- Solve Equation

References:

User manuals of MATLAB package Version 18.0

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H		
CO2		H	M							M			H	M	
CO3			H		L					M				H	L

B.Tech
III Year I Semester

B.Tech III Year I Semester

S.No.	Course Code	Course Title
1	20BST09	Industrial Management
2	20MET09	Design of Machine Members-II
3	20MET10	Heat Transfer
4	20MET11	Kinematics of Machinery
5		**ELECTIVE –I**
	20MET18	Non Conventional Energy Sources
	20MET19	Refrigeration &Air conditioning
	20MET20	Fuels Combustion and Environment
	20MET21	Gas Turbines and jet propulsion
6		**ELECTIVE –II**
	20MET23	Robotics
	20MET24	Automation in Manufacturing
	20MET25	Mechanical Vibrations
	20MET26	Modern Manufacturing Methods
7	20BST11	Constitution of India
8	20MEP08	Fluid Mechanics & Hydraulics Machinery Lab
9	20MEP09	Heat Transfer
10	20MEI01	Internship-1
11	20BSS01	Skill Oriented Course 3

20BST09: INDUSTRIAL MANAGEMENT

Credits – 3 **Sessional Marks: 30**
L:T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To impact in-depth knowledge of the subject and highlights the role of the management in the field of engineering.
2. To strengthen the fundamentals of management functions and organisation structures.
3. To select the suitable type of organisation
4. To know the feasible location for the plant & layout
5. To understand the role of human resource management in organisations.
6. To select suitable marketing mix, channels of distribution for the organisation

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define the function of management, organisation, material management & HRM
CO2. Evaluate the thoughts of management, performance of employees & job evaluation.
CO3. Identify the type & location of organisation.
CO4. Understand the functions of HRM
CO5.Determine the marketing mix, channels of distribution and PLC

UNIT I

Introduction to Management: Concept of Management - Functions of Management – Evaluation of Management Thought: Taylor's Scientific Management, Fayol's principles of Management, Douglas MC Gregor's theory X and Y, Maslow's Hierarchy of human needs.

UNIT II

Organisation: Concept - Principles of organisation. Organisational Structure: Line Organisation, Functional Organisation and Line and Staff Organisation. Types of Business Organisations: Features, Merits and Demerits of Sole trading Proprietorship, Partnership, Joint stock Companies.

UNIT III

Introduction to Operations Management: Plant location and Layout, Methods of Production. Work-study: Method study- Procedure and charts. Work measurement – procedure & work sampling. Materials Management: objectives of inventory control - EOQ & ABC analysis.

UNIT IV

Introduction to Human Resource Management: The concept of HRM. Functions of the HR manager - Manpower planning, Recruitment, Selection, Training and Development, Performance Appraisal and Job evaluation.

UNIT V

Marketing: Marketing –Definition –Marketing concepts–Marketing Environment - Marketing Mix, Marketing Vs Selling, Stages in Product Life Cycle, Channels of Distribution.

Text Book

1. A.R. Aryasri , Management Science for JNTU (B.Tech), TMH, 2002

Reference Books

1. Koontz and O'Donnel, Principles of Management, MC Graw Hill, 2001
2. Phillip Kotler, Marketing Management (11th Ed 2002) Prentice Hall of India.
3. Gary Dessler, Human Resource Management, Pearson Education, Asis, 2002
4. O.P. Khanna, Industrial Engineering & Management, Dhanpat Rai 1999

5. Chandra Bose, Management and Administration, Prentice Hall, 2002
6. W. Glueck & L.R. Jauch, Business Policy and Strategic Management, MC Graw Hill,

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1								**H**				
CO2					**M**				**H**			**L**
CO3									**H**		**M**	
CO4					**L**				**H**		**M**	**L**
CO5									**H**		**M**	**L**

20MET09: DESIGN OF MACHINE MEMBERS – II

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the basic knowledge in design of Keys and Couplings.
2. Apply the theories of failures and design optimization procedures using strength and stiffness criteria.
3. Select the bearings for industrial applications using design data hand book.
4. Comprehend the principles of standardization and interchange ability.
5. Design Piston, Cylinder, Connecting Rod, Crank shafts Spur and Helical Gears.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understanding of the basic features of power transmission commonly used in mechanical engineering.
CO2. Capability to design of journal bearings and Awareness of Modes of lubrication and their importance in bearing Design.
CO3. Ability to identify different types of rolling contact bearings, their basic features, related terminology and designations.
CO4. Expertise to analyze and design all types of gears for given application.
CO5. Proficiency in using and obtaining information from engineering data handbooks.

Points applicable to university examinations

Use of Standard Data and Catalogues is allowed for the examinations.

UNIT I

Keys and Couplings: Keys: Types of Keys, Design of Keys, effect of Key Way. Design of Splines.
Shaft Couplings: Types, design of sleeve or muff couplings - clamp or compression coupling- flange couplings, design of bushed pin type flexible coupling.

UNIT II

Sliding Contact Bearings: Classification of bearings- hydrodynamic lubricated bearings, materials for sliding contact bearings, lubricants – properties and their selection terminology used in hydrodynamic journal bearings, design procedure for journal bearings .
Rolling Contact Bearings: Types of rolling contact bearings , merits and demerits of rolling contact bearings over sliding contact bearings. static and dynamic load capacities, equivalent bearing load-reliability of a bearing, selection of bearings, stribeck's equation, design for cyclic loads.

UNIT III

Transmission of Motion: Types of belts and belt drives, materials used for belts, velocity ratio in belt drive, length of open and crossed belt drives, slip in belt, ratio of tensions for flat belts, initial tension, power transmitted , belt- centrifugal tension. condition for the transmission of maximum power-v-belts-ratio of tension, advantages and disadvantages of various belt drives-rope drives- power transmitted-selection of v-belt.

UNIT IV

Gears: Types of gears and their applications- gear materials allowable stresses. Law of Gearing.
Spur Gears: Terminology- force analysis- Design of Spur Gears – Lewis equation. check for dynamic load and wear load. gear wheel proportion helical gears: terminology- force analysis design of helical gears, check for wear load.

UNIT V

Worm Gears: Terminology- force analysis- Design of worm gears.
Bevel Gears: Terminology- force analysis- Design of Bevel Gears.
Engine Parts: Pistons- forces acting on Pistons – constructional features.
Connecting Rod: Thrust in Connecting Rod – stress due to whipping action on connecting rod ends.

Text Books

1. V.B. Bhandari , "Design of Machine Elements", TMH Publishers, New Delhi, 2nd edition, 2013.
2. R.S. Khurmi and J.K. Gupta, "Machine Design", S. Chand Publishers, New Delhi.
3. Pandya and Shah, "Machine Design", Charotar Publishers, Anand, 17th edition, 2009.

Reference Books

1. Joseph E. Shigely, "Mechanical Engineering Design", TMH Publishers, New Delhi, 9th edition, 2011.
2. Sadhu Singh, "Machine Design", Khanna Publishers, New Delhi.
3. Schaum's series, "Machine Design", TMH Publishers, New Delhi, 1st edition, 2011.
4. M.F. Spotts, "Design of Machine Elements", PHI Publishers, New Delhi.
5. Jain R.K, "Machine Design" 5th Edition, Khanna Publications P.S.G.College of Technology: Design Data Book- PSG College of Technologies.
6. Mahadevan& Balaveera Reddy "Mechanical Engineering Design Data Hand Book" CBS Publishers and Distributors.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M				L			M			M	M	L
CO2	L	H	M				M			M		L	M	H	M
CO3	L	M	H							M		L	H	M	
CO4	L	M	L	H			M			M		L	M	H	L
CO5	M	L	H	H			M			M		L	M	H	M

20MET10: HEAT TRANSFER

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the basic concepts of conduction, convection and radiation of heat transfer.
2. Understand the fundamentals of the relationship between fluid flows, convection heat transfer.
3. Know the fundamentals of the heat exchanger concepts.
4. Evaluate radiation view factors using tables and the view factor relationships.

Course Outcomes

After successful completion of course the student should be able to

CO1. Familiarize the basic concept of heat transfer.
CO2. Understand the analytical solving in the process of heat transfer (conduction, convection and radiation).
CO3. Know the necessity and importance of Dimensionless parameters of convective heat transfer.
CO4. Design various types of heat exchanger & Extended surfaces.
CO5. Apply scientific and engineering principles to analyze and design aspects of engineering systems that relate to modes of heat transfer.

Points Applicable to University Examinations

- Heat transfer data book is allowed

UNIT I

Introduction: Modes of Heat Transfer – Basic Laws of Heat Transfer –General Discussion about applications of Heat Transfer.

Conduction Heat Transfer: Effect of temperature on thermal conductivity of different solids, liquids and gases, Fourier's equation – general heat conduction equation in Cartesian and cylindrical coordinates.

UNIT II

One Dimensional Steady State Conduction Heat Transfer: Homogeneous slabs, hollow cylinders and spheres – overall heat transfer co-efficient – electrical analogy – critical radius of insulation-Variable thermal conductivity. Extended surface (fins) heat Transfer – long fin, and short fin.

One Dimensional Transient Conduction Heat Transfer: lumped heat capacity analysis, significance of Biot and Fourier numbers

UNIT III

Convective Heat Transfer: Newton's law of cooling, Classification of convective heat transfer – Buckingham Pi Theorem for forced and free convection. Dimensional analysis applied to forced and free convection, Significance of non-dimensional numbers

External & Internal Flows: Concepts about hydrodynamic and thermal boundary layer.

UNIT IV

Heat Exchangers: Classification of heat exchangers – overall heat transfer coefficient and fouling factor – concepts of LMTD for parallel and counter flow exchanger, Problems.

Two-phase heat transfer: Boiling of liquids, Pool boiling curve, different types of pool boiling, condensation of vapor-Film wise & drop wise condensation.

UNIT V

Radiation Heat Transfer: Absorptivity, reflectivity and transmissivity, black, white and grey body, emissive power and emissivity, laws of radiation – Planck, Stefan-Boltzmann, Kirchhoff's law – Irradiation – total and monochromatic quantities – heat exchange between two black bodies – concepts of shape factor – Emissivity – heat exchange between grey bodies.

Text Books

1. J. P. Holman, "Heat. Transfer", Sixth Edition, Mc Graw-Hill.
2. P.K. Nag, "Heat & Mass Transfer", McGraw Hill.
3. Frank Kreith, RM Manglik & MS Bohn, "Principles of Heat Transfer", Cengage learning Publishers.

References Books

1. Arora and Domkundwar, "Heat and Mass Transfer", Dhanpatai & sons.
2. R.C.Sachdeva, "Fundamentals of Engg. Heat and Mass Transfer", New Age International.
3. R K Rajput, "Heat and Mass Transfer", S.Chand Publication.
4. Yunus Cengel, "Heat and Mass Transfer: Fundamentals and Application", McGraw Hill.
5. Incropera and Dewitt, "Fundamental of Heat and Mass Transfer", Wiley Publication
6. Mills and Ganesan, "Heat Transfer", Pearson Education.
7. Dutta, Binay, "Heat Transfer: Principles and Applications", PHI Publication

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	L								M			H	M	
CO2		H	M	L		L				M			M	H	L
CO3	H	M								M			H	M	L
CO4		M	H							M				H	M
CO5		M	H							M				H	M

20MET11: KINEMATICS OF MACHINERY

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Basic concept of kinematics and kinetics of machine elements.
2. Ability to analyze and interpret data of degree of freedom and degree of movability of mechanisms.
3. Drawing velocity and acceleration diagrams for different mechanisms,
4. Power transmission and different types of gears.
5. Different types of cams & followers by their working, design, construction of cam profile for different motion of the follower.

Course Outcomes

After successful completion of course the student should be able to

CO1. To study about different types of cams & followers by their working, design, construction of cam profile for different motion of the follower.
CO2. Draw velocity and acceleration diagrams of various mechanisms by graphical method.
CO3. Draw velocity and acceleration diagrams of various mechanisms by Klein's instantaneous center and analytical method
CO4. Select and analyze appropriate gear and power transmission in mechanisms
CO5. Construct and analyze cam profile for the specific follower motion

UNIT I

Basics of mechanisms: Classification of links and kinematic pairs – Sliding, Turning, Rolling, Screw and spherical pairs- Lower and higher pairs- Degree of freedom, Mobility – Kutzbach criterion, Gruebler's criterion – Grashof's Law .

Kinematic inversions of four-bar chain, Single and double slider crank chains – Quick return mechanisms

UNIT II

Mechanisms with lower pairs: Straight line motion mechanisms, Peaucellier, Hart, Scottrussel, Grasshopper, Watt, Tchebicheff, Robert and pantograph.

Steering mechanisms: Conditions for correct steering – Davis Steering gear, Ackermann's steering gear. Hooke's Joint (Universal coupling) -Single and double Hooke's joint -applications – Simple problems.

UNIT III

Kinematics: Displacement, Velocity and acceleration analysis of simple mechanisms –relative velocity- Graphical method.

Velocity analysis: Using instantaneous centers – kinematic analysis of simple mechanisms. Kennedy's theorem

Acceleration analysis: Coriolis component of Acceleration. Coincident points.

UNIT IV

Cams - Classification of cams and followers – Terminology and definitions – Displacement diagrams –Uniform velocity, Parabolic, Simple harmonic and Cycloidal motions.

Cam profiles – Specified contour cams – Circular arc and tangent cams – Pressure angle and undercutting – Sizing of cams.

UNIT V

Gears: Law of toothed gearing – Involutes and Cycloidal tooth profiles –Spur Gear terminology and definitions –Gear tooth action – Contact ratio – Condition for constant velocity ratio for transmission of motion - Interference and undercutting. Minimum number of teeth required on the Pinion in order

to avoid interference, Minimum number of teeth required on the Wheel in order to avoid interference, Interference between Rack and Pinion and Minimum number of teeth required on the Pinion for Involute Rack in order to avoid interference.

Gear trains: Speed ratio, Train value – Parallel axis gear trains tooth required for pinion and wheel to avoid interference – Epicyclic Gear Trains, Differential gear of an automobile, simple problems only.

Text Books

1. S.S. Rattan, "Theory of Machine", Tata McGraw-Hill, 3rd Edition, 2013.
2. R.S Khurmi, "Theory of Machine", S Chand Publications, 14th Edition, 2005.
3. R.K. Bansal, J.S .Brar, "Theory of Machine", Laxmi Publications, Revised Edition 2016.

Reference Books

1. J.E. Shigley "Theory of Machines and Mechanisms", 4rd Edition" Oxford International student edition
2. Sadhu Singh, "Theory of Machines" , Second Edition, 2006.
3. Thomas Bevan, "Theory of Machines", Pearson (P), 3 rd Edition, 2012.
4. Ramamurthy, "Mechanics of Machines", V. Narosa Publishing House, 2002.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M				L			M			H	M	
CO2	H	L	M				M			M		L	M	H	L
CO3	L	H	H							M		L	M	H	M
CO4	L	H	H	L			M			M		L	M	H	
CO5	H	L	H	H			M			M		L	M	H	L

20MET18: NON CONVENTIONAL ENERGY SOURCES

Credits - 3 **Sessional Marks: 30**

L: T: P:: 2:1:0 **University Exam Marks:70**

Course Objectives

To expose the students to the following

1. Important knowledge of basics of different non-conventional energy sources.
2. Power generation from the non-conventional energy sources.
3. Help them in understanding the need and role of non-conventional energy sources.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the different non-conventional sources and solar radiation data.
CO2. Design a prescribed solar device.
CO3.Description of solar photovoltaic system and solar storage system.
CO4. Expand the details of the wind energy and fuel cell.
CO5. Recognize the need and ability to engage in lifelong learning for further developments in this field.

UNIT I

Solar Energy: Fundamentals; need of new renewable energy, Solar Radiation; Estimation of solar radiation on horizontal and inclined surfaces; Measurement of solar radiation data

UNIT II

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

UNIT III

Solar Photovoltaic systems: Introduction; Solar cell Fundamentals; Characteristics and classification; Solar cell: Module- panel and Array construction; Photovoltaic thermal systems. Energy storage systems: Thermal energy storage methods- Energy saving.

UNIT IV

Wind Energy: Introduction; Origin and nature of winds; Wind turbine siting; Basics of fluid mechanics; Wind turbine aerodynamics; wind turbine types and their construction; Wind energy conversion systems.Fuel cells: Overview; Classification of fuel cells; Operating principles; Fuel cell thermodynamics

UNIT V

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

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

Text Books

1. Sukhatme S.P. and J.K.Nayak, “Solar Energy - Principles of Thermal Collection and Storage”, Second Edition, Tata McGraw Hill, New Delhi.
2. Khan B.H, “Non-Conventional Energy Resources”, Fifth Edition, Tata McGraw Hill, New Delhi.
3. Er.R.K.Rajput, “Non-Conventional Energy Sources and Utilisation (Energy Engineering)”, S Chand Pvt.Limited, 2012.

Reference Books

1.M.V.R. Koteswara Rao, “Energy Resources: Conventional & Non-Conventional”, BSP Publications,2006.
2. D.S. Chauhan, “Non-conventional Energy Resources”, Third Edition,New Age International.
3. N K Bansal, “Non-Conventional Energy Resources”, Vikas publishing house Pvt. ltd, 2018.
4. G.D.Rai, “Non-Conventional Energy Resources” 6th Edition,Khanna Publishers.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H						L			M			L	M	
CO2	M		H				L			M			H	M	L
CO3	H						L			M			H	M	L
CO4	M	H					L			M			M	M	H
CO5	M	M					L			M			M	M	H

20MET19: REFRIGERATION &AIR CONDITIONING

Credits – 3 **Sessional Marks: 30**
L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following
1. Understand vapour compression and vapour absorption system operation.
2. Analyses the refrigeration cycle and method for improving performance.
3. Familiarize the components of refrigeration systems.
4. Design air conditioning systems using cooling load calculations.
5. Know the application of refrigeration and air conditioning system.

Course Outcomes

After successful completion of course the student should be able to
CO1. Ability to understand the Refrigeration system.
CO2. Design refrigeration system realistic constraints such as economic, environmental.
CO3. Understand of vapour absorption of system.
CO4. Know the working of air condition system.
CO5. Identify, formulate and solve air conditioning problems.

UNIT I

Introduction to Refrigeration: Necessity and Applications- Carnot Refrigerator- First and Second Law Applied to Refrigerating Machines- Unit of Refrigeration- COP- EER- Different Refrigeration Methods Air Refrigeration- Bell-Coleman Cycle- Ideal and Actual Cycles- Open and Dense Air Systems- Numerical Problems – Refrigeration Needs of Air Crafts.

UNIT II

Vapour Compression Refrigeration (VCR) System: Basic Cycle - Working Principle and Essential Components of The Plant – COP – Representation of Cycle On T-S and P-h Charts – Expander Vs. Throttling- Effect of Sub Cooling and Super Heating – Cycle Analysis – Actual Cycle- Influence of Various Parameters on System Performance – Construction and Use of P-h Charts – Numerical Problems.

Refrigerants – Desirable Properties – Classification of Refrigerants Used – Nomenclature- Secondary Refrigerants- Lubricants – Ozone Depletion – Global Warming- Newer Refrigerants.

UNIT III

Vapour Absorption Refrigeration (VAR) System: Description and Working of NH3 – Water System and Li Br –Water (Two Shell & Four Shell) System -Calculation of Max COP- Principle of Operation of Three Fluid Absorption System.

Steam Jet Refrigeration System- Working Principle and Basic Components-Estimation of Motive Steam Required- Principle and Operation of- (i) Thermo-Electric Refrigerator (ii) Vortex Tube orHilsch Tube.

UNIT IV

Introduction to Air Conditioning: Psychrometric Properties & Processes – Characterization of Sensible and Latent Heat Loads — Need For Ventilation- Consideration of Infiltrated Air – Heat Load Concepts. Air Conditioning Systems- Air Cooler (Evaporative Cooling) -Window- Split- Summer - Winter- Year Round- Central Air Conditioning Systems.

UNIT V

Air Conditioning Equipment: Humidifiers – Dehumidifiers – Air Filters- Fans and Blowers.Human Comfort- Requirements of Temperature- Humidity and Concept of Effective Temperature- Comfort Chart.Heat Pump – Heat Sources – Different Heat Pump Circuits.

Text Books

1.C P Arora, "Refrigeration and Air Conditioning" -15th edition, TMH.

2. S.CArora&Domkundwar, "A Course in Refrigeration and Air conditioning", 3rd Edition, Dhanpatrai.

3. R.S.Khurmi & J K Gupta, "Text book of Refrigeration and Air Conditioning", Revised Edition, S Chand.

Reference Books

1. Althouse, Turnquist, Bracciano, "Modern Refrigeration and Air Conditioning", 20th Edition, G H willcox Publisher.

2.Manohar Prasad, "Refrigeration and Air Conditioning", 3rd Edition, New Age International Publishers.

3. Ramesh Chandra Arrora, "Refrigeration and Air conditioning", Eastern Economy Edition, PHI learning Pvt. Ltd.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M	M	M	L				M		L	H		
CO2	M	M	M	H	L	L				M		L	H	M	L
CO3	H	M	M	M	L	L	L			M		L	H	M	
CO4	M	H	M	M	L	L	L			M		L	H		
CO5	M	H	M	L	L	L	L			M		L	H	M	L

20MET20: FUELS COMBUSTION AND ENVIRONMENT

Credits – 3 **Sessional Marks: 30**
L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Learn about types of fuels and their characteristics, and combustion systems with emphasis on engineering applications.
2. Buildup knowledge of the concepts of classical fuel combustion.
3. Provide students with the required skills for analyzing thermal cycles.
4. Familiar with fundamental physical and chemical principles regarding formation and control of air-pollutants in industrial and technological processes

Course Outcomes

After successful completion of course the student should be able to

CO1: Outline the basics, theory and physical concepts of fuels and combustion.
CO2: Recognize the different types of fuels in combustion
CO3: Understand and analyze the combustion process
CO4: Ability to characterize the fuels
CO5: Apply knowledge for the protection and improvement of the environment.

UNIT I

Fuels: Introduction of fuels, combustion-Detailed classification- conventional and unconventional fuels- solid, liquid, gaseous. Environmental norms, B S standards.

UNIT II

Coal: origin of coal – Analysis of coal - carburization, gasification and liquefaction-Types of coals-Lignite, Anthracite, Bituminous, Peat coal. Petroleum based fuels-Problems associated with very low calorific value of gases-Coal gas-Blast furnace gas, Alcohol and Biogas.

UNIT III

Principles of combustion: Chemical composition-Flue gas analysis-Dew point of products-Combustion stoichiometry. Chemical Kinetics-Rate of reaction-Reaction order- zeroth, first and second order reaction.

UNIT IV

Thermodynamics of combustion: Enthalpy formation-Heating value of Fuel-Adiabatic flame Temperature-Equilibrium composition of gaseous mixtures. Flame stability-Measurement of burning velocity - factor affecting the burning velocity.

UNIT V

Environmental considerations: Automobile emissions-Air pollution-Effects on environment, human health etc., and Principle pollutants-Methods of emission control.

Text Books

1. S.R. Turns, "An Introduction to Combustion: Concepts and Applications", 3rd edition, McGraw Hill Education (India) Private Limited.
2. Roger A, Strehlow, "Combustion Fundamentals", 2nd Edition, McGraw Hill.
3. Sharma and Chander Mohan, "Fuels and combustion", 2nd Edition, Tata McGraw Hill.
4. Shaha A.K., "Combustion Engineering and Fuel Technology", 1st Edition, Oxford and IBH.

Reference Books

1. Sarkar, "Combustion", 2nd Edition, Mc. Graw Hill.
2. Stephen R. Turns, "An Introduction to Combustion", 2nd Edition Mc. Graw Hill.
3. Kenneth K. Kuo, "Principles of Combustion", 2nd Edition 200, John Wiley & Sons.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H			M			L	L		M			L		M
CO2		H		M			L			M			H	M	M
CO3	L	H					L			M			H	H	H
CO4	L	H	L				L			M			H		M
CO5	L	L				L	H			M			H	M	H

20MET21: GAS TURBINES & JET PROPULSION

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the applications of gas turbines and the fundamentals of jet propulsion.
2. Know about jet engines and aircraft propulsion theories.
3. Understand propulsion systems in aircraft in the context of its manufacturing and maintenance.

Course Outcomes

After successful completion of course the student should be able to

CO1. Familiarize the working of various parts of gas turbines & Jet Propulsion.
CO2. Determine the applicability of a given propeller system for a given aircraft.
CO3. Know the various forces acting on the flights/jet performance.
CO4. Gain the knowledge in problem solving for aircraft propulsion systems, in particular gas turbine.
CO5. Understand the different types of propulsion system of the Rocket engines.

Points Applicable to University Examinations

- Steam Tables and Gas Tables should be provided at the time of external examination.

UNIT I

Gas Turbines: classification-open and closed cycle arrangements-ideal and actual cycle analysis-methods to improve the gas turbine efficiencies-problems-applications-fuels usages.

UNIT II

Jet Propulsion: classification-air breathing engines (turbo jet, turbo prop and ram jet engines) and rocket engines (liquid and solid propellant)-applications-fuel usages.

UNIT III

Flight Performance: forces acting on vehicle-basic relations of motion

Aero Thermo Chemistry of the combustion products: Review of properties of mixture of gases-gibbs-daltons law-equivalent ratio-enthalpy changes in reactions-heat of reaction and heat of formation-calculation of adiabatic flame temperature and specific impulse.

UNIT IV

Solid Propellent Rocket Engine: Internal ballistics-equilibrium motor operation and equilibrium pressure to various parameters-transient and pseudo equilibrium operation-end burning and burning grains-grain design-heat transfer consideration in solid rocket motor design.

UNIT V

Liquid Propellent Rocket Engines: mono and bi propellants-cryogenic and storage propellantsignition delay of hypergolicpropellants-physical and chemical characteristics of liquid propellent-pump, pressure and feed system components-injectors-atomization and drop size distribution.

Text Books

1. M L Mathur& R R Sharma, "Gas turbines and Jet & Rocket Propulsion", Second edition, Standard Publishers Distributors.
2. R K Rajput, "Thermal Engineering", Seventh edition, Laxmi Publications (P) Limited.
3. R K Rajput, "Steam Tables with Mollier Diagram (SI Units)", Laxmi Publications (P) Limited.
4. S M Yahya, "Gas Tables for Compressible Flow Calculation", Sixth edition, New Academic Science.

Reference Books

1. G G Smith, "Gas Turbines and Jet Propulsions for Aircraft", Goldberg Press.
2. R S Khurmi and J K Gupta, "Thermal Engineering", S. Chand & Company Limited.
3. R S Khurmi and N Khurmi, "Steam Tables with Mollier Diagram in SI units", S. Chand & Company Limited.
4. S M Yahya, "Fundamentals of Compressible Flow", Fourth edition, New Age International Publishers.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H	M	
CO2	M	H	L			L				M			M	H	L
CO3	H	M								M			H	M	L
CO4			M	H		L				M			M	H	L
CO5	H	M	L							M			H		

20MET23: ROBOTICS

Credits – 3 **Sessional Marks: 30**

L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the students with the concepts and techniques in robotic engineering, manipulator kinematics, dynamics and control, robot drives and controls, sensors used in robots, chose, and incorporate robotic technology in engineering systems.
2. Make the students acquainted with the theoretical aspects of Robotics.
3. Make the students to understand the importance of robots in various fields of engineering.
4. Expose the students to various robots and their operational details.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the basic components of robots, differentiate types of robots and robot grippers.
CO2. Analyze the Robot Motions associated with drive systems.
CO3. Model forward and inverse kinematics of robot manipulators.
CO4. Evaluate the robot trajectory and motion equations and analyze forces in links and joints of a robot.
CO5. Programme a robot to perform tasks in industrial applications. Design intelligent robots using sensors.

UNIT I

Robotics: Introduction, definition of Robot, Classification of robotics, History of robotics, Robot components, DOF, Robot coordinates, reference frames, Programming modes, robot characteristics, robot work space, robot languages, advantages, disadvantages and applications of robotics.

UNIT II

Motion Analysis: Basic rotation matrices, Composite rotation matrices, Equivalent Angle and Axis, Homogeneous transformation - Problems.

Robot drive systems: Hydraulic, electric and pneumatic drive systems, resolution, accuracy and repeatability.

UNIT III

Manipulator Kinematics: D-H notations, Joint coordinates and world coordinates, Forward and inverse kinematics - problems.

Robot Dynamics: Lagrange, Euler formulations, Newton-Euler formulations - Problems on planar two link manipulators.

UNIT IV

Trajectory Planning: Joint space scheme, cubic polynomial fit, Avoidance of obstacles, Types of motion: Slew motion - joint interpolated motion - straight line motion - problems.

UNIT V

Robot Actuators And Feed Back Components: Actuators: Pneumatic, Hydraulic actuators, electric & stepper motors. Feedback components: position sensors – potentiometers, resolvers, encoders – Velocity sensors.

Robot Applications In Manufacturing: Material Transfer - Material handling, loading and unloading- Processing - spot and continuous arc welding & spray painting - Assembly and Inspection.

Text Books

1. Groover M P, “Industrial Robotics”, Pearson Edu.
2. Fu K S, “Robotics”, McGraw Hill.
3. Saeed B Niku, “Introduction to robotics-Analysis, system, applications”,PHI.

Reference Books

1. Mittal R K &Nagrath I J, “Robotics and Control”, TMH.
2. Richard D. Klafter, “Robotic Engineering”, Prentice Hall.
3. Asada and Slow time, “Robot Analysis and Intelligence” Wiley Inter-Science.
4. John J Craig,“Introduction to Robotics”, Pearson Education.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H				M					M			M	M	M
CO2	M	H												M	
CO3		M	H							M			M	M	L
CO4	M	H								M					
CO5			H							M					M

20MET24: AUTOMATION IN MANUFACTURING

Credits − 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Know the concepts and Principle of Manufacturing Automation.
2. Various types of Controls, Components of Automation and their Practical use in Manufacturing Application.
3. Automation using Pneumatic Systems in Various Application Areas.
4. Understand the Automation using Hydraulic Systems.
5. Knowledge levels needed for PLC Programming and Operating.

Course Outcomes

After successful completion of course the student should be able to

CO1. Implement concepts of automation in machine tools and plant.

CO2. Students will understand the fundamentals of control in automation as they apply to manufacturing.

CO3. Design of Pneumatic Circuit for manufacturing application

CO4. Design of Hydraulic Circuit for manufacturing application

CO5. Ability to apply PLC timers and counters for the control of industrial processes

UNIT I

Introduction: Fundamentals of Manufacturing; Production system facilities; Manufacturing support systems; Different types of manufacturing systems; Automation in Production Systems

UNIT II

Manufacturing: Manufacturing operations; Product, Production relationships; Production Concepts & Mathematical Models, Costs of Manufacturing Operations, Case studies

UNIT III

Automation: Automation Principles & Strategies, Concept of automation; Basic elements and types of automation; flexibility, degree, levels and yardstick of automation

Components of Automation: Sensors, Actuators, ADC, DAC and Input/output devices.

UNIT IV

Industrial Control: Industrial control systems; Mechanical, Hydraulic, Pneumatic, Electrical, Electronic and hybrid systems; Concepts, features and parameters governing the selection of various components of Industrial control systems.

UNIT V

Programmable logical controller(PLC): Discrete Control using PLC & PLC network, Micro PLC, Programming a PLC, Logic Functions, input & output Modules, PLC Processors, PLC Instructors, Documenting a PLC System, Timer & counter Instructions, data Handling instructions, Sequencing Instructions, Mask Data representation. Basics of CNC terminology.

Text Books

1. Mikell. P Groover, “Automation, production systems and computer integrated manufacturing”, 3rd edition,PHI.

Reference Books

1. P. Radha Krishnan & S. Subrahamanyarn and Raju,"CAD/CAM/CIM", New Age International Publishers.
2. Singh / John Wiley, "System Approach to Computer Integrated Design and Manufacturing".
3. Tien Chien Chang, Richard A. Wysk and Hsu-Pin Wang,"Computer Aided Manufacturing", Pearson.
4. R Thomas Wright and Michael Berkeihiser,"Manufacturing and Automation Technology", Good Heart Willcox Publishers.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M	H						M			H	H	H
CO2	M	H	M	M						M			M	H	M
CO3	M		H	L						M				M	M
CO4	M		L	M						M			L		
CO5	M	M	H	M	L					M			L		L

20MET25: MECHANICAL VIBRATIONS

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Know the fundamentals of mechanical vibrations and understand the basic concepts, principles and theory.
2. Understand the significance of damping in real world systems which are subjected to vibrations.
3. Realize the importance of forced vibrations and the different theoretical methods available to simulate it and study their responses and its effect in real world systems.
4. Get a feel of what two degree of freedom systems mean and their characteristics and to know the importance of vibration measurement and its applications.
5. Apply numerical methods to solve multi-degree of freedom system problems.

Course Outcomes

After successful completion of course the student should be able to

CO1. Explain the basics and fundamentals of mechanical vibrations.
CO2. Know different types of damping and its effect on vibrations.
CO3. Appreciating the need and importance of vibration analysis in mechanical systems subjected to harmonic, periodic and non-periodic excitations and obtain its responses and understand its significance in real world systems.
CO4. Ability to use mathematical modelling to linear vibratory systems of different complexities and understanding different aspects of vibration measurements.
CO5. Appreciating the use of numerical methods for finding solutions to multi-degree freedom system problems.

UNIT I

Introduction & Importance of Mechanical Vibration: Brief history of Mechanical Vibration, Types of Vibration, Simple Harmonic Motion (S.H.M.), Principle of superposition applied to S.H.M., Beats, Fourier Analysis, Concept of degree of freedom for different vibrating systems.

UNIT II

Undamped Free Vibration of Single Degree Freedom Systems: Modeling of Vibrating Systems, Evaluation of natural frequency – differential equation, Energy & Rayleigh's methods, Equivalent systems.

UNIT III

Damped Free Vibration of Single Degree Freedom Systems: Different types of damping, Equivalent viscous damping, structural damping, Evaluation of damping using free and forced Vibration technique, Concept of critical damping and its importance, study of vibration response of viscous damped systems for cases of under damping, critical damping and over damping, Logarithmic decrements.

UNIT IV

Forced Vibration of Single Degree Freedom Systems: Steady state solution with viscous damping due to harmonic force, reciprocating and rotating unbalance mass, vibration isolation and transmissibility due to harmonic force excitation and support motion.Vibration measuring instruments – vibrometer and accelerometer.Whirling of shaft with single disc and with our damping, Concept of critical speed and its effect on the rotating shaft.

UNIT V

Undamped Vibration of Two Degree Freedom Systems: Free vibration of spring coupled and mass coupled systems, Longitudial, Torsional and transverse vibration of two degree freedom systems, influence coefficient technique, Un-damped vibration Absorber.

Text Books

1. S. S. Rao, "Mechanical Vibrations", Pearson Education Inc, 4th Edition, 2003.
2. V. P. Singh, "Mechanical Vibrations", DhanpatRai& Company Pvt. Ltd., 3P 2006. P Edition,
3. G. K. Groover, "Mechanical Vibrations", Nem Chand and Bros., Rookee, India, Seventh Edition, 2003.
4. William Seto, "Mechanical Vibrations", Schaum's Outline Series, McGraw Hill, 1983

Reference Books

1. S. Graham Kelly, "Mechanical Vibrations", Schaum's Outline Series, Tata McGraw Hill, Special Indian Edition, 2007.
2. J. S. Rao and K. Gupta, "Theory and Practice of Mechanical Vibrations", New Age International Publications, New Delhi, 2001.
3. J. B. K. Das and Srinivasa Murthy, "Mechanical Vibrations", Sapna Book House, Fifth Edition, 2009.
4. W. T. Thomson and Marie Dillon Dahleh, "Theory of Vibration with Applications", Pearson Education, 5thEdition, 2007.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M				L			M			H	M	
CO2	H	H	M				M			M		L	M	H	H
CO3	M	H	L				M			M		L	M	H	M
CO4	H	H	M	M			M			M		L	M	H	L
CO5	H	H	H	L			M			M		L	M	H	M

20MET26: MODERN MANUFACTURING METHODS

Credits – 3 **Sessional Marks: 30**
L:T:P : 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. The course aims in identifying the classification of unconventional machining processes.
2. Understand the principle, mechanism of metal removal of various unconventional machining processes.
3. Study the various process parameters and their effect on the component machined on various unconventional machining processes.
4. Understand the applications of different processes.
5. Make the students to understand the advanced manufacturing techniques evolved in manufacturing scenario.

Course Outcomes

After successful completion of course the student should be able to

CO1. Importance of non-traditional machining processes, features, classifications and applications of non-traditional methods.

CO2. The processes of USM and AJM, process parameters, application and limitations.

CO3. The Electro-chemical process and applicable in manufacturing environment in terms of accuracy, surface finish and MRR and their relative advantages and disadvantages.

CO4. Understand the chemical machining advantages and applications.

CO5. The types of thermal based metal removal processes, principle of working, accuracy in machining, surface finish, tool selection and other machining parameters.

UNIT I

Introduction: Need for Modern Manufacturing Methods: Non-traditional machining methods and rapid prototyping methods - their relevance for precision and lean manufacturing. Classification of non-traditional processes - their selection for processing of different materials and the range of applications. Introduction to rapid prototyping - Classification of rapid prototyping methods - Sterolithography, fused deposition methods - materials, principle of prototyping and various applications

UNIT II

Ultrasonic Machining: Elements of the process, mechanics of material removal, process parameters, applications and limitations. Abrasive jet, Water jet and abrasive water jet machining: Basic mechanics of material removal, descriptive of equipment, process variables, applications and limitations.

UNIT III

Electro-Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, metal removal rate in ECM, Tooling, process variables, applications, economic aspects of ECM. Chemical Machining: Fundamentals of chemical machining- Principle of material removal- maskants – etchants- process variables, advantages and applications.

UNIT IV

Thermal Metal Removal Processes: Basic principle of spark erosion (EDM), Wire cut EDM, and Electric Discharge Grinding processes - Mechanics of machining, process parameters, selection of tool electrode and dielectric fluids, choice of parameters for improved surface finish and machining accuracy - Applications of different processes and their limitations. Plasma Machining: Principle of material removal, description of process and equipment, process variables, scope of applications and the process limitations.

UNIT V

Electron Beam Machining: Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes - process mechanics, parameters, applications and limitations. Laser Beam Machining: Process description, Mechanism of material removal, process parameters, capabilities and limitations, features of machining, applications and limitations.

Text Books

1. VK Jain, "Advanced machining processes", Allied publishers.
2. Serope Kalpakjian and Steven R Schmid, "Manufacturing processes for engineering materials", 5th edition, Pearson Pub.

Reference Books

1. Bhattacharya A, "New Technology", The Institution of Engineers, India,1984.
2. Kalpak Jian, "Manufacturing Technology", Pearson.
3. Pandey P.C. and Shah H.S, "Modern Machining Process", TMH.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M				L			M			H	M	
CO2	H	H	M				M			M		L	M	H	H
CO3	M	M	L				M			M		L	M	H	M
CO4	H	M	M	M			M			M		L	M	H	L
CO5	H	M	M	H			M			M		L	M	H	M

20BST11: CONSTITUTION OF INDIA

Credits – No credits
L:T: P::3:0:0

Course Objectives

1. To learn basic concepts of Indian Constitution.
2. To understand Fundamental Rights, Fundamental Duties and its implications.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire the knowledge of Indian constitution.

CO2. Understand the Fundamental Rights, Directive Principles of State Policies and Fundamental Duties.

UNIT I

Constitution-structure and principles: Meaning and importance of Constitution, making of Indian Constitution, salient features of Indian constitution.

UNIT II

Fundamental Rights and Directive Principles of State Policy: Fundamental Rights , Fundamental Duties, Directive Principles.

UNIT III

Government of the Union: President of India – election, powers and functions, Prime Minister and Council of Ministers, Loksabha - composition and powers, Rajyasabha -composition and powers.

UNIT IV

Government of states: Governor - powers and functions, Chief Minister and Council of Ministers, Legislative Assembly and Legislative Council.

UNIT V

Judiciary: Features of Judicial System in India, Supreme Court, High court- structure and Jurisdiction.

Administrative Organizations and Construction: Federalism in India, local government – panchayat, election commission, citizen oriented measures - RTI and PIL significance and provisions.

Text Books

1. HM Seervai ,"Constitutional Law of India",Universal Law Publishing Co Ltd
2. Parvinrai Mulwantrai Bakshi, Constitution of India, LexisNexis,2019.

Reference Books

1. Dr.J.N.Pandey," Constitutional Law Of India", Central Law Agency,Allahabad, 2019
2. Durga Das Basu, Shorter Constitution of India,LexisNexis, 2019.

20MEP08: FLUID MECHANICS & HYDRAULIC MACHINERY LAB

Credits – 1 **Sessional Marks: 40**
L: T: P:: 0:0:2 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Impart the experimental skills in flow measurement and real fluid flow problems.
2. Instruct experimental skills to verify the performance characteristics of pumps and turbines.

Course Outcomes

After successful completion of course the student should be able to

CO1. Utilize the knowledge in the design of water supply pipe networks and measure the rate of flow in pipes and channels.

CO2. Get confidence in the hydraulic design of turbines and should be able to identify suitable pumps and turbines for different working conditions.

List of Experiments

1. Determination of correction factor of Rotameter.
2. Determination of force exerted on vane by Impact of jet.
3. Determination of discharge coefficient of Venturimeter
4. Determination of discharge coefficient of Orifice meter
5. Determination of friction factor for a given pipe line
6. Performance test on Multi-stage Centrifugal Pump
7. Performance test on Pelton wheel Turbine
8. Performance test on Kaplan Turbine

Note: Any **6** experiments must be done by the student.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H	M	L
CO2		M	H	M		L				M				H	M

20MEP09: HEAT TRANSFER LAB

Credits – 1 **Sessional Marks: 40**
L: T: P:: 0:0:2 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Impart the experimental skills in heat transfer problems.
2. Learn about the importance of dimensionless numbers and its significances.
3. Communicate experimental skills to determination of amount of heat exchange in various modes of heat transfer including condensation and boiling for several geometries.

Course Outcomes

After successful completion of course the student should be able to

CO1. Utilize the knowledge in the various modes of heat transfers and its applications

CO2. Get confidence in the design of heat transfer devices like Heat Exchanger, Composite Walls, Stefan Boltzmann Apparatus etc. and should be able to identify the different working conditions.

CO3. Evaluate the amount of the heat exchange for plane, cylindrical and spherical geometries and should be able to compare the performance of extended surface.

List of Experiments

1. Determination of overall heat transfer co-efficient of a composite slab
2. Determination of heat transfer rate through a lagged pipe
3. Determination of heat transfer rate through a concentric sphere
4. Determination of thermal conductivity of a metal rod
5. Determination of efficiency of a pin-fin
6. Determination of heat transfer coefficient in forced convection
7. Determination of heat transfer coefficient in natural convection
8. Determination of effectiveness of parallel and counter flow heat exchangers
9. Determination of emissivity of a given surface
10. Determination of Stefan Boltzmann constant

Note: Any **8** experiments must be done by the student.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	L							M			H	M	
CO2		M	M	H						M				H	L
CO3		H	M							M				H	M

20MEI01: INTERNSHIP

Credits – 1 **Sessional Marks: 100**
L:T:P:: 0:0:0

Course Objectives

To expose the students to the following

1. Expose technical students to the industrial environment, which cannot be simulated in the classroom and creating competent professionals for the industry.
2. Provide possible opportunities to learn understand and sharpen the real time technical/managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the "industrial internship" in classroom will be used in classroom discussions.
5. Create conditions conductive to quest for knowledge and its applicability on the job.

Course Outcomes

After successful completion of course the student should be able to

CO1. An opportunity to get hired by industry/organization.
CO2. Practical experience in organization setting
CO3. Excellent opportunity to see how the theoretical aspects learned in classes are integrated into practical world.
CO4. Helps to decide if the industry and the profession is the best career option to pursue.
CO5. Opportunity to learn new skills and supplement knowledge.
CO6. Opportunity to practice communication and team work skills.
CO7. Opportunity to learn strategies like time management, multi-tasking in an industrial setup.
CO8. Enhances their candidacy for higher education.
CO9. Creating network and social circle and developing relationships with industry people.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1												H		M	H
CO2		H							M			M		M	H
CO3	M					H	M						H	M	
CO4					H							M	M	H	
CO5	M	M								H					H
CO6									M	M	H				H
CO7												H			H
CO8						M							M		M
CO9						H									M

20BSS01: EFFECTIVE COMMUNICATION SKILLS

Credits - 2 **Sessional Marks:40**
L:T:P::0:1:2 **University Exam Marks:60**

Course Objectives

- To enhance speaking skills through participation in activities such as role plays, discussions and structured talks/oral presentations
- To write well structured paragraphs on specific topics.
- To improve the fluency in spoken English and neutralize mother tongue influence.
- To train students to use language appropriately for interview skills, group discussion and public speaking

Course Outcomes

- Understand verbal and non-verbal communication and become efficient in formal/informal conversations
- Applying presentation & Interview skills for their personal and professional growth.
- Implementing skills and master their Interpersonal skills.
- Transmitting the abilities of Debates and Group discussion for better performance in professional life.

UNIT- I

Introduction to Communication Skills

- Introducing oneself - Introducing others – Greetings
- Role play/Situational Dialogues
- Just A Minute (JAM)

UNIT – II

Soft Skills

- Intrapersonal Skills :

  Time Management, Positive Thinking & Goal Setting
- Interpersonal Skills :

  Leadership Skills, Team Building & Crisis Management

UNIT – III

Writing Skills

- Technical Report Writing
- Resume Writing
- Email Writing

UNIT – IV

Presentation Skills

- Oral Presentations
- Power Point Presentation
- Non- verbal Communication Skills

UNIT – V

Career Skills

- Group Discussions
- Debates
- Interview Skills
- FAQs & Quick tips

MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF PROGRAM OUTCOMES AND PROGRAM SPECIFIC OUTCOMES:

Course Outcomes	Program Outcome											
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO1		H								M		L
CO2			*L*	M		*H*						M
CO3									M	H		*M*
CO4				M						*H*		*M*

H = Highly Related; M = Medium L = Low

REFERENCE BOOKS:

1. Soft Skills, revised 2nd edition, K.Alex, S.Chand &Company, New Delhi.2014.
2. Effective Technical Communication | 2nd Edition Paperback,M Ashraf Rizvi, McGraw Hill Education. 2017.
3. Speaking English Effectively, 2nd Edition Krishna Mohan & NP Singh, 2011. (Mcmillan).
4. A Hand book for English language skills, E.Suresh kumar, P.Sreehari, Foundation Books,2011
5. Basics of Communication in English, Soundararaj, Francis. 2012.. *New Delhi: Macmillan*
6. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.

B.Tech

III Year II Semester

B.Tech

III Year II Semester

S.No	Course Code	Course Title
1	20MET12	Dynamics of Machinery
2	20MET13	Operations Research
3	20MET14	Mechanical Measurements & Metrology
		OPEN ELECTIVE –I
4	20MET33	Power Plant Engineering
5	20MET34	Plant layout and Design
6	20MET35	Energy conservation and Management
		OPEN ELECTIVE – II
7	20MEP13	Engineering Projects in Community Services(Project based)
8	20MET36	Time and Motion Study
9	20MET37	NanoTechnology
10	20MEP10	Computer Aided Machine Drawing
11	20MEP11	Machine Tools and Metrology Lab
12	20MES03	Skill Oriented Course 4

20MET12: DYNAMICS OF MACHINERY

Credits – 4 **Sessional Marks: 30**
L:T:P :: 3:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the student with fundamental knowledge of dynamics of machines so that student can appreciate problems of dynamic force balance, transmissibility of forces, isolation of systems.
2. Develop understanding of clutches and its significance on engineering design.
3. Develop understanding of dynamic balancing, flywheel analysis, gyroscopic forces and moments

Course Outcomes

After successful completion of course the student should be able to

CO1. Carry out graphical and analytical analysis of static and inertial force on mechanisms.

CO2. Design and develop power transmission system using flat belt drives considering friction. Similarly calculate the torque in bearings using friction.

CO3. Explain with sketches functions and design of Porter and Hartnell governors.

CO4. Analyze stabilization of sea vehicles, aircrafts and automobile vehicles.

CO5. Proficiency in computing frictional losses, torque transmission of mechanical systems.

CO6. Analyze dynamic force analysis of slider crank mechanism and design of flywheel.

UNIT I

Clutches: Friction Clutches- Single Disc Or Plate Clutch- Multiple Disc Clutch- Cone Clutch- Centrifugal Clutch

Brakes and Dynamometers: Simple Block Brake-Band Brake- Internal Expanding Brake. Braking of a Vehicle, Dynamometers Absorption- Prony Brake-Rope Brake and transmission types- Epi-cyclic train –belt transmission-torsion, general description and methods of operations.

UNIT II

Centrifugal Governors: Sleeve loaded Governors-Watt Governor, Porter Governor,Pronell Governor- Spring loaded Governors- Hartnell- Hartung Governors and Governors with auxiliary springs- sensitiveness- isochromism- stability and hunting in Governors- Governor effort and Power- controlling force diagrams.

UNIT III

Turning Moment Diagrams And Flywheel: Construction of Crank Effort and torque diagrams- Fluctuation of energy and speed in fly wheels- Fly wheel of an IC Engine- Fly wheel of a Punching Press and Problems.

Gyroscopic Couple And Processional Motion: Gyroscopic Couple- Effect of Precession on stability of moving vehicle's such as motor cars- motor cycles- aero planes and ships.

UNIT IV

Balancing of Rotating Masses: Introduction-Balancing of rotating masses-Couple polygon, force polygon, Analytical Method.

Balancing of Reciprocating Masses : Introduction , Balancing of reciprocating Engine, Partial balancing of Primary Force, Partial balancing of Locomotives, Effect- variation of tractive force, swaing couple, Hammer blow, coupled locomotives, Primary and Secondary balance of multi-cylinder in-line Engines- analytical method.

UNIT V

Fundamental Aspects of Vibrations: Vibration, main causes, advantages and disadvantages; engineering applications of vibration, Simple Harmonic Motion (S.H.M.), Work done by harmonic force, Principle of super position applied to SHM

Un damped Free Vibrations (Single DOF): Derivations for spring mass systems, Methods of Analysis, Natural frequencies of simple systems, Springs in series and parallel, simple problems

Text Books

1. S.S. Rattan, "Theory of Machine", Tata McGraw-Hill, 3rd Edition, 2013.
2. R.S Khurmi, "Theory of Machine", S Chand Publications, 14th Edition,2005 .
3. R.K.Bansal, J.S.Brar, "Theory of Machine", Laxmi Publications, Revised Edition 2016.
4. G. K. Grover, 'Mechanical Vibrations', Nemchand and Bros, 8th edition, 2009.

Reference Books

1. J.E. Shigley, "Theory of Machines and Mechanisms", 4th Edition, Oxford International student Edition.
2. Sadhu Singh, "Theory of Machines", Second Edition, 2006.
3. Thomas Bevan, "Theory of Machines", Pearson (P), 3rd Edition, 2012.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M				L			M			H	M	L
CO2	M	L	H				M			M		L	M	H	H
CO3	L	M	H							M		L	M	H	
CO4	M	H	H	L			M			M		L	M	H	M
CO5	H	L	M	H			M			M		L	M	H	

20MET13: OPERATIONS RESEARCH

Credits – 4 **Sessional Marks: 30**
L:T:P ::3:1:0 **University Exam Marks: 70**

Course Objectives
To expose the students to the following
1. Familiarize optimized Decision Making models in Operations Management.

Course Outcomes
After successful completion of course the student should be able to
CO1. Define and formulate mathematical models for Operation Management.
CO2. Formulate the Assignment Models. `
CO3.Define replacement strategies for maintenance of production systems.
CO4. Understand game, queuing and decision theories.
CO5. Formulate multi-stage applications into a dynamic programming framework

UNIT I

Development: definition– characteristics and phases – types of operation research models – applications.
Allocation: Linear programming problem formulation – graphical solution – simplex method – artificial variables techniques -two–phase method, big-M method – duality principle.

UNIT II

Transportation Problem: Formulation – optimal solution, unbalanced transportation problem – degeneracy, assignment problem – formulation – optimal solution - variants of assignment problem- traveling salesman problem.
Sequencing: Introduction – flow –shop sequencing – *n* jobs through two machines – *n* jobs through three machines – job shop sequencing – two jobs through 'm'machines.

UNIT III

Replacement: Introduction – replacement of items that deteriorate with time – when money value is not counted and counted – replacement of items that fail completely, group replacement.

UNIT IV

Theory of games: Introduction – mini. max (max. mini) – criterion and optimal strategy – solution of games with saddle points – rectangular games without saddle points – 2 x 2 games – dominance principle – m x 2 & 2 x n games –graphical method.
Waiting Lines: Introduction – single channel – poison arrivals – exponential service times – with infinite population and finite population models– multichannel – poison arrivals – exponential service times with infinite population single channel poison arrivals.

UNIT V

Dynamic Programming: shortest path problem, PERT, CPM, Applications and simulation techniques and applications.

Text Books
1. S.D.Sharma-Kedarnath, "Operations Research".
2. Kenneth H. Rosen, "Discrete Mathematics and its Applications", 7th edition, Tata McGraw Hill.

Reference Books

1. Hiller &Libermann, "Introduction to O.R", Tata McGraw Hill.
2. A.M.Natarajan, P.Balasubramani, A.Tamilarasi, "Operations Research", Pearson.
3. Maurice Saseini, ArhurYaspan& Lawrence Friedman., "Operations Research Methods & Problems".
4. R.Pannerselvam, "Operations Research", PHI Publications.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H	M		M		M		L	L	M	L	H		M
CO2		H	M				M				M	L			M
CO3	H	H	M		M		M		L		M	L			M
CO4	H									L		M			M
CO5		H	M		M		M		L		M	M			

20MET14: MECHANICAL MEASUREMENTS AND METROLOGY

Credits – 3 Sessional Marks: 30
L: T: P:: 3:1:0 University Exam Marks: 70

Course Objectives

To expose the students to the following

1. To identify and estimate measurement errors and suggest suitable techniques to minimise the errors.
2. Interpret characteristics of measuring instruments, apply suitable methods of measurement while measuring field quantities such as force, pressure, temperature, velocity, torque, vibration etc.,
3. Identify suitable methods and devices for dimensional, geometrical and surface roughness measurements, design limit gauges.

Course Outcomes

After successful completion of course the student should be able to

CO1. Working of various instruments used for measuring for displacement, temperature and pressure.

CO2. Working of various instruments used for measuring for flow, speed, stress, strain and Vibration.

CO3. Explain the measurement concepts of displacement, temperature, pressure, level, speed, acceleration, strain etc.

CO4. Use the various sources of measurement by measuring instruments with precision. humidity, force, torque and power and control system.

CO5. Select a measuring instrument to inspect the dimensional and geometric features of a given component**s**

UNIT I

ntroduction: Errors in measurements, statistical analysis of data, regression analysis, correlation, estimation of uncertainty and presentation of data, design of experiments, measurement of field quantities like temperature, pressure, force, torque, velocity measurement of derived quantities. measurement of vibration and noise, computer assisted data acquisition, data manipulation, data presentation.

UNIT II

Measurement of Pressure: Standards and calibration, basic methods of pressure measurement, dead weight gauges and manometers.

Measurement of Speed: Mechanical Tachometers - Electrical tachometers - Stroboscope, Noncontact type of tachometer.

Measurement of Acceleration and Vibration: Different simple instruments – Principles of Seismic instruments - Vibrometer and accelerometer.

UNIT III

Stress & Strain Measurements: Various types - electrical strain gauge - gauge factor – method of usage of resistance strain gauge for bending, compressive and tensile strains - usage for measuring torque, Strain gauge Rosettes.

Measurement of Force: Standards and calibration, Basic methods of Force Measurement

UNIT IV

Metrology Introduction: Basic concepts in measurement: Basic terminology, definition, types, need of inspection, technologies ,methods of measurement, selection of instruments, measurementerrors, units, measurement standards, calibration, statistical concepts in metrology.

Length standard:line and end standard-slip gauges-calibrations of slip gauges-dial indicator-micrometres.

UNIT V

Angular measurement: different methods-bevel protractor-angle slip gauges-spirit levels-sine bar-sine plate used to determine the tappers.

Limit gauges: Taylor's principle-design of go and no –go gauge-plug –ring-snap-taper-profile and position gauges.

Text Books

1. Doebelin E O, *Measurement Systems, Application and Design,* 4th Edition, McGraw Hill Higher Education (1989).
2. Hume K J, *Engineering Metrology,* 3rd Edition, TBS The Book Service Lt (1970).

Reference Books

1.Beckwith G and Thomas G, Mechanical Measurements, 6th Edition, Pearson Education (2013).
2. Czichos H, Saito T and Smith L E, The Springer handbook of metrology and Testing, 2nd Edition, Springer (2011).
3. Smith G T, Industrial Metrology, 1st Edition, Springer (2002).

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	H		M							M			H	H	H
CO 2	M	H	M	M						M			H		M
CO 3	M	H	M							M			M	M	M
CO 4	M	H	L	M						M			H		
CO 5	H	M	L	M	M					M			H	L	L

20MET33: POWER PLANT ENGINEERING

Credits – 3 **Sessional Marks: 30**
L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following
1. Introduce students to different aspects of power plant engineering.
2. Familiarize the students to the working of power plants based on different fuels.
3. Expose the students to the principles of safety and environmental issues.

Course Outcomes

After successful completion of course the student should be able to
CO1**:** Describe sources of energy and types of power plants. Analyze different types of steam cycles and handling of ash in a steam power plant.
CO2: Expand the types of steam generator, Mounting& Accessories
CO3: Describe the working of different condensers
CO4: Describe the plant instrument and control components
CO5: List types of nuclear reactor and different components

UNIT I

Coal based Steam Power Plants: Thermal power plants: Introduction- plant lay out of a modern steam power plant. Cycles: Reheat- Regenerative- Binary vapour cycle. Different types of fuels used for steam generation- Selection of site for steam power station. Fuel handling system – coal handling systems- various stages in coal handling Fuel system – Pulverized fuel firing system-Ash handling system: Classify ash handling systems -Hydraulic and Pneumatic systems- Dust collector : Classify dust collectors – Mechanical- Cyclone separator.

UNIT II

Steam Generators: Steam Boilers: Classification- Fire tube- Water tube boiler- High pressure boilers – Lamont- Benson selection of a boiler. Boiler Mounting& Accessories: Super heater- Economiser- Air Preheater- types – construction. Water Treatment: Impurities in water and their effects - Methods of water treatment- Demineralising process. Chimney draught: Classification of draught- Steam jet draught- Mechanical draught.

UNIT III

Steam Condensers: Steam condensers: Introduction-types- Surface condenser- condenser auxiliaries- Methods of cleaning condenser tubes. Cooling Ponds & Cooling tower: Directed flow- Spray ponds- Natural draught cooling tower- Mechanical draught cooling tower- Maintenance of cooling towers. Steam Turbines: Classify- reaction turbine- governing of turbines – Methods of governing- Throttle control governing.

UNIT IV

Plant Instrumentation & Control: Power plant instrumentation- Classification- commonly used instruments -Bourdon tube pressure gauge-Radiation pyrometer- classify-components - throttling calorimeter-steam calorimeter.Importance of measurement and instrumentation in power plant- measurement of water purity- gas analysis- O_2 and CO_2 measurements- measurement of smoke and dust- measurement of moisture in carbon dioxide circuit- nuclear measurements.

UNIT V

Nuclear Power Station: Nuclear power plants - Introduction- nuclear fission- nuclear fusion- chain reaction. Nuclear reactor - Basic principles – types of reactors -Pressurized Water Reactor (P.W.R)- Boiling Water Reactor(B.W.R)-shielding-radio Active waste disposal- radiation hazards – Control and safety rods. Safety measures for Nuclear Power Plants.

Text Books

1. Er. R.K.Rajput, “Power plant engineering”, Laxmi publications pvt limited, New Delhi.
2. AroraS.C.& Domkundwar S,“A course in power plant engineering”, 3rd Edition, DhanpatRai.
3.P K Nag, “Power plant engineering”, 3rd Edition,Tata McGraw-Hill Publishing Company ltd.

Reference Books

1. Anup Goel Laxmikant D. Jathar Siddu S. P, “Power plant engineering”, 3rd Edition, PHI Ltd.
2. A.K. Raja, “Power plant engineering”,3rd Edition, New age international publishers.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-POS)Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M	H		M			L	L		M		M	L		M
CO2	H	M		M			L			M		M	H	M	M
CO3	H	L		M			L			M		M	H	M	L
CO4	H		L	M			L			M		M	H		M
CO5	H	L		H		L	L			M		M	H	M	L

20MET34: PLANT LAYOUT AND DESIGN

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Provide the basic knowledge in the field of plant layout design and material handling in an industry.
2. It focuses primarily on computerised design systems and applies the principles of material handling for their modeling.
3. The application of quantitative models to design and processes are analysed, in the field of a strategic planning of an industry.
4. Providing basic knowledge over computerised layout techniques.

Course Outcomes

After successful completion of course the student should be able to

CO1. Learn different types of plant layout designs and material handling techniques.
CO2. Build model for plant layout.
CO3. Develop skills in the design of layouts for various engineering environmental projects.
CO4. Generate computerised layouts.
CO5. Know basics of ALDEP, CORELAP, CRAFT etc.

UNIT I

Introduction: Criteria−strategies/tactics−sustainability and eco-efficiency in plant design−basic planning−alternative machine arrangements−flow lines−location models−act/building details−aisles and security−storage−shipping and receiving−offices−specialized areas.

UNIT II

Material Handling: Workstations, Unit Loads & Containers, Conveyors, Vehicles, Lifting Devices, Workstation Material Handling, Ethics in Plant Design Facilities design procedure and planning strategies, Production, activity and materials flow analysis, Space requirements and personnel services design considerations.

UNIT III

Layout construction techniques: systematic layout planning; activity relationship analysis, pair wise exchange, graph-based construction algorithmic.

Material Handling: Material handling principles; material handling equipment and material handling systems.

UNIT IV

Computerized Layout and Analytical Methods: ALDEP, CORELAP, CRAFT, BLOCPLAN, etc.

Warehouse operations: function, storage operations − manufacturing operation: JIT, TQM, AM, CIM, SCM, Facility systems

Quantitative models: Layout model, waiting line, AS/RS, simulation model, etc.

UNIT V

Layout Assessments: Assessment and evaluation of layout alternatives Projects use Spiral software to practice plant layout design, Apply mathematical and engineering techniques such as systematic layout planning approach, quantitative model, cost estimate to solve practical facility layout problem.

Text Books

1. B. K. Aggarwal, “Plant Layout and Material Handling”, Jain Brothers.
2. Dr. KC Arora & Shinde, “Aspects of Material handling”, Lakshmi Publications.

Reference Books

1. James M. Apple, “Plant Layout and Material Handling”, John Wiley & Sons.
2. S. C. Sharma, “Plant Layout and Material Handling”, Jain Brothers.
3. Peters, “Plant Design and Economics”, McGraw Hill Education.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H		M
CO2	L	M	H					M		M			H		M
CO3		M	H		M					M			H		M
CO4	M	H								M		M	H		M
CO5	H	M								M		M	H		M

20MET35: ENERGY CONSERVATION AND MANAGEMENT

Credits – 3	**Sessional Marks: 30**
L:T: P::3:0:0	**University Exam Marks: 70**

Course Objectives

1. The course is intended to
2. Demonstrate the importance and role of energy management in the functional areas like Manufacturing Industry, Process Industry,. Commerce and Government
3. To know the different energy resources
4. Understand thermodynamic power cycles and the associated processes and fuels
5. Understand the economics of energy conversion
6. Enable the students to understand the basic energy conversion and management
7. principles and to identify sources of energy loss and target savings
8. Enable students in carrying out budgeting and risk analysis
9. Analyze the performance of the wind turbine

Course Outcomes

After successful completion of the course the student should be able to

CO1. Explain the fundamentals of energy management and its influence on environment

CO2. Describe methods of energy production for improved utilization.

CO3. Apply the principles of thermal engineering and energy management to improve the performance of thermal systems.

CO4. Analyze the methods of energy conservation and energy efficiency for buildings, airconditioning, heat recovery and thermal energy storage systems.

CO5. Assess energy projects on the basis of economic and financial criteria.

UNIT I

INTRODUCTION: Principles of energy management. Managerial organization, Functional areas for i) manufacturing industry, ii) Process industry, iii) Commerce, iv) Government, Role of Energy manager in each of these organizations. Initiating, Organizing and managing energy management programs

UNIT II

ENERGY AUDIT: Definition and concepts. Types of energy audits, Basic energy concepts, Resources for plant energy studies. Data gathering, Analytical techniques. Energy Conservation: Technologies for energy conservation, Design for conservation of energy materials, Energy flow networks. Critical assessment of energy usage. Formulation of objectives and constrains, Synthesis of alternative options and technical analysis of options. Process integration.

UNIT III

ECONOMIC ANALYSIS: Scope, Characterization of an investment project. Types of depreciation, Time value of money. Budget considerations, Risk analysis.

UNIT IV

METHODS OF EVALUATION OF PROJECTS: Payback, Annualized costs, Investor's rate of return, Present worth, Internal rate of return, Pros and cons of the common method of analysis, Replacement analysis.

UNIT V

ALTERNATIVE ENERGY SOURCES: SOLAR ENERGY: Types of devices for solar energy collections, Thermal storage system, Control systems. Wind Energy, Availability, Wind Devices, Wind Characteristics, performance of turbines and systems.

Reference Books

1.Energy Management Hand Book / W.C. Turner (Ed)
2. Energy Management Principles / CB Smith/ Pergamon Press
3. Energy Management / W.R.Murthy and G.Mc.Kay / BS Publication
4. Management / H.Koontz and Cyrill Donnel / McGraw Hill

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					**M**		**L**					
CO2					**M**						**H**	**L**
CO3									**L**			
CO4				**M**					**M**			**L**
CO5					**H**				**M**		**H**	**L**

20MEP13: ENGINEERING PROJECTS IN COMMUNITY SERVICES (PROJECT BASED)

Credits – 3 **Sessional Marks: 30**
L: T: P:: 0:0:3 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. It enhances the students to have leadership, entrepreneurship skills.
2. It enables the students to learn the design thinking course for community services
3. It enables the students to understand social problems and design sustainable solutions for the problems.

Course Outcomes

After completion of the course the students will be able to

1. Familiarize with the concepts of social engineering.
2. Study existing research in social engineering problems.
3. Understand the concepts of HUMAN CENTERED DESIGN
4. Learn and apply the design thinking concepts in community engaged aspects.
5. Develop a prototype model through functional requirements with brainstorming.

EVALUATION: Each activity carries
Prototyping Model Development

ACTIVITIES:

1.Reviewing the websites regarding social innovations from startupstories.com, https://www.academia.edu/13952799/Engineering_Design_Thinking_Teaching_and_Learning
2. Reading blogs and brain storming techradar.com,consumerhelpline.gov.in,gadgets.ndtv.com,mygov.in,gsmareana.com about challenges addressing community …etc
3. Reviewing of 5-10 Articles of Social Innovation.
4. Asking reflection on their design experience understanding technological innovation.
5. Presenting the Experienced designer characteristics through design thinking.
6. Research about a potential project with a community partner in a community.
7. Requiement from the community partner of the identified project.
8. Pitching the idea of a project.
9. Concept of Human Centered Design and review of its literature.
http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.426.5107&rep=rep1&type=pdf
https://docs.lib.purdue.edu/dissertations/AAI3413917/
10. Identifying true need of the project.
11. Prepare the list of specifications.
12. Investigate the current projects or bench marks that are available in the market.
13. Develop functional requirements including sub-functions (use flow chart /free chart as tool of representation)

a) Create a functional decomposition for a stapler. Make the diagram using a word process or PowerPoint or by hand and upload the diagram. If it is done by hand, please write legibly so the graders can evaluate properly.

14. Prototyping the selected design of innovation from brainstorming.
15. Testing the prototype using DFMEA (Design for Failure model and Effects Analysis)

Process Step / Input	Potential Failure Mode	Potential Failure Effects	SEVERITY	Potential Causes	OCCURRENCE	Current Controls	DETECTION	RPN
What is the process step and Input under investiga-tion?	In what ways does the Key Input go wrong?	What is the impact on the Key Output Variables (Customer Requirements)?		What causes the Key Input to go wrong?		What are the existing controls and procedures (inspection and test) that prevent either the cause or the Failure Mode?		
								0
								0
								0

16. Taking feedback from community partner about the performance of prototype and preparing the delivery checklist.

Delivery Checklist :

Team: _____ **Project:_____**

Project Partner: _____ **Project Leader: _____**

Advisor: _____ **Date delivered:_____**

Delivery Location:_____

	Proj. Leader	Advisor Instructor	EPICS Admin
Delivery Checklist			
1. The key components been reviewed by the advisor and/or external reviewers.			
2. The system has been completely tested in the delivery configuration.			
3. The project identified as an EPICS project (e.g. an EPICS sticker).			
4. The team has appropriate design documentation for the project on SharePoint.			
5. The project partner's requirements have been addressed by the project.			
6. The quality of the appearance of the project is acceptable for delivery.			
7. Safety issues identified in design reviews have been addressed.			
8. User manuals and/or troubleshooting guides are complete.			
9. Maintenance and upkeep roles for EPICS students and project partner have been clearly identified.			
10. EPICS team has taken a photograph of the project to include in summary and team website.			
The EPICS team will check on the status of the project in two weeks.			
11. Contact information has been provided to program coordinator [Pam Brown].			
12. Copy of Customer Satisfaction Questionnaire has been given to community partner.			
13. Preliminary copy of the delivery checklist delivered			

to the program coordinator.			
14. **Two week check (two weeks after delivery)**			
1. Delivered Project form completed.			
2. Project is working and should remain deployed at the Project Partner.			
3. User manuals and/or troubleshooting guides are complete and delivered to Project Partner.			
4. Completed checklist delivered to the program coordinator before the end of the semester.			
5. Customer Satisfaction Questionnaire has been completed by Community Partner.			

20MET36: TIME AND MOTION STUDY

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Know on scientific processes of work measurement.
2. Understand the applications of motion study in various fields of manufacturing industries.
3. Familiarize time study methods to design and control production systems.
4. Provide basic knowledge over Ergonomics.

Course Outcomes

After successful completion of course the student should be able to

CO1. Learn different method study techniques.
CO2. Determine standard time for the operations.
CO3. Use the models to calculate wages and incentives of an employee.
CO4. Design efficient workstation.
CO5. Apply ergonomic principles in plant layout design.

UNIT I

Work study: Definition of work study – Productivity – Time and motion study, work simplification – process charts and flow diagrams, Production Planning.

UNIT II

Motion Study: Operation analysis-Analysis of Motion-principles of motion Economy-Design of workplace Layout-Therbligs- S.I.M.O Charts-Analytical Estimating-Advantages and applications of motion study.

UNIT III

Work Measurement and Time Study: Introduction- Time Study Equipment – Stop watch Procedure for collecting data - Performance Rating –methods - Allowances - sample problems-Use time study data in Wage incentives and Collective bargaining**.**

UNIT IV

Predetermined Motion Time Standards: Work Factor System - Method Time Measurement - Basic Motion Time Study – MOST (Maynard Operation Sequence Technique).

Work Sampling - Objectives - Procedure - Number of Cycles to be timed - Applications of Work Sampling -Advantages of Work Sampling over Time Study –Disadvantages.

UNIT V

Ergonomics: Introduction, history of development, man-machine system and its components. Introduction to structure of the body- features of the human body, stress and strain, and metabolism, measure of physiological functions- workload and energy consumption, biomechanics, types of movements of body members, strength and endurance, speed of movements.

Text Books

1. International Labour organization, “Work-study”, Oxford and IBH publishing company Pvt. Ltd., N.Delhi, 2001.
2. Barnes Ralph M., “Motion & Time study: Design and Measurement of Work”, Wiley Text Books, 2001.

Reference Books

1. Benjamin E Niebel and FreivaldsAndris, “Methods Standards & Work Design”, McGraw Hill, 1997.
2. Groover, M.P., Automation production Systems and Computer Integrated Manufacturing, Pearson Education, 2003.

3. Marvin E, Mundel& David L, “Motion & Time Study: Improving Productivity”, Pearson Education, 2000
4. Sanders Mark S and McCormick Ernert J, “Human Factors in Engineering and Design”, McGraw Hill Inc., 1993.

Course Outcomes – Program Outcomes–Program Specific Outcome (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H									M			H		M
CO2	M	H		M						M	M		H		M
CO3	L	H	M							M			H		M
CO4	L		H							M			H		M
CO5		H	M							M	M	H	H		M

20MET37: NANO TECHNOLOGY

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

5. Provide the basic knowledge in the field Nano technology.
6. Focuses primarily on technological processes and properties of Nano materials.
7. Knowledge of manipulation and scaling of materials to Nano scale.
8. The applications of Nano technology in the field of biology and medicine.
9. Provide basic knowledge over quantum dots and structure of Nano crystals.

Course Outcomes

After completion of the course the student will be able to

CO1. Understand the synthesis and properties of Nano-structured materials.
CO2. Analyzemagnetic and electronic properties of quantum dots.
CO3. Investigate and manipulating materials in the Nanoscale.
CO4. Understand the structure, properties and applications of Fullerenes and Carbon nanotubes.
CO5. Applications of Nanoparticles in Nano biology and Nanomedicine.

UNIT I

General properties of Nano materials: Origin of nanotechnology − classification of nanomaterials. Fullerene, carbon, nanotubes (CNT's) – nanoparticles − physical, chemical, electrical, optical, magnetic and mechanical properties of nanomaterials.

Fullerenes and Carbon Nano Tubes (CNT's): Introduction: Synthesis and purification. Preparation of fullerenes in the condensed phase, transport, mechanical, physical properties of CNT's.

UNITII

Investigation and manipulating materials in the Nanoscale: Electron microscope, scanning probe microscopes, optical microscopes for nanoscience and Technology, X-Ray Diffraction.

UNIT III

SAMs and clusters: Growth process − Patterning monolayers− types of clusters−bonding and properties of clusters.

Semi conducting Quantum Dots: Introduction − synthesis of Quantum Dots− electronic structure of Nanocrystals−properties.

UNIT IV

Nano biology: Interaction between Biomolecules and Nanoparticle surfaces− different types of Inorganic materials used for the synthesis of Hybrid Nano-bio assemblies. Nano probesfor Analytical Applications.

Nano sensors: Nano sensorsbased on optical properties. Nano sensors based on quantum size effects.Nano-biosensors.

UNIT V

Nanomedicines: Developments of nanomedicines. Nanotechnology in Diagnostic applications, materials for use in Diagnostic and therapeutic Applications.

Text Books

1. T.Pradeep, “Nano: The Essentials” TaTa McGraw-Hill,2008.
2. W.R.Fahrner, “Nanotechnology and Nanoelectronics” Springer,2006.

Reference Books

1. Rechard Booker and Earl Boysen, “Nanotechnology”,Willey, 2006.

Course Outcomes – Program Outcomes – Program Specific Outcome (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H									M			H	M	
CO2	M	H								M			H	M	
CO3			H	M	M					M			H	M	
CO4	H				M					M			H	M	
CO5		H		M						M		M	H	M	

20MEP10: COMPUTER AIDED MACHINE DRAWING

Credits – 3 **Sessional Marks: 40**
L: T: P:: 0:0:6 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Introduce students to the basics and standards of engineering drawing related to machines and components.
2. Teach students technical skills regarding assembly, production and part drawings.
3. Help students gain knowledge about standard CAD packages on modeling and drafting.
4. Understand and apply national and international standards while drawing machine component.
5. Familiarize technical skills regarding assembly, production and part drawings.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire the knowledge of various standards and specifications about standard machine components.
CO2. Make drawings of assemblies with the help of given part drawings.
CO3. Select, configure and synthesize mechanical components into assemblies.
CO4. Model components of their choice using CAD software.
CO5. Get exposure to advanced CAD packages.

Points Applicable to Examinations

- End semester examination shall be based on Module IV only.
- 40 marks are allotted for internal evaluation: Internal exam 20 marks and day-to-day class exercises
  20 marks.
- The external examination shall be conducted as a CAD examination only.

Module	Content
I	Introduction: Principles of drawing, free hand sketching, manual drawing, CAD drawing etc.
II	Drawing standards: 2 exercises Code of practice for Engineering Drawing, BIS specifications – lines, types of lines, dimensioning, sectional views, Welding symbols, riveted joints, keys, fasteners – bolts, nuts, screws, keys etc. Limits, Fits – Tolerances of individual dimensions – Specification of Fits – basic principles of geometric & dimensional tolerances. Preparation of production drawings and reading of part and assembly drawings, surface roughness, indication of surface roughness, etc.
III	Introduction to drafting package: 1 exercises Input, output devices, introduction to drafting software like Auto CAD, basic commands and development of simple 2D and 3D drawings. Drawing, Editing, Dimensioning, Plotting Commands, Layering Concepts, Matching, Detailing, Detailed drawings.

IV	Assembly drawings using software package (2D): 10 exercises Cross heads, Stuffing boxes, , Eccentrics, Petrol Engine connecting rod, Pipe vice, Clapper box, Screw jack, Air cock, Non-return valve, Revolving centre Preparation of Bill of materials and tolerance data sheet

Text Books

1. C Jensen, J Helsel, D D. Voisinet,"Computer Aided Engineering Drawing", McGraw-Hill.
2. S.Trymbaka Murthy, "A Text Book of Computer Aided Machine Drawing", CBS Publisher.
3. Dhawan, "A Text Book of Machine Drawing", S. Chand & Company

Reference Books

1. K R Gopala Krishna, A S Ravindra, "Computer Aided Machine Drawing", Subhas Stores.
2. Goutam Pohit & Goutham Ghosh, "Machine Drawing with Auto CAD", Pearson.

Softwares

1. Auto CAD
2. CATIA

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H		
CO2		H	M							M			H	M	
CO3			H		L					M				H	L
CO4			M		H					M				H	L
CO5	H				M					M			H		

20MEP11: MACHINE TOOLS AND METROLOGY LAB

Credits – 1 **Sessional Marks: 40**
L: T: P:: 0:0:2 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Understand the parts of various machine tools and operate them.
2. Perform the different shapes of products that can be produced on the machine tools.
3. Measure the dimensions of various standard parts.

Course Outcomes

After successful completion of course the student should be able to

1. Perform plain turning, step turning, knurling, threading, eccentric turning, chamfering and facing operations on a lathe.
2. Estimate the chip reduction coefficient and shear angle on a shaping machine
3. Drill holes and produce internal threads
4. Machine spur and helical gears on a milling machine
5. Prepare setups and measure dimensional and geometrical features of components
6. Measure surface roughness of components.

PART A: MACHINE TOOLS

1. Introduction of general purpose machines -lathe, drilling machine, milling machine, shaper, planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.
2. Step turning and taper turning on lathe machine
3. Thread cutting and knurling on -lathe machine.
4. Drilling and tapping.
5. Planning
6. Slotting
7. Milling
8. Grinding of tool angles**.**

PART B: METROLOGY

1. Find the taper angle of given specimen by using bevel protractor and explain with a neat sketch.
2. Find the gear tooth profile of given specimen by using gear tooth vernier and explain with a neat sketch.
3. Find the screw thread parameter of given specimen using two wire method by floating carriage micrometer and explain with a neat sketch,
4. Find out the depth, internal and external diameter of specimen by using inside micrometer outside micrometer and Vernier calliper and explain inside micrometer with a neat sketch.
5. Find the taper angle of given specimen by using bevel protractor
6. Calibrate micrometer by using slipgauges
7. Find the taper angle of given specimen by using sine bar
8. Find the bore diameter of given specimen by using bore gauge and explain with a neat sketch.
9. Find the height of given specimen by using vernier height gauge and explain with a neat sketch.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1		M								M			M	M	H
CO2	H				M					M			M		M
CO3		M	H							M				M	H
CO4			H							M				M	M
CO5			H							M			H	M	H
CO6	H		M							M			M		M

20MES03: SOLID WORKS

Credits – 2 **Sessional Marks: 40**
L:T:P :: 0:1:2 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. To gain practical experience in handling 2D drafting and 3D modeling software system.
2. Familiarize the usage of SOLID WORKS software packages.

Course Outcomes

After successful completion of course the student should be able to

CO1 Develop 2D models using SOLID WORKS software.

CO2 Develop and model mechanical system using SOLID WORKS Software.

CO3 To impart knowledge on the use of SOLID WORKS software to solve various field problems in mechanical engineering to optimize and verify the design of machine elements.

Description

Solid Edge Essentials will provide a user of any proficiency the skill set to use Edge as their primary tool for design and change. This course will build on Part, Assembly and Draft workflows as they assist the user's daily tasks.

Expectations and Goals

- To understand how to create a 2D parametrically constrained sketch
- To create a 3D model using sketch driven features
- Create a 3D model using Synchronous driven features
- Combine individual parts into assemblies and build a BOM
- Create a 2D draft file driven from part and assembly files

Intended Audience

Our Solid Edge Essentials course invites both CAD users and Non-CAD users alike. This includes both existing Solid Edge users on older versions as well as CAD users on different software.

Course Outline:

Part Design:

- Part break down
  - Where to start? Construction geometry?
  - Ordered or Synchronous design approach?
  - Which features to model first?
- Profile/Sketch
  - **2D&3D designs that will improve your use of Intellisketch. Tips to faster and more reliable sketching. You'll learn to build predictable and reliable profiles that will not blow up**
- Optimize Design
  - What features to draw? Which to model? Learn to model the part, not draw it out. How detailed should profiles be? Learn to combine treatment features to reduce file overhead.

- ❖ Part design
  - ➢ Machined, Plastic (process for plastics design), cast and Sheet metal parts, Feature Libraries – grouping features to optimize the design.

References:

User manuals of SOLID WORKS package Version 17.0

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H		
CO2		H	M							M			H	M	
CO3			H		L					M				H	L

B.Tech

IV Year I Semester

B.Tech IV Year I Semester

S.No	Course Code	Course Title
1	20MET15	CAD/CAM
2		**ELECTIVE –III**
	20MET27	Finite Element Method
	20MET28	Composite Materials
	20MEP14	Design Thinking
	20MET29	Design for assembly and Manufacturing Fundamentals
	20BST10	Design and Management of Small Enterprise
3	20MEM01	**ELECTIVE– IV** (Mandatory MOOCs)
4		**ELECTIVE– V**
	20MET30	Operations Management
	20MET31	Non-linear Programming
	20MET32	Work Study
5		**OPEN ELECTIVE – III**
	20MET38	Total Quality Management
	20MET39	Supply Chain Management
6	20MEP12	Machine Dynamics& Mechanical Measurements Lab
7	20MEI02	Internship2
8		Skill Oriented Course 5

20MET15: CAD/CAM

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following:

1. Provide an overview of how computers are being used in design, development of manufacturing plans and manufacture.
2. Learn the part programming, importance of group technology,computer aided quality control.
3. Analyze the different geometric modeling techniques like solid modeling, surface modeling, and to visualize how the components look like before its manufacturing or fabrication.
4. Learn the overall configuration and elements of computer integrated manufacturing systems.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand geometric transformation techniques in CAD.
CO2. Develop mathematical models to represent curves and surfaces.
CO3. Model engineering components using solid modeling techniques.
CO4. Develop programs for CNC to manufacture industrial components.
CO5. Understand the application of computers in various aspects of Manufacturing viz., Design, Proper planning, Material handling system.

UNIT I

Overview of CAD-CAM: Product cycle,CAD, CAM and CIM. CAD Tools, CAM Tool, Utilization in an Industrial Environment, Evaluation criteria.CAD standards, CAD data structure, 2D and 3D transformations- translation, rotation, scaling, mirror, clipping.

UNIT II

Geometric Modeling: Representation techniques, parametric and non parametric representation, various construction methods- wire frame modeling, synthetic curves and their representations. Surface modeling- synthetics surfaces and their representations.Solid modeling – solid representation, fundamentals- introduction to boundary representations - constructive solid geometry**.**

UNIT III

Part Programming For NC Machines: NC, NC modes, NC elements, CNC machine tools,structure of CNC machine tools, features of Machining center, turning center, CNC Part Programming, fundamentals, manual part programming methods, Direct Numerical Control, Adaptive Control.

UNIT IV

Group Technology: Part Family,Classification and Coding,advantages & limitations, Group technology machine cells,benefits. FMS: Introduction,components of FMS, material handling systems, FMS control.

Computer Aided Quality Control- Terminology in Quality control,Inspection and testing,Contact inspection methods, optical and non optical- integration of CAQC with CAD and CIM.

UNIT V

Computer Integrated Manufacturing Systems: Types of manufacturing systems, machine tools and related equipment, material handling systems, material requirement planning, computer control systems, human labor in manufacturing systems, CIM benefits, advantages and disadvantages of CIM.

Text Books

1. A. Zimmers&P.Groover, “CAD-CAM” Pearson Publication.
2. P.N. Rao, “CAD-CAM Principles and applications”.

ReferenceBooks

1. Radha krishnan and Subramaniah,“CAD-CAM-CIM”.
2. R. Siva subramaniam, ”CAD-CAM”, TMHs.

Course Outcomes–Program Outcomes–Program Specific Outcome (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1	H	M								M			H		
CO 2		M	H							M				H	
CO 3			H	M						M				H	
CO 4		H	M							M				H	M
CO 5	H	M								M		M	H		M

20MET27: FINITE ELEMENT METHOD

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Enable the student to analyze the engineering problems in the design process of solids and their structures.
2. Make the students to apply the knowledge of mathematics, science and engineering to do the analysis of simple and complex elastic structures using the finite element analysis.
3. Derive the finite element equations for different mechanical elements.
4. Learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Course Outcomes

After completion of the course the students will be able to

CO1. Apply and understand the basic concepts of Finite element analysis procedure.
CO2. Knowledge of mathematics and engineering in solving the problems related to structural and heat transfer.
CO3. Identify the application and characteristics of FEA elements such as bars, beams, plane and iso-parametric elements
CO4. Develop element characteristic equation and generation of global equation.
CO5. Use the commercial FEA packages like ANSYS and modern CAD/CAE tools for solving real life structural problems.

UNIT I

Fundamental Concepts: Introduction, Historical background, Outline of presentation, General procedure for FEA, Stresses and Equilibrium, Boundary conditions, Strain Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy and equilibrium. The Rayleigh-Ritz method, Hamilton's principle.Galerkin's method, Saint Venant's principle.

UNIT II

One-dimensional Problems: Introduction, Finite element modeling, Coordinates and Shape functions. The potential energy approach. The Galerkin approach, Assembly of the global stiffness matrix- mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects. Trusses: Introduction, Plane trusses, Three-dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

UNIT III

Two-dimensional Problems Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle inplane and Bending, problem modeling and boundary conditions.
Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

UNIT IV

Two-dimensional Isoparametric Elements and Numerical Integration: Introduction, The four-node quadrilateral, Numerical integration, requirements, h-refinement and p-refinement, Higher-order elements, Convergence

UNIT V

Beams and Frames: Introduction, Finite element formulation, Load vector, Boundary considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

Mesh generation techniques such as semi automatic and fully automatic use of softwares such as ANSYS- NISA-NASTRAN etc.

Text Books

1. Chandrupatla- Ashok and Belegundu "Introduction to Finite Elements in Engineering", Prentice - Hall.
2. J N Reddy "Finite Element Analysis",TMH.

Reference Books

1. S. Md. Jalaludeen ,"Introduction to Finite element analysis", Anuradha Publications.
2. Krishna Murthy, "Learning Finite Element Method", TMH.
3. Bathe, "Finite Element Analysis", PHI.
4. SS Rao, "The Finite Element Methods in Engineering" , Pergamon.
5. Chennakesava-Alavala ,"Finite Element Methods: Basic Concepts and applications",PHI.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M	M				L			M			H	M	
CO2	M	H	H				M			M		L	M	H	H
CO3	H	M	M		H		M			M		L	M	M	M
CO4	M	H	M	M			L			M		L	M	H	M
CO5	L	M	H	L			M			M		L	M	H	M

20MET28: COMPOSITE MATERIALS

Credits – 3 **Sessional Marks: 30**
L:T:P :: 2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Understand the concept of the composite materials and its terminologies used.
2. Analyze the different processing/ fabrication techniques of composite materials especially fiber components
3. Analyze brief descriptions for the polymer materials and its applications
4. Familiarize about fiber and matrix properties for structural applications.
5. Describe the optimum fabrication techniques for metal matrix materials and powder metallurgy techniques to enhance material properties.

Course Outcomes

After completion of the course the students will be able to

CO1. Explain concept of the composite materials and its terminologies used.
CO2. Analyze the different processing/ fabrication techniques of composite materials especially fiber components
CO3. Describe the polymer materials and its applications which are having better improved properties to suit with conventional materials
CO4. Analyze the fiber and matrix properties for structural applications.
CO5. Evaluate the optimum fabrication techniques for metal matrix materials and powder metallurgy techniques to enhance material properties.

UNIT I

Introduction To Composites: Fundamentals Of Composites - Need For Composites – Enhancement Of Properties – Classification Of Composites – Matrix-Polymer Matrix Composites (PMC)- Metal Matrix Composites (MMC)- Ceramic Matrix Composites (CMC) – Reinforcement – Particle Reinforced Composites- Fibre Reinforced Composites. Applications Of Various Types Of Composites.

UNIT II

Polymer Matrix Composites: Polymer Matrix Resins – Thermosetting Resins- Thermoplastic Resins – Reinforcement Fibres – Rovings – Woven Fabrics – Non Woven Random Mats – Various Types Of Fibres. PMC Processes - Hand Lay Up Processes – Spray Up Processes – Compression Moulding – Reinforced Reaction Injection Moulding - Resin Transfer Moulding – Pultrusion – Filament Winding – Injection Moulding. Fibre Reinforced Plastics (FRP)- Glass Fibre Reinforced Plastics (GRP).

UNIT III

Metal Matrix Composites: Characteristics Of MMC- Various Types Of Metal Matrix Composites Alloy Vs. MMC- Advantages Of MMC- Limitations Of MMC- Reinforcements – Particles – Fibres. Effect Of Reinforcement -Volume Fraction – Rule Of Mixtures. Processing Of MMC – Powder Metallurgy Process -Diffusion Bonding – Stir Casting – Squeeze Casting.

UNIT IV

Ceramic Matrix Composites: Engineering Ceramic Materials – Properties – Advantages – Limitations – Monolithic Ceramics -Need For CMC – Ceramic Matrix - Various Types Of Ceramic Matrix Composites - Oxide Ceramics– Non Oxide Ceramics – Aluminium Oxide – Silicon Nitride – Reinforcements – Particles- Fibres whiskers. Sintering - Hot Pressing – Cold Isostatic Pressing (Ciping) – Hot Isostatic pressing (Hiping).

UNIT V

Advances In Composites : Carbon -Carbon Composites – Advantages Of Carbon Matrix – Limitations Of Carbon Matrix Carbon Fibre – Chemical Vapour Deposition Of Carbon On Carbon Fibre Perform. Sol-Gel Technique – Composites for Aerospace Applications.

Text Books

1. Mathews F.L. and Rawlings R.D.- "Composite Materials: Engineering and Science", Chapman and Hall- London- England.
2. Chawla K.K.- "Composite materials"- Springer, Verlag.

Reference Books

1. T.W. Clyne and P.J. Withers- "Introduction to Metal Matrix Composites"- Cambridge University Press.
2. A.B. Strong- "Fundamentals of Composite Manufacturing", SME.
3. S.C. Sharma- "Composite materials", Narosa Publications.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H		M				L			M			H	M	L
CO2	M	H								M		L		H	H
CO3	L	M	H							M			M		
CO4	M	H	H							M		L	M		M
CO5		L	M	H			M			M		L		H	

20MEP14: DESIGN THINKING

Credits – 3 **Sessional Marks: 30**
L:T:P :: 0:0:3 **University Exam Marks: 70**

Course Objectives
To expose the students to the following
1. It enables the students to learn the design thinking course for community services
2. It enables the students to understand social problems and design sustainable solutions for the problems.
3. To establish network with community principles.

Course Outcomes
After completion of the course the students will be able to
1. Understand the Design thinking Process.
2. Identify & Assess customer needs.
3. Create product based on customer needs that are desirable, feasible and viable.
4. Generate & evaluate new product service.
5. Design prototype
6. Create robust product Architecture.
7. Test product for sustainability
8. Plan & Manage Innovation projects

UNIT I

Design thinking –Meaning –Significance-Skills expected, Innovation challenges-Real win- worth framework-Innovation processes, leadership-Overall culture.

UNIT II

Product Development Process- Design planning & Analysis- customer needs & markets- types of product users –customer need analysis-product specifications Identification-Dynamics and quality function deployment.

UNIT III

Creativity techniques-Problem decomposition techniques-creative thinking and systems exploration –prototyping –types-strategy.

UNIT IV

Product Architecture- Types- Integral-Modular-Design for services- Services cycle experience map-Product vs Service systems- selection of product /service architecture –DFMEA Analysis

UNIT V

Product Development Economics-Financial Modelling -NPV –Cashflow analysis of the product-Design for Environment integration –Product life cycle-Herman Miller story-Product Development Process-staged. Spiral and agile Methodologies.

Text Book(s)
1. Philip Kosky, Robert T. Balmer, William D. Keat, George Wise, "Exploring Engineering: An Introduction to Engineering and Design", 4th edition, Elsevier, 2016.
2. David Ralzman, "History of Modern Design", 2nd edition, Laurence King Publishing Ltd., 2010
3. An AVA Book, "Design Thinking", AVA Publishing, 2010.

Reference Books:

1. G. Pahl, W.Beitz, J. Feldhusen, KH Grote, "Engineering Design: A Systematic Approach", 3rd edition, Springer, 2007.
2. Tom Kelley, Jonathan Littman, "Ten Faces in Innovation", Currency Books, 2006.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H							M			M		M
CO2	H	M								M			M		H
CO3		M	H							M					H
CO4		H		M						M					H
CO5		H								M					H
CO6			H							M			M		H
CO7		M					M							M	
CO8		H					H						M		M

20MET29: DESIGN FOR ASSEMBLY AND MANUFACTURING FUNDAMENTALS

Credits – 3 **Sessional Marks: 30**

L:T:P::2:1:0 **University Exam Marks: 70**

Course Objectives

1. To expose the students to the basics of product design and manufacturing.
2. To introduce students to principles and evaluation methods of various aspects of designing components.
3. To teach students about the manufacturability requirements and assembly processes.

Course Outcomes

After successful completion of course the student should be able to

1. Possess customer-oriented, manufacturing and life cycle sensitive approach to product design and development, with product design principles and structured design methodologies.
2. Possess methods and approaches for developing, implementing and nurturing an effective DFM process within the firm.
3. Demonstrate the knowledge of DFMA software for case studies.

UNIT-I

Introduction to Product design: Introduction to Product design: Asimow's Model - Product design practice in Industry - Strength consideration in product design - Design for stiffness and rigidity.

UNIT-II

Principles and evaluation methods: Principles and evaluation methods of various aspects of Design for X (machining - sheet metal working - injection molding - environment - service and repair - etc.)

UNIT-III

Manufacturability requirements: Manufacturability requirements - Forging design - Pressed component design - Casting design - Die Casting and special castings.

UNIT-IV

Assembly and assembly process: Assembly and assembly process - principles of Design for assembly and applications (Boothroyd/Dewhurst Method – case studies using DFMA software.)

UNIT-V

Other supporting techniques: Other supporting techniques for new product development processes such as quality function deployment - and quality engineering and Taguchi Method.

TEXT BOOKS

1. Boothroyd, G., (1999), Product Design for Manufacture and Assembly, Marcel Decker

REFERENCE BOOKS

1. Bralla, J.G., (1999), Design for Manufacturability Handbook, McGraw-Hill.
2. A.K. Chitale, R.C. Gupta, (1997), Product Design and Manufacturing., Printice –Hall of India.
3. James G. Bralla, (1999), Hand Book of Product Design for Manufacturing, McGraw Hill Company.
4. Swift K.G., (1999), Knowledge based design for manufacture, Kogan Page Ltd.

20BST10: DESIGN AND MANAGEMENT OF SMALL ENTREPRISE

Credits – 3 **Sessional Marks: 30**
L:T: P::3:0:0 **University Exam Marks: 70**

Course Objectives

1. To understand the principles & phases of projects
2. To identify the resources of the project & duration.
3. To know the role entrepreneurship in economic development
4. To understand the problems of SSE
5. To learn the design & preparation of business plan.

Course Outcomes

After successful completion of the course the student should be able to

CO1. Define the concepts of project, engineering project design, and prototyping and feasibility study
CO2. Evaluate product duration, cost & quality control charts
CO3. Identify the ways to enhance economic development
CO4. Capable to maintain the problems of SSE and SWOT analysis
CO5. Design the business plan

UNIT I

Project Management: Concept of project - Project Life Cycle Phases – Human centred Engineering Project Design – Design thinking – Principles – Preliminary project specification – Feasibility Study – Detailed Project Design - Prototyping Methods – Validation of project with users.

UNIT II

Project Evaluation Techniques: PERT - CPM - Statistical Quality Control: X & R charts, P & C charts - Report preparation - Incubation – Concept – Support System.

UNIT III

Introduction to Entrepreneurship: Definition of Entrepreneur, Entrepreneurial Traits, Entrepreneur vs Manager, Entrepreneur vs Entrepreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development – Problems faced by women entrepreneurs – Support System for entrepreneurs.

UNIT IV

Small Scale Enterprise: Definition, Characteristics, Role of Small Enterprise in Economic Development, Problems of SSE, and Steps involved to start SSE, Package for promotion of Small Scale Enterprise, SWOT Analysis.

UNIT V

Business Model Design: Innovation readiness to commercialisation – Business Plan Preparation - Venture capital support system – Start-up support system and Review of Indian start-up business models.

Reference Books

1 L.S. Srinath, PERT/CPM, Affiliated East-West Press, New Delhi , 2002
2 S. Choudary, Project Management, McGraw Hill Education (India) Private Limited, New Delhi.
3 S.S.Khanka, Entrepreneurial Development, S Chand & Company Ltd., New Delhi.

Course Outcomes – Program Outcomes (CO-PO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1					**M**		**L**					
CO2					**M**						**H**	**L**
CO3									**L**			
CO4				**M**					**M**			**L**
CO5					**H**				**M**		**H**	**L**

20MET30: OPERATIONS MANAGEMENT

Credits – 3 **Sessional Marks: 30**
L:T:P::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Familiarize the Operations Management Philosophy.
2. Know the knowledge of Operations planning.
3. Learn the models scheduling of operations.
4. Application of manufacturing and business environment.
5. Develop efficient productivity methods.

Course Outcomes

After successful completion of course the student should be able to

CO1.Understand the factors affecting productivity and developing decision support system.
CO2.Device facility location and layouts for different production capacities.
CO3.Analyze different forecasting models for demand.
CO4.Evaluate different material and capacity requirement planning methods.
CO5. Create and analyze different job scheduling strategies.

UNIT I

Operations Management Concepts: Introduction Historical Development–Operations Management Definition– and Framework for managing operation– The trending operation management Products v/s Services–Productivity– Factors affecting Productivity– International Dimensions of Productivity–The environment of operations– scope of Operations Management.

Operations Decision Making: Introduction–Characteristics of decisions–framework for Decision Making–methodology– Concept and Numerical problems on economic model (BEA)–Decision tree analysis.

UNIT II

Capacity Planning: Introduction– Design capacity–System capacity– capacity planning– investment decisions and Numerical problem.

Facility Location and Layout: Introduction– Need of selecting a suitable location– factors influencing plant location– Location Planning for Goods and Services– Foreign locations– Objectives of the good plant layout–facility layout– Classification of layouts–analysis and selection of Layouts–minimizing cost in job shop layout.

UNIT III

Demand Forecasting: Nature and use of forecast – Forecasting time horizon– short and long range forecasting– sources of data– demand patterns– forecasting models: qualitative forecasting techniques–quantitative forecasting models- linear regression– moving average– exponential smoothing–monitoring and controlling forecasting models–Numerical problems.

UNIT IV

Aggregate Planning and Master Scheduling: Introduction –Planning and Scheduling – Objectives of Aggregate Planning– Aggregate planning strategies.

Master Scheduling: Master Scheduling Methods–Numerical problems. Material and Capacity Requirements Planning–MRP(inputs and outputs of MRP system, BOM, MRP logic).

UNIT V

Scheduling and Controlling Production Activities: Introduction –scheduling strategy &guidelines–Scheduling methodology– concept of single machine scheduling– measure of performance–SPT– WSPT rule – EDD rule– minimizing nos. of tardy jobs. flow shop scheduling: Johnson algorithm's' jobs on '2' and '3' machines. Job shop scheduling: Scheduling '2' jobs on 'M' machines. Numerical problems.

Text Books

1. B. Mahadevan, "Operations Management", Theory and practice, Pearson education, 2nd edition, 2007.
2. Pannerselvam "Production and Operations Management", PHI, 2012.

Reference Books

1. I. Monks, J.G, "Operations Management", McGrawHill International Editions, 1987.
2. Buffa, "Modern Production/Operations Management", Wiley Eastern Ltd, Year 2007.
3. Adam & Ebert, "Productions & Operations Management", Year 2002.
4. Chary,"Production and Operations Management", Tata-McGraw Hill, Year 2000.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	H			M	M						L			M
CO2		H	M									L	H		M
CO3		H			M	L									M
CO4			H		M	L						L			H
CO5		H			H				M			L			M

20MET31: NON-LINEAR PROGRAMMING

Credits – 3 **Sessional Marks: 30**
L: T: P:: 2:1:0 **University Exam Marks: 70**

CourseObjectives

To expose the students to the following

1. Introduce various optimization techniques i.e. classical, linear programming, transportation problem, simplex algorithm, dynamic programming
2. Constrained and unconstrained optimization techniques for solving and optimizing problems in real world situations.
3. Explain the concept of optimization algorithms and its applications to project implementation.
4. Expose the students to various modern methods of optimization

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand optimization algorithms for constrained and unconstrained problems
CO2. Explain the need of optimization of engineering systems
CO3. Develop the classical optimization techniques, linear programming, simplex algorithm, transportation problem.
CO4. Apply unconstrained optimization and constrained non-linear programming.
CO5. Formulate optimization problems in modern methods using genetic algorithm.

UNIT I

Non-linear Programming: Introduction –Classification of Non Linear programming – Lagrange multiplier method – Karush – Kuhn Tucker conditions–Reduced gradient algorithms–Quadratic programming method – Penalty and Barrier method.

UNIT II

Unconstrained Nonlinear Programming: One dimensional minimization methods – Classification – Fibonacci method and Quadratic interpolation method Unconstrained Optimization Techniques: Univariant method – Powell's method and steepest descent method. Optimization techniques characteristics of a constrained problem – Indirect methods – Search and gradient methods.

UNIT III

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

UNIT IV

Integer – Linear programming problem Gomory's cutting plane method – Gomory's method for all integer programming problems – mixed integer programming problems

Network Technique: Shortest path model Dijkstra's Algorithm Floyd's Algorithm – minimum spanning tree problem – PRIM algorithm – Maximal Flow Problem algorithm References**.**

UNIT V

Project Scheduling: Introduction to network analysis, Rules to draw network diagram, Fulkerson rule for numbering events, Critical path method, PERT.

Text books

1. Singiresu S. Rao, "Engineering Optimization: Theory and Practice", 4th edition, 2009John Wiley and Sons.
2. H. S. Kasene & K. D. Kumar, "Introductory Operations Research", 2004,Springer (India), Pvt. Ltd.

Reference Books

1. George Bernard Dantzig, Mukund Narain Thapa, "Linear programming", Springer series in operations research 3rd edition, 2003.
2. H.A. Taha, "Operations Research: An Introduction", 8th Edition, Pearson/Prentice Hall, 2007.
3. Kalyanmoy Deb, "Optimization for Engineering Design – Algorithms and Examples", PHI Learning Pvt. Ltd, New Delhi, 2005.

Course Outcomes – Program Outcomes – Program Specific Outcome (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M								M			H		
CO2	H									M			H		
CO3		M	H							M			H		
CO4		H	M							M			H		
CO5		M			H					M			H		

20MET32: WORK STUDY

Credits – 3 **Sessional Marks: 30**
L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. Impart knowledge in the area of Method study and Time study.
2. Implement these principles and techniques to improve productivity in manufacturing and Service sectors.

Course Outcomes

After successful completion of course the student should be able to

CO1. Calculate the basic work content of a specific job for employees of an organization. Thereby they will be able to calculate the production capacity of man power of an organization.

CO2. Analyze and calculate the level of risk in a job causing stress, fatigue and musculoskeletal disorders and design appropriate work systems.

CO3. Rate a worker engaged on a live job and calculate basic, allowed and standard time for the same.

CO4. Analyze the existing methods of working for a particular job and develop an improved method through questioning technique.

CO5. Devise appropriate wage and incentive plan for the employees of an organization.

UNIT I

Productivity: Total time for a job or operation, total work content and ineffective time, – Production and Productivity - Productivity and standard of living, Factors affecting Productivity, Introduction to Productivity measurement Models.

UNIT II

Methods Engineering: Methods Engineering-Steps -Tools and techniques, Motion study.

UNIT III

Work Measurement: Stop watch time study, performance rating, allowances, Development of Standard data, learning effect.Work measurement inAutomated Processes. Computerised Labour standards.

UNIT IV

Applied Work Measurement: Work sampling, Group Timing Technique (GTT), predetermined time systems, types, Methods Time Measurement (MTM), Introduction to MOST standard, Wage incentive plans.

UNIT V

Work Design For Office Work: Organization and methods (O & M), Work measurement of office work, Work Analysis techniques applied to support staff, Form design and control.

Text Books

1. Barnes, R.M, "Motion and Time Study, Design and measurement of work", John Wiley sons(Asia), 7th edition,2003.

Reference Books

1. Benjamin W.Niebel, AndrisFreivalds, “Methods, standards and Work Design”, McGraw hill, Eleventh edition, 2002.
2.Maynard H.B, “Industrial Engineering Hand book”, McGraw-Hill,2008.
3.PremVrat, G.D. Sardana and B.S. Sahay, “Productivity Management – A Systems Approach”, Narosa Publishing House, 1998.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	M									M			M		
CO2	M	H													L
CO3		M								M					M
CO4			H									M			M
CO5		H				M				M			M		M

20MET38: TOTAL QUALITY MANAGEMENT

Credits – 3 **Sessional Marks: 30**
L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following

1. An overview of quality and TQM with salient contributions of Quality Gurus like Deming, Juran and Crosby.
2. Expose to the management tools, Six sigma, Failure mode effect analysis.
3. Understand Quality function deployment, taguchi quality concepts and TPM.
4. Expose the quality systems like ISO and its standards.

Course Outcomes

After Completion of the course the student will be able to

1. Develop an understanding on quality management philosophies and frameworks.
2. Apply quality tools and techniques in both manufacturing and service industry.
3. Design Quality frameworks.
4. Map the Quality designs to implementation.
5. Device quality strategies in line with objective of organisation.
6. Develop as quality auditors.

UNIT I

Introduction: Need for Quality, Evolution of quality, Definition of quality, Dimensions of manufacturing and service quality, Basic concepts of TQM, Definition of TQM, TQM Frame work, Contribution of Deming, Juran andCrosby, Barriers to TQM.

UNIT II

TQM Principles: Leadership, Strategic quality planning, Quality statements, Customer focus, Customer orientation, Customer satisfaction, Customer complaints, Customerretention, Employee involvement, Motivation, Empowerment, Team and Teamwork, Recognition and Reward, Performance appraisal, Continuous processimprovement, PDSA cycle, 5S, Kaizen, Supplier partnership, Partneringsupplier selection, Supplier rating.

UNITIII

TQM Tools & Techniques I: The seven traditional tools of quality, New management tools, Six sigma: Concepts,Methodology, applications to manufacturing, service sector, Bench marking, Reasonto bench mark, Bench marking process, FMEA, Stages, Types.

UNIT IV

TQM Tools & Techniques II: Control Charts, Process Capability, Quality FunctionDevelopment (QFD), Taguchi quality loss function, TPMConcepts, improvement needs, Performance measures.

UNIT V

Quality Systems: Need for ISO 9000, ISO 9001-2008, Quality SystemElements, Documentation,Quality Auditing, QS 9000, ISO 14000 Concepts, Requirements and Benefits, TQM implementation in manufacturing and service sectors.

Text Books

1. Dale H Besterfield, Total Quality Management / Pearson Education.
2. N.V.R Naidu, G. Rajendra, Total Quality Management /New Age international.
3. S. Rajaram, Total Quality Management / Dreamtech Press

Reference Books

1. SubburajRamasamy, “Total Quality Management”, Tata McGraw Hill Publishing Company Ltd., New Delhi, 2005.
2. Narayana V and Sreenivasan N.S., Quality Management - Concepts and Tasks, New Age International, Delhi, 1996.
3. Organizational Excellence through TQM, H. Lal, New age pub, 2008

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			H							M			M		M
CO2	H	M								M			M		H
CO3		M	H							M					H
CO4		H		M						M					H
CO5		H								M					H
CO6			H							M			M		H

20MET39: SUPPLY CHAIN MANAGEMENT

Credits – 3 **Sessional Marks: 30**
L:T:P ::2:1:0 **University Exam Marks: 70**

Course Objectives

To expose the students to the following
1. Enable the students to be trained with planning/production and plant layouts.
2. Study about strategies of material handling and equipments, and selection of site locations
3. Explore the layout planning by computer applications through different algorithms.

Course Outcomes

After successful completion of course the student should be able to
CO1.Understand the decision phases and apply competitive & supply chain strategies.
CO2.Understand drivers of supply chain performance.
CO3. Analyze factors influencing network design.
CO4.Analyze the influence of forecasting in a supply chain.
CO5.Understand the role of aggregate planning, inventory, IT and coordination in a supply chain.

UNIT I

Strategic Framework: Introduction to Supply Chain Management, Decision phases in a supply chain, Process views of a supply chain: push/pull and cycle views, Achieving Strategic fit, Expanding strategic scope.

UNIT II

Supply Chain Drivers and Metrics: Drivers of supply chain performance, Framework for structuring Drivers, Obstacles to achieving strategic fit.

UNIT III

Designing Supply Chain Network: Factors influencing Distribution Network Design, Design options for a Distribution network, E-Business and Distribution network, Framework for Network Design Decisions, Models for Facility Location and Capacity Allocation.

UNIT IV

Forecasting in SC: Role of forecasting in a supply chain, Components of a forecast and forecasting methods, Risk management in forecasting.

UNIT V

Aggregate Planning and Inventories in SC: Aggregate planning problem in SC, Aggregate Planning Strategies, Planning Supply and Demand in a SC, Managing uncertainty in a SC: Safety Inventory.

Coordination in SC: Modes of Transportation and their performance characteristics, Supply Chain IT framework, Coordination in a SC and Bullwhip Effect.

Text Books

1. David Simchi-Levi, Philp Kamintry and Edith Simchy Levy, "Designing and Managing the Supply Chain - Concepts Strategies and Case Studies", 2nd Edition, Tata-McGraw Hill, 2000.

Reference Books

1. Sunil Chopra and Peter Meindl, "Supply Chain Management - Strategy, Planning and Operation", 4th Edition, Pearson Education Asia, 2010.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1			L		L	M	L	L	M	L	M	L	H		
CO2		L	L			M		L			L		M		
CO3	L	M	L				L		L						L
CO4		L	M		M	L	M				H				L
CO5	M	M				M		L	M		M	L			L

20MEP12: MACHINE DYNAMICS & MECHANICAL MEASUREMENTS LAB

Credits – 1 **Sessional Mark: 40**
L:T:P :: 0:0:2 **University Exam Marks: 60**

Course Objective

To expose the students to the following

1. Equip students with understanding of the fundamental principles and techniques for Identify different types of dynamic systems and classify them by their governing equations
2. Develop a model of a mechanical system using a free body diagram
3. Develop equations of motion for translational and rotational mechanical systems
4. Instrumentation & control engineering refers to the design, maintenance and production of electromechanical devices,
5. Which are used in various circumstances that require precise control and measurement.

Course Outcomes

After successful completion of course the student should be able to

CO1. Select proper instrumentation for measuring pressure, strain, temperature etc.
CO2. Apply the fundamentals of vibration measurement systems.
CO3. study the damped and undamped torsional vibration of single rotor and double rotor system
CO4. Perform measurement of pressure, strain, temperature etc.
CO5. Calibrate instruments used for measuring pressure, strain, temperature etc.

PART A: MACHINE DYNAMICS LAB

1. To verify the relation of a simple pendulum.
2. To study the radius of gyration of By-filler suspension.
3. To determine the radius of gyration "k" of a given compound pendulum.
4. To study the undamped torsional vibration of single rotor system.
5. To study the undamped torsional vibrations of double rotor system.
6. To study the longitudinal vibration of helical spring and to determine the frequency and time period of oscillation theoretically and actually by experiment.
7. Determination of characteristics curves of sleeve position against speed for all governors.
8. Cam analysis on eccentric cam with knife edge follower.
9. Cam analysis on Tangent cam with roller follower.
10. Cam analysis on circular cam with mushroom follower.

Note: Perform any <u>FIVE</u> out of 10 experiments.

PART B: MECHANICAL MEASUREMENTS LAB

1. To study and calibration of McLeod gauge for low pressure.
2. To study and calibration of LVDT transducer for displacement measurement.
3. To study and calibration of thermocouple for temperature measurement.
4. To study and calibration of thermostat for temperature measurement.
5. To study and calibration of pressure gauge transducer for pressure measurement.
6. To study and calibration of anemometer for flow measurement.
7. To study and calibration of force cell or load cell for force measurement.
8. Determination of Modulus of Elasticity of a Mild Steel Specimen Using Strain Gauges.

Note: Perform any <u>FIVE</u> out of 8 experiments.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**H**												**H**		
CO2	**H**		**H**											**M**	
CO3	**H**		**M**		**M**								**M**		**M**
CO4	**H**			**L**	**L**								**M**	**L**	
CO5	**M**		**L**	**L**	**L**										**L**

20MEI02: INTERNSHIP-2

Credits – 1 **Sessional Marks: 100**
L:T:P:: 0:0:0

Course Objectives

To expose the students to the following

1. Expose technical students to the industrial environment, which cannot be simulated in the classroom and creating competent professionals for the industry.
2. Provide possible opportunities to learn understand and sharpen the real time technical/managerial skills required at the job.
3. Exposure to the current technological developments relevant to the subject area of training.
4. Experience gained from the "industrial internship" in classroom will be used in classroom discussions.
5. Create conditions conductive to quest for knowledge and its applicability on the job.

Course Outcomes

After successful completion of course the student should be able to

CO1. An opportunity to get hired by industry/organization.
CO2. Practical experience in organization setting
CO3. Excellent opportunity to see how the theoretical aspects learned in classes are integrated into practical world.
CO4. Helps to decide if the industry and the profession is the best career option to pursue.
CO5. Opportunity to learn new skills and supplement knowledge.
CO6. Opportunity to practice communication and team work skills.
CO7. Opportunity to learn strategies like time management, multi-tasking in an industrial setup.
CO8. Enhances their candidacy for higher education.
CO9. Creating network and social circle and developing relationships with industry people.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1												H		M	H
CO2		H							M			M		M	H
CO3	M					H	M						H	M	
CO4					H							M	M	H	
CO5	M	M								H					H
CO6									M	M	H				H
CO7												H			H
CO8						M							M		M
CO9						H									M

20MES05: FUSION360

Credits – 2	**Sessional Marks: 40**
L:T:P :: 0:1:2	**University Exam Marks: 60**

Course Objectives

1. Principles of 3D parametric part design, assembly design and creating production-ready part, and assembly drawing by using Autodesk Fusion 360
2. To develop Geometric modelling and assembly using CAD tools.

Course Outcomes

After successful completion of course the student should be able to

CO1. Understand the design process in Autodesk Fusion 360

CO2.Able to design model from conceptual sketching through solid modeling

CO3.Create multiple designs using several of tools

CO4. Understand how to assembly parts.

CO5. Understand how to use work plane on X, Y, Z axis.

List of Experiments :

1. **Getting Started**

   Autodesk Fusion 360 User Interface , Data Panel Interface , Navigating the model , Understanding workspace, Design history
2. Intermediate Sketching
3. Sculpting
4. Solid Modelling
5. Editing Your Model
6. Model Assembly and Drawing

Equipment needed: Computers and Software

1.https://asti.com/LiveLab-Learning-amp-Training/ LiveLab-System-Requirements

2.Working knowledge of Microsoft® Windows® 10.

Course Outcomes - Program Outcomes - Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO 1		H			M								H		
CO 2	H	M	M	M	M							H	H	M	
CO 3	M		H		M									M	
CO 4		H	M		H					M				M	

B.Tech

IV Year II Semester

B.Tech IV Year II Semester

S.No	Course Code	Course Title
1	20MEJ01	Internship-3 cum Project Work

20MEJ01: INTERNSHIP 3 cum PROJECT WORK

Credits – 2 **Sessional Marks: 40**
L:T:P::0:0:4 **University Exam Marks: 60**

Course Objectives

To expose the students to the following

1. Offer students a glimpse into real world problems and challenges that needs Mechanical Engineering.
2. Provide students with the opportunity to synthesize knowledge in the area of Mechanical Engineering.
3. Introduce students to the vast array of literature available of the various research challenges in the field of Mechanical Engineering.
4. Create awareness among the students of the characteristics of several domain areas where Mechanical Engineering can be effectively used.
5. Enhance students knowledge and enables them to acquire skills like collaboration, communication and independent learning, prepares them for lifelong learning and the challengers a head.

Course Outcomes

After successful completion of course the student should be able to

CO1. Acquire in-depth knowledge in the core and/or interdisciplinary area of project topic.
CO2. Critically analyze the chosen topic for arriving at conclusions.
CO3. Develop and design feasible solutions for the project topic.
CO4. Undertake research and solve real world problems in the project domain.
CO5. Apply appropriate techniques, resources and modern software tools necessary for implementing the project work.
CO6. Use project results for sustainable development of the society.
CO7. Understand the impact of project results in the context of environmental sustainability.
CO8. Understand professional and ethical responsibilities for sustainable development of society in the chosen field of project.
CO9. Function effectively as individual and a member in the project team.
CO10. Develop communication skills, both oral and written for preparing and presenting project report.
CO11. Demonstrate knowledge and understanding of cost and time analysis required for carrying out the project.
CO12. Engage in continuous learning to improve knowledge and competence in the chosen subject area of project.

Course Outcomes – Program Outcomes – Program Specific Outcomes (CO-PO-PSO) Mapping

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	H	M		M									H	M	
CO2		H	M		M								M	H	
CO3		M	H		M								H	M	
CO4				H		M				M				M	H
CO5			M		H					M				H	
CO6						H	M								H
CO7						M	H								H
CO8							M	H							M
CO9									H	M	M				M
CO10								M		H	M				H
CO11									M		H				H
CO12	M	M										H			H