Bapatla Engineering College

(*Autonomous*)

BAPATLA

B.Tech

Mechanical Engineering

Curriculum Effective from A.Y. 2018-19 (R18 Regulations)

Bapatla Engineering College:: Bapatla

(Autonomous under Acharya Nagarjuna University)

(Sponsored by Bapatla Education Society)

BAPATLA - 522102 Guntur District, A.P., India

www.becbapatla.ac.in

BAPATLA ENGINEERING COLLEGE

(*Autonomous*)

DEPARTMENT OF MECHANICAL ENGINEERING

Vision

To become a centre of Excellence in producing the graduates as professional Mechanical Engineers with a high-quality education, innovative and entrepreneurial skills to secure the society and industry needs.

Mission

- To impart high-quality education in curriculum and to build the students in their capacity and enhancing skills to make them globally competitive Mechanical Engineers.
- To prepare the students by providing exceptional academic environment, leadership, ethical guidelines and lifelong learning needed for a long professional career.
- To enhance the overall academic performance of the students gradually and thereby increasing their placement potential.
- To build the institute-industry interaction by providing the internship programs

BAPATLA ENGINEERING COLLEGE

(*Autonomous*)

DEPARTMENT OF MECHANICAL ENGINEERING

Program Educational Objectives (PEOs)

1. To provide students with a sound foundation in the mathematical, scientific and Engineering fundamentals necessary to formulate, solve and analyze engineering problems and to prepare them for graduate studies.
2. To prepare students for successful careers in an industry that meet the needs of Indian and multinational companies.
3. To develop the ability among students to synthesize data and technical concepts for application to product design.
4. To provide an opportunity for students to work as part of teams on multidisciplinary projects.
5. To promote student awareness of the life-long learning and to introduce them to professional ethics and codes of professional practice.

Programme Outcomes:

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identity, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis, and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **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.
11. **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.
12. **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.

Program Specific Outcomes:

1. An ability to utilize the knowledge in engineering, basic sciences, and mathematics on an applied basis.
2. An ability to apply the basic principles of mechanical engineering to the analysis, design development and implementation of advanced mechanical systems.
3. An ability to apply the principles of manufacturing technology and scientific management towards improvement of product quality.

Bapatla Engineering College::Bapatla
(Autonomous)
Department of Mechanical Engineering

COURSE STRUCTURE

Course Structure Summary:

S.No.	Category	Proposed	Percentage
1	Humanities & Social Science including Management Courses	14	8.38
2	Basic Science Courses	21	12.57
3	Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.	20	11.97
4	Professional Core Courses	75	44.91
5	Professional Elective Courses	15	8.98
6	Open Elective Courses	06	3.59
7	Project work, seminar and internship in industry / elsewhere	12	7.18
8	Industry Internship	2	1.19
9	MOOCs	2	1.19
8	Mandatory Courses [Environmental Studies, Biology, Indian Constitution, Essence of Indian Traditional Knowledge etc]	(non-credit courses)	--
	Total:-	**167**	**100**

Semester wise Credits

SEMESTER	Credits
SEMESTER – I	20
SEMESTER – II	20
SEMESTER – III	21
SEMESTER – IV	22
SEMESTER – V	22
SEMESTER – VI	22
SEMESTER – VII	24
SEMESTER – VIII	16
Total	**167**

BAPATLA ENGINEERING COLLEGE: BAPATLA

(Autonomous)

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Mechanical Engineering

Effective from the Academic Year2018-2019(R18 Regulations)

First Year B.Tech (SEMESTER – I)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18MA001	Linear Algebra and Ordinary Differential Equations	4	0	0	4	50	50	100	3
18PH001	Physics	4	1	0	5	50	50	100	4
18ME103	Engineering Mechanics- I	4	1	0	5	50	50	100	4
18EE001	Basic Electrical and Electronics Engineering	4	0	0	4	50	50	100	3
18CS001	Problem Solving using Programming	4	0	0	4	50	50	100	3
18PHL01	Physics Laboratory	0	0	3	3	50	50	100	1
18EEL01	Basic Electrical and Electronics Engineering Lab	0	0	3	3	50	50	100	1
18CSL01	Problem Solving Using Programming lab	0	0	3	3	50	50	100	1
	NCC/NSS			3	3				0
	TOTAL	20	2	12	34	400	400	800	20

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical

BAPATLA ENGINEERING COLLEGE: BAPATLA

(Autonomous)

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Mechanical Engineering

Effective from the Academic Year2018-2019(R18 Regulations)

First Year B.Tech (SEMESTER – II)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18MA002	Numerical Methods and Advanced Calculus	4	0	0	4	50	50	100	3
18CY001	Engineering Chemistry	4	0	0	4	50	50	100	3
18ME203	Engineering Mechanics- II	4	1	0	5	50	50	100	4
18CE001	Environmental Studies	3	0	0	3	50	50	100	2
18EL001	Communicative English	3	0	0	3	50	50	100	2
18MEL01	Engineering Graphics	1	0	4	5	50	50	100	3
18CYL01	Engineering Chemistry Laboratory	0	0	3	3	50	50	100	1
18ELL01	English Communication Skills Laboratory	0	0	3	3	50	50	100	1
18MEL02	Workshop practice	0	0	3	3	50	50	100	1
	NCC/NSS	0	0	3	3				0
	TOTAL	19	1	16	36	450	450	900	20

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical

BAPATLA ENGINEERING COLLEGE: BAPATLA

(Autonomous)

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Mechanical Engineering

Effective from the Academic Year2018-2019(R18 Regulations)

Second Year B.Tech (SEMESTER – III)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18ME301	Strength of Materials-I	4	1	0	5	50	50	100	4
18ME302	Professional Ethics& Human Values	4	0	0	4	50	50	100	3
18ME303	Thermodynamics	4	1	0	5	50	50	100	4
18ME304	Fluid Mechanics &Hydraulic Machines	4	1	0	5	50	50	100	4
18ME305	Basic manufacturing processes	4	0	0	4	50	50	100	3
18ME306	Constitution of India	2	0	0	2	50	50	100	0
18MEL31	Strength of Materials & Fluid Mechanics lab	0	0	3	3	50	50	100	1
18MEL32	Basic Manufacturing Processes lab	0	0	3	3	50	50	100	1
18MEL33	Computer aided drafting and Modelling lab	0	0	3	3	50	50	100	1
	NCC/NSS			3	3				0
	TOTAL	22	3	12	37	450	450	900	21

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical

BAPATLA ENGINEERING COLLEGE: BAPATLA

(Autonomous)

SCHEME OF INSTRUCTION & EXAMINATION (Semester System)

For

Mechanical Engineering

Effective from the Academic Year2018-2019(R18 Regulations)

Second Year B.Tech (SEMESTER – IV)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18MA003	Probability and Statistics	4	0	0	4	50	50	100	3
18ME401	Strength of Materials- II	4	1	0	5	50	50	100	4
18ME402	Applied Thermodynamics	4	1	0	5	50	50	100	4
18ME403	Materials Engineering	4	0	0	4	50	50	100	3
18ME404	Kinematics of Machines	4	1	0	5	50	50	100	4
18EL002	Technical English	3	0	0	3	50	50	100	2
18ME405	Essence of Indian Traditional Knowledge	2	0	0	2	50	50	100	0
18MAL01	Probability and Statistics lab	0	0	3	3	50	50	100	1
18MEL41	Pneumatic and Hydraulic drives lab	0	0	3	3	50	50	100	1
	NCC/NSS			3	3				0
	TOTAL	25	3	9	37	450	450	900	22

CIE: Continuous Internal Evaluation SEE: Semester End Examination

L: Lecture, T: Tutorial, P: Practical

BAPATLA ENGINEERING COLLEGE: BAPATLA
(Autonomous)
SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
Mechanical Engineering
Effective from the Academic Year2018-2019(R18 Regulations)
Third Year B.Tech (SEMESTER – V)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18ME501	Machine Dynamics	4	1	0	5	50	50	100	4
18ME502	IC Engines & Gas Turbines	4	0	0	4	50	50	100	3
18ME503	Design of Machine Elements-I	4	1	0	5	50	50	100	4
18ME504	Metal Cutting and Machine Tools	4	0	0	4	50	50	100	3
18ME505	Industrial Engineering &Management	4	0	0	4	50	50	100	3
18MED11/12/13	Elective-I	4	0	0	4	50	50	100	3
18MEL51	CAE lab	0	0	3	3	50	50	100	1
18MEL52	Fuels & IC Engines lab	0	0	3	3	50	50	100	1
	NCC/NSS			3	3				0
	TOTAL	24	2	9	35	400	400	800	22

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical

Elective-I:

1. Operations Research
2. Finite Element Analysis
3. Composite Materials

BAPATLA ENGINEERING COLLEGE: BAPATLA
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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
Mechanical Engineering
Effective from the Academic Year2018-2019(R18 Regulations)
Third Year B.Tech (SEMESTER – VI)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18ME601	Engineering Economics &Financial Analysis	4	0	0	4	50	50	100	3
18ME602	Heat transfer	4	1	0	5	50	50	100	4
18ME603	Design of Machine Elements – II	4	1	0	5	50	50	100	4
18ME604	Manufacturing Technology	4	0	0	4	50	50	100	3
18MED21/22/23	Elective –II	4	0	0	4	50	50	100	3
18MEL61	Heat Transfer Lab	0	0	3	3	50	50	100	1
18MEL62	Machine shop practice	0	0	3	3	50	50	100	1
18ELL02	Soft Skills Lab	0	0	3	3	50	50	100	1
	MOOCs			3	3				2
	TOTAL	20	2	12	34	400	400	800	22

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical

Elective –II

1. Computational Fluid Dynamics
2. Power Plant Engineering
3. Mechatronics

BAPATLA ENGINEERING COLLEGE: BAPATLA
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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
Mechanical Engineering
Effective from the Academic Year2018-2019(R18 Regulations)
Fourth Year B.Tech (SEMESTER – VII)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18ME701	Automation in Manufacturing	4	0	0	4	50	50	100	3
18ME702	Operations Management	4	0	0	4	50	50	100	3
18ME703	Instrumentation and Control Systems	4	0	0	4	50	50	100	3
18—I--	Institutional Elective -I	4	0	0	4	50	50	100	3
18MED31/32/33/34	Elective –III	4	0	0	4	50	50	100	3
18MED41/42/43	Elective-IV	4	0	0	4	50	50	100	3
18MEP01	Project-I	0	0	4	4	50	50	100	2
18MEL71	Design & Metrology lab	0	0	3	3	50	50	100	1
18MEL72	CAM lab	0	0	3	3	50	50	100	1
18MEII1	Internship								2
	TOTAL	24	0	10	34	450	450	900	24

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical

Elective –III

1. Fluid Power Systems
2. Computer Aided Design
3. Refrigeration and Air conditioning
4. Project Management

Elective – IV

1. Mechanical Vibrations
2. Robotics
3. Supply Chain Management

BAPATLA ENGINEERING COLLEGE: BAPATLA
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SCHEME OF INSTRUCTION & EXAMINATION (Semester System)
For
Mechanical Engineering
Effective from the Academic Year2018-2019(R18 Regulations)
Second Year B.Tech (SEMESTER – VIII)

Code No.	Subject	Scheme of Instruction (Periods per week)				Scheme of Examination (Maximum marks)			No. of Credits
		L	T	P	Total	CIE	SEE	Total Marks	
18MED51/52/53/54	Elective –V	4	0	0	4	50	50	100	3
18—I--	Institutional Elective –II	4	0	0	4	50	50	100	3
18MEP02	Project-II	0	0	12	12	75	75	150	10
	TOTAL	8	0	12	20	175	175	350	16

CIE: Continuous Internal Evaluation SEE: Semester End Examination
L: Lecture, T: Tutorial, P: Practical

Elective –V

1. Advanced Manufacturing
2. Total Quality Management
3. Automobile Engineering
4. Entrepreneurship Development

Institutional Elective-I (in VII semester – position as 4th theory subject)

18CEI01: Air Pollution & Control
18CEI02: Sustainable Water and Sanitation
18CSI01: Java Programming
18CSI02: Database Management Systems
18ECI01: Consumer Electronics
18ECI02: Embedded Systems
18EEI01: Application of Wavelets to Engineering Problems
18EEI02: Industrial Electrical Systems
18EII01: Introduction to MEMS
18EII02: Power System Instrumentation
18ITI01: Data Analytics
18ITI02: Cyber Security
18MAI01: Linear Algebra
18PHI01: Nano-Materials and Technology
18PHI02: Fibre Optic Communication
18HUI01: System Thinking

Institutional Elective-II(in VIII semester – position as 2nd theory subject)

18CEI03: Disaster Management
18CEI04: Remote sensing & GIS
18CSI03: Python Programming
18CSI04: Computer Networks
18ECI03: Artificial Neural Network
18ECI04: Internet of Things (IoT)
18EEI03: High Voltage Engineering
18EEI04: Energy Auditing and Conservation
18EII03: Robotics and Automation
18EII04: Advanced Computer Control Systems
18ITI03: Mobile Application Developments
18ITI04: Web Technology
18MAI02: Graph Theory
18PHI03: Advanced Materials
18PHI04: Optical Electronics
18HUI02: Organizational Psychology
18HUI03: Telugu Modern Literature

LINEAR ALGEBRA AND ORDINARY DIFFERENTIAL EQUATIONS
18MA001
Ist Year B. Tech. First Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment	:	50	Semester End Examination (3 Hours)	:	50		

Course Objectives:

1. To learn about solving a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors
2. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and higher order ordinary differential equations.
3. Create and analyse mathematical models using first and second order differential equations to solve application problems that arises in engineering.
4. To learn about solving linear Differential equations with constant coefficients with the given initial conditions using Laplace transform technique.

Course Outcomes: Students will be able to

1. To learn about solving a system of linear homogeneous and non-homogeneous equations, finding the inverse of a given square matrix and also its Eigen values and Eigen vectors.
2. Identify the type of a given differential equation and select and apply the appropriate analytical technique for finding the solution of first order and higher order ordinary Differential equations.
3. Create and analyze mathematical models using first and second order differential equations to solve application problems that arises in engineering.
4. To learn about solving linear Differential equations with constant coefficients with the given initial conditions using Laplace transform technique

UNIT-I

Linear Algebra: Rank of a Matrix; Elementary transformations of a matrix; Gauss-Jordan method of finding the inverse; Consistency of linear System of equations: Rouches theorem, System of linear Non-homogeneous equations, System of linear homogeneous equations; vectors; Eigen values; properties of Eigen values(without proofs); Cayley-Hamilton theorem (without proof).

[Sections: 2.7.1; 2.7.2; 2.7.6; 2.10.1; 2.10.2; 2.10.3; 2.12.1; 2.13.1; 2.14; 2.15.]

[12 Hours]

UNIT-II

Differential Equations of first order: Definitions; Formation of a Differential equation; Solution of a Differential equation; Equations of the first order and first degree; variables separable; Linear Equations; Bernoulli‟s equation; Exact Differential equations; Equations reducible to Exact equations: I.F found by inspection, I.F of a Homogeneous equation, In the equation M dx+ N dy=0.

Applications of a first order Differential equations: Newton‟s law of cooling; Rate of decay of Radio-active materials.

[Sections: 11.1; 11.3; 11.4; 11.5; 11.6; 11.9; 11.10; 11.11; 11.12.1; 11.12.2; 11.12.4; 12.6;

12.8] [12 Hours]

UNIT-III

Linear Differential Equations: Definitions; Theorem; Operator D; Rules for finding the complementary function; Inverse operator; Rules for finding the Particular Integral; Working procedure to solve the equation; Method of Variation of Parameters; Applications of Linear Differential Equations: Oscillatory Electrical Circuits.

[Sections: 13.1; 13.2.1; 13.3; 13.4; 13.5; 13.6; 13.7;13.8.1;14.1;14.5] [12 Hours]

UNIT-IV

Laplace Transforms: Definition; conditions for the existence; Transforms of elementary functions; properties of Laplace Transforms; Transforms of derivatives; Transforms of integrals; Multiplication by t^n; Division by t; Inverse transforms- Method of partial fractions; Other methods of finding inverse transforms; Convolution theorem(without proof); Application to differential equations: Solution of ODE with constant coefficients using Laplace transforms.

[Sections:21.2.1; 21.2.2; 21.3; 21.4; 21.7; 21.8; 21.9; 21.10; 21.12; 21.13; 21.14; 21.15.1]

[12 Hours]

TEXT BOOKS

1. B.S.Grewal, “Higher Engineering Mathematics”, 44thedition, Khanna publishers, 2017.

REFERENCE BOOKS

1. ErwinKreyszig, “Advanced Engineering Mathematics”, 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, “A Text book of Engineering Mathematics” Laxmi Publications, 2010.

PHYSICS
18PH001
I^st Year B. Tech. First Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To circulate the knowledge about the advanced optics and know its Engineering applications.
2. To familiarize the basis of quantum theory and to make students to solve the physical problems.
3. To classify solids and to have a basic idea about the structural determination of crystals.
4. To make aware of some of the analytical techniques for material testing.

Course Outcomes:

1. Student's ability to understand the principles in the production and application of lasers and their effective utilization in optical communications.
2. Students demonstrate appropriate competence and working knowledge of laws of modern physics in understanding advanced technical engineering courses.
3. Students demonstrate the ability to apply knowledge of band theory of solids and to make understand the concept of energy band gap and hole.
4. Ability to understand the crystal geometrics and estimation of crystal structure by X-ray diffraction technique.
5. Student's ability to understand the principle in the production and applications of ultrasonics and extend it for material testing using various nuclear techniques.

UNIT-I

ADVANCED OPTICS

Lasers: Interaction of radiation with matter. Einstein co-efficient, Properties of laser, Population inversion, LASER principle, pumping schemes-Three level and four level laser, Types of lasers: solid-state lasers (Ruby), gas lasers (He-Ne), Semiconductor lasers; applications of lasers in industry and medicine.

Fibre Optics: Importance of optical fibre, Structure and principle of optical fibre, acceptance angle and numerical aperture, Types of optical fibres based on modes and refractive index, V-number, losses associated with optical fibres, fibre optical communication, advantages of optical fibres

UNIT-II

Quantum Mechanics

Dual nature of light, de-Brogli‟s concept of matter waves, Davisson-Germer electron diffraction experiment, Heisenberg Uncertainty principle and applications (non-existence of electron in a nucleus and finite width of spectral lines), one dimensional time- independent and dependent Schrödinger wave equations, physical significance of wave function, applications of time-independent Schrödinger wave equation to particle in a box (one dimensional), tunneling, the scanning tunneling microscope.

UNIT-III

Band theory of solids and Structure determination

Band theory of Solids: Failures of classical free electron theory, success and failures of quantum free electron theory, Bloch theorem statement, Kronig-Penny model (without derivation), effective mass of electron, concepts of energy band gap and hole.

Structure determination: Crystal lattices (Bravias), Crystal systems and structures, planes, Miller indices, Bragg‟s law, structural analysis of crystals using X-Ray powder diffraction method (XRD).

UNIT-IV

Ultrasonics and Nuclear Techniques

Ultrasonics: Properties of ultrasonics, General applications of ultrasonics.

Applications of Ultrasonic Testing: Weld inspection, Material analysis, corrosion testing, concrete under water measurements, Ultrasonic testing in the foundry industry.

NDT: Production of Ultrasonic waves, Pulse echo technique, time of flight diffraction technique, A –scan presentation, B- scan presentation, C –scan presentation.

Nuclear Techniques: Nuclear radio isotopes, Applications of radio isotopes (medical and industry) Properties of α,β,ɤ-rays and radiographic testing (NDT).

TEXT BOOKS

1. A Text Book of Engineering Physics ,M.N.Avadhanulu& P. Kshirsagar, S.Chand& Co., (Edition – 2013).
2. Engineering physics by S.O.Pillai

REFERENCE BOOKS

1. Engineering physics by R .K.Gour and S.L.Gupta. Dhanpatrai publications.
2. Engineering physics by M .R.Sreenivasan. New age international publications
3. Engineering physics by Palaniswamy. Scitechpublications.
4. Basic engineering physics – Dr.P.srinivasaRao, Dr.K.Muralidhar, Himalaya publication
5. Applied physics - Dr.P.srinivasaRao, Dr.K.Muralidhar, Himalaya publication
6. Engineering physics by Dr.D.Thirupathi Naidu, M. Veeranjaneyulu.

ENGINEERING MECHANICS - I
18ME103
Ist Year B. Tech. First Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

To introduce the students to basic laws and principles of Engineering Mechanics with emphasis on the analysis and application to practical Engineering problems, where bodies and systems are in static equilibrium.

Course Outcomes: After completion of the course the students will be able to

1. Find the resultant and analyse the equilibrium of a coplanar concurrent and parallel force systems.
2. Find the resultant and analyse the equilibrium of coplanar general and spatial concurrent force systems
3. Apply Coulombs laws of dry friction. Deduce relationships between external forces and equilibrium configuration using the principal of virtual work
4. Find the properties of plane areas and curves i.e., centroids and moment of inertias.

UNIT-I

Introduction:
Engineering mechanics - Units and dimensions - Method of problem solution and the accuracy of solutions.

Concurrent forces in a plane:
Principles of statics - Composition and resolution of forces - Equilibrium of concurrent forces in a plane - Method of projections - Method of moments.

Parallel forces in a plane:
Couple - Resultant and Equilibrium of parallel forces in a plane.

UNIT-II

General case of forces in a plane:
Composition of forces in a plane - Equilibrium of forces in a plane - Analysis of trusses: Method of joints and sections.

Force systems in space (using vector notation):
Position vector - Unit vector - Force vector - Resultant and equilibrium of concurrent forces in space - Moment of a force about a point - Moment of a force about an axis.

UNIT-III

Friction:

Introduction - Laws of dry friction - Problems involving dry friction: Connected bodies on rough horizontal and inclined planes, Ladder friction and Wedge friction.

Virtual Work:

Introduction - Principle of virtual work - Equilibrium of ideal systems.

UNIT-IV

Centroid, Centre of Mass and Centre of Gravity:

Concept of Centroid, Centre of Mass and Centre of Gravity - Centroid of two dimensional bodies - Problems on locating centroids of simple and composite plane figures and curves – Pappus theorems

Moments of Inertia of Plane figures:

Moments of inertia of a plane figure with respect to an axis in its plane and an axis perpendicular to the plane of the figure - Parallel axis theorem - Moments of inertia of simple and composite figures.

TEXT BOOKS

1. Engineering Mechanics (in SI units) by S Timoshenko, D H Young, J V Raoand Sukumar Pati, McGraw Hill Education, 5th edition,2016.
2. Engineering Mechanics: Statics and Dynamics by A K Tayal, Umesh publications, 14th edition, 2015.

REFERENCE BOOKS

1. Vector mechanics for Engineers: Statics and Dynamics by Ferdinand Beer, E Russell Johnston Jr, David Mazurek, Phillip Cornwell, Brian Self and SanjeevSanghi, McGraw Hill Education, 11th edition, 2017.
2. Engineering Mechanics: Statics and Dynamics by R C Hibbeler, Pearson, 14thedition, 2017.
3. Engineering Mechanics (Statics) by J L Meriam and L G Kraige, Wiley student edition, 7th edition.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING
18EE001
Ist Year B. Tech. First Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To understand basic Laws in circuits, analysis of simple DC circuits, Theorems and its applications, fundamentals of AC circuits & its analysis and concepts of three phase balanced circuits.
2. To learn basic properties of magnetic materials and its applications.
3. To understand working principle, construction, applications and performance of DC machines, AC machines.
4. To learn basic concepts, working principal, characteristics and applications of semiconductor diode and transistor family.
5. To gain knowledge about the static converters and regulators.
6. To learn basic concepts of power transistors and operational amplifiers closer to practical applications.

Course Outcomes: After completion of the course the students will be able to

1. Solve problems involving with DC and AC excitation sources in electrical circuits.
2. Compare properties of magnetic materials and its applications.
3. Analyze construction, principle of operation, application and performance of DC machines and AC machines.
4. Explore characteristics and applications of semiconductor diode and transistor family.
5. Make the static converters and regulators.
6. Analyze concepts of power transistors and operational amplifiers closer to practical applications.

UNIT-I

Electrical Circuits

Electrical circuit elements (R, L and C), voltage and current sources, Kirchhoff current and voltage laws, analysis of simple circuits with dc excitation. Superposition, Thevenin and Norton Theorems. Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase AC circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance. Three-phase balanced circuits, voltage and current relations in star and delta connections.

UNIT-II

Electrical Machines

Magnetic materials, BH characteristics, Construction, working of DC machines, ideal and practical transformer, equivalent circuit, losses in transformers, regulation and efficiency. Auto-transformer and three-phase transformer connections. Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components and efficiency, starting and speed control of induction motor. Single-phase induction motor. Construction and working of synchronous generators.

UNIT-III

Semiconductor Diodes and applications

Semiconductor materials, semiconductor diode, Resistance levels, Diode equivalent circuits, Zener diode, Light emitting diode, Load line analysis, half wave rectification, Full wave rectification, Bridge rectifier, Use of capacitor filter in rectifier, Zener diode voltage regulator, Clippers, Clampers

Bipolar Junction Transistors

Transistor construction and operation, Common base configuration, Transistor amplifying action, Common emitter configuration, Common collector configuration, Limits of operation. DC load line and bias point, Voltage divider bias of transistor.

UNIT-IV

Field Effect Transistors

Construction and characteristics of JFET and MOSFET

Operational Amplifiers

Introduction, Differential and common mode operation, OP-AMP Basics, Practical OP-AMP circuits: Inverting amplifier, Non inverting amplifier, Unity follower, summing amplifier, Integrator and differentiator.

TEXT BOOKS

1. S.K.Bhattacharya, "Basic Electrical and Electronics Engineering", Pearson publications.
2. RobertL.Boylestad&LouisNashelsky,„ElectronicDevicesandcircuittheory",PHI Pvt.Limited, 11th edition.
3. Basics of Electrical and Electronics Engineering", Nagsarkar T K and Sukhija M S, Oxford press University Press.

REFERENCE BOOKS

1. David A. Bell, „Electronic Devices and Circuits", oxford publisher,5thedition
1. "Basic Electrical, Electronics and Computer Engineering", Muthusubramanian R, Salivahanan S and Muraleedharan K A, Tata McGraw Hill, Second Edition,(2006). edition, 7th edition.

PROBLEM SOLVING USING PROGRAMMING
18CS001
I Year B. Tech. First Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives: students will be able to

1. Understand basic concepts of C Programming such as: C-tokens, Operators, Input/output, and Arithmetic rules.
2. Develop problem-solving skills to translate "English" described problems into programs written using C language.
3. Use Conditional Branching, Looping, and Functions.
4. Apply pointers for parameter passing, referencing and differencing and linking data structures.
5. Manipulate variables and types to change the problem state, including numeric, character, array and pointer types, as well as the use of structures and unions, File.

Course Outcomes: After completion of the course the students will be able to

1. Choose the right data representation formats based on the requirements of the problem.
2. Analyse a given problem and develop an algorithm to solve the problem.
3. Use the comparisons and limitations of the various programming constructs and choose the right one for the task in hand.
4. Write the program on a computer, edit, compile, debug, correct, recompile and r unit.
5. Identify tasks in which the numerical techniques learned are applicable and apply them to write programs, and hence use computers effectively to solve the task.

UNIT-I

Overview of C, Constants, Variables and Data Types, Operators and Expressions, Managing I/O Operations. Decision Making and Branching.

Programming Exercises: C-expressions for algebraic expressions, evaluation of arithmetic and Boolean expressions. Syntactic and logical errors in a given program, output of a given program, values of variables at the end of execution of a program fragment, Programs using Scientific and Engineering formulae. Finding the largest of the three given numbers.Computationofdiscountamountondifferenttypesofproductswithdifferent discount percentages. Finding the class of an input character, finding the type of triangle formed with the given sides, computation of income-tax, finding given year is leap year or not, and conversion of lower case character to its upper case.

UNIT-II

Decision Making and Looping, Arrays, Character Arrays and Strings.

Programming Exercises for Unit II: To print the sum of the digits of a given number and to display the image of a given number. To find whether a given number is prime, printing Fibonacci sequence and to find prime factors of a given number. To print graphic patterns of symbols and numbers. To find the length of a string, compare strings, reverse a string, copy a string and to find whether the given string is palindrome or not with and without using String Handling Functions. Transpose of a matrix and sorting of names using arrays.

UNIT-III

User-defined Functions, Structures and Unions, Pointers
Programming Exercises for Unit - III: Functions - Recursive functions to find factorial & GCD (Greatest Common Divisor), string operations using pointers and pointer arithmetic. Swapping two variable values. Sorting a list of student records on register number using array of pointers.

UNIT-IV

File Management in C, Dynamic Memory Allocation, Pre-processor
Programming Exercises for Unit - IV: Operations on complex numbers, and to read an input file of marks and generate a result file, sorting a list of names using command line arguments. Copy the contents of one file to another file. Allocating memory to variables dynamically.

TEXT BOOKS

1. Kernighan BW and Dennis Ritchie M, "C programming language", 2nded, Prentice Hall.
2. Yashavant P. Kanetkar, "Let us C", BPB Publications.
3. Herbert Schildt, "C: The Complete Reference", 4th edition, Tata Mcgraw-Hill.
4. Ashok N.Kamthane, "Programming in C", PEARSON 2nd Edition.

PHYSICS LABORATORY
18PHL01
Ist Year B. Tech.First Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

LIST OF EXPERIMENTS

1. Determination of acceleration due to gravity at a place using compound pendulum.
2. Study the variation of intensity of magnetic field along the axis of a circular coil using Stewart-Gee's apparatus.
3. Determination of thickness of thin wire using air wedge interference bands.
4. Determination of radius of curvature Plano convex lens by forming Newton rings.
5. Determination of wavelengths of mercury spectrum using grating normal incidence method.
6. Determination of dispersive power of a given material of prism using prism minimum deviation method.
7. Draw the resonant characteristic curves of L.C.R. series circuit and calculate the resonant frequency.
8. Draw the characteristic curves of a photocell and calculate the maximum velocity of electron.
9. Verify the laws of transverse vibration of stretched string using sonometer.
10. Determine the rigidity modulus of the given material of the wire using Torsional pendulum.
11. Draw the load characteristic curves of a solar cell.
12. Determination of Hall coefficient of a semiconductor.
13. Determination of voltage and frequency of an A.C. signal using C.R.O.
14. Determination of Forbidden energy gap of Si &Ge.
15. Determination of wavelength of laser source using Diode laser.

Any three experiments are virtual

TEXT BOOK:

1. Engineering physics laboratory manual P.Srinivasarao & K.Muralidhar, Himalaya publications.

BASIC ELECTRICAL AND ELECTRONICS ENGINEERING LAB
18EEL01
I Year B. Tech. First Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

LIST OF EXPERIMENTS

1. Verification of KCL and KVL
2. Verification of Superposition theorem
3. Verification of Thevenin‟s theorem
4. Verification of Norton‟s theorem
5. Parameters of choke coil
6. Measurement of low and medium resistance using volt ampere method
7. OC & SC test of single phase transformer
8. Load test on single phase transformer
9. V-I characteristics of PN junction Diode
10. V-I characteristics of Zener Diode
11. Characteristics of CE Configuration
12. Transfer and Drain Characteristics of JFET
13. Calculation of Ripple factor using Half wave rectifier
14. Calculation of Ripple factor using Full wave rectifier
15. Non linear wave shaping – clippers/clampers

Note: Minimum 10 experiments should be carried.

PROBLEM SOLVING USING PROGRAMMING LAB
18CSL01
I^st Year B. Tech. First Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

1. A program for electricity bill taking different categories of users, different slabs in each category. (Using nested if-else statement).

Domestic Customer:		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 200	0.50 per unit	
201 – 400	100 plus	0.65 per unit
401 – 600	230 plus	0.80 per unit
601 and above	390 plus	1.00 per unit
Commercial Customer:		
Consumption Units	**Rate of Charges(Rs.)**	
0 – 100	0.50 per unit	
101 – 200	50 plus	0.6 per unit
201 – 300	100 plus	0.70 per unit
301 and above	200 plus	1.00 per unit

2. Write a C program to evaluate the following (using loops):
   a) $1 + x^2/2! + x^4 / 4!+ \ldots$upto ten terms
   b) $x + x^3/3! + x^5/5!+ \ldots$ upto ten terms
3. Write a C program to check whether the given number is
   a) Prime or not.
   b) Perfect or Abundant or Deficient.

4. Write a C program to display statistical parameters (using one – dimensional array).
   a) Mean
   b) Mode
   c) Median
   d) Variance.

5. WriteaCprogramtoreadalistofnumbersandperformthefollowingoperations
   a) Print the list.
   b) Delete duplicates from the list.
   c) Reverse the list.

6. Write a C program to read a list of numbers and search for a given number using Binary search algorithm and if found display its index otherwise display the message "Element not found in the List".

7. Write a C program to read two matrices and compute their sum and product.

8. Write a C program to read list of student names and perform the following operations

   a) To print the list of names.
   b) To sort them in ascending order.
   c) To print the list after sorting.

9. Write a C program that consists of recursive functions to

   a) Find factorial of a given number
   b) Solve towers of Hanoi with three towers (A, B & C) and three disks initially on tower A.

10. A Bookshop maintains the inventory of books that are being sold at the shop. The list includes details such as author, title, price, publisher and stock position. Whenever a customer wants a book the sales person inputs the title and the author, and the system searches the list and displays whether it is available or not. If it is not, an appropriate message is displayed, if it is, then the system displays the book details and request for the number of copies required ,if the requested copies are available the total cost of the requested copies is displayed otherwise the message "required copies not in stock" is displayed. Write a program for the above in structures with suitable functions.

11. Write a C program to read a data file of students' records with fields (Regd. no, Name, M1,M2,M3,M4,M5) and write the successful students data (percentage > 40%) to a data file.

12. Write a C program to read a file as command line argument and count the given word frequency in a file

NUMERICAL METHODS AND ADVANCED CALCULUS
18MA002
Ist Year B. Tech. Second Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To learn about some advanced numerical techniques e.g. solving a nonlinear equation, linear system of equations, Interpolation and Approximation techniques.
2. To learn about evaluation of double and triple integrals and their applications.
3. To learn some basic properties of scalar and vector point functions and their applications to line, surface and volume integrals.

Course Outcomes: Students will be able to

1. To learn about some advanced numerical techniques e.g. solving a nonlinear equation, linear system of equations.
2. To learn about some Interpolation and Approximation techniques.
3. To learn about evaluation of double and triple integrals and their applications.
4. To learn some basic properties of scalar and vector point functions and their applications to line, surface and volume integrals.

UNIT-I

Numerical Solution of Equations: Introduction; Solution of algebraic and transcendental equations: Bisection method, Method of false position, Newton-Raphson method; Useful deductions from the Newton-Raphson formula; Solution of linear simultaneous equations; Direct methods of solution: Gauss elimination method, Gauss-Jordan method, Factorization method; Iterative methods of solution: Jacobi‟s iterative method, Gauss-Seidel iterative method.

[Sections: 28.1; 28.2; 28.3; 28.5; 28.6; 28.7.1;28.7.2]. [12 Hours]

UNIT-II

Finite differences and Interpolation: Finite differences: Forward differences, Backward differences; Newton‟s interpolation formulae: Newton‟s forward interpolation formula, Newton‟s backward interpolation formula; Interpolation with unequal intervals; Lagrange‟s interpolation formula; Divided differences; Newton‟s divided difference formula; Numerical integration; Trapezoidal rule; Simpson‟s one-third rule; Simpson‟s three-eighth rule; Numerical solution of ODE‟s: Introduction; Picard‟s method; Euler‟s method; Runge-Kutta method.

[Sections:29.1; 29.1-1; 29.1.2; 29.6; 29.9; 29.10; 29.11; 29.12; 30.4; 30.6; 30.7; 30.8; 32.1;

32.2; 32.4; 32.7]. [12 Hours]

UNIT-III

Multiple Integrals: Double integrals; Change of order of integration; Double integrals in polar coordinates; Area enclosed by plane curves; Triple integrals; Volumes of solids: Volume as Triple integrals, Change of variables.

[Sections: 7.1; 7.2; 7.3; 7.4; 7.5; 7.6.2; 7.7.2]. [12 Hours]

UNIT-IV

Vector calculus and its Applications: Scalar and vector point functions; Del applied to scalar point functions-Gradient: Definition, Directional derivative; Del applied to vector point functions: Divergence, Curl; Line integral; Surfaces: Surface integral, Flux across a surface; Green‟s theorem in the plane (without proof); Stokes theorem (without proof); Gauss divergence theorem(without proof).

[Sections: 8.4; 8.5.1; 8.5.3; 8.6; 8.11; 8.12; 8.13; 8.14; 8.16] [12 Hours]

TEXT BOOKS

1. B.S.Grewal, "Higher Engineering Mathematics", 44thedition, Khanna publishers, 2017.

REFERENCE BOOKS

1. ErwinKreyszig, "Advanced Engineering Mathematics", 9th edition, John Wiley & Sons.
2. N.P.Bali and M.Goyal, "A Text book of Engineering Mathematics" Laxmi Publications, 2010.

ENGINEERING CHEMISTRY
18CY001
Ist Year B. Tech. Second Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. With the principles of water characterization and treatment of water for industrial purposes and methods of producing water for potable purposes.
2. To understand the thermodynamic concepts, energy changes, concept of corrosion & its control.
3. With the conventional energy sources, solid, liquid and gaseous Fuels & knowledge of knocking and anti-knocking characteristics.
4. With aim to gain good knowledge of organic reactions, plastics, conducting polymers & biodegradable polymers.

Course Outcomes: Students will be able to

1. Develop innovative methods to produce soft water for industrial use and potable water at cheaper cost.
2. Apply their knowledge in converting various energies of different systems and protection of different metals from corrosion.
3. Have the capacity of applying energy sources efficiently and economically for various needs.
4. Design economically and new methods of organic synthesis and substitute metals with conducting polymers and also produce cheaper biodegradable polymers to reduce environmental pollution.

UNIT-I

Water chemistry **15hrs**

Introduction: water quality parameters
Characteristics: Alkalinity, Hardness **-** Estimation & simple numerical problems, **Boiler Troubles** - Sludges, Scales, Caustic embrittlement, boiler corrosion, Priming and foaming;
Internal conditioning- phosphate, calgon and carbonate methods.
External conditioning - Ion exchange process & Zeolite proess
WHO Guidelines, Potable water, Sedimentation, Coagulation, Filtration. Disinfection methods: Chlorination, ozonization and UV treatment.
Salinity – Treatment of Brackish water by Reverse Osmosis and Electro-dialysis.

UNIT-II **15hrs**

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications.
Corrosion: Types of corrosion - Chemical or dry corrosion, Electrochemical or wet corrosion; Galvanic, stress, pitting and differential aeration corrosion; Factors effecting corrosion, **Corrosion control** – Cathodic protection, and electro plating (Au) & electoless Ni plating.

UNIT-III

Fuels **15hrs**

Classification of fuels; Calorific value of fuels (lower, higher)

Solid fuels: Determination of calorific value (Bomb Calorimeter) & related problems, Coal ranking,

Liquid Fuels: Petroleum refining and fractions, composition and uses. Knocking and anti-knocking Agents, Octane number and Cetane number; Bio fuels- Biodiesel, general methods of preparation and advantages

Gaseous fuels: CNG and LPG, Flue gas analysis – Orsat apparatus.

UNIT-IV

Organic reactions and synthesis of a drug molecule

Introduction to reactions involving substitution (SN^1, SN^2), addition (Markownikoff‟s and anti-Markwnikoff‟s rules) , elimination (E_1& E_2), Synthesis of a commonly used drug molecule.(Aspirin and Paracetamol)

Polymers: Conducting polymers: Classification, Intrinsic and Extrinsic conducting polymers and their applications**.** Plastics: Thermoplasts and thermosetting plastics, Bskelite and PVC. Bio degradable polymers: types, examples-Polyhydroxybuterate (PHB), Polyhydroxybuterate-co-β-hydroxyvalerate (PHBV), applications.

TEXT BOOKS

1. P.C. Jain and Monica Jain, “Engineering Chemistry” DhanpatRai Pub, Co., New Delhi 17th edition (2017).
2. SeshiChawla, “Engineering Chemistry ” Dhanpat Rai Pub, Co LTD, New Delhi 13th edition, 2013.

REFERENCE BOOKS

1. Essential Of Physical Chemistry by ArunBahl, B.S. Bahl, G.D.Tuli, byArunBahl, B.S. Bahl, G.D.Tuli, Published byS Chand Publishers, 12th Edition, 2012.
2. Text Book of Engineering Chemistry by C.P. Murthy, C.V. Agarwal, A. Naidu B.S. Publications, Hyderabad (2006).
3. Engineering Chemistry by K. Maheswaramma, Pearson publishers 2015

ENGINEERING MECHANICS - II
18ME203
Ist Year B. Tech. Second Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
To introduce the students to the principles of particle and rigid body dynamics in terms of kinematics and kinetics, with emphasis on the analysis and application to practical Engineering problems limited to motion in a plane.

Course Outcomes: Students will be able to
1. Develop relationships between different parameters of motion of a particle in a plane to analyse rectilinear and curvilinear motions
2. Analyze the motion parameters and forces acting on a particle by relating them using Newton's laws of motion, dynamic equilibrium, work & energy and impulse & momentum principles.
3. Find the moment of inertia of material bodies. Develop relationships between different parameters of motion to analyse bodies undergoing fixed axis rotation and general plane motion
4. Analyze the motion parameters and forces acting on a body by Newton's laws of motion, dynamic equilibrium and work & energy principles

UNIT-I

Kinematics of Particle: Rectilinear Translation:
Introduction to Dynamics – Displacement, Velocity and Acceleration – Graphical representations – Motion with uniform acceleration – Motion with variable acceleration.
Kinematics of Particle: Curvilinear Translation:
Introduction – Position vector, Velocity and Acceleration – Components of motion: Rectangular and Normal & tangential.
Relative Motion:
Introduction – Relative motion between two particles: Position, Velocity and Acceleration.

UNIT-II

Kinetics of Particle: Equations of motion
Equations of rectilinear motion – D'Alembert's principle in rectilinear motion - Equations of curvilinear motion: Rectangular components and Normal & tangential components - D'Alembert's principle in curvilinear motion.

Kinetics of Particle: Work and Energy – Impulse and Momentum – Impact

Introduction – Principle of work and energy – Potential energy and conservative forces – Principle of conservation of energy – Principle of impulse and momentum – Conservation of momentum – Direct central impact.

UNIT-III

Moment of Inertia of Material bodies:

Moment of inertia of a rigid body – Moment of inertia of laminas – Moment of inertia of three dimensional bodies: Solid right circular cone, Solid cylinder and Sphere

Kinematics of Rigid Body:

Introduction – Rotation – Parameters of motion of a body rotating about a fixed axis – General plane motion – Absolute and relative velocity in plane motion – Instantaneous centre of rotation in plane motion.

UNIT-IV

Kinetics of Rigid Body: Equations of motion

Introduction – Equations of motion – Relation between translatory motion and rotary motion of a body in plane motion – D‟Alembert‟s principle in plane motion.

Kinetics of Rigid Body: Work and Energy

Kinetic energy of a rigid body – Work of the forces acting on a rigid body – Principle of work and energy for a rigid body – Principle of conservation of energy.

TEXT BOOKS

1. Engineering Mechanics (in SI units) by S Timoshenko, D H Young, J V Raoand Sukumar Pati, McGraw Hill Education, 5th edition, 2016.
2. Engineering Mechanics: Statics and Dynamics by A K Tayal, Umesh publications, 14th edition, 2015.

REFERENCE BOOKS

1. Vector mechanics for Engineers: Statics and Dynamics by Ferdinand Beer, E Russell Johnston Jr, David Mazurek, Phillip Cornwell, Brian Self and Sanjeev Sanghi, McGraw Hill Education, 11th edition, 2017.
2. Engineering Mechanics: Statics and Dynamics by R C Hibbeler, Pearson, 14thedition, 2017.
3. Engineering Mechanics (Statics) by J L Meriam and L G Kraige, Wiley student edition, 7th edition.

ENVIRONMENTAL STUDIES
18CE001
I Year B. Tech. Second Semester

Lectures	3	Tutorial	0	Practical	0	Credits	2
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To develop an awareness, knowledge, and appreciation for the natural environment.
2. To understand different types of ecosystems exist in nature.
3. To know our biodiversity.
4. To understand different types of pollutants present in Environment.
5. To know the global environmental problems.

Course Outcomes: Students will be able to

1. Develop an appreciation for the local and natural history of the area.
2. Hope for the better future of environment in India which is based on many positive factors like Biodiversity, successive use of renewable energy resources and other resources, increasing number of people's movements focusing on environment.
3. Know how to manage the harmful pollutants.
4. Gain the knowledge of Environment.
5. Create awareness among the youth on environmental concerns important in the long-term interest of the society

UNIT-I

Introduction: Definition, Scope and Importance, Need for public awareness. Ecosystems: Definition, Structure and Functions of Ecosystems, types - Forest, Grassland, Desert, Aquatic (Marine, pond and estuaries). *6 periods*

Biodiversity: Definition and levels of Biodiversity; Values of Biodiversity - Consumptive, Productive, Social, Aesthetic, Ethical and Optional; Threats and Conservation of Biodiversity; Hot Spots of Biodiversity, Bio-geographical Classification of India, India as a mega diversity nation. *Chipko movement case study* *6 periods*

UNIT-II

Natural resources: Land: Land as a resource, Causes and effects of land degradation - Soil erosion, Desertification. **Forest**: Use of forests, Causes and effects of deforestation, Afforestation, Mining - benefits and problems. **Water**: Uses, floods and drought, Dams - benefits and problems.

Energy: Importance of energy, Environmental Impacts of Renewable and Non-renewable energy resources. *Silent Valley Project and Narmada BachaoAndolan case studies8 periods*

Sustainability: Definition, Concept and Equitable use of resources for sustainable development; Rain water harvesting and Watershed management. Fieldwork on Rain water harvesting and Watershed management.*6 periods + 6 hours field work/Demonstration*

UNIT-III

Pollution: Definition; Causes, effects and control of air, water and nuclear pollution; *Chernobyl Nuclear Disaster* case study; Solid Waste: urban, Industrial and hazardous wastes; Integrated waste management - 3R approach, composting and vermin-composting.

12 periods

Environmental acts: Water and air (Prevention and Control of pollution) acts, Environmental protection act, Forest Conservation act. *6 periods*

UNIT-IV

Environmental issues: Green house effect & Global warming, Ozone layer depletion, Acid rains, Green Revolution, Population Growth and environmental quality, Environmental Impact Assessment. Environmental Standards (ISO 14000, etc.) *12 periods*

Case Studies: Bhopal Tragedy, Mathura Refinery and Taj Mahal, and Ralegan Siddhi (Anna Hazare). *6 periods*

Field work: Visit to a local area to document environmental assets – Pond/Forest/Grassland. Visit to a local polluted site- Urban and industry/ Rural and Agriculture. *6 periods*

TEXT BOOKS

1. "Environmental Studies" by Benny Joseph, Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. "Comprehensive environmental studies"- JP Sharma, Laxmi Publications.
3. Text Book of environmental Studies – ErachBharucha

REFERENCE BOOKS

1. "Environmental studies", R.Rajagopalan, Oxford University Press.
2. "Introduction to Environmental Science", Anjaneyulu Y, B S Publications
3. "Environmental Science", 11th Edition – Thomson Series – By Jr. G. Tyler Miller.

COMMUNICATIVE ENGLISH
18EL001
Ist Year B. Tech. Second Semester

Lectures	3	Tutorial	0	Practical	0	Credits	2
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

UNIT-I

1.1 **Vocabulary Development**: Word formation-Formation of Nouns, Verbs & Adjectives from Root words-Suffixes and Prefixes
1.2 **Essential Grammar:** Prepositions, Conjunctions, Articles
1.3 **Basic Writing Skills**: Punctuation in writing
1.4 **Writing Practices**: Mind Mapping, Paragraph writing (structure-Descriptive, Narrative, Expository & Persuasive)

UNIT-II

2.1 **Vocabulary Development**: Synonyms and Antonyms
2.2 **Essential Grammar**: Concord, Modal Verbs, Common Errors
2.3 **Basic Writing Skills**: Using Phrases and clauses
2.4 **Writing Practices**: Hint Development, Essay Writing

UNIT-III

3.1 **Vocabulary Development**: One word Substitutes
3.2 **Essential Grammar**: Tenses, Voices
3.3 **Basic Writing Skills**: Sentence structures (Simple, Complex, Compound)
3.4 **Writing Practices**: Note Making

UNIT-IV

4.1 **Vocabulary Development**: Words often confused
4.2 **Essential Grammar**: Reported speech, Common Errors
4.3 **Basic Writing Skills**: Coherence in Writing: Jumbled Sentences
4.4 **Writing Practices**: Paraphrasing &Summarising

REFERENCE BOOKS

- Communication Skills, Sanjay Kumar &PushpaLatha. Oxford University Press:2011.
- Practical English Usage, Michael Swan. Oxford University Press:1995.
- Remedial English Grammar, F.T.Wood. Macmillan:2007.
- Study Writing, Liz Hamplyons& Ben Heasley. Cambridge University Press:2006

ENGINEERING GRAPHICS
18MEL01
I Year B. Tech. Second Semester

Lectures	1	Tutorial	0	Practical	4	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. Clear picture about the importance of engineering graphics in the field of engineering
2. The drawing skills and impart students to follow Bureau of Indian Standards
3. To give an idea about Geometric constructions, Engineering curves, orthographic projections and pictorial projections
4. Imagination skills about orientation of points, lines, surfaces and solids
5. Basic drafting skills of AutoCAD

Course Outcomes: After completion of the course the students will be able to

1. Draw projections of points and projections of lines using Auto CAD
2. Plot projections of surfaces like circle, square and rhombus
3. Plot the Projections of solids like Prisms and pyramids
4. Convert the of Orthographic views into isometric views of simple objects
5. Generate the of pictorial views into orthographic views of simple castings

UNIT-I

INTRODUCTION: Introduction to Drawing instruments and their uses, geometrical construction procedures

INTRODUCTION TO AUTOCAD:

Basics of sheet selection, Draw tools, Modify tools, dimensioning

METHOD OF PROJECTIONS: Principles of projection - First angle and third angle projection of points. Projection of straight lines. Traces of lines.

UNIT-II

PROJECTIONS OF PLANES: Projections of plane figures: circle, square, rhombus, rectangle, triangle, pentagon and hexagon.

UNIT-III

PROJECTIONS OF SOLIDS: Projections of Cubes, Prisms, Pyramids, Cylinders and Cones Inclined to one plane.

UNIT-IV

ISOMETRIC PROJECTIONS: Isometric Projection and conversion of Orthographic views into isometric views. (Treatment is limited to simple objects only).

UNIT-V

ORTHOGRAPHIC PROJECTIONS: Conversion of pictorial views into Orthographic views. (Treatment is limited to simple castings).

TEXT BOOKS

1. Engineering Drawing with AutoCAD by Dhananjay M. Kulkarni (PHI publication)
2. Engineering Drawing by N.D. Bhatt & V.M. Panchal. (Charotar Publishing House, Anand). (First angle projection)

REFERENCE BOOKS

1. Engineering Drawing by Dhananjay A Jolhe, Tata McGraw hill publishers
2. Engineering Drawing by Prof.K.L.Narayana& Prof. R.K.Kannaiah.

ENGINEERING CHEMISTRY LABORATORY
18CYL01
Ist Year B. Tech. Second Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

LIST OF EXPERIMENTS

1. **Introduction to Chemistry Lab** (the teachers are expected to teach fundamentals like Calibration of Volumetric Apparatus, Primary, Secondary Solutions, Normality, Molarity, Molality etc. and error, accuracy, precision, theory of indicators, use of volumetric titrations).
2. **Volumetric Analysis:**
    a. Estimation of Washing Soda.
    b. Estimation of Active Chlorine Content in Bleaching Powder
    c. Estimation of Mohr's salt by permanganometry.
    d. Estimation of given salt by using Ion-exchange resin using Dowex-50.
3. **Analysis of Water:**
    a. Determination of Alkalinity of Tap water.
    b. Determination of Total Hardness of ground water sample by EDTA method
    c. Determination of Salinity of water sample
4. **Estimation of properties of oil:**
    a. Estimation of Acidic Value.
    b. Estimation of Saponification Value.
5. **Preparations:**
    a. Preparation of Soap
    b. Preparation of Urea-formaldehyde resin
    c. Preparation of Phenyl benzoate
6. **Demonstration Experiments (Any two of the following):**
    a. Determination of p^H of given sample.
    b. Determination of conductivity of given sample by conductometer.
    c. Potentiometric Determination of Iron.

TEXT BOOK:

1. Practical Engineering Chemistry by K.Mukkanti, Etal, B.S. Publicaitons, Hyderabad, 2009.
2. Inorganic quantitative analysis, Vogel, 5th edition, Longman group Ltd. London, 1979.

REFERENCE BOOKS:

1. Text Book of engineering chemistry by R.n.Goyal and HarrmendraGoel.
2. A text book on experiments and calculations- Engineering Chemistry. S.S. Dara.
3. Instrumental methods of chemical analysis, Chatwal, Anand, Himalaya Publications.

ENGLISH COMMUNICATION SKILLS LABORATORY
18ELL01
Ist Year B. Tech. Second Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

UNIT-I

1.1 Listening Skills; Importance – Purpose- Process- Types
1.2 Barriers to Listening
1.3 Strategies for Effective Listening

UNIT-II

2.1 Phonetics; Introduction to Consonant, Vowel and Diphthong sounds
2.2 Stress
2.3 Rhythm
2.4 Intonation

UNIT-III

3.1 Formal and Informal Situations
3.2 Expressions used in different situations
3.3 Introducing Yourself & Others-Greeting & Parting-Congratulating-Giving Suggestions & Advices-Expressing Opinions-Inviting People-Requesting-Seeking Permission-Giving Information- Giving Directions- Sympathizing- Convincing People-Complaining & Apologizing-Thanking Others- Shopping- Travelling-Conversational Gambits

UNIT-IV

4.1 JAM Session
4.2 Debates
4.3 Extempore

REFERENCE BOOKS:

- Communication Skills, Sanjay Kumar and Pushpa Lata. Oxford University Press. 2011
- Better English Pronunciation, J.D. O‟ Connor. Cambridge University Press:1984
- New Interchange (4rth Edition), Jack C Richards. Cambridge University Press: 2015v English Conversation Practice, Grant Taylor. McGraw Hill:2001

SOFTWARE:

- Buzzers for conversations, New Interchange series
- English in Mind series, Telephoning in English
- Speech Solutions, A Course in Listening and Speaking

WORKSHOP PRACTICE
18MEL02
Ist Year B. Tech. Second Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To impart student knowledge on various hand tools for usage in engineering applications.
2. Be able to use analytical skills for the production of components.
3. Design and model different prototypes using carpentry, sheet metal and welding.
4. Make electrical connections for daily applications.
5. To make student aware of safety rules in working environments.

Course Outcomes: After completion of this course student should be able to:

1. Make half lap joint, Dovetail joint and Mortise &Tenon joint
2. Produce Lap joint, Tee joint and Butt joint using Gas welding
3. Prepare trapezoidal tray, Funnel and T-joint using sheet metal tools
4. Make connections for controlling one lamp by a single switch, controlling two lamps by a single switch and stair case wiring.

SYLLABUS:

1. Carpentry
   a. Half Lap joint
   b. Dovetail joint
   c. Mortise &Tenon joint
2. Welding using electric arc welding process/gas welding
   a. Lap joint
   b. Tee joint
   c. Butt joint
3. Sheet metal operations with hand tools
   a. Trapezoidal tray
   b. Funnel
   c. T-joint
4. House wiring
   a. To control one lamp by a single switch
   b. To control two lamps by a single switch
   c. Stair-case wiring

TEXT BOOKS:

1. P.Kannaiah and K.L.Narayana, Workshop Manual, SciTech Publishers, 2009.
2. K. Venkata Reddy, Workshop Practice Manual, BS Publications, 2008.

STRENGTH OF MATERIALS - I
18ME301
II Year B. Tech. (Mech) Third Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. Classification of the stresses into various categories and define the elastic properties of Materials
2. Computations of stress and strain intensities caused by applied loads in simple and compound sections and temperature changes
3. Determination of the shear force and bending moment and draw the shear force and bending moment diagrams for different beams and different loads
4. Explain the structural behaviour of members subjected to torque, Calculate twist and stress induced in shafts subjected to bending and torsion
5. Derivation of equations for principal stress and maximum in-plane shear stress and calculation of their magnitude and direction. Draw Mohr circle for plane stress system and interpret this circle.

Course Outcomes:

1. To define stress strain diagram and various points on it and define the types of stresses.
2. To analyse the bars under axially loaded members of statically determinate and statically indeterminate members and to calculate the power transmitted by circular shafts
3. To draw the SF and BM diagrams and analyse the bending stresses and shear stresses.
4. To draw the Mohr's circle for plane stress for principal stresses and maximum shear stresses.

UNIT-I

TENSION, COMPRESSION AND SHEAR: Introduction to Mechanics of materials, normal stress and strain, stress strain diagram for mild steel, elasticity and plasticity, linear elasticity, Hooke's law and Poisson's ratio, shear stress and strain, volumetric strain and bulk modulus, allowable stresses and allowable loads. (9)

AXIALLY LOADED MEMBERS: Introduction, changes in lengths of axially loaded members, changes in lengths under non uniform conditions. (6)

UNIT-II

STATICALLY INDETERMINATE AXIALLY LOADED MEMBERS: Statically indeterminate structures, thermal effects, misfits and pre strains, strain energy. (8)

TORSION: Introduction, torsion of circular bars, non-uniform torsion, relationship between E and G, transmission of power by circular shafts, strain energy in torsion. (7)

UNIT-III

SHEAR FORCE AND BENDING MOMENT: Introduction, Types of Beams, Loads and Reactions. Shear force and bending moment, relationships between load, Shear force and bending moment, S.F. and B.M. diagrams. (15)

UNIT-IV

STRESSES IN BEAMS: Introduction, normal strains and stresses in beams. Shear stresses in beams of rectangular cross section, shear stresses in beams of circular cross section. (8)
ANALYSIS OF STRESS AND STRAIN: Introduction, plane stress, principal stresses and maximum shear stresses, Mohr's circle for plane stress, Hooke's law for plane stress. (7)

TEXT BOOKS

1. 'Mechanics of Materials' by James M Gere

REFERENCE BOOKS

1. 'Strength of materials' by G.H. Ryder: MacMillan India Ltd. publishers.
2. 'Mechanics of Materials' by Beer and Johnston
3. 'Strength of Materials' by L.S.Srinath
4. 'Applied strength of materials' by RobortL.Mott

PROFISSIONAL ETHICS & HUMAN VALUES
18ME302
II Year B.Tech. (Mech) Third Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. Understand the Engineering Ethics and uses of ethical theories
2. Understand social responsibilities and rights
3. Familiar with Global issues like Multinational Corporations-Environmental Ethics-Computer Ethics-Weapons Development-Engineers As Managers -Consulting Engineers-Engineers as Expert Witnesses And Advisors-Moral Leadership Sample Code Of Ethics Like ASME, ASCE, IEEE, Institution Of Engineers(India), Indian Institute Of Materials Management, Institution Of Electronics and Telecommunication Engineers (IETE), India Etc.

Course Outcomes:

Upon successful completion of the course, the student will be able:

1. To create awareness on professional ethics and Human Values
2. To create awareness on Engineering Ethics providing basic knowledge about engineering Ethics, Variety of moral issues and Moral dilemmas, Professional Ideals and Virtues.
3. To provide basic familiarity about Engineers as responsible Experimenters, Research Ethics, Codes of Ethics, Industrial Standards
4. To inculcate knowledge and exposure on Safety and Risk, Risk Benefit Analysis and have an idea about the Collective Bargaining, Confidentiality, Professional, Employee, Intellectual Property Rights

UNIT-I

Human Values: Morals, Values and Ethics, Integrity, Work Ethic, Service Learning, Civic Virtue, Respect for others, Living peacefully, Caring, Sharing, Honesty, Courage, Valuing timeCo-Operation, Commitment, Empathy, Self Confidence, Character, Spirituality (14)

UNIT-II

Engineering Ethics: Senses Of 'Engineering Ethics, Variety of Moral Issues, Types of Inquiry,Moral Dilemmas, Moral Autonomy, Kohlberg's Theory, Gilligan's Theory, Consensus and controversy, Professions and Professionalism, ProfessionalIdeals and Virtues, Theories about Right Action. (14)

UNIT-III

Engineering as Social Experimentation: Engineering as Experimentation, Engineers as Responsible Experimenters, Safety, Responsibility and Rights: Safety and Risk – Assessment of Safety and Risk, Risk Benefit Analysis and Reducing Risk.
Collegiality and Loyalty, Respect For Authority, Collective Bargaining, Confidentiality, Conflicts Of Interest, Occupational Crime, Professional Rights, Employee Rights, Intellectual Property rights (IPR). (20)

UNIT-IV

Global Issues:
Multinational Corporations, Environmental Ethics, Computer Ethics, Weapon Development, Engineers as Managers, Consulting Engineering, Engineering as Expert Witnesses and Advisors, Moral leadership, Sample codes of Ethics like ASME, ASCE, IEEE, and Institution of Engineers(India), Indian institute of material management, Institution of Electronics and Telecommunication Engineers (IETE), India etc.,

TEXT BOOKS

1. Govindarajan. M, Natarajan. S, Senthilkimar.V.S, Engineering Ethics, Phi, 2004.
2. Mike Martin and Roland Schinzinger, Ethics In Engineering, McGraw Hill, New York 1996.
3. M.P.Raghavan, ProfessiionalEhics and Human Values, Scitech Publications (India)Pvt.ltd., 2009.

REFERENCE BOOKS

1. Charles D Fleddermann, Engineering Ethics, Prentice Hall, New Jersey, 2004.
2. Charles E Harris, Michael S Pritchard and Michael J Robins, Engineering Ethics Concepts and Cases, Thomson Learning, United States, 2000.
3. John R Boatright, Ethics and The Conduct Of Business, Phi, New Delhi, 2003.
4. Edmund G SeebauerAnd Robert L Barry, Fundamentals Of Ethics For Scientists And Engineering, Oxford University Press, 2001.

THERMODYNAMICS
18ME303
II Year B.Tech. (Mech) Third Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To Understand the fundamental concepts of Thermodynamics
2. To acquire the knowledge about the laws of Thermodynamics
3. To learn the principles of Work and Heat energy
4. To Understand the Concepts of Entropy and Availability
5. To analyse the Vapour power cycles and differentiate the Phase diagrams of the steam and usage of Steam tables

Course Outcomes:

Upon successful completion of the course, the student will be able

1. To explain the differences between Open system and Closed system and to analyse the work and heat interactions for various processes.
2. To Define the fundamentals of first law and second law of thermodynamics and their applications to the various systems
3. To Evaluate the Entropy changes for various processes and determine the reversibility or irreversibility of a process
4. To understand the principle of Rankine cycle and methods to improve its efficiency.
5. To learn the process of Steam generation and calculate the Properties of Steam using Steam tables and Mollier chart.

UNIT-I

FUNDAMENTAL CONCEPTS AND DEFINITIONS: Introduction, Macroscopic and microscopic points of view, Thermodynamic system and control volume, Perfect gases, properties and state of a substance, Thermodynamic equilibrium and Quasi-static Process, Concept of Continuum, thermodynamic path, cycle, Path function and Point function, Zeroth law of thermodynamics, concept of temperature. (7)

WORK AND HEAT: Definitions and comparisons, Displacement work, Displacement work in various Quasi-Static processes, Forms of Work transfer.

FIRST LAW OF THERMODYNAMICS: First law of thermodynamics for a closed system undergoing a cycle and a change of state, Energy- A property of the system, First law analysis for a closed system (Non-flow processes), Internal energy and Enthalpy. (8)

UNIT-II

FIRST LAW OF THERMODYNAMICS FOR FLOW SYSTEMS: First law of thermodynamics for a control volume, Steady flow energy equation and its application to engineering equipment, Limitations of first law of thermodynamics, PMM of first kind. (7)
SECOND LAW OF THERMODYNAMICS: Heat engines and Refrigerators, Statements of Second law, PMM of second kind, reversible and irreversible processes, factors that render a process irreversible, Carnot cycle and Carnot theorem and its corollaries, Thermodynamic temperature scale. (8)

UNIT-III

ENTROPY: Inequality of Classius, Entropy change in reversible process, T-ds relations, Entropy change of a system during an irreversible process, Principle of increase of entropy, Applications, Entropy change of an ideal gas. (8)
AVAILABILITY AND IRREVERSIBILITY: Available and unavailable energy, Availability Function for a non-flow Process, Availability Function of Flow Processes, Irreversibility, Second law efficiency, Helmholtz & Gibb's function, Elementary treatment of Third law of thermodynamics. (7)

UNIT-IV

PURE SUBSTANCE: Definition, process of steam generation, P-v, T-s and h-s diagrams, properties of saturated and superheated steam, Use of Steam Tables, Mollier chart. (7)
VAPOR POWER CYCLES: Rankine cycle, Effect of pressure and temperature on the Rankine cycle, reheat cycle, regenerative cycle. (8)

TEXT BOOKS

1. Engineering Thermodynamics- P.K.Nag, TMH, New Delhi.
2. Thermal Science and Engineering- D.S.kumar, S.K.Katariapubl, New Delhi.
3. Thermodynamics—Rajput, LaxmiPubl, New Delhi.

REFERENCE BOOKS

1. Fundamentals of Engineering Thermodynamics-Rathakrishnan-PHI, New Delhi.
2. Thermodynamics -- J.P.Holman, MGH, New York.
3. Engineering Thermodynamics—Cengel& Boles, TMH

FLUID MECHANICS & HYDRAULIC MACHINES
18ME304
II Year B.Tech. (Mech) Third Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

To make the students to perceive
1. Understanding the properties of fluids, principles of buoyancy, flow, force and head calculations.
2. Evaluation of types of fluid flow and pipe flow.
3. Principles of operation of different types of hydraulic turbines.
4. Principles of operation of pumps

Course Outcomes:

After completion of the course the student will be able to:
1. Analyze the fluid properties to solve flow, force and velocity problems.
2. Evaluate the flow characterizing in static and dynamic nature of flow
3. Apply fluid flow and dynamics in solving problems in hydraulic turbines.
4. Apply fluid flow and dynamics in solving problems in hydraulic pumps.

UNIT-I

INTRODUCTION: Definition of fluid, Properties of a fluid – density, specific weight, specific gravity, viscosity, compressibility, surface tension, capillarity, vapor pressure, Classification of fluid (4)
FLUID STATICS: Pressure, variation of pressure in a fluid, measurement of pressure – simple and differential manometers, pressure head, Pascal's law, Total pressure and center of pressure on plane surfaces, Introduction to Buoyancy and Metacentric height. (5)
FLUID KINEMATICS: Velocity and acceleration of fluid particle, types of fluid flow, Description of flow pattern, Rotational and irrotational flows, velocity potential, stream function, flow net, continuity equation in Cartesian coordinates. (6)

UNIT-II
FLUID DYNAMICS: Introduction, Euler's equation of motion, Bernoulli's equation, Pitot tube, venturimeter, Introduction to orifice- various coefficients of an orifice. Impulse momentum Principle, Equation and Application - Force on pipe bend. (7)
FLOW THROUGH PIPES: Reynolds experiment, Darcy Wiesbach equation, minor losses, pipes in series and parallel, transmission of power through a pipe, water hammer. Laminar flow through a circular pipe, Hagen-Poiseuille law. (8)

UNIT-III

INTRODUCTION: Classification of fluid machines, angular momentum principle.
IMPACT OF JETS: Introduction, Force exerted by a fluid jet on stationary and moving flat plate and curved vanes, flow over radial curved vanes. (6)
HYDRAULIC TURBINES: Heads and efficiencies of a turbine, Classification of turbines, Pelton, Francis and Kaplan turbines- Working, proportions of turbines, Numerical problems. Introduction to draft tube theory. (7)
PERFORMANCE OF TURBINES: Performance under unit quantities, Performance under specific conditions - Specific speed. Performance characteristics curves, Cavitation in turbines- Thoma's cavitation factor. (2)

UNIT-IV

RECIPROCATING PUMPS: Types, Working principle, Power required by a Reciprocating pump, Coefficient of discharge, Slip and negative slip, Effect of Acceleration of piston on velocity and pressure in suction and delivery pipes, Indicator diagram, Maximum speed of a reciprocating pump. Introduction to Air vessels.(8)
CENTRIFUGAL PUMPS: Types, Working, Reciprocating vs. Centrifugal pump, Work done by impeller, Head of a pump, losses and efficiencies, Minimum starting speed, Specific speed, Multistage pumps, Pumps in parallel, Performance characteristic curves, limitation of suction lift, NPSH, Cavitation. (7)

TEXT BOOKS

1. Hydraulics and fluid mechanics -P.N. Modi&S.M.Seth, Standard Book House, New Delhi.
2. Fluid Mechanics and hydraulic machines-R.K.Bansal

REFERENCE BOOKS

1. Fluid Mechanics and Fluid machines – Agarwal, TMH.
2. Fluid mechanics and fluid power engineering - D.S.Kumar, SK Kataria& Sons, New Delhi.
3. Fluid mechanics including Hydraulic machines - A.K.Jain. 4. Fluid Mechanics- K.L.Kumar

BASIC MANUFACTURING PROCESSES
18ME305
II Year B. Tech. (Mech) Third Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To enable students to understand basic casting processes used in the manufacturing industry.
2. To learn various aspects of different advanced casting techniques and their applicability in the modern manufacturing industries.
3. To obtain a broad knowledge in different welding and joining techniques and their applications.
4. To calculate of power and design requirements in sheet metal and metal forming operations.

Course Outcomes:

Upon successful completion of the course, the student will be able to

1. Recommend the particular casting process required to be selected for a specific engineering application.
2. Design and model the required gating system for a given casting process.
3. Select a specific welding process to minimize defects and to develop sound joint.
4. Understand and design the metal working processes to produce wrought products.

UNIT-I

METAL CASTING: Introduction, advantages of Casting method, pattern types, materials and allowances. Sand moulding procedure, Moulding materials and equipment. Preparation, control and testing of moulding sands. (15)

UNIT-II

GATING DESIGN: Design Considerations and problems.

SPECIAL CASTING METHODS: Permanent Mould Casting, Die Casting, Centrifugal casting, Investment casting, shell moulding, CO_2 process and continuous casting. Fettling of castings, casting defects: causes, remedies and testing. (15)

UNIT-III

WELDING: Gas and arc welding - Principles of oxy-acetylene welding, oxyacetylene flame cutting, MMAW (Manual metal arc welding), TIG, MIG, submerged arc welding. Resistance welding principles - Butt welding, Spot welding, Seam welding. Thermit Welding, Electro slag welding. Laser beam welding. Brazing & Soldering, welding defects - causes and remedies. (15)

UNIT-IV

METAL WORKING PROCESSES: Introduction, Hot and Cold working of metals. Rolling, Forging, Extrusion, Tube making, Swaging, Spinning, Coining, Embossing and Wire drawing. (6)

SHEET METAL WORKING OPERATIONS: Introduction, Types of Sheet metal working operations, Blanking and Punching operations, Clearance and shear as applied to Punching/Blanking operations, Simple related problems, High energy rate forming of metals, Bending, deep drawing. (9)

TEXT BOOKS

1. Manufacturing Technology-Vol- I by PN Rao, TMH
2. Workshop Technology Vol.1 by S.K.HazraChowdary. Khanna Publishers
3. A course in Work shop technology, Vol-I by B.S.Raghuvanshi, Dhanpatrai& sons.

REFERENCE BOOKS

1. Welding Technology by Little, TMH
2. Principles of Metal Casting by Heine, Loper, Rosenthal, TMH.
3. Manufacturing Engineering & Technology, Kalpakjian, Pearson Education / PHI
4. Material Science and Metallurgy - R. B. Choudary -Khanna Pub.

CONSTITUTION OF INDIA
18ME306
II Year B.Tech. (Mech) Third Semester

Lectures	2	Tutorial	0	Practical	0	Credits	0
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

The constitution of India is the supreme law of India. Parliament of India cannot make any law which violates the Fundamental Rights enumerated under the part III of the constitution. The Parliament of India has been empowered to amend the constitution under Article 368, however, it cannot use this power to change the "basic structure" of the constitution, which has been ruled and explained by supreme-court of India in its historical judgments. The constitution of India reflects the idea of "Constitutionalism" – a modern and progressive concept historically developed by the thinkers of "liberalism" – an ideology which has been recognized as one of the most popular political ideology and result of historical struggles against arbitrary use of sovereign power by state. The historic revolutions in France, England, America and particularly European Renaissance and Reformation movement have resulted into progressive legal reforms in the form of "constitutionalism" in many countries. The Constitution of India was made by borrowing models and principles from many countries including United Kingdom and America.

The constitution of India is not only a legal document but it also reflects social, political and economic perspectives of the Indian Society. It reflects India's legacy of "diversity". It has been said that Indian constitution reflects ideals of its freedom movement; however, few critics have argued that it does not truly incorporate our own ancient legal heritage and cultural values. No law can be "Static" and therefore the constitution of India has also been amended more than one hundred times. These amendments reflect, political, social and economic developments since the year 1950. The Indian judiciary and particularly the Supreme Court of India has played an historic role as the guardian of people. It has been protecting not only basic ideals of the Constitution but also strengthened the same through progressive interpretations of the next of the Constitution. The judicial activism of the Supreme Court of India and its historic contributions has been recognized throughout the world and it gradually made it "as one of the strongest court in the world".

Course Contents:

1. Meaning of the constitution law and constitutionalism.
2. Historical perspective of the Constitution of India.
3. Salient features and characteristics of the constitution of India.
4. Scheme of the fundamental rights.
5. The scheme of the fundamental duties and its legal status.
6. The Directive principles of state policy- its importance and implementation.
7. Federal structure and distribution of legislative and financial powers between the union and the states.
8. Parliamentary form of government of India – the constitution powers and status of the president of India.
9. Amendment of constitutional powers and procedure.
10. The historical perspectives of the constitutional amendments in India.
11. Emergency provisions: National Emergency, President Rule, Financial Emergency.
12. Local Self Government – constitutional scheme in India.
13. Scheme of the Fundamental Right to Equality.
14. Scheme of the Fundamental Right to certain Freedom under Article 19.
15. Scope of the Right to Life and Personal Liberty under Article 21.

TEXT BOOKS

1. Introduction to constitution of India, D.D.Basu, Lexis Nexus
2. The constitution of India, P.M.Bhakshi, Universal law publishing

STRENGTH OF MATERIALS & FLUID MECHANICS LAB
18MEL31
II Year B. Tech. (Mech) Third Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. Study the shear behaviour of mild steel.
2. To know deflection formula and application to find 'E'.
3. To know the fixed support characteristics and applications of the deflection formula to calculate E''.
4. Verify the deflection formula for a helical spring.
5. To study the torsion formula and application.
6. To know about impact strength.
7. To know about B.H.N. and R.H.N.
8. To study the elastic properties.
9. To understand the flow measurements in a pipe and tanks.
10. To identify the various types of flow in pipe.
11. To determine the energy loss in pipe.
12. To verify the Bernoulli's Energy equation.
13. To study the characteristics of turbines.
14. To study the characteristics of pumps.

Course Outcomes:

After completion of the course student will be able to

1. Calculate shear strength of material familiar with U.T.M.
2. Distinguish between various types of beams.
3. State the various features of supports and importance of 'E'.
4. Analyze rigidity modulus and analysing deflection formula for spring.
5. State the torsion formula and the application.
6. AnalyzeCharpy test and calculate impact strength.
7. Determination of B.H.N. and R.H.N.
8. Calculate the elastic properties in tension.
9. Measure discharge in pipes and identification of type of flow.
10. Verify the Bernoulli's equation.
11. Determine the energy loss in conduits.
12. Evaluate the characteristics of turbines.
13. Evaluate the characteristics of pumps.

LIST OF EXPERIMENTS

Strength of Materials Lab

1. Determination of shear strength on mild steel bar using UTM.
2. Find young's modulus using simply supported beam on steel and wood.
3. Find young's modulus using cantilever beam on steel.
4. Calculate rigidity modulus for the spring by using deflection formula.
5. Evaluate shear modulus by conducting torsion test on a mild steel bar.
6. Charpy test.
7. Conduct hardness tests (B.H.T & R.H.T.) on steel and brass specimens.
8. Tension test on U.T.M. to find elastic properties.

Fluid Mechanics Lab

1. Verification of Bernoulli's theorem
2. Venturi meter Determination of coefficient of discharge
3. Determination of friction factor for pipes of different materials
4. Determination of loss of head in pipes due to bends, sudden contractions and sudden expansion.
5. Measurement of force due to impact of jets on vanes of different types.
6. Performance study on Pelton turbine
7. Performance studies on single acting reciprocating pump
8. Performance studies on single stage centrifugal pump

Note: A minimum of 6 experiments shall be done and recorded from each lab.

BASIC MANUFACTURING PROCESSES LAB
18MEL32
II Year B. Tech. (Mech) Third Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objective:
Lab is having foundry, patternmaking, fitting and lathe operations. Preparation of wooden pattern using carpentry tools and making sand mold using pattern enables the student to know the necessity of pattern, mold during the preparation of casting.

Course Outcomes:
The student will

1. Have an idea to write steps involved in making casting by considering practical aspects into account.
2. Have an idea about lathe operations like as Facing, turning, threading and knurling
3. Knows the importance of operations in fitting and about several fits.
4. Know how to prepare pattern by considering several allowances and know the difference between wooden pattern and metal pattern.

MOULDING: Stepped cone pulley, Hand wheel, Bush.

FITTING: Four Standard Exercises

TURNING: Plain, Step and Taper turning, Right-hand and Left-hand threads, Eccentric turning, Knurling and contour turning.

COMPUTER AIDED DRAFTING AND MODELLING LAB
18MEL33
II Year B. Tech. (Mech) Third Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To understand the working of the software and different commands
2. To enable the students create 3D models.
3. To design assemblies of various products.
4. To generate orthographic views of parts and assemblies.

Course Outcomes:

After completing the course, the student should be able to:

1. Execute steps required for modelling 3D objects.
2. Use isometric views and dimensioning of part models.
3. Execute the steps for assembling the parts of a product.
4. Execute the steps required for generating the orthographic views of parts and products.

Course Content:

3D modelling using any of the modelling packages like CATIA, Pro/ENGINEER, NX, Solid Works, Ideas, Autodesk Inventor etc.
List of Modules to be Covered:

1. Sketcher
2. Part Modelling
3. Assembly Modelling Of Stuffing Box and Screw Jack.
4. Drawing Module for creating the orthographic views of Stuffing box and Screw Jack

TEXT BOOKS

1. A Text book of “Machine Drawing” by K. L. Narayana, P. Kannaiah, K. Venkata Reddy.

PROBABILITY AND STATISTICS
18MA003
II Year B.Tech. (Mech) Fourth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To provide principles of statistical methods and probability concepts that serves the foundations for the applications of methods in engineering.
2. To educate the student on the applications of various t-tests to various problems in the field of engineering.
3. To educate the student on the application of completely randomized designs (CRD) and randomized block designs (RBD) to different realistic problems in the field of engineering.
4. To motivate the student on the applications of single and multiple regression analysis to the regression model arising in the field of engineering.

Course Outcomes:

Upon successful completion of the course, the student will be able

1. To provide principles of statistical methods and probability concepts that serves the foundations for the applications of methods in engineering.
2. To educate the student on the applications of various t-tests to various problems in the field of engineering.
3. To educate the student on the application of completely randomized designs (CRD) and randomized block designs (RBD) to different realistic problems in the field of engineering.
4. To motivate the student on the applications of single and multiple regression analysis to the regression model arising in the field of engineering.

UNIT-I

Probability Densities: Continuous Random Variables, Normal Distribution, Normal Approximation to the Binomial Distribution, Uniform Distribution, Gamma Distribution, Beta Distribution, Joint Distributions-Discrete and Continuous.The Central Limit Theorem, distributions of the sample mean and the sample variance for a normal population, Chi-Square, t and F distributions. (12)

UNIT-II

Inferences Concerning Means: Point Estimation, Interval Estimation, Tests of Hypotheses, Null and alternative hypotheses and p-value of a test. Student's t-Tests concerning mean-one sample, two sample and paired sample t-tests. (9)

UNIT-III

Analysis of Variance: Analysis of Variance (ANOVA) for comparing the means of k (>2) groups- one way and two –way ANOVA. Multiple comparison tests for post-hoc analysis- Duncan's, Tukey's and Dunnet's test and their applications. Outline of application of ANOVA for industrial experiments. (9)

UNIT-IV

Multivariate Analysis: The concept of bivariate relationship, scatter diagram, Pearson's correlation and correlation matrix. Multiple linear regression with k explanatory variables. Least Square Estimation of regression coefficients and the concept of R-square.The concept of Stepwise regression. (9)

Introduction to Design of Experiments: Factorial Design, Robust parameter design, Nested and Split plot design. (6)

TEXT BOOKS:

1. Miller & Freund's "Probability and Statistics for Engineers", Richard A. Johnson, 6th Edition, PHI.
2. Douglas C.Montgomery, George &C.Runger, 'Applied Statistics and Probability for Engineers', 6ed, ISV Paperback, 2016.

REFERENCE BOOKS:

1. R.E Walpole, R.H. Myers & S.L. Myers 'Probability & Statistics for Engineers and Scientists', 6th Edition, PHI.
2. Murray R Spiegel, John J.Schiller, R. AluSrinivasa, 'Probability Statistics',Schaum's Outline series.
3. K.V.S.Sarma,'Statistics Made Simple – Do it yourself on PC',Prentice Hall India, Second Edition, 2015.

STRENGTH OF MATERIALS - II
18ME401
III Year B. Tech. (Mech) Fourth Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. Determination of deflection of statically determinate members and statically indeterminate members
2. Understand the concept of stability and derive crippling loads for columns.
3. Evaluation of the stresses in thin and thick pressure vessels
4. Determination of the stresses in curved beams with different cross sections
5. Understand the concept of shear centre and find the position of shear centre
6. Analyze the centrifugal stresses in rotating members.

Course Outcomes:

1. To find the deflection of statically determinate and statically indeterminate beams.
2. To find the critical load for columns with axial and eccentric axial loading
3. To calculate the stresses in thin and thick cylinders and to calculate the stresses in beams of rectangular, circular and trapezoidal cross sections.
4. To calculate the position of shear centre and to determine the centrifugal stresses in rotating disc.

UNIT-I

DEFLECTIONS OF BEAMS : Introduction, Differential Equations of the Deflection Curve, Deflections by Integration of the Bending Moment Equation. Moment Area Method, Macaulay's Method. (9)

COLUMNS : Buckling and Stability, Columns with Pinned ends, Columns with other support conditions, Limitations of Euler's Formula, Rankine's Formula, Columns with eccentric Axial Loads, Secant formula. (6)

UNIT-II

STATICALLY INDETERMINATE BEAMS: Statically indeterminate Beams, Analysis by the differential equations of the Deflection curve, Moment Area Method. (8)

CONTINUOUS BEAMS: Clapeyron's theorem of three moments, Beams with constant and varying moments of inertia. (7)

UNIT-III

PRESSURE VESSELS: Thin Spherical and Cylindrical Pressure Vessels [Biaxial Stresses], Thick Cylinders: Lame's theory, Radial Deflection, Compound Cylinders. (7)

CURVED BEAMS : Stresses in Beams of small and large initial curvature, The Winkler-Bach theory, Stresses in Crane Hook and C-Clamp with Rectangular, Circular and Trapezoidal cross-sections. (8)

UNIT-IV

SHEAR CENTER: Bending Axis and Shear Center, Position of Shear Center, Shear flow, Shear Center of Channel section, Angle section, T- section and I- section. (6)

CENTRIFUGAL STRESSES: Introduction, Rotating Ring, Rotating Disc, Rotating Disc of uniform strength. (9)

TEXT BOOKS

1. Mechanics of Materials by James M Gere.
2. Strength of materials by Sadhu Singh, Khanna Publishers

REFERENCE BOOKS

1. Advanced Solid Mechanics by L.S. Srinath
2. Strength of materials by G.H. Ryder: MacMillan India Ltd. Publishers

APPLIED THERMODYNAMICS
18ME402
II Year B.Tech. (Mech) Fourth Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To acquire the knowledge about the principle and working of various components associated with a Thermal power plant.
2. To compare the Working principles of various compressors.
3. To Analyse the different Refrigeration systems and process involved in air conditioning.

Course Outcomes:

On successful completion of the course, the student will be able to,

1. Explain the Working principles of different boilers its mountings and Accessories.
2. Understand the working of various components such as Steam nozzles, Steam condensers, steam turbines.
3. Differentiate the operation of Impulse and reaction turbines.
4. Describe the operation of centrifugal pumps, centrifugal and axial compressors.
5. Explain the working of Refrigeration systems.
6. The ability to apply Psychometric process to analyze for various air conditioning systems.

UNIT-I

STEAM BOILERS: Function, classification, working of Babcock and Wilcox boiler, Cochran boiler, Mountings & Accessories. (8)
STEAM NOZZLES: Types of nozzles, Isentropic flow through nozzles, Effect of friction, Nozzle efficiency, Critical pressure ratio and maximum discharge, calculation of throat and exit areas using Mollier diagram. (7)

UNIT-II

STEAM CONDENSERS: Jet and Surface condensers, condenser vacuum and vacuum efficiency, Condenser efficiency, Thermodynamic analysis. (4)
STEAM TURBINES: Types of steam turbines, **Impulse turbines:** pressure and velocity compounding, velocity diagrams, work output, power, blade efficiency and stage efficiency.
Reaction turbines: velocity diagrams, degree of reaction, work output, power, blade efficiency and stage efficiency. Governing of turbines, Overall efficiency and reheat factor. (11)

UNIT-III

RECIPROCATING AIR COMPRESSORS: Classification, Reciprocating Air compressor with out and with clearance volume, volumetric efficiency, Multi-stage compression, Effect of inter cooling, optimum intermediate pressure in a two-stage compressor. (7)

ROTARY COMPRESSORS: Classification, working principle of Roots blower, Vane type compressor, Comparison of Reciprocating and Rotary compressors, Centrifugal compressor, Working and expression for Work done, Axial flow compressor, Degree of Reaction, Surging, Choking and Stalling. Comparison of Centrifugal and Axial compressor. (8)

UNIT-IV

REFRIGERATION: Need for Refrigeration, Definitions, Methods of refrigeration, Bell Coleman cycle, Refrigerating effect, COP, Vapor compression refrigeration system, Influence of various parameters on cycle performance, Vapor absorption refrigeration cycle (7)

PSYCHROMETRY AND AIR CONDITIONING: -Introduction, Psychrometric properties, Psychrometric chart, Psychrometric processes, Types of Air conditioning systems. (8)

TEXT BOOKS

1. Treatise on Heat Engineering-V.P.Vasandani and D.S.Kumar, Metropolitan Book co, NewDelhi.
2. Thermal Engineering ---Rajput, LaxmiPubl, New Delhi.
3. Thermal Science and Engineering- D.S.kumar, S.K.katariaPubl, New Delhi.

REFERENCE BOOKS

1. Engineering Thermodynamics----Cengel and Boles, TMH.
2. Refrigeration and Air Conditioning -- C.P. Arora, TMH.
3. Engineering Thermodynamics—Achuthan, PHI, New Delhi

MATERIALS ENGINEERING
18ME403
II Year B. Tech. (Mech) Fourth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To familiarize with the basic meaning of crystalline and non-crystalline materials with a detailed understanding of crystal imperfection of alloys and compounds and their applications in engineering fields
2. To describe phase diagrams and phase transformations in the binary alloys and the iron-iron carbide system with the basic classification of steels and cast irons.
3. To describe different heat treatment routes to modify the properties of steels and to introduce the composite materials classification and applications
4. To give an introduction to powder metallurgy and other advanced materials.

Course Outcomes:

Upon successful completion of the course, the student will be able to

1. Describe and recommend the material type required to be selected for a specific engineering application.
2. Understand and calculate the phases and their relative amounts present in a given phase diagram and determine the material behavior with respect to its constituting phases.
3. Select a suitable heat treatment or strengthening route to alter the mechanical behavior of structures made of steels.
4. Understand and compare the performance of different modern engineered materials such as composite materials, powder metallurgy components and nano materials.

UNIT-I

CRYSTALLOGRAPHY: Basic material properties, classification of materials, crystalline and non-crystalline materials, classification of crystals – Bravi's lattices – Packing factor and coordination number in cubic systems — Miller Indices crystal imperfections – crystal deformation – Slip and Twinning. (10)

CONSTITUTION OF ALLOYS: Introduction to alloys and compounds, solid solutions, Hume-Rothery principles, compounds, electron compounds (4)

UNIT-II

PHASE DIAGRAMS: Binary phase diagrams – Gibb's Phase rule – one component system, two component system, Phase transformations - isomorphous, eutectic, peritectic systems. Phase transformations in solid state: eutectoid and peritectoid systems. (6)

STEELS AND CAST IRONS: Iron–Iron carbide equilibrium diagram and phase transformations, Cast irons: classification of cast irons (4)

HEAT TREATMENT OF STEELS: Annealing, normalizing, hardening, tempering, age hardening, austempering, martempering and hardenability concept and experimental determination. (6)

UNIT-III

ISOTHERMAL TRANSFORMATINS: TTT diagrams for eutectoid, hypo and hyper eutectoid steels, martensite and bainitic transformations, surface hardening – carburizing, nitriding, cyaniding, flame hardening and induction hardening. (6)

STRENGTHENING MECHANISMS: Strain hardening, solid solution strengthening, grain refinement, dispersion strengthening. (4)

COMPOSITE MATERIALS: Properties and applications of Particulate-reinforced composites, fibre reinforced composites, Laminar composites and metal matrix composites. (6)

UNIT-IV

POWDER METALLURGY: Powder metallurgy process, preparation of powders, characteristics of metal powders, mixing, compacting, sintering, Applications of Powder Metallurgy. (8)

ADVANCED MATERIALS: Introduction to Nanomaterials, biomaterials, non-ferrous metals and their alloys: Properties and applications. Brief study of copper and aluminium alloys. (6)

TEXT BOOKS

1. Introduction to Physical Metallurgy - Sidney H. Avner, McGrawHill
2. Material Science and Metallurgy - V. Raghavan, Pearson Education / PHI.
3. Material Science and Metallurgy - R. B. Choudary -Khanna Pub.

REFERENCE BOOKS

1. Material Science and Metallurgy - V. D. Kodgire, Everest Publishers
2. Nano materials – J. Dutta& H. Hofman
3. Biomaterials: an introduction – J. Park, Springer
4. Manufacturing Engineering & Technology – Kalpak Jain &Schmid, Pearson / PHI

KINEMATICS OF MACHINES
18ME404
II Year B.Tech. (Mech) Fourth Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To understand the fundamentals of kinematics.
2. To understand the concept of machines, mechanisms and related terminologies.
3. To calculate mobility (number of degrees-of-freedom). Enumeration of rigid links and types of joints within mechanisms.
4. To make the students become familiar and understanding of the most commonly used mechanisms (4-bar, 6-bar linkages, and cams).
5. To understand the concept of synthesis and analysis of different mechanisms.
6. To understand the Principles and working of various straight line motion mechanisms
7. To analyze a mechanism for displacement, velocity and acceleration at any point in a moving link which is prerequisite for dynamics of machines.
8. To analyze Steering gear mechanisms and working of hooks joint
9. To understand the working principles in Belt and chain drives
10. To understand the theory of gears, gear trains and cams

Course Outcomes:

1. Upon Completion of the course student will be able to develop critical thinking and problem solving capacity of various mechanical engineering problems related to kinematics of machines.
2. The student should be able to employ various concepts of mechanisms like straight line motion mechanisms, Steering gear mechanisms and working principles of Gears, gear trains, Cams, Belt and Chain drives and design related problems effectively.
3. The student should be able to employ analytical, mathematical and graphical aspects of kinematics of Machines for effective design.

UNIT-I

INTRODUCTION : Mechanisms and machines, Rigid and resistant bodies, Link, Kinematic pair, Degrees of Freedom, Classifications of Kinematic pairs, kinematic-chain, Linkage, Mechanism, and structure, Classification of mechanisms, Equivalent Mechanisms, Four - Link (bar) Mechanism, Inversions of Slider - Crank Chain, Double – Slider Chain. (7)

VELOCITY ANALYSIS: Introduction, Absolute and Relative Motion, Vectors, Addition and subtraction of Vectors, Motion of a Link, Four Link Mechanism, Angular Velocity of Links, Velocity of Rubbing, Slider - Crank Mechanism, Crank and Slotted Lever Mechanism. (8)

UNIT-II

Instantaneous centre, Notation, Number of I - Centres, Kennedy's theorem, Locating I - Centres, Angular velocity by I - Centre Method. (5)

ACCELERATION ANALYSIS : Acceleration, Four-Link Mechanism, Angular acceleration of Links, Acceleration of Intermediate and offset points, slider-Crank Mechanism, Coriolis acceleration component, Crank and slotted lever Mechanism. (10)

UNIT-III

KINEMATIC SYNTHESIS: Stages of synthesis-Concepts of type, Number and dimensional synthesis - Tasks of dimensional synthesis, Concepts of function generation, Rigid body guidance and path generation, Freudenstein equation for function generation using three precision points. (7)

CAMS : Introduction, Types of cams, Types of Followers, Definitions, Graphical synthesis of cam profile.(Knife Edge, Roller and Flat faced Followers). (8)

UNIT-IV

GEARS : Introduction, Classification gear terminology, Law of Gearing, Velocity of Sliding, Forms of Teeth, Cycloidal Profile Teeth, Involute Profile Teeth, Path of contact, Arc of contact, Number of pairs of Teeth in contact, Interference in Involute Gears, Minimum number of Teeth, Interference between Rack and Pinion, Undercutting, Comparison of Cycloidal and Involute tooth forms. (8)

GEAR TRAINS: Introduction, simple Gear Train, Compound Gear Train, Reverted Gear train, Planetary or Epicyclic Gear Train, Analysis of Epicyclic Gear Train, Torques in Epicyclic Trains. Tabular and Algebraic Methods. (7)

TEXT BOOKS

1. Theory of Machines of by S.S.Rattan. TMH.
2. Theory of Mechanisms and Machines by C.S.Sharma, KamleshPurohit, PHI

REFERENCE BOOKS

1. Theory of Mechanisms and Machines by Ghosh and Mallik
2. Mechanism and Machine Theory by J.E. Shigley

TECHNICAL ENGLISH
18EL002
II Year B.Tech. (Mech) Fourth Semester

Lectures	3	Tutorial	0	Practical	0	Credits	2
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

The course aims

1. At enhancing the vocabulary competency of the students
2. To enable the students to demonstrate proficiency in the use of written English, including proper spelling, grammar, and punctuation
3. To introduce corrective measures to eliminate grammatical errors in speaking and writing
4. To enhance theoretical and conceptual understanding of the elements of grammar.
5. Understand and apply the conventions of academic writing in English
6. To enhance the learners' ability of communicating accurately and fluently

Course Outcomes:

By the end of the course the student will be able to

1. Build academic vocabulary to enrich their writing skills
2. Make use of contextual clues to infer meanings of unfamiliar words from context
3. Produce accurate grammatical sentences
4. Skim for main idea(s) & can for details
5. Distinguish main ideas from specific details
6. Identify author's purpose and tone
7. Make inferences and predictions based on comprehension of text
8. Discuss and respond to content of the text in writing
9. Produce coherent and unified paragraphs with adequate support and detail

UNIT-I

1.1 Vocabulary Development: Familiarising Idioms & Phrases
1.2 Grammar for Academic Writing: Making Requests
1.3 Language Development: Using Transition & Link words
1.4 Technical Writing: Letter Writing & Email Writing

UNIT-II

2.1 Vocabulary Development: Analogous words, Gender Sensitive language
2.2 Grammar for Academic Writing: Tenses: Simple Past /Present Perfect, The Future: Predicting & Proposing
2.3 Language Development: Cloze tests
2.4 Technical Writing: Technical Reports

UNIT-III

3.1 Vocabulary Development: Abbreviations& Acronyms
3.2 Grammar for Academic Writing: Describing(People/Things/Circumstances) : Adjectival & Adverbial groups
3.3 Language Development: Transcoding (Channel conversion from chart to text)
3.4 Technical Writing: Circular, Memos, Minutes of Meeting

UNIT-IV

4.1 Vocabulary Development: Corporate vocabulary
4.2 Grammar for Academic Writing: Inversions & Emphasis
4.3 Language Development: Reading Comprehension
4.4 Technical Writing: Resume Preparation

REFERENCE BOOKS

1. Communication Skills, Sanjay Kumar &PushpaLatha. Oxford University Press: 2011.
2. Technical Communication Principles and Practice. Oxford University Press: 2014.
3. Advanced Language Practice, Michael Vince. MacMilan Publishers: 2003.
4. Objective English(Third Edition), Edgar Thorpe &Showick. Pearson Education:2009
5. English Grammar: A University Course (Second Edition), Angela Downing & Philip Locke, Routledge Taylor & Francis Group: 2016

ESSENCE OF INDIAN TRADITIONAL KNOWLEDGE
18ME405
II Year B.Tech. (Mech) Fourth Semester

Lectures	2	Tutorial	0	Practical	0	Credits	0
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Outline:

This Course is to facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.

Course Objectives:

1. This course gives a broad range description of Indian Knowledge system and associated perspective of modern scientific world-view
2. The course aims at imparting basic principles of thought process, reasoning and inferencing as well as sustainability of Indian traditional knowledge systems connecting society and nature.
3. 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.
4. The course focuses on the study of various case studies in Indian Traditional knowledge system.

Course Outcomes:

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

1. Understand the structure of Indian knowledge and its importance

2. Compare the Indian traditional knowledge Systems with Other Global systems. .

3. Know the concept of yoga and its correlations to science.

4. Recognise various case studies related to Indian Traditional knowledge.

Course Contents:

UNIT I

Basic Structure of Indian Knowledge System (i) वेद, (ii) उपवेद (आयुर्वेद, धनुर्वेद, गन्धर्वेद, स्थापत्य आदि) (iii) वेदांग (शिक्षा, कल्प, निरुत, व्याकरण, ज्योतिष छंद), (iv) उपाइग (धर्म शास्त्र, मीमांसा, पुराण, तर्कशास्त्र)

(8)

UNIT II

Modern Science and Indian Knowledge System

Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge, The historical impact of social change on traditional knowledge systems. Indigenous Knowledge (IK), characteristics, traditional knowledge Vs indigenous knowledge, traditional knowledge Vs western knowledge. (8)

UNIT III

Yoga and Holistic Health care

Science of Yoga, Yoga as a tool for healthy Life style,8 limbs of Yoga (Yama,Niyama ,Aasana , Pranayama , Pratyahara , Dharana , Dhyana , Samadhi). (8)

UNIT IV

Case Studies

Traditional knowledge in different sectors: Traditional knowledge in Engineering and Architecture, Traditional Medicinal systems, TK in Agriculture, Traditional Harvesting methods, Traditional food and healthcare needs (8)

TEXT BOOKS:

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course material, BharatiyaVidyaBhavan, Mumbai, 5th Edition, 2014.
2. Swami Jitatmanand, Modern Physics and Vedant, BharatiyaVidyaBhavan
3. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta.
4. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, PratibhaPrakashan 2012.
5. Traditional Knowledge System in India by Amit Jha Atlantic publishers, 2002.

REFERENCE BOOKS :

1. G N Jha, (ENG. Trans.), Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, VidyanidhiPrakasam, Delhi, 2016.

2. R N Jha, Science of consciousness Psychotherapy and yoga practices, Vidyanidhiprakasham, Delhi, 2016.

PROBABILITY AND STATICSTICS LAB
18MAL01
II Year B. Tech. (Mech) Fourth Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

At the end of course students will able to

1. Use R programming to solve probability and statistics problems.
2. Use probability distributions to understand and analyse various systems.
3. Perform ANOVA calculations.
4. Perform Hypothesis Testing, Perform Regression Analysis.

Course Outcomes:

At the end of the course the student should be able to

1. Use R Programming as medium to solve Probability and Statistics Problems.
2. Solve problems pertaining to various probability distributions.
3. Perform Hypothesis Testing.
4. Calculate ANOVA for relevant problems, Perform Regression Analysis.

Syllabus

1. Introduction to R-Programming
2. Inputting data with EXCEL
3. Importing Data into R from EXCEL or other format
4. Distributions – development and Interpretation
5. Hypothesis Testing
    a. Using EXCEL
    b. Using R-programming
6. ANOVA applications – industrial experiments
7. Regression Experiments
8. Factorial Design Experiment

PNEUMATIC AND HYDRAULIC DRIVES LAB
18MEL41
II Year B. Tech. (Mech) Fourth Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. This lab provides the student with the basic knowledge concerned with the function, process, and applications of the hydraulic, pneumatic, electro pneumatic, electro hydraulics, Sensors and PLC.
2. The student should recognize the importance of hydraulic and pneumatic components and their functions.
3. The students should understand the process of generation, transmission and control of hydraulic and pneumatic drives.
4. To make students Identify, Classify, and apply the various sensors used in industry.

Course Outcomes:

Upon successful completion of this laboratory course student should be able to:

1. Identify the main components of hydraulic and pneumatic systems.
2. Understand energy conservations in hydraulic, pneumatic, electro pneumatic and electro hydraulic systems and also make the devices used in generating the hydraulic and pneumatic power and how to transmit and control energy.
3. Be able to use Sensors for various applications in industry.
4. Students will be able to describe typical components of a Programmable Logic Controller and write application programs using ladder logic.

LIST OF EXPERIMENTS

Pneumatics

1. Direct control, indirect control and speed regulation of a double acting cylinder.
2. Displacement and time dependent control of a double acting cylinder.
3. Basic circuits with AND function, OR function and electric latching.
4. Sequential control of 2 double-acting cylinders without overlapping signals.

Hydraulics

5. Pressure intensification of a single rod cylinder.
6. Flow characteristics of a single rod cylinder.
7. Characteristics of a Hydraulic motor.

Sensors & PLC

1. Behavior of inductive, capacitive and magnetic sensors, through beam, reflex photoelectric and ultrasonic sensors.
2. PLC Input – Output Wiring Methods
3. Programming the PLC Via Ladder logic

References:

1. Practice for professional's pneumatics trainee's manual-BOSCH-REXROTH.
2. Practice for professional's electro pneumatics trainee's manual-BOSCH-REXROTH.
3. Project manual on industrial hydraulics-BOSCH-REXROTH.
4. Practice for professional's Sensors and PLC trainee's manual-BOSCH-REXROTH.

MACHINE DYNAMICS
18ME501
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To equip the student with fundamental knowledge of dynamics of machines so that student can analyse and appreciate problems on dynamic force analysis, governors, gyroscopic forces & moments and balancing of rotating & reciprocating masses..
2. Develop understanding of vibrations and its significance in engineering design and analyse the same.

Course Outcomes:

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

1. Develop expressions for parameters of motion and find the dynamic forces in a slider-crank mechanism &relate the working parameters of the governors.
2. Find the gyroscopic effect on naval ships, aeroplanes and two wheelers & balance rotating and reciprocating masses.
3. Find the parameters of free vibration of undamped and damped systems with single DOF.
4. Find the parameters of forced vibration with single DOF subjected to harmonic excitation & understand the working of vibrations measuring equipment.

UNIT-I

DYNAMIC FORCE ANALYSIS:

Introduction, D'Alembert'sprinciple, Equivalent offset inertia force, Dynamic analysis of slider - crank mechanism (Using analytical method): Velocity and Acceleration of piston, Angular velocity and Angular acceleration of connecting rod, Piston effort (Effective driving force), Crank effort, Turning moment on crankshaft, Inertia of connecting rod.

GOVERNORS:

Introduction, Types of governors, Watt governor, Porter governor, Hartnell governor, Sensitiveness of a governor, Hunting, Isochronism, Stability, Controlling force.

UNIT-II

GYROSCOPES:

Angular velocity, Angular acceleration, Gyroscopic torque, Gyroscopic effect on naval ships, Stability of a two wheel vehicle.

BALANCING: Introduction, Static balancing, Dynamic balancing, Transferring of a force from one plane to another, Balancing of several rotating masses in different planes, Primary & Secondary balancing of reciprocating masses.

UNIT-III

FUNDAMENTALS OF VIBRATION:
Introduction, Definitions,Vector method of representing harmonic motions, Addition of two simple harmonic motions of the same frequency.

UNDAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:
Introduction, Derivations of differential equations, Solution of differential equation, Torsional vibrations, Equivalent stiffness of spring combinations, Energy method.

DAMPED FREE VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS: Introduction, Different types of damping, Free vibrations with viscous damping, Logarithmic Decrement, Viscous dampers.

UNIT-IV

FORCED VIBRATIONS OF SINGLE DEGREE OF FREEDOM SYSTEMS:
Introduction, Forced vibrations with constant harmonic excitation, Forced vibration with rotating and reciprocating unbalance, Forced vibrations due to excitation of the support, Critical speed of a light shaft having a single disc without damping, Critical speed of a light shaft having a single disc with damping, Vibration isolation and transmissibility, Vibration measuring instruments.

TEXT BOOKS

1. Theory of Machines by S.S. Rattan
2. Mechanical Vibrations by G.K.Groover

REFERENCE BOOKS

1. Theory of Machines by T. Bevan
2. Theory of Mechanisms and Machines by A. Ghosh and A.K. Mallik.
3. Theory of Machines and Mechanisms by JagadishLal
4. Mechanical Vibrations – W.T.Thomson
5. Mechanical Vibration – S.S.Rao

I.C.ENGINES & GAS TURBINES
18ME502
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
To make the student to perceive the knowledge of

1. To make the student to learn the working of I.C. engine and analyse the performance.
2. To make the student to know the recent developments in fuels and pursue the understanding of emission and control.
3. To make the student to learn the working of gas turbines and jet propulsion systems and analyse the performance.

Course Outcomes:
After completion of the course the student will be able to:

1. To make the student to learn the working of I.C engines and fuel supply systems.
2. To make the students to understand the combustion phenomenon and analyse the performance of IC engines.
3. To make the student to perceive the knowledge about alternative fuels and engine emissions, its control.
4. To make the student to learn the working of gas turbines and jet propulsion systems and analyze the performance.

UNIT-I
I.C.ENGINES: Introduction, Basic engine nomenclature, Review and classification of I.C. Engines, working principles of S.I. Engine (Otto Cycle) and C.I.Engine (Diesel Cycle), (both 4 stroke and 2-stroke) - valve timing and Port Timing diagrams - Differences between S.I. & C. I. and 2 stroke & 4 stroke engines (7)
FUEL SUPPLY SYSTEMS: S.I. Engines- Chemically correct air-fuel ratio, Air-fuel mixture requirements, Carburetion, Simple float type carburetor, injection system, types, electronic fuel injection system, MPFI. (4)
C. I. Engines- Air- fuel requirements, fuel supply and injection systems, Bosch fuel pump, electronic injection system, CRDI. (4)

UNIT-II
COMBUSTION PROCESSES: S.I.Engines- Normal combustion, abnormal combustion, Knock rating and Octane number. (3)
C.I. Engines- Ignition delay, combustion knock in C.I. engines, Knock rating and Cetane number. (3)
Combustion chambers for S.I and C.I engines- Turbo charging and Supercharging. (2)
TESTING OF I.C.ENGINES: Indicator diagram, evaluation of Indicated Power, Brake power, Fuel consumption, SFC, Mechanical & thermal efficiencies, mean effective pressure, air-fuel ratio, Heat balance, Engine performance curves, Variables affecting engine performance for both S.I. & C.I. Engines. (7)

UNIT-III

ALTERNATIVE FUELS: Liquid fuels **-** Alcohol, Methanol, Ethanol, Gaseous fuels – Hydrogen, Natural Gas and Liquefied Petroleum and Bio Fuels. (9)

IC ENGINES EMISSIONS AND CONTROL: Formation of CO, Unburnt hydro carbons, NO_X, Smoke and Particulate matter. Methods of controlling: Catalytic converter and particulate traps. (6)

UNIT-IV

GAS TURBINES: Closed and Open cycle gas turbines, analysis of closed cycle gas turbine, efficiencies of Compressor and turbine, cycles with intercooling, reheat and regeneration. (9)

JET & ROCKET PROPULSION: Basic principles of Jet propulsion - specific thrust, propulsive efficiency and overall thermal efficiency of a jet engine, Principles of Rocket propulsion, Types of rocket propulsion. (6)

TEXT BOOKS

1. Treatise on heat Engineering - Vasandani& Kumar-Metropolitan Book Company, New Delhi
2. Thermal Engineering- Rajput-Laxmi Pub, New Delhi
3. Internal Combustion Engines - V.Ganeshan , Tata McGraw – Hill Publishing Company Ltd.

REFERENCE BOOKS

1. Fundamentals of I.C. Engines - P.W. Gill, J.H. Smith &Ziurys- IBH & Oxford publ, Mumbai.
2. A Course in I.C. Engines - M.L. Mathur& R.P. Sharma - DhanpatRai& Sons- New Delhi.
3. Gas Turbine Theory - Cohen, Rogers and Sarvanamuttu.

DESIGN OF MACHINE ELEMENTS-I
18ME503
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. The student shall gain appreciation and understanding of the design function in mechanical engineering, the steps involved in designing and the relation of design activity with manufacturing activity
2. Selection of proper materials to different machine elements based on their physical and mechanical properties.
3. Learn and understanding of the different types of failure modes and criteria.
4. Design Procedure for the different machine elements such as fasteners, Shafts, keys, couplings etc.

Course outcomes:

Upon successful completion of this course student should be able to:

1. Apply the design procedure to engineering problems, including the consideration of technical and manufacturing constraints.
2. Select suitable materials in critical design applications.
3. Identify the loads, the machine members subjected and calculate static and dynamic stresses to ensure safe design.
4. Design various machine elements such as fasteners and shafts, keys, couplings etc.

UNIT I

BASICS: Basic procedure of machine design, requirements and design of machine elements, traditional design methods. Design synthesis, use of standards in design, preferred numbers and significance. (7)

Common engineering materials and their properties. (2)

DESIGN FOR STATIC STRENGTH: Simple Stresses, Combined stresses, Torsional and bending stresses, stress strain relation, various theories of failure, Factor of safety and its importance in design. (6)

UNIT II

DESIGN FOR FATIGUE STRENGTH: Stress concentration, stress concentration factors, reduction of stress concentration, fluctuating stresses, fatigue failure, endurance limit, low cycle and high cycle fatigue, notch sensitivity, reversed stresses, design for finite and infinite life, Soderberg and Goodman lines, , Gerber equation. (9)

THREADED JOINTS – Basic types, bolt of uniform strength, materials and manufacture, Eccentrically loaded bolted joints in shear. (6)

UNIT III

RIVETED JOINTS: Types of riveted joints, Failures of riveted joints, Eccentrically loaded riveted joints, Design of boiler joints. (9)

WELDED JOINTS: Types of welded joints, Design of butt and fillet welded joints, Eccentrically loaded welded joints. (6)

UNIT IV

SHAFTS: Design of solid and hollow shafts for strength, Rigidity – For Bending, Torsion, Combined bending and torsion and combined bending, torsion and axial loads (7)

KEYS: Introduction, Design of square and flat keys (3)

SHAFT COUPLINGS: Rigid couplings: Muff Coupling, Flange coupling, Bushed pin flexible coupling. (5)

TEXT BOOKS:

1. Bhandari, "Design of machine elements", Tata McGraw Hill book Co, Fourth edition, 2017.
2. Joseph Shigley,Charles Mischke, Richard Budynas and Keith Nisbett " Mechanical Engineering Design", Tata McGraw-Hill book Co, Tenth edition,2020.
3. Robert L.Norton "Machine Design", Pearson, Fifth edition, 2017.

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. Design data book, P.S.G. College of Technology,Coimbatore
2. Design data book, Mahadevan & Balaveera Reddy –CBS Pub

COURSE RELEVANT WEBSITE:

1. WWW.nptel.iitm.ac.in/video

METAL CUTTING AND MACHINE TOOLS
18ME504
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To describe the primary and auxiliary motions in machine tools and parameters defining them.
2. To provide fundamental knowledge regarding working principle, classification, parts, mechanisms and operations performed on various machine tools.
3. To provide basic information regarding formation of chip and its types in metal cutting.
4. To establish relation between shear angle, chip thickness ratio, stress and strain in the chip and cutting forces.
5. To provide information regarding geometry of single point cutting tool, tool materials and their application.
6. To provide information about heat generation, temperature distribution and application of cutting fluids in metal cutting.

Course Outcomes:

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

1. Describe the parts, mechanisms, selection of cutting parameters and operations that can be done on a lathe machine.
2. Describe the parts, mechanisms and operations that can be done on drilling, shaping, planing and grinding machines.
3. Explain the construction, types and operations that can be done on a milling machine. Also discuss about milling cutters and methods of indexing.
4. Discuss about tool geometry, chip formation and heat generation in metal cutting. Also calculate shear angle, stress, strain, velocities and cutting forces in metal cutting.

UNIT-I

MACHINING PROCESSES AND MACHINE TOOLS: Introduction, Primary and Auxiliary Motions in Machine Tools, Parameters defining working motions of a Machine Tool. (3)

LATHE: Constructional details, specifications, classification of lathes**.**
Lathe Mechanisms: Spindle speed Mechanisms in Belt driven and All Geared Head stock, Apron and Half-nut mechanisms. Lathe accessories – various work holding devices. Lathe operations including taper turning and thread cutting and related problems. (12)

UNIT-II

DRILLING MACHINES: Types of drilling machines and specifications, drilling operations, drilling time. (4)

SHAPING AND PLANING MACHINES: Constructional details, types of shapers and planers, specifications, Quick Return Mechanism and automatic feed mechanisms, operations done on these machines. (4)

GRINDING MACHINES: General Principles, Types of grinding machines, Wheel materials, Selection and specification of grinding wheels, Truing and Dressing of grinding wheels. (7)

UNIT-III

SURFACE FINISHING OPERATIONS: Honing and Lapping operations. (3)

MILLING MACHINES:

Working Principle, Size and Specification, Types of milling machines, Description and working of Universal Milling machine, Up and Down Milling, Milling operations, Milling cutters, Indexing methods and Indexing Head, related problems. (12)

UNIT-IV

THEORY OF METAL CUTTING:

Introduction, Basic elements of machining, Nomenclature of single point cutting tool, Tool Geometry, Mechanics of chip formation, Types of chips. Determination of shear angle and chip thickness ratio, stress and strain in the chip, velocity relations, Merchant's theory of orthogonal cutting forces, related simple problems. (7)

Tool wear, Tool life and Tool life criteria (3)

Heat Generation and temperature distribution in metal cutting , cutting fluids- types and required characteristics. (3)

CUTTING TOOL MATERIALS: Requirements of Tool materials and types. (2)

TEXT BOOKS

1. Workshop Technology Vol. II:Machine Tools by S.K. Hajra Choudhury, MPP Pvt.Ltd.
2. Production Engineering by P.C. Sharma, S.Chand& Co.

REFERENCE BOOKS

1. Materials and Processes in Manufacturing by E.Paul De Garmo, J.T.Black and Ronald A.Kohser.
2. Machining and machining process by PN.Rao, TMH.
3. Manufacturing Science by Ghosh&Mallick
4. Manufacturing Engineering and Technology by Kalpakjian.

INDUSTRIAL ENGINEERING & MANAGEMENT
18ME505
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To develop the skills of the student in industrial management such as productivity, Business process reengineering
2. To Provide the working knowledge of work Study, Method study, work measurement, time study and micro motion study
3. To imbibe the knowledge of forms of business organisation and the process of their formation and facility design
4. To make the student perceive evolution, principles and functions of management, Organization and human resource management. Also the concepts of basic understanding of marketing management and digital marketing

Course Outcomes:
After completion of the course the student must be able to

1. Understand concepts of industrial management such as productivity, Business process reengineering
2. Analyse work Study, Method study, work measurement, time study and micro motion study
3. Distinguish various forms of business organisations and the process of their formation and facility design
4. Evaluate the principles and functions of management. Also apply the principles of Human resource management and marketing management in their career.

UNIT-I

Industrial Engineering: Meaning, Definition, Objective, Need, Scope, Evolution and developments. (2)
Productivity: Introduction, methods to measure productivity, measures to improve productivity, Productivity of personnel, materials, Total productivity, factors affecting the productivity. (4)
Business Process Reengineering: Introduction and History of BPR, Definition and Benefits of BPR, BPR Model, BPR Methodology Selection Guidelines, Steps to implement BPR. (4)

UNIT-II
Method Study: Definition, objective and scope of method study, activity recording and examining aids. Charts to record moments in shop operation – process charts, flow process charts, and multiple activity charts. Development, definition and installation of the improved method, (6)
Micro Motion Study: Principles of motion economy, classification of moments SIMO chart. (4)

Work Measurement: Definition, objective and benefit of work measurement. Work measurement techniques. **Work sampling**: need, confidence levels, sample size determinations, random observation, conducting study with the simple problems. (4)

Time Study: Time Study, Definition, time study equipment, selection of job, steps in time study. Breaking jobs into elements, recording information. Rating & standard Rating, Introduction to Method time measurement (MTM) (6)

UNIT-III

Facilities design:

Plant Location: Factors affecting the plant location, comparison of rural and urban sites (2)

Plant Layout: Introduction, principles of plant layout, types of plant layouts, Problems (6)

Forms of Business Organization: Single owner, partnership, Private and Public limited companies. Formation procedures (6)

UNIT-IV

Management: Introduction, Levels of management, Evolution of management thought: Taylor's Scientific Management, Functions of management (4)

Human Resource Management: Functions of HR management, human resource planning, Introduction to organization, principles and types of organization structures, leadership styles and performance appraisal. Motivation Theories (8)

Marketing Management: Introduction, marketing mix, distribution channels, and product life cycle. Concepts of digital Marketing (4)

TEXT BOOKS

1. Management: A Global & Entrepreneurial Perspective, Heinz Weihrich, Mark Cannice, and Harold Koontz, McGraw hill Education, 2010.
2. R. Radhakrishnan, S. Balasubramanian. (2010). Business Process Reengineering, Text and Cases. Prentice Hall of India, New Delhi.
3. Principles of Motion and Time Study / Ralph Barnes, John Wiley, 8th Edition, 1985.
4. Industrial Engineering and Management by A Ravi Shankar, second edition, Galgotia publications,2001
5. Handbook of industrial Engineering: Technology and Operations Management, Gayriel Salvendy, 3rd Edition, wiley publication,2007
6. Industrial Engineering and Production Management by Martand T Telsang, S Chand publication, 2018
7. Industrial Engineering and production Management by M Mahajan Dhanpat Rai and Co. Publishers, 2014

REFERENCE BOOKS

1. Maynard's Industrial Engineering Handbook, Kjell B. Zandin, Fifth Edition, 2001, The McGraw-Hill Companies, Inc.
2. Human Factors in Engineering Design/S Sanders and E J McCormick, 6th Edition, McGraw Hill.
3. Work study / ILO, III Revised Edition, 1981
4. Principles of Marketing - Basic concepts of Marketing Philip T. Kotler, Gary Armstrong, et al., Pearson, 2018.

ELECTIVE- I
OPERATIONS RESEARCH
18MED11
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To provide an in-depth coverage and applications of Operations Research (O.R) to real-world systems.
2. To understand the concepts of formulation of linear programming problem and its solution.
3. Expose to different O.R models such as Transportation Problems, Assignment Problems, Queuing problems, and Game theory.
4. To enable the students apply dynamic programming and simulation

Course Outcomes:

At the end of the semester, Students will be able to

1. Realize the importance of operations research & acquire skills to develop linear programming mathematical models and its solution.
2. Analyze and solve typical problems in transportation and Assignment models.
3. be Proficient with Queuing Theory and game theoretic models
4. Explain Dynamic programming and deterministic and probabilistic models. Also, identify the utility of simulation in engineering applications and solve simple problems in simulation.

UNIT-I

LINEAR PROGRAMMING: Definition, Scope of Operations Research, Mathematical formulation of the problem, Graphical method, Simplex method, Artificial variables techniques: Big-M method, Duality Principle. (14)

UNIT-II

TRANSPORTATION PROBLEM: Introduction, Formulation, Optimal solution, Un balanced transportation problem, Degeneracy. (8)

ASSIGNMENT PROBLEM: Formulation, Hungarian method, Optimal solution, Assignment Problems. (6)

UNIT-III

QUEUING THEORY: Introduction, Characteristics of Queuing models, Single Channel Queuing Theory models with Poisson arrivals and exponential service times with infinite population. (8)

Game Theory: Introduction, 2 person zero sum games, games with saddle point (pure strategy), games without saddle points (mixed strategy), (6)

UNIT-IV

DYNAMIC PROGRAMMING: Introduction toDynamic Programming, Characteristics of Dynamic Programming Problems, Deterministic Dynamic Programming, (8)

SIMULATION: Introduction. Discrete and continuous Simulation, Random number generation, applications. (6)

TEXT BOOKS

1. Ravindran, A., Philips, D.T., and Solberg, J.J., Operations research, John Wiley and Sons.
2. Operations Research / H.A. Taha, Pearson

REFERENCE BOOKS

1. Pemkumar Gupta & D.S.Hira, Operations Research", S.Chand & Company Ltd
2. Wagner, "Operations Research", PHI Publications.
3. J K Sharma, "Operations Research" MacMilan publishers.
4. Hiller & Libermann, "Introduction to operations Research",TMH.

ELECTIVE- II
FINITE ELEMENT ANALYSIS
18MED12
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To provide the basics of 3D stress analysis and functional derivation for various types of problems
2. To provide the students, analysis of 1D problems and truss problems using finite element method
3. To provide the students 2dimensional problems using triangular elements, general method to derive the element stress and load vectors using potential energy method
4. To provide the students about axi- symmetric problems using triangular elements

Course Outcomes:

1. Students will demonstrate an ability to derive element matrix equation by different methods by applying basic laws in mechanics and integration by parts
2. Students will demonstrate an ability to apply the steps required for FEM solution to variety of physical systems and obtain engineering design quantities. Analysis of trusses
3. Students will demonstrate an ability to determine the deformations, stress and stains in 2D plates using triangular elements
4. Students will demonstrate an ability to determine the deformation, stresses and strains in axi-symmetric problems using triangular elements

UNIT-I
FUNDAMENTAL CONCEPTS: Introduction, historical background, Analysis of 3-D stresses & strains, stress-strain relations, stress cubic, principal stress calculations, temperature effects, potential energy and equilibrium, the Rayleigh-Ritz method, Galerkine's method, saint venant's principle, Von Mises stress. (15)

UNIT-II

BASIC CONCEPTS OF F.E.M. AND ONE DIMENSIONAL PROBLEMS : Fundamental concepts, Finite Element Modelling, Coordinates and Shape functions, The Potential Energy Approach, The Galerkin Approach, Assembly of the Global Stiffness Matrix and Load Vector, Properties of Global Stiffness Matrix, The Finite Element equations; Treatment of boundary conditions, Examples of Axially Loaded Members. (8)

ANALYSIS OF PLANE TRUSSES : Introduction, ***Plane Trusses:*** Local and Global Coordinate systems, Element Stiffness Matrix, Stress Calculations, Example of plane Truss with three members. (7)

UNIT-III

TWO DIMENSIONAL PROBLEMS : Introduction, Plane Stress and Plane Strain, Finite Element Modelling, Constant Strain Triangle (CST); Iso-parametric representation, Potential Energy Approach, Element Stiffness, Force terms, Galerkin Approach, Stress calculation, Problem modelling and boundary conditions, Examples of plane Stress and plane Strain problems with three degrees of freedom using CST Element. (10)

UNIT-IV

Axi-Symmetric solids subjected to Axi-Symmetric loading : Introduction, Axi-Symmetric formulation, FEM using triangular element, problem modelling and boundary conditions. (5)

Scalar Field Problems : Introduction, study-state heat transfer, one-dimensional heat conduction, governing equation, boundary conditions, the one dimensional element, functional approach for heat conduction. (10)

TEXT BOOKS

1. Introduction to Finite Elements in Engineering by Chandrupatla& Belegundu, PHI.
2. Experimental Stress analysis by P. Seshu, PHI.

REFERENCE BOOKS

1. Finite Element Analysis by C.S.KrishnaMoorthy.
2. Finite Element Analysis by L.J.Segerlind.
3. Cook, Robert Davis et al, "Concepts and Applications of Finite Element Analysis" , Wiley, John & Sons,1999
4. George R Buchanan, "Schaum's Outline of Finite Element Analysis", McGraw Hill Company, 1994.

ELECTIVE- I
COMPOSITE MATERIALS
18MED13
III Year B.Tech. (Mech) Fifth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To familiarize with the basic meaning of composite materials and their properties with potential industrial applications.
2. To formulate and analyze problems related to the mechanical behavior of the composites subjected to different external influencing factors.
3. To familiarize the expressions and methods in evaluating the mechanical performance of composite laminates.
4. To acquire sound knowledge on different manufacturing processes of composites.

Course Outcomes:

Upon successful completion of the course, the student will be able to

1. Understand and differentiate the mechanical behavior of laminated composites compared with isotropic materials.
2. Apply the basic equations to analyze the mechanics of the composites at micro and macro level.
3. Determine stresses and strains developed in composites materials
4. Adopt and develop appropriate manufacturing processes to produce composite materials.

UNIT-I

INTRODUCTION: Classification and characteristics of composite materials – polymer matrix composites, ceramic matrix composites, metal matrix composites, carbon—carbon composites, fiber-reinforced composites and nature-made composites. Applications of composites (7)

MECHANICAL BEHAVIOR OF ISOTROPIC AND ORTHOTROPIC MATERIALS: terminology of laminated fibre reinforced composite materials – Engineering constants for orthotropic materials – stress, strains, relation for plane stress in an orthotropic material (8)

UNIT-II

MECHANICAL BEHAVIOUR OF A LAMINA: Stress strain relations in a lamina of arbitrary orientation – strength of an orthotropic laminates – Basic strength theories – Determination of engineering constants – mechanics of materials approach. (15)

UNIT-III

MACHANICAL BEHAVIOUR OF A LAMINATE: Classical lamination theory – lamina stress - strain behavior – Resultant forces and moment in a laminate – Types of laminates – Strength and Stiffness of laminates - Inter laminar stress in laminates. (15)

UNIT-IV

PRODUCTION OF COMPOSITE MATERIALS & PRODUCTS: Matrix and their role – Principal types of fibre and matrix materials - Basic principle of production of composite materials & products - Advantages and Limitations of different processes. (7)

MOULDING AND FORMING OF COMPOSITES: Layup and curing – open and closed mould process hand layup techniques – filament winding – Pultrusion – Pulforming – Thermoforming – Injection moulding - blow moulding. (8)

TEXT BOOKS

1. Robert M.Jones.'Mechanics of composite Materials" McGraw Hill book co.1970.
2. Meier schwartyx "Composites materials Hand book" .McGraw Hill Book co.1984.

REFERENCE BOOKS

1. Agarwal B.D. &Brout man LJ."Analysists and performance of Fibre composites, Johnwileay& sons.
2. Tery Richardson, "Composite – A design guide "Industrial press inc, NY,1987.

CAE LAB
18MEL51
III Year B. Tech. (Mech) Fifth Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To impart the fundamental knowledge on using various CAE software packages like ANSYS, CFD, etc., for Engineering Simulation
2. To develop the student's skills in proper modelling, meshing, and setting up material properties, loads, and constraints for computer simulation and analysis (e.g. structural, thermal and computational fluid dynamics) and then solve the problem using CAE software packages.

Course outcomes:
Upon successful completion of this course student should be able to:

1. Use of Engineering tools for any engineering and real time applications
2. Acquire knowledge on utilizing these tools for a better project in their curriculum as well as they will be prepared to handle industry problems with confidence when it matters to use these tools in their employment.

Course content:

Analysis of Mechanical Components – Use of FEA Packages like ANSYS/ NASTRAN etc.,

FEA introduction
CAD Import
Types of elements
Meshing – 2D, 3D Meshing
Convergence of mesh size
Defining mesh Joints
Application of Loads and boundary conditions
Solver – Types of analysis
Machine elements under Static loads
Thermal Analysis of mechanical systems
Modal Analysis Machine elements under Dynamic loads
Non-linear systems
Post processing – a. Viewing FEA results – Stress, deflection, Mode shapes etc.
Interpretation of FEA Results for design validation.
Machine elements under Static loads
Thermal Analysis of mechanical systems
Modal Analysis
Machine elements under Dynamic loads Non-linear systems

FUELS & IC ENGINES LAB
18MEL52
III Year B. Tech. (Mech) Fifth Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To familiarize with the flash point and fire point of fuels.
2. To determine the variations in viscosity with temperature of lubricating oils and other liquid fuels.
3. To understand calorific value of fuels and determine the calorific value of fuels of different forms.
4. To measure the consistency of lubricating greases by the penetrometer.
5. To study the carbon deposit in given sample of lubricating oil and fuel.
6. To provide practical approach of assessing the performance of IC engines and compressors

Course outcomes:

After completion of this course, students will be able to:

1. Predict flash point, fire point and viscosity of given lubricating oils & fuels and to predict the suitable operating temperature.
2. Estimate the calorific value of given fuel and compare the different fuels based on their calorific value.
3. Predict an approximate indication of the combustibility and deposit forming tendencies of the fuel.
4. Evaluate the consistency of lubricating greases by the penetration of a cone of specified dimensions, mass, and finish.
5. Interpret the working of four stroke engine and two stroke engines with the help of draw the VTD and PTD.
6. Conduct performance tests on both petrol and diesel engines.
7. Conduct performance test on Reciprocating compressor and Blower test rig.

CYCLE-I

1. Viscosity measurement using Saybolt viscometer.
2. Viscosity measurement using Engler's viscometer.
3. Carbon residue test using Conradson's carbon residue apparatus
4. Calorific value of LPG using Junker's Gas Calorimeter
5. Measurement of flash point using Abel's / Pensky-Martin's apparatus
6. Measurement of flash and fire points using Cleveland's open cup apparatus
7. Grease penetration test using Penetrometer apparatus

CYCLE-II

1. Valve timing diagrams on 4-stroke single cylinder petrol and diesel engine models.
2. Port Timing diagram on 2 stroke single cylinder petrol engine model.
3. Air compressor- to determine volumetric and isothermal efficiencies
4. Blower test rig- to determine overall efficiency
5. Two stroke single cylinder petrol engine – load test
6. Four stroke single cylinder petrol engine - load test & motoring test
7. Four stroke four cylinder petrol engine – load test
8. Four stroke four cylinder petrol engine – heat balance test
9. Four stroke four cylinder petrol engine – Morse test
10. Four stroke four cylinder diesel engine – load test
11. Four stroke four cylinder diesel engine – heat balance test
12. Four stroke single cylinder petrol engine – variable compression ratio test
13. Computer interfaced single cylinder Four stroke petrol engine – load test
14. Computer interfaced single cylinder Four stroke diesel engine – load test

Any 5 Experiments from each cycle.

ENGINEERING ECONOMICS AND FINANCIAL ANALYSIS
18ME601
III Year B.Tech. (Mech) Sixth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To provide the concepts of economics and evaluation of alternatives.
2. To calculate the depreciation, to acquire skills of costing methods and carry out break-even analysis
3. To understand financial statements and analyze them
4. To provide the basics of project management

Course Outcomes:

Upon successful completion of this course, students will acquire the skills to apply the basics of economics and cost analysis to engineering and take economically sound decisions and be able to

1. Discuss the basics of economics and evaluate the alternatives based on economical aspect.
2. Apply the concept of depreciation, costing and breakeven analysis by calculation.
3. Analyze financial statements and concepts of working capital management, and capital budgeting.
4. Determine the critical path and the estimated time of completion for a given project work.

UNIT-I

Economics: Relation between Science, Engineering, Technology and Economic Development, Factors of Production, Price determination theories (4)

Evaluation of Alternatives: Time Value of Money, Cash Flow Analysis, Equivalence Calculations under inflation, Present worth analysis, Annual Equivalence Analysis, Rare of Return Analysis, (10)

UNIT-II

Depreciation: Definition, causes of depreciation, Methods of Depreciation: Straight line method, Declining balance method, Sum of the years digits method. (4)

Costing: Cost Concepts, Elements of Cost, Methods of distribution of Overhead Costs. Unit Costing, Job Costing and Process Costing (6)

Break-Even Analysis: Assumptions, Break–Even Charts, Simple problems. (4)

UNIT-III

Financial Management: Scope, Objectives and functions of Financial Management**;** Reading Profit & Loss account and Balance sheet. Ratio Analysis and Trend analysis, Problems. (10)

Working Capital Management*:* Concepts and Objective. Need for Working Capital, Estimation of Working Capital (4)

Capital Budgeting: Definition, Objectives and Process. (2)

UNIT-IV

Project Management: Introduction, Project Life Cycle, Project Schedule Planning, Work Breakdown Structure, CPM and PERT – Problems (12)

TEXT BOOKS

1. Theusen and Theusen: Engineering Economy, PHI
2. Engineering Economics by R Panneerselvam, PHI Learning.
3. Financial Management by Prasanna Chandra, McGraw Hill India.
4. Principles of Financial Engineering (Academic Press Advanced Finance) 3rd Edition by Robert Kosowski , Salih N. Neftci,
5. Project Management: The Managerial Process by Erik Larson and Clifford Gray, McGraw Hill Education

REFERENCE BOOKS

1. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2011.
2. Zahid A khan: Engineering Economy, Dorling Kindersley, 2012
3. CPM and PERT by Wesley, PHI.

HEAT TRANSFER
18ME602
III Year B.Tech. (Mech) Sixth Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course objectives

1. To study one dimensional heat conduction.
2. To study fundamentals of forced convection heat transfer along with boundary layer theory.
3. To study fundamentals of free convection, heat exchangers, LMTD and NTU methods of heat exchanger analysis.
4. To study fundamentals of radiation heat transfer. To evaluate shape factors and to evaluate radiation heat exchange between two bodies either black or grey.

Course outcomes

Student should be able to

1. Understand the basic concepts of conduction, convection and radiation heat transfer. Understand how to formulate and be able to solve one dimensional conduction heat transfer.
2. Understand the fundamentals of the relationship between fluid flows and convection heat transfer. Apply empirical correlations for force convection to determine values for the convection heat transfer coefficient
3. Understand empirical correlations for free convection to determine values for the convection heat transfer coefficient. Design a heat exchanger using either LMTD method or NTU method
4. Understand the basic concepts of radiation heat transfer which include both black body and grey body radiation. Able to evaluate radiation shape factors using tables and shape factor algebra

UNIT-I

INTRODUCTION: Basic Modes and Laws of Heat transfer, thermal conductivity, Steady state Heat Conduction, General conduction equation in Cartesian and Cylindrical coordinates, initial and boundary conditions. (4)

ONE- DIMENSIONAL STEADY STATE HEAT CONDUCTION: Heat flow through plane wall and cylinder with constant thermal conductivity, Heat flow through composite slab and Cylinders, Thermal resistance, Electrical analogy, Thermal contact resistance, problems on variable thermal conductivity, critical insulation thickness, uniform heat generation in slabs. (7)

EXTENDED SURFACES: Types, Applications, Fin materials, Heat transfer from fins with uniform cross section, Fin efficiency and Effectiveness. (4)

UNIT-II

TRANSIENT HEAT CONDUCTION (One dimensional only) - Lumped heat capacity systems. (3)

FORCED CONVECTION: Introduction, Dimensional analysis for natural and forced convection, Hydrodynamic and thermal boundary layers and their thicknesses, Correlations for heat transfer in Laminar and Turbulent flows over a flat plate, and in pipes, Reynolds-Colburn Analogy. (12)

UNIT-III

NATURAL CONVECTION: Correlations for vertical and horizontal plates, vertical and horizontal cylinders. (4)

BOILING AND CONDENSATION: Boiling, Pool boiling regimes, Condensation, Laminar film wise condensation, condensation on vertical plate, horizontal tubes, Dropwise condensation. (4)

HEAT EXCHANGERS: Types of heat exchangers, Fouling, LMTD and NTU methods of Heat exchanger. Analysis for double pipe heat exchanger. (7)

UNIT-IV

RADIATION: Fundamentals of Radiation: Basic Concepts and definitions, Absorptivity, Reflectivity, Transmissivity, concept of Black body, Laws of Radiation, Kirchhoff's law, Planck's law, Wein's law, Stefan Boltzman's law. (7)

RADIANT HEAT TRANSFER: Heat Exchange by radiation between two finite parallel surfaces, Electrical analogy, radiant heat transfer between two finite black and gray surfaces, shape factor, Radiation shields. (8)

TEXT BOOKS

1. Heat and Mass Transfer – Sachdeva, New Age India, New Delhi
2. Heat Transfer—Rajput, Laxmipubl, New Delhi.

REFERENCE BOOKS

1. Heat transfer - J.P.Holman, MGH, New York.
2. Heat transfer - S.P.Sukhatme, TMH.
3. Heat Transfer – Cengel and Boles, TMH, New Delhi

NOTE: Heat and Mass Transfer Data Book by Kothandaraman and Subramanian to be allowed in University Examination.

DESIGN OF MACHINE ELEMENTS-II
18ME603
III Year B.Tech. (Mech) Sixth Semester

Lectures	4	Tutorial	1	Practical	0	Credits	4
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. Selection of proper materials to different machine elements based on their physical and mechanical properties.
2. To understand the principles involved in evaluating the shape and dimensions of a component to satisfy functional and strength requirements.
3. This course gives the insight of slider and roller bearings and the life prediction.
4. Design the power transmission elements such as springs, belts, Flywheel, gears, brakes and clutches.

Course outcomes:

Upon successful completion of this course student should be able to:

1. Utilize design data hand book and design the elements for strength, stiffness and fatigue.
2. Identify the loads, the machine members subjected and calculate static and dynamic stresses to ensure safe design.
3. The student will able to select the suitable bearing based on the application of the loads and predict the life of the bearing.
4. Design power transmission elements such as Springs, belts, brakes, clutches, flywheels and gears.

UNIT I

POWER SCREWS: Types - Mechanics of power screws, self-locking of screw and stresses in screw, efficiency. (5)

SPRINGS: Introduction, Materials, Types of springs, Helical springs under axial load, Fatigue loading, leaf springs. (10)

UNIT II

BALL AND ROLLER BEARINGS: Static load, Dynamic load, Equivalent radial load, selection of ball and roller bearings. (7)

BEARINGS AND LUBRICATION: Lubrication, Types of lubrications, types of lubricants, properties of lubricants, types of Bearings, Bearing materials, Journal bearing design (using
Mckee's equation and Raymond and Boyd charts & tables) (8)

UNIT III

BELT DRIVES: Flat and V-belts, Belt constructions, Geometrical relationships, Analysis of belt tensions, condition for maximum power, Selection of Flat-belts, Selection of V-belts (6)

BRAKES AND CLUTCHES:- Introduction to Brakes, Types, Analysis and design of block brakes, band brakes, Internal shoe brakes, external shoe brakes, pivoted shoe brakes, Temperature rise, Friction materials, Clutches, Analysis and design of simple and multiple disc clutches, friction materials, comparison of brakes and clutches. (9)

UNIT IV

FLYWHEEL: Introduction, construction, Torque analysis, solid flywheel, Rimmed flywheel, stresses in rimmed flywheel, Design of flywheel. (5)

SPUR GEARS : Classification of gears, Terminology of spur gear, standard systems of Gear Tooth, Force analysis, Gear tooth failures, Selection of material, Beam Strength of gear teeth, lubrication, Lewis Equation. (5)

HELICAL GEARS: Terminology of helical gears, virtual number of teeth, Tooth proportions, force analysis, Beam Strength of helical gears, effective load on gear tooth, wear strength of helical gears. Lewis Equation. (5)

TEXT BOOKS:

1. Bhandari, "Design of machine elements", Tata McGraw Hill book Co, Fourth edition, 2017.
2. Joseph Shigley,Charles Mischke, Richard Budynas and Keith Nisbett " Mechanical Engineering Design", Tata McGraw-Hill book Co, Tenth edition,2020.
3. Robert L.Norton "Machine Design", Pearson, Fifth edition, 2017.

HAND BOOKS TO BE ALLOWED IN SEMESTER EXAMINATION:

1. Design data book, P.S.G. College of Tech, Coimbatore
2. Design data book, Mahadevan & Balaveera Reddy – CBSPub.

COURSE RELEVANT WEBSITE:

1. WWW.nptel.iitm.ac.in/video

MANUFACTURING TECHONOLOGY
18ME604
III Year B.Tech. (Mech) Sixth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To provide fundamental knowledge about measurement, standards, theory of limits and fits.
2. To describe the application of limit gauges, design of plug and ring gauges, use of sine bar,slip gauges.
3. To provide information about various comparators, projector and tool makers microscope.
4. To describe the importance of surface finish and its measurement, machine tool alignment tests.
5. To describe about the design principles and study of different types of jigs and fixtures.
6. To provide information about gear hobbing, gear shaping and gear finishing methods.
7. To describe about various sheet metal working operations like punching, blanking, drawing and bending operations.

Course Outcomes:

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

1. Describe the need for measurement, IS system of limits and fits, types of fits, interchangeability and design plain plug and ring gauges.
2. Discuss about various comparators, projector and tool makers microscope, describe the terms associated with surface finish and its measurement using Talysurf and measure the effective diameter of screw thread by 3-wire method and conduct alignment tests on lathe and milling machines.
3. Discuss about design principles of jigs and fixtures, gear hobbing and gear shaping and gear finishing operations.
4. Describe the sheet metal working operations like punching, blanking, drawing and bending
   and also design tooling for above operations and calculate the forces required.

UNIT-I

INTRODUCTION: Elements of engineering measurements, Standards of length, end and line standards. Theory of limits, Fits, Tolerances and their selection, Hole Basis and Shaft basis system, IS system of limits & fits, simple problems. Interchangeability, Selective Assembly. (8)

GAUGES: Limit gauges, Taylor's Principle of limit gauging, Plug gauges, Ring gauges and Design of plain cylindrical plug and ring gauges. Slip gauges, Angle gauges, Sine bar. (7)

UNIT-II

COMPARATORS:

Sigma comparator, Solex pneumatic gauge, projectors, Tool Maker's Microscope, Auto collimator, Bore gauge. (6)

MEASUREMENT OF SURFACE FINISH: Surface texture, roughness, waviness, Indian standard terminology, various methods of measuring surface finish, Tomlinson surface meter and Taylor Hobson Talysurf. (4)

MEASUREMENT OF SCREW THREADS: Introduction-Types of threads-Measurement of outside diameter, root diameter, effective diameter using 3 wire method. (2)

MACHINE TOOL PERFORMANCE TESTS: Static and Dynamic alignment tests-Alignment tests on Lathe, Universal Milling Machine. (3)

UNIT-III

JIGS &FIXTURES : Introduction, design considerations for jigs & fixtures. The principle of six point location, locating pins. Clamping and clamping devices. A few examples of drilling jigs like box type, template jig, inverted jig, indexing jig. Fixtures – Lathe and milling. (8)

GEAR MANFUACTURING : Introduction to various gear manufacturing methods, gear shaping, gear hobbing - principles and methods, gear finishing methods. (5)

THREAD MANUFACTURING PROCESSES: Thread rolling, thread milling, thread grinding. (2)

UNIT-IV

PRESS WORKING TOOLS : Major components of a press, shear action in die cutting operation, centre of pressure and its calculation, scrap strip layout for blanking. (6)

Types of dies – compound die, combination die and progressive die. (3)

Drawing die – Calculation of blank size, number of draws, percentage reduction, radius on punch and die, drawing force. (3)

Bending die – Bending methods, spring back, bending allowance, bending force. (3)

TEXT BOOKS

1. Engineering Metrology - R.K.Jain , Khanna publishers
2. A Text book of Production Engineering by P.C.Sharma, S.Chand& Co.

REFERENCE BOOKS

1. A text book of Engg.Metrology – I.C.Gupta
2. Manufacturing engineering & technology by Kalpakjian, Pearson Education / PHI
3. Manufacturing Science by Ghosh&Mallik,

ELECTIVE - II
COMPUTATIONAL FLUID DYNAMICS
18MED21
III Year B.Tech. (Mech) Sixth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
To make the learners to

1. Understand the scope, principles, norms, accountabilities and bounds of contemporary engineering practice in the fluid flow.
2. Describe the finite difference method and the finite element method with emphasis on fluid dynamics on various computational problems in fluid dynamics such as boundary conditions and meshing.
3. Provide the essential numerical background for solving the partial differential equations governing the fluid flow.
4. Develop student's skills by using a commercial software package.

Course Outcomes:
After successful completion of this course, student will be able to:

1. Familiar with the differential equations for flow phenomena and numerical methods for their solution.
2. Use and develop flow simulation software for the most important classes of flows in engineering and science.
3. Analyze the different mathematical models and computational methods for flow simulations.
4. Define the relevant engineering flow problems and analyzes the CFD results by CFD software. Compare with available data, and discuss the findings.

UNIT-I
INTRODUCTION: Historical Background of CFD, Applications, Boundary conditions and steps in CFD. (5)
GOVERNING EQUATIONS: Continuity, Momentum and Energy equations in 3 Dimensions, Navier-Stokes equations, Single Generic Integral form equations for Continuity, Momentum and Energy. (10)

UNIT-II
DISCRETIZATION: Basic aspects of discretization, Techniques used--Finite Difference, Finite Volume and Finite Element, comparison of methods, difference equations, Explicit and Implicit approaches. (15)

UNIT-III

GRID GENERATION AND TRANSFORMATION: Generation of grid, Transformation of non- uniform grids, General transformation of equations, form of governing equations suitable for CFD, Compressed grids, Boundary filled coordinate systems—Elliptic grid generation, Adaptive grids, Modern developments in grid generation. (15)

UNIT-IV

CFD TECHNIQUES: Introduction, CRANK-NICHOLSON technique, Relaxation technique, ADI technique, suitability for different conditions. Errors due to approximation and their analysis-Consistency, Convergence, Stability Analysis. (15)

TEXT BOOKS

1. Computational Fluid Mechanics - Anderson, D.C., J.C, Tannehil, and R.H. Fletcher, Hemisphere Publishing Corporation, New York.
2. Computational Fluid Dynamics – T.J.Chung, Cambridge University Press 2002

REFERENCE BOOKS

1. Computational Methods for Fluid Dynamics – Ferziger, J.H. and M.Peric, Springer, 3rd Edition, 2002.
2. An Introduction to Computational Fluid Dynamics – The Finite Volume Method – Versteeg, H.K. and W.Malalasekera, Second Edition, 2007.

ELECTIVE- II
POWER PLANT ENGINEERING
18MED22
III Year B.Tech. (Mech) Sixth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
To make the students

1. To get the knowledge about different types of power plants and its working procedure with the complete plant layout.
2. To identify & apply fundamentals to solve problems like performance of internal combustion engine plant and gas turbine power plant.
3. To design the components of steam power plant, gas turbine power plant, I.C plant, nuclear power plant and hydroelectric power plant.
4. To design a system, component or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, and safety manufacturability and sustainability related to different types of power plants.

Course Outcomes:
After successful completion of this course, the student will be able to:

1. Understand the working principles of diesel power plant and hydro electric power plant.
2. Understand the various systems in thermal power plant.
3. Evaluate the power plant economics and environmental consideration and creating awareness on nuclear power plants.
4. Identify and create knowledge on various renewable energy sources.

UNIT-I
INTRODUCTION: Various Energy sources, types of power plants. (1)
HYDRO ELECTRIC POWER PLANT: Hydrology, Rainfall, Run off and their measurement, hydrograph, Flow duration curve, Mass curve and calculation of storage capacity, site selection of hydro plant, different types of hydro plants. (9)
DIESEL POWER PLANTS: Classification, main components of plant, plant layout, application. Introduction to combined cycle power plants. Comparison of Diesel Power plants with other power plants. (5)

UNIT-II

THERMAL POWER PLANT: General layout, Fuels, Coal analysis, Coal handling, burning of coal - stoker and pulverized systems, Ash handling systems, ESP, Need for Draught, High pressure boilers, Condensers, cooling ponds and towers (wet and dry types), Deaeration. (15)

UNIT-III

NUCLEAR POWER PLANTS: Nuclear Fission, Nuclear Fuels, Components of Reactor, types of Nuclear Reactors, Breeding, Fast Breeder Reactor, Radiation shields, nuclear waste disposal. (7)

FLUCTUATING LOADS ON POWER PLANTS: Various performance Factors (load factor, diversity factor, use factor etc.). (3)

POWER PLANT ECONOMICS: Fixed costs, operating costs, cost per kWh, comparison of fixed and operating costs of hydro, thermal, nuclear plants, power tariffs. (3)

POLLUTION AND CONTROL: Introduction, particulate and gaseous pollutants, thermal pollution and solid waste pollution, methods to control pollution - brief description. (2)

UNIT-IV

SOLAR ENERGY: Solar collectors, solar energy storage, solar ponds, solar energy utilization and applications. (4)

WIND POWER: Basic principle, different types of wind mills, wind energy conversion systems, other applications. (3)

GEOTHERMAL POWER: sources, energy conversion system. (2)

OTEC: ocean thermal energy conversion systems, introduction to tidal power. (3)

DIRECT ENERGY CONVERSION SYSTEMS: Fuel cells, MHD, Solar cell. (3)

TEXT BOOKS

1. Power Plant Engineering - G.R. Nagpal, Khannapubl, New Delhi
2. Power Plant Engineering –P.K.Nag, TMH
3. Non Conventional Energy Sources - G.D. Rai, Khannapubl, New Delhi.

REFERENCE BOOKS

1. Power Plant Technology - M.M. El Wakil, MGH, New York.
2. Principles of Energy Conversion - A.W.Culp, MGH, New York.

ELECTIVE - II
MECHATRONICS
18MED23
IIIYear B.Tech. (Mech) Sixth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To describe basic elements of Mechatronics systems and signal conditioning theory
2. To analyze basic system models ,building blocks and analogy between various systems
3. To derive response of systems to step input
4. To describe the functioning of various modes of system control
5. To apply knowledge and able to design a typical Mechatronics system

Course Outcomes:

At the end of the course students will be able to

1. define various static performance terms of sensors
2. write mathematical model of various systems
3. Understand the working of various controllers
4. Write simple ladder programs for various applications

UNIT-I

INTRODUCTION TO MECHATRONICS: Sensors & transducers: Introduction, performance terminology, classification of sensors, selection of sensors. Signal Conditioning: Introduction to data acquisition – Quantizing theory, analogue to digital conversion, digital to analogue conversion. Data Presentation Systems: Data presentation elements magnetic displays, data acquisition systems, systems measurement, testing and calibration.

UNIT-II

ACTUATION SYSTEMS: Pneumatic and hydraulic actuation systems, stepper motors.
SYSTEM MODELS: Modelling of one and two degrees of freedom, mechanical, electrical, fluid and thermal systems. Block diagram representations for these systems.

UNIT-III

DYNAMIC RESPONSE OF SYSTEMS: Zero order, First order and second order systems. Block diagram representation, Transfer function. Systems in series, Systems with feedback loops.

CLOSED LOOP CONTROLLERS: Continuous and discrete processes control modes, two step, proportional, derivative, integral, PID controllers.

UNIT-IV

PLC : Introduction, basic structure, I/P, O/P, processing, programming, ladder diagrams, timers, internal relays and counters, data handling, analogue input and output selection of PLC.

DESIGN: Designing of mechatronics systems, possible design solutions, case studies of mechatronics systems – pick and place robot. Role of magnetic bearings in mechatronics. Introduction to industry 4.0.

TEXT BOOKS

1. William Bolton, "Mechatronics-A Multidisciplinary approach", 4th edition-2010, Pearson Education.
2. Godfrey C. Onwubolu, "Mechantronics-Principles and Applications" Butterworth-Heinemann-An Imprint of Elsevier-2006.

REFERENCE BOOKS

1. Devdasshetty, Richard A kolk, "Mechatronics system Design" 2nd edition, Cengage Learning (India) Pvt Ltd
2. M.D.Singh, J.G.Joshi, "Mechatronics" 2nd print, PHI Learning Private Limited.
3. David G Alciatore, Michael B Histand,"Introduction to Mechatronics and Measurement systems" Tata mc Graw hill publishing company Limited.
4. Newton C Braga, "Mechatronics source book" Ist Indian print, Cengage Learning (India) PvtLtd..
5. W.Bolton, "Industrial control and Instrumentation" Universities Press (India) Private Limited.
6. W.Bolton, "Programmable Logic Controllers" 4th edition, Newnens-An Imprint of Elsevier.
7. Akira Chiba Tadashi Fukao Osamu Ichikawa Masahide Oshima Masatugu Takemoto David Dorrell, "Magnetic Bearings and Bearingless Drives" 1st edition, Newnens-An Imprint of Elsevier.

HEAT TRANSFER LAB
18MEL61
III Year B. Tech. (Mech) Sixth Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To predict thermal conductivity and thermal resistivity of the given material.
2. To analyze the coefficient of heat transfer between fluids and solid boundaries.
3. To carry out simple experimental work in radiation heat transfer.
4. To analyze the performance of heat exchangers and fins.
5. To determine the COP of a refrigerator.

Course Outcomes:

After completion of this course, students will be able to:

1. Measure the thermal conductivity of composite slab, lagged pipe, concentric sphere and metal rod.
2. Determine the heat transfer coefficient in natural convection and forced convection and also the efficiency of the fins.
3. Determine the LMTD and effectiveness of a heat exchanger.
4. Find the emissivity of a given surface.
5. Measure the COP and refrigeration effect of the refrigerator.

Conduct experiments on Any **Ten** of the Following:

1. Heat Exchanger – Parallel Flow
2. Heat Exchanger – Counter Flow
3. Heat transfer through a Composite Slab
4. Heat transfer through a Metal Rod
5. Critical Heat flux Apparatus
6. Emissivity Apparatus
7. Pin fin – Natural Convection
8. Pin fin – Forced Convection
9. Insulating powder Apparatus
10. Forced Convection Apparatus
11. Stefan – Boltzmann's Apparatus
12. Lagged pipe Apparatus
13. Refrigeration Test Rig
14. Air Conditioning Test Rig

MACHINE SHOP PRACTICE
18MEL62
III Year B. Tech. (Mech) Sixth Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To impart student knowledge on various hand tools for usage in engineering applications.
2. Be able to use analytical skills for the production of components.
3. Understand the speed and feed mechanisms of lathe, shaper, planer, drilling, milling and grinding machines.
4. Produce various shapes on work pieces by using lathe, shaper, drilling and milling machines.
5. To make student aware of safety rules in working environments.

Course Outcomes:

1. Perform various operations on a lathe machine.
2. Produce plain and bevel surfaces on Shaping machine.
3. Drill holes and produce internal threads.
4. Machine Spur and Helical gears on milling machine.
5. Can operate planning and slotting machines.
6. Can grind the tool on the tool and cutter grinder.

Course Content:

TURNING:

L.H. & R.H. Threading, Multi-start Threading, Drilling, Boring and Internal Threading.

DRILLING & TAPPING:

Drilling and Tapping of Different Threads.

MILLING:

Key-way, Spur and Helical Gear Milling, Gear Hobbing.

SHAPING:

At least three models involving production of flat surface, Stepped surface, Cutting dovetail and Rectangular grooves.

PLANING AND SLOTTING:

Working on Planing and Slotting Machines

GRINDING:

At least one model on surface grinder, cylindrical grinder or tool or cutter grinder.

Text Books:

1. Workshop Technology Vol. II by Hazra Chowdary
2. Production Engineering by P.C.Sharma, S. Chand & Co.

Reference Books:

1. Machining and Machining Processes by P.N.Rao, TMH.

SOFT SKILLS LAB
18ELL02
III Year B. Tech. (Mech) Sixth Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To understand facial expressions, gestures and postures for effective communication.
2. To understand the importance of interpersonal and intrapersonal skills in an employability setting.
3. To understand the process of thinking and analytical skills.

Course outcomes:
Upon successful completion of this course student should be able to:

1. Use appropriate body language in social and professional contexts.
2. Use Problem-Solving techniques in personal and professional life.
3. Use effective writing skills in drafting resume, Cover letters and E-mails.
4. Use effective team skills and develop leadership qualities

Course content:

1. BODY LANGUAGE & IDENTITY MANAGEMENT

a. Facial Expressions – Kinesics - Occulesics
b. Haptics - Proxemics
c. Para Linguistics
d. Appearance
e. Identity Management Communication

2. EMOTIONAL INTELLIGENCE & LIFE SKILLS

a. Self Awareness through Johari Window and SWOC analysis
b. Self Motivation
c. Empathy
d. Assertiveness& Managing Stress
e. Positive Attitude
f. Time Management
g. Goal Setting: Short term, Long Term, Vision, Mission.

3. BUSINESS PRESENTATIONS

a. Preparing effective Presentations Power Point Presentations
b. Power Point Presentations
c. Using Visual Aids
d. Mock Presentations

4. EMPLOYABILITY SKILLS

a. Group Discussion
b. Team Building and Leadership Qualities
c. Interview Skills

AUTOMATION IN MANUFACTURING
18ME701
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To familiarize the basic concepts of automation technologies used in the manufacturing industry.
2. To create strong programming skills to develop CNC programs.
3. To give sound knowledge on using computer assisted and integrated systems in manufacturing processes
4. To familiarize the advanced concepts of process planning and automated inspection systems.

Course Outcomes:

Upon successful completion of the course, the student will be able to

1. Understand and describe the available automated technologies to improve quality and productivity in the manufacturing industry.

2. Successfully write part programs for CNC turning, drilling and machining operations for a given geometry.

3. Develop process planning for production of different components.

4. Prepare layouts and logic diagrams to automate the production. Also, to describe and choose appropriate manufacturing system suitable for a given component.

UNIT-I

Introduction: Automation in production systems – automated manufacturing systems, computerized manufacturing support systems, reasons for automating, merits and demerits, automation principles and strategies, manufacturing industries and products, manufacturing operations – processing and assembly operations, other factory operations, Production Concepts. (8)

Transfer lines: fundamentals of automated production lines, system configurations, work part transfer mechanism, storage buffers, control of the production line. Applications of automated production lines (7)

UNIT-II

Numerical Control : Introduction, basic components of an NC system, nomenclature of NC machine axes, interpolation methods, features of CNC, the machine control unit for CNC, CNC software, direct numerical control, distributed numerical control, applications of NC, advantages and disadvantages of NC, adaptive control machining. (8)

NC Part Programming: NC coding systems, manual part programming, simple examples on drilling, milling and turning operations, computer assisted part programming, part programming with APT language, simple examples in drilling and milling operations. (7)

UNIT-III

Group Technology & Cellular Manufacturing: Introduction, part families, parts classification and coding, selecting a coding system, developing coding system in an industry OPITZ, MICLASS, Product Flow Analysis, composite part concept, machine cell design, applications. (12)

Computer Aided Process Planning: Introduction, retrieval CAPP system, generative CAPP systems, benefits of CAPP. (4)

UNIT-IV

Flexible Manufacturing Systems: Introduction, types of FMS, components, FMS layout configurations, computer control system, human resources, applications and benefits (7)

Computer integrated Manufacturing: Introduction to Computer Integrated manufacturing, **Automated Inspection:** Fundamentals, types of inspection methods and equipment, Coordinate Measuring Machines (CMM), Machine Vision (8)

TEXT BOOKS

1. Automation, Production systems and Computer Integrated Manufacturing by M.P.Groover, Pearson Education / PHI.
2. CAD/CAM by P.N.Rao, Tata McGraw Hill
3. CAD / CAM / CIM/Radhakrishnan and Subramanian, New Age

REFERENCE BOOKS

1. Computer Numerical Control Concepts and programming by Warren S Seames, Delmar Thomson Learning, NY.
2. Computer Aided Manufacturing by Tien Chien Chang, Pearson Education
3. Flexible Manufacturing Cells and System by William. W. Luggen Hall, Pearson.,
4. Computer Aided Manufacturing- Rao, Tewari, Kundra, McGraw Hill

OPERATIONS MANAGEMENT
18ME702
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To develop skills of forecasting, Aggregate Planning and Scheduling.
2. To provide the knowledge of materials management and determining the optimum inventory.
3. To guide in learning the key concepts and issues of quality management in both manufacturing and service organizations.
4. To develop the knowledge and skill to find out the optimum solutions for a given situation using OR techniques.

Course Outcomes:

Upon successful completion of this course, the student should be able to:

1. Apply appropriate forecasting techniques & Aggregate plans to schedule
2. Apply Materials management analysis and inventory control techniques
3. Apply quality management principles proposed by Taguachi, Juran & Demigs
4. Apply optimization to LP model & transportation and assignment problems

UNIT-I

Forecasting: Introduction, types of forecasting and their uses, General principles of forecasting, forecasting techniques: qualitative and quantitative methods of Forecasting. **Production Systems:** Types of production systems: job, batch, mass and flow type production.

Aggregate Planning: Introduction, aggregate planning strategies, aggregate planning methods, problems (6)

Scheduling: Introduction, difference with loading, scheduling policies, techniques, standard scheduling methods (4)

UNIT-II

Materials Management: Introduction, functions of materials management, inventory, inventory management, types of inventories, Selective inventory control techniques: ABC analysis, VED analysis. (8)

Inventory Control: P and Q Systems, Basic Economic Order Quantity model, Price break model, assumptions and problems (4)

Material Requirement Planning: Introduction, Inputs, outputs and MRP logic. (2)

Contemporary management techniques: Introduction to Lean, JIT, ERP and Supply chain Management. (2)

UNIT-III

Quality Management: Quality engineering, Taguchi Principles, SQC – X bar, p and c charts, problems (8)

Juran's principles Introduction to quality acceptance sampling (2)
Deming's Philosophy, Introduction to Total quality management, Quality Function Deployment, Introduction to six sigma and ISO 9000 2015 standards. (4)

UNIT-IV

Optimization: Linear Programming – Graphical and simplex method – problems (7)

Demonstration of Transportation and Assignment Models, Travelling Salesman problem (7)

TEXT BOOKS

1. Modern Production/ operations managements / Baffa & Rakesh Sarin
2. Operations Management – an Integrated Approach, International student Version, R. Dan Reid and Nada R. Sanders, John Wiley & Sons
3. Production and Operations management by K. C. Jain, Wiley
4. Operations Management by William J. Stevenson, McGraw-Hill Companies 2015
5. Operations Management by Jay Heizer , Barry Render, Chuck Munson , Amit Sachan Twelfth Edition, Pearson, 2017

REFERENCE BOOKS

1. Maynard's Industrial Engineering Handbook, Kjell B. Zandin, Fifth Edition 2001, The McGraw-Hill Companies, Inc.
2. Operations Management S.N. Chary.
3. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.

INSTRUMENTATION & CONTROL SYSTEMS

18ME703

IV YearB.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To describe the elements of generalized measurement system and principle of operation of various displacement sensors
2. To Illustrate the use of strain gauges for stress and strain measurement
3. To explain the principle and working of temperature and pressure sensors
4. To describe the function and working of various flow and level sensors
5. To analyze the control system components and their working

Course Outcomes:

At the end of the course students will be able to

1. Differentiate various sensors for measurement of displacement.
2. Describe the principle and working of various temperature and pressure sensors
3. Analyze the various types of sensors for level and flow measurement.
4. Distinguish force and torque measurement sensors. Understand the basic principles of control system theory

UNIT-I

Definition - Basic principles of measurement – Measurement systems, generalized configuration and functional descriptions of measuring instruments - examples. (3)

Measurement of Displacement: Theory and construction of various transducers to measure displacement - Piezo electric, Inductive, capacitance, resistance, ionization and Photo electric transducers. (6)

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. (6)

UNIT-II

MEASUREMENT OF TEMPERATURE: Classification – Ranges - Various Principles of measurement - Expansion, Electrical Resistance - Thermistor - Thermocouple - Pyrometers - Temperature Indicators. (8)

MEASUREMENT OF PRESSURE: Units - classification - different principles used-Manometers, Piston, Bourdon pressure gauges, Bellows - Diaphragm gauges. Low pressure measurement - Thermal. Conductivity gauges - ionization pressure gauges, McLeod pressure gauge. (7)

UNIT-III

MEASUREMENT OF LEVEL: Direct method - Indirect methods - capacitative, ultrasonic, magnetic, cryogenic fuel level indicators - Bubbler level indicators. (7)

FLOW MEASUREMENT: Rota meter, magnetic, Ultrasonic, Turbine flow meter, Hot - wire anemometer Laser Doppler Anemometer (LDA). (8)

UNIT-IV

MEASUREMENT OF FORCE, TORQUE AND POWER: Elastic force meters, load cells, Torsion meters, Dynamometers. (7)

ELEMENTS OF CONTROL SYSTEMS: Introduction, Importance - Classification - Open and closed systems Servomechanisms-Examples with block diagrams-Temperature, speed & position control systems. (8)

TEXT BOOKS

1. Thomos G Beckwith, Roy D Marangoni, John H Lienhard V, "Mechanical Measurements" 5th edition, Pearson Education.
2. A.K.Ghosh," Introduction to Instrumentation and Control" 2nd edition, Prentice-Hall of India (Pvt) Ltd.

REFERENCE BOOKS

1. Alan S Moris," Measurement & Instrumentation Principles" 1st edition, Butterworth-Hienemann publications.
2. J.P.Holman,"Experimental methods for Engineers" 7th edition, Tata McGraw hill Publishing company Limited.
3. R.S.Sirohi, H C Radhakrishna, "Mechanical Measurements" 3rd edition, New Age International (P) Ltd.
4. SudhirGupta,"Elements of control systems" Prentice-Hall of India (Pvt) Ltd.
5. I J nagarath, M Gopal,"Control systems Engineering" 2nd edition, New Age International (P) Ltd.
6. M.Gopal, "Control systems-Principles and Design", Prentice Hall of India (Pvt)Ltd

ELECTIVE - III
FLUID POWER SYSTEMS
18MED31
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To acquire knowledge in fluid power sources, power utilization and trouble shooting
2. To construct and develop hydraulic and pneumatic circuits for various applications
3. To familiarize with pneumatic system circuits used in automation
4. To understand the importance and uses of accumulator

Course Outcomes:

At the end of the course students will be able to

1. understand significance of Pascal's law and explain the construction, operation and performance characteristics of different types of pumps
2. Identify and explain the operations and applications of different hydraulic actuators, valves and other hydraulic system components and build basic hydraulic circuits to execute desired functions
3. explain the basic principles and applications of pneumatic system, identify and explain operations & applications of different pneumatic system components & build pneumatic circuits.
4. Understand the operation accumulators and Identify faults in hydraulic circuits and maintenance of hydraulic system

UNIT-I

Introduction: Fluid Power, Basic Law, Application of Fluid Power, Advantages of Fluid Power Systems, Types of Fluid Power Systems.
Hydraulic Systems: Pumps – Gear Pumps and Vane Pumps. Selection and Specification of Pumps. Hydraulic Actuators: Linear and Rotary Actuators.

UNIT-II

Control and Regulation Elements: Pressure, Flow and Direction Control Valves Hydraulic Circuits: Reciprocation, Quick Return, Sequencing, Synchronizing Circuits, Industrial Circuits - Punching Press Circuit, Milling Machine Circuits

UNIT-III

Introduction to Pneumatic Systems: Pneumatic fundamentals, Pneumatic Valves Pneumatic Circuits: Pneumatic circuits- Basic pneumatic circuit, Quick exhaust circuit, feed control circuit and Time delay circuit.

UNIT-IV

Hydraulic Circuits: Accumulators, Accumulator Circuits – Leakage Compensation, Auxiliary Power Source, Emergency Source of Power Maintenance of Hydraulic Systems: Maintenance of Hydraulic Systems, Trouble Shooting of Hydraulic System.

TEXT BOOKS

1. Anthony Esposito 'Fluid Power with applications" Pearson Education.
2. Andrew Parr " Hydraulics and Pneumatics-A technicians and engineers guide" Jaico publishing co

REFERENCE BOOKS

1. W.Bolton,"Pneumatic and Hydraulic systems" Butterworth-Heinemann

Web page references

1. https://www.grc.nasa.gov/www/k-12/WindTunnel/Activities/Pascals_principle.html
2. http://www.vickers.sh.cn/pdfs/M-SRSR-MC001-E.pdf
3. http://file.seekpart.com/keywordpdf/2011/3/31/20113319837232.pdf
4. http://www.associatedgroups.com/EATON-CAT/pdfs/i3155s.pdf

ELECTIVE - III
COMPUTER AIDED DESIGN
18MED32
IVYearB.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment	:	50	Semester End Examination (3 Hours)	:	50		

Course Objectives:

1. Understand the basic fundamentals of computer aided design.
2. To learn line generation and circle generation algorithms.
3. To understand the different geometric modelling techniques like solid modelling, surface Modelling and solid modelling
4. The transformation techniques on points and lines

Course Outcomes:

Upon successful completion of this course, the student will be able to

1. Differentiate the CAD and conventional design
2. Describe the different types of display devices
3. Write the programme to generate basic primitives.
4. Apply the transformation techniques on basic primitives

UNIT-I

INTRODUCTION: Fundamentals of CAD, Design process, Applications of computer for design, Benefits of CAD, Computer peripherals for CAD workstation, Graphic terminal, CAD software, CAD database and structure. (8)
DISPLAY DEVICES: Video display devices – Raster- scan display, CRT, DVST, Inherent memory display devices, Random Scan Display, Input devices. (7)

UNIT-II

PRIMITIVES: Points and Lines, Line drawing algorithms, DDA algorithm, Bresenham‘s line algorithm, Circle generation algorithm, Mid- point circle algorithm. (7)
GEOMETRIC MODELING: 2D wire frame modeling, 3D Wire frame modeling, Wire frame models, Entities and their definitions. Concept of Parametric and nonparametric representation of curve, Curve fitting techniques, Definitions of cubic splines. (8)

UNIT-III

SURFACE MODELING: Surface modeling and entities, Parametric space of Surface, Blending functions, Surface of revolution,. (7)
SOLID MODELING: Solid models, Solid entities, Solid representation, Sweep representation, Constructive solid geometry and Boundary representation, Solid modeling based applications. (8)

UNIT-IV

GEOMETRIC TRANSFORMATIONS: Transformation Principles, Translation,Scaling, Rotation, Matrix Representations and Homogeneous Coordinates, Composite transformations . (15)

TEXT BOOKS

1. CAD/CAM by MikelP.Groover and Emory W.Zimmers,Prentice Hall of India , Delhi
2. Principles of Interactive Computer Graphics by Newman and Sproull, McGrawhill

REFERENCE BOOKS

1. CAD/CAM by P.N.Rao, Tata McGrawhill , Delhi
2. CAD/CAM by Ibrahim Zeid, Tata McGrawhill,Delhi.

ELECTIVE - III
REFRIGERATION AND AIR CONDITIONING
18MED33
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
To make the learner to
1. Understand the fundamental thermodynamic concepts of Refrigeration and Air-Conditioning systems.
2. Demonstrate the working different types Refrigeration Systems, properties of refrigerants and analyse their performance .
3. Describe the air-Conditioning Systems and perform the heat load calculations with the aid of psychometric chart.

Course Outcomes:

Upon completion of this course, the student will be able to:
1. Discuss the working of components of different types of Refrigeration systems.
2. Demonstrate the ability to calculate the performance of different types of Refrigeration systems.
3. Describe the working of different types of Air-Conditioning systems.
4. Demonstrate the ability to calculate the performance of Air-Conditioning System using psychometric chart.

UNIT-I

INTRODUCTION TO REFRIGERATION: Necessity and applications, unit of refrigeration and C.O.P, mechanical refrigeration, types of ideal cycle of refrigeration, Refrigerants- desirable properties, commonly used refrigerants, nomenclature. (6)
AIR REFRIGERATION: Bell Coleman cycle and Brayton cycle, Open and Dense air systems, Actual refrigeration system, refrigeration needs of aircrafts, adoption of air refrigeration, Justification, types of systems (9)

UNIT-II

VAPOUR COMPRESSION REFRIGERATION: Working principle, essential components of plant, simple vapor compression refrigeration cycle, Multi pressure systems – multi stage compression, multi evaporator system, Cascade system, use of p – h charts (8)
SYSTEM COMPONENTS: Compressors- general classification, comparison, advantages and disadvantages, Condensers - classification, working, Evaporators - classification, working, Expansion devices - types, working. (7)

UNIT-III

VAPOUR ABSORPTION SYSTEM: Calculation of max COP, description and working ofNH3 - water system, Li - Br, H2O system, principle of operation of three fluid absorption system and salient features. (10)
STEAM JET REFRIGERATION: Principle of working, application, merits and demerits. (2)

NON-CONVENTIONAL REFRIGERATION METHODS: Principle and operation of Thermoelectric refrigerator and Vortex tube or Hirsch tube. (3)

UNIT-IV

INTRODUCTION TO AIR CONDITIONING: Psychrometric properties and processes, sensible and latent heat loads, need for ventilation, infiltration, concepts of RSHF, ASHF, ESHF& ADP, concept of human comfort and effective temperature, comfort air conditioning, industrial air conditioning requirements, air conditioning load calculations. (9)
AIR CONDITIONING SYSTEMS: Classification of equipment, cooling, heating, humidification and dehumidification, filters, grills and registers, deodorants, fans and blowers, heat pump, heat sources, different heat pump circuits, application. (6)

TEXT BOOKS

1. Refrigeration and air conditioning - C.P.Arora, TMH.
2. Refrigeration and Air conditioning - Manohar Prasad, New Age India, New Delhi.
3. A course in refrigeration and air conditioning - S.C.Arora&Domkundwar, DhanpatRai&sons, New Delhi.

REFERENCE BOOKS

1. Principles of Refrigeration - Dossat.
2. Refrigeration and air conditioning - Stoecker.

ELECTIVE - III
PROJECT MANAGEMENT
18MED34
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
The course is aimed at project planning and control before implementing any project.
The objectives are,

1. To acquire the knowledge of planning a project.
2. To perform SWOT analysis of project
3. To use PERT and CPM techniques in implementing a project
4. To learn to manage a project
5. To control the project and evaluate it.

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

1. Develop work breakdown structure
2. Apply critical path , risk analysis using PERT Methods
3. Apply scheduling of resources for a given project purpose relevant cost
4. Develop organisation structure for a project &identify the appropriate leadership style

UNIT - I
Introduction to Project Management - Definitions, scope and contents, Relevance, Classification of Projects, Defining the Project, Project Life Cycle, WBS, Project Life cycle, Developing a project Plan, Network analysis, Exercises (14)

UNIT - II
Critical path method, Risk analysis, PERT; problems, Reducing Project Duration (14)

UNIT - III
Estimating project Times and Costs, Scheduling Resources and Costs, problem solving, Progress and Performance Measurement (14)

UNIT - IV
Organization – Structure and Culture, Designing a structure for a project, Leadership styles, Leading, Managing Project Teams.The Project Management Maturity Model (PMMM) (14)

TEXT BOOKS

1. Harold Kerzner, "*Project Management*", 8th Edition, Wiley, New York, 2003. (pdf available)
2. Project Management: The Managerial Process, Erik W. Larson, and Clifford F. Gray. McGraw-Hill Higher Education

REFERENCE BOOKS

1. A Guide to the Project Management Body of Knowledge (PMBOK guide), PMI, 2017
2. Prasanna Chandra, "*Projects – Planning, analysis, selection, implementation and review*",Tata McGraw-Hill, New Delhi, 2010.

ELECTIVE - IV
MECHANICAL VIBRATIONS
18MED41
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
The objective of this course is to learn how to treat the vibration phenomena by transforming the physical model into a mathematical model and solve it by using the appropriate mathematical operations to find the response and analyze this response and bring it back to its physical concept.

Course Outcomes:
After the completion of the course the students will be able to

1. Understand the basics of vibration and analyze free & forced vibrations of single DOF systems.
2. Convert a multi DOF physical system into a mathematical method and calculate the parameters of vibrations.
3. Analyze continuous systems for their vibration parameters.
4. Use classical methods to analyze multi DOF systems and find their natural frequencies.

UNIT-I
Oscillatory Motion: - Harmonic motion, Periodic motion, Vibration terminology

Free Vibration: - Vibration model, Equations of motion: Natural frequency, Energy method, Rayleigh method: Effective mass, Principal of virtual work, Viscously damped free vibration, logarithmic decrement.

Harmonically Excited Vibration: - Forced harmonic vibration, Rotating unbalance, Support motion, Vibration isolation.

UNIT-II
Systems with Two or More Degrees of Freedom: - The normal mode analysis, Initial conditions, Coordinate coupling, Forced harmonic vibration, Finite difference method for systems of equations, Vibration absorber, Centrifugal pendulum vibration absorber, Vibration damper

UNIT-III
Properties of Vibrating Systems: - Flexibility influence coefficients, Reciprocity theorem, Stiffness influence coefficients, Orthogonality of eigenvectors, Decoupling forced vibration equations.
Vibration of Continuous Systems: - Vibrating string, longitudinal vibration of rods, torsional vibration of rods, vibration of suspension bridges, Euler equation for beams, systems with repeated identical sections

UNIT-IV

Classical Methods: - Rayleigh method, Dunkerley's equation, Rayleigh-Ritz method, Holzer method.

TEXT BOOKS

Theory of Vibration with Applications – Willam T Thomson & Marie Dillon Dahleh, Pearson Education, Fifth edition.

REFERENCE BOOKS

Mechanical Vibrations – Singiresu S Rao, Pearson education, Fourth edition.
Mechanical Vibrations – G. K. Grover, Nem Chand & Bros, Eighth edition.

ELECTIVE - IV
ROBOTICS
18MED42
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To provide the student with knowledge of classification of robots and application of robots
2. To develop the student's knowledge in various end effectors of robots
3. To provide the student with some knowledge of various sensory devices used in robots.
4. To develop student's skills in performing spatial transformations associated with rigid body motions.
5. To provide the student with some knowledge and analysis skills associated with Trajectory planning
6. To develop student's skills in perform kinematics analysis of robot systems

Course Outcomes:
After completion of the course the student must be able to

1. Acquire knowledge on basic structure & development of Industrial robots
2. Understand various types of end effectors & methods of programming a robot
3. Plan and execute sensors used in robots
4. Solve transformation and kinematic problems of robots

UNIT-I

Introduction to Robotics, major components of a robot, robotic like devices, classification of robots– Classification by coordinate system and by control method, Specifications of robots, fixed versus flexible automation, economic analysis, overview of robot application. (15)

UNIT-II

Robot end Effectors: Introduction, end effectors, interfacing, types of end effectors, grippers and tools, considerations in the selection and design of remote cantered devices. Various methods of programming robots. (15)

UNIT-III

Robotic sensory devices: Objective, Non-optical position sensors – potentiometers, synchros, inductocyn, optical position sensors – optic interrupters, optical encoders (absolute &incremental)
Proximity sensors: Contact type, non contact type – reflected light scanning laser sensors.
Touch & slip sensors: Touch sensors – proximity rod & photo detector sensors, slip sensors – Forced oscillation slip sensor, interrupted type slip sensors, force and torque sensors. (15)

UNIT-IV

Transformations and Kinematics: Objectives, homogenous coordinates, basic transformationoperations, forward solution – DenavitHartenberg procedure. Simple problems involving planarmanipulators, inverse or backward solution – problems involved, techniques.Introduction to Trajectory Planning, the manipulator jacobian. (15)

TEXT BOOKS

1. Robotic Engineering by Richard D.Klafter
2. Industrial Robotics by MikellP.Groover

REFERENCE BOOKS

1. Introduction to Robotics – John J.Craig
2. Robotics – K.S.Fu, Gonzalez & Lee
3. Robotics for Enginers by YoramKoren.
4. Robotics Technology and Flexible Automation by S.R.Deb

ELECTIVE - IV
SUPPLY CHAIN MANAGEMENT
18MED43
IV Year B.Tech. (Mech) Seventh Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To enable the students understand the principles of SCM
2. To provide the details of planning of SCM and SCM integration
3. To acquire the knowledge of supply chain integration with push and pull systems.
4. To learn the concepts of coordination in SCM

Course Outcomes:

After completion of the course, Student will be able to

1. Implement SCM in industries
2. Possess the knowledge of supply chain and competitive advantage
3. Possess the knowledge of supply chain and integration
4. Applying the bull whip effect in SCM coordination

UNIT-I

Introduction to Logistics and Supply Chain Management: Definition: Supply Chain, Supply Chain Management- Decision Phases in Supply Chain Management – Process view of Supply Chain – Managing Uncertainty – Global Optimization – Importance of Supply chain Management – Key issues in Supply Chain Management.

UNIT-II

Competitive advantage: Competitive advantage – Gaining Competitive advantage through logistics – The Mission of Logistics Management - Integrated supply chains – Supply Chain and Competitive performance. The changing logistics environment - Models in Logistics Management - Logistics to Supply Chain Management.

UNIT-III

Supply Chain Integration: Introduction – Push, Pull and Push-Pull systems: Push based supply Chain, Pull Based supply chain, Push- Pull supply Chain – Demand Driven Strategies – Impact of Internet on Supply Chain Strategies – Distribution Strategies – Centralized Vs Decentralized control.

UNIT-IV

Coordination and Technology in SCM: Introduction – Bull Whip effect, Impact of Centralized information on the Bullwhip effect, Methods for coping with the Bull whip effect – Lead time reduction.

TEXT BOOKS

1. Chopra, S., and Meindl, P., Supply chain Management: Strategy, Planning and Operations. 2nd Edition, Pearson Education (Singapore) Pvt. Ltd, 2004.
2. Simchi-Levi, D., Kaminsky, P., and Simchi-Levi, E., Designing & Managing the Supply Chain: Concepts, Strategies & Case studies. Third Edition, McGraw-Hill Education, 2007.

REFERENCE BOOKS

1. Raghuram, G. and Rangaraj, N., Logistics and Supply Chain Management: Cases and Concepts, Macmillan India Limited, New Delhi, 2000.
2. Doebler, D.W. and Burt, D.N., Purchsing and Supply Chain Management: Text and Cases, McGraw-Hill Publishing Company Limited, New Delhi, 1996.
3. Christopher, M., Logistics and Supply Chain Management, Pitman Publishing Company, London, 1993.

Project - I
18MEP01
IV Year B. Tech. (Mech) Seventh Semester

Lectures	0	Tutorial	0	Practical	4	Credits	2
Continuous Internal Assessment				Semester End Examination (3 Hours)			

Internal marks for the Project - I will be awarded based on a minimum of two SEMINARS/ PRESENTATIONS and the report submitted at the end of semester

DESIGN & METROLOGY LAB
18MEL71
IV Year B. Tech. (Mech) Seventh Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To illustrate the concepts of accuracy and precision through experiments.
2. Analyze limits and tolerances for engineering components.
3. To illustrate the use of various measuring tools measuring techniques.
4. To make student understand importance of statistical quality control techniques using experiments.

Course outcomes:

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

1. Measure the taper angle using sine bar in conjunction with slip gauges, dial indicator, and surface plate.
2. Measure the angle between surfaces using bevel protractor.
3. Use micrometer to determine diameter & thickness of given work piece and to use control charts to make decisions about the lot.
4. Measure the chordal width and chordal height of given gear wheel using gear tooth vernier.
5. Use bore dial gauge to measure the internal diameter of work piece & to check taper and ovality of the bore.
6. Measure pitch angle, depth of a given thread pitch gauge.
7. Measure the taper of given work piece using taper plug gauge.
8. Measure pitch, depth, angle of given pitch gauge by using profile projector.
9. Measure diameter and thickness using dial caliper.
10. Measure pitch, depth and included angle of thread.

Syllabus:

List of experiments:

1. Angle measurement by Bevel Protractor.
2. Angle and taper measurement by sine bar.
3. Measuring effective dia. of thread using 3 - wire method.
4. Measuring gear tooth thickness using gear tooth vernier.
5. Measuring internal diameter using bore dial gauge.
6. Measuring external diameters using Micrometer& Plotting $\bar{X}$ & R Charts
7. Measuring different parameters of a thread / gear tooth using profile projector
8. Measuring different parameters of a thread / gear tooth using Tool Makers Microscope.
9. Measurement of external diameter and thickness using Dial caliper.
10. Measurement of taper angle using taper plug gauge.
11. Balancing machine
12. Wear & Friction measurement
13. Journal Bearing apparatus
14. Fatigue test
15. Photo elasticity bench setup

TEXT BOOKS:

1. Metrology - R.K.Jain , Khanna publishers
2. Mechanical Measurements & Control - by D.S. Kumar

CAM LAB
18MEL72
IV Year B. Tech. (Mech) Seventh Semester

Lectures	0	Tutorial	0	Practical	3	Credits	1
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To write manual part programs for different operations on CNC Lathe.
2. To write manual part programs for different operations on CNC Machining centre.
3. To check the part programs using FANUC Simulation software.
4. Demonstration of parts and operation of CNC Lathe and CNC Machining centre.
5. Modelling of simple parts and generation of part program using MASTER CAM software.

Course Outcomes:

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

1. Write part programs for step turning, taper turning, profile turning, external and internal threading.
2. Write part program using canned cycles and sub-programs.
3. Write part programs for slot milling, profile milling and drilling.
4. Explain cutter radius and length compensation.
5. Simulate the above programs using FANUC Simulation software.
6. Explain the operation of CNC lathe and Machining centre to produce simple components.

Course Content:

I. Manual Part Programming and tool path simulation using offline simulation software on CNC

Lathe for the following operations.

1) Step turning,
2) Taper turning,
3) Profile turning
4) External threading
5) Drilling, boring and internal threading

II. Manual Part Programming and tool path simulation using offline simulation software on CNC

Machining centre for the following operations.

1) Slot milling.
2) Step milling
3) Diagonal milling.
4) Profile milling.
5) Hexagon milling & drilling.

III. Modeling, Part Program generation and tool path simulation using Master CAM software.

IV. Demo on working of CNC Lathe and CNC Machining centre.

Internship
18MEII1
IV Year B. Tech. (Mech) Seventh Semester

Lectures	0	Tutorial	0	Practical	0	Credits	2
Continuous Internal Assessment				Semester End Examination (3 Hours)			

Credits will be given based on the report submitted at the beginning of seventh semester as per internship policy.

ELECTIVE - V
ADVANCED MANUFACTURING
18MED51
IV Year B.Tech. (Mech) Eighth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To describe and demonstrate different unconventional machining processes
2. To explore the recently developed welding and adhesive bonding processes and their applications
3. To familiarize with the basic concepts of micromachining and different processes with potential applications.
4. To describe the principles and applications of different additive manufacturing processes

Course Outcomes:

Upon successful completion of this course, the student will be able to

1. Understand and learn different unconventional machining processes and choose appropriate process to produce a given component
2. Distinguish the advanced welding processes suitable for various material systems.
3. Differentiate the basic principles of machining and micromachining and select a suitable micromachining process and develop a miniature micromahchine tool.
4. Understand the basic mechanisms of additive manufacturing processes and their potential applications in different engineering fields.

UNIT-I

UNCONVENTIONAL MACHINING PROCESSES: Introduction, principles, operation, equipment and applications of abrasive jet machining (AJM), ultrasonic machining (USM), water jet machining (WJM), electric discharge machining (EDM), chemical machining and electrochemical machining (CHM and ECM), electron beam machining (EBM), laser beam machining (LBM) and plasma arc machining (PAM) (15)

UNIT-II

ADVANCED WELDING: Principles, mechanisms and applications of solid state welding, friction welding, friction stir welding, explosion welding, ultrasonic welding, underwater welding, diffusion welding, cold pressure welding and hot pressure welding. (12)

ADHESIVE BONDING: Introduction, classification of adhesives, joint design, methods, applications. (3)

UNIT-III

MICROMACHINING: Introduction, microstructure and material properties, theory of micromachining, chip formation, surface roughness, cutting fluids, principles and applications of micro turning, micro milling, micro drilling, precision grinding, and laser beam micromachining. Fabrication of micro cutting tools and development of miniature machine tools. (15)

UNIT-IV

ADDITIVE MANUFACTURING: Introduction, CAD in additive manufacturing, liquid based and solid based processes, laser technology, stereo lithography, fused deposition, selective laser sintering, 3D printing technologies, laser engineered net shaping (LENS), principles and applications. (15)

TEXT BOOKS

1. A Text book of Production Engineering by P.C.Sharma, S.Chand& Co.
2. Manufacturing Science by Ghosh & Mallik,
3. Sami Franssila, "Introduction To Micro Fabrication", John Wiley And Sons Ltd., UK, 2004.
4. Chua C.K., Leong K.F., And Lim C.S., "Rapid Prototyping: Principles And Applications", Third Edition, World Scientific Publishers, 2010.

REFERENCE BOOKS

1. Kalpakjian, "Manufacturing engineering & technology", Pearson Education / PHI
2. Mikell P. Groover, "Fundamentals of Modern Manufacturing: Materials, Processes, and Systems", 2010, John Wiley, NY.
3. Messler R. W., "Principles of Welding Processes: Physics, Chemistry, and Metallurgy", 1999, John Wiley, NY
4. Madore J, "Fundamental Of Micro Fabrication", CRC Press, 2002. USA
5. Liou L.W. and Liou F.W., "Rapid Prototyping And Engineering Applications: A Tool Box for Prototype Development", CRC Press, 2007. USA

ELECTIVE - V

TOTAL QUALITY MANAGEMENT

18MED52

IV Year B.Tech. (Mech) Eighth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To facilitate the understanding of Quality Management principles and process.
2. To know the importance of quality and various methods of quality and TQM.
3. To acquire the knowledge of different types of TQM principles.
4. Explain the importance of TQM Tools and principles. Acquire the knowledge of control charts theory.
5. To prepare a good quality systems with different ISO series in manufacturing sectors.

Course Outcomes:

After completion of the course, the student would be able to

1. Apply the tools and techniques of quality management to manufacturing and service processes. Identify and articulate how quality contributes to the achievement of an organization's strategic objectives.
2. Appraise and apply TQM principles as the basis of quality councils and quality circles. Describe the role of PDCA cycle and its importance in industry and
3. Apply Kaizen technique to a given case. Critically evaluate the TQM in manufacturing and service production sectors.
4. Get the solutions using new management tools for six sigma concepts. Give an example of QFD in detail. Recognize the importance of Quality systems with ISO series in production sectors.

UNIT-I

Introduction - Need for quality - Evolution of quality - Definitions of quality - Dimensions of product and service quality - Basic concepts of TQM - TQM Framework - Contributions of Deming, Juran and Crosby - Barriers to TQM - Quality statements - Customer focus - Customer orientation, Customer satisfaction, Customer delight, Customer complaints, Customer retention - Costs of quality. (14)

UNIT-II

TQM Principles: Leadership - Strategic quality planning, Quality Councils - Employee involvement - Motivation, Empowerment, Team and Teamwork, Quality circles Recognition and Reward, Performance appraisal - Continuous process improvement - PDCA cycle, 5S, Kaizen - Supplier partnership - Partnering, Supplier selection, Supplier Rating. (14)

UNIT-III

TQM Tools and Principles: The seven traditional tools of quality - New management tools - Six sigma: Concepts, Methodology, applications to manufacturing, service sector including IT - Bench marking - Reason to bench mark, Bench marking process - FMEA - Stages, Types. Concept of Just-in-time. (14)

UNIT-IV

Quality Function Deployment: House of Quality. (6)
Quality Systems: Need for ISO 9000 - ISO 9001-2008 Quality System - Elements, Documentation, Quality Auditing - QS 9000 - ISO 14000 - Concepts, Requirements and Benefits - TQM Implementation in manufacturing and service sectors (8)

TEXT BOOKS

1. Dale H Besterfield, (2008), Total Quality Management, Pearson Education
2. L.S. Srinath, (2005) Reliability Engineering, Affiliated East West Press, New Delhi

REFERENCE BOOKS

1. Juran's Quality Handbook by Joseph M. Juran and A. Blanton Godfrey, McGraw Hill, 2010
2. James R. Evans and William M. Lindsay, "The Management and Control of Quality", 8th Edition, First Indian Edition, Cengage Learning, 2012.
3. Suganthi.L and Anand Samuel, "Total Quality Management", Prentice Hall (India) Pvt. Ltd., 2006.
4. Janakiraman. B and Gopal .R.K., "Total Quality Management - Text and Cases", Prentice Hall (India) Pvt. Ltd., 2006.
5. Joel E. Rose, (1993), Total Quality Management, II Edition, Kogan Page Ltd., USA.

ELECTIVE - V
AUTOMOBILE ENGINEERING
18MED53
IV Year B.Tech. (Mech) Eigth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:
To make the students to

1. Familiarize the fundamentals of Engine Components, Chassis and suspension system, braking and transmission system, and cooling and lubrication system.
2. Develop a strong base for understanding future developments like hybrid and electric vehicles in the automobile industry.

Course Outcomes:
After successful completion of this course, student will be able to:

1. List different types of Vehicles and their applications.
2. Define working of Automobile Engine cooling and lubrication system.
3. Describe functioning of Ignition system and its accessories.
4. Describe functioning of Transmission, Steering, and Braking and Suspension system

UNIT-I

INTRODUCTION: Classification of vehicles – applications, valves, valve arrangements and operating Mechanisms, Piston - design basis, types, piston rings, firing order; Crankshafts, Flywheel, Air and Fuel Filters, Mufflers. (8)
FUEL SUPPLY SYSTEMS: Fuel supply pumps, Mechanical and Electrical type Diaphragm pumps. (3)
COOLING SYSTEMS: Need for cooling system, Air and water cooling, Thermal syphon cooling systems (4)

UNIT-II

LUBRICATING SYSTEMS: Various lubricating systems for I.C. Engines. (3)
ELECTRICAL SYSTEM: Ignition system, Spark plugs, Distributor, Electronic Ignition, Alternator, cutout, Current and voltage regulators, charging circuit, starting motors, lighting, instruments and accessories. (9)
CHASSIS: Introduction, Construction, Requirements of Chassis. (3)

UNIT-III

TRANSMISSION: Gear Box - Theory, Four speed and Five Speed Sliding Mesh, Constant mesh & synchromesh type, selector mechanism, automatic transmission, overdrive, propeller shaft, differential - principle of working. (8)
SUSPENSION SYSTEMS: Need for suspension systems, springs, shock absorbers, axles – front and rear, different methods of floating rear axle, front axle and wheel alignment. (7)

UNIT-IV

VEHICLE CONTROL: Steering mechanisms and power steering, types of brakes and brake actuation mechanisms (air and hydraulic). (6)
ELECTRIC, HYBRID AND FUEL CELL VEHICLES: Layout of electric and hybrid vehicles – Advantages and drawbacks, System Components, Electronic control system, Different configurations of electric and hybrid vehicles hybrid vehicles, Power split device, High energy and power density batteries – Basics of fuel cell vehicles. (9)

TEXT BOOKS

1. Automobile Engineering - G.B.S.Narang.
2. Automobile Engineering -R.B.Gupta
3. Automobile Engineering - Vol I & II - Kirpal Singh

REFERENCE BOOKS

1. Automotive Mechanics - Joseph Heitner
2. Automobile Engineering -S. Srinivasan

ELECTIVE - V
ENTREPRENEURSHIP DEVELOPMENT
18MED54
IV Year B.Tech. (Mech) Eighth Semester

Lectures	4	Tutorial	0	Practical	0	Credits	3
Continuous Internal Assessment			50	Semester End Examination (3 Hours)			50

Course Objectives:

1. To develop and strengthen the basicentrepreneurship knowledge for students
2. To impart basic entrepreneurial skills and understanding to run a business efficiently and effectively.
3. To develop skills for registering a company and gain the knowledge on sources of funds and Establishing distribution network
4. To make the student aware MSMEs, Role and schemes of government in establishing enterprises in general and women entrepreneurship,social entrepreneurship in specific.

Course Outcomes:
Upon completion of the course, students will be able to

1. Understand the meaning of entrepreneur and able to visualize the benefits of being an entrepreneur
2. Unearth the entrepreneurial qualities hidden in them and apply them to the entrepreneurial activities
3. Understand the procedure for registering a company and gain the knowledge on sources of funds and Establishing distribution network
4. Realize the importance of MSMEs and the government support, formation and the characteristics of women entrepreneurship and social entrepreneurship

UNIT-I

ENTREPRENEURSHIP:

Evolution of the concept of entrepreneurship, Meaning of Entrepreneur, functions of an entrepreneur, types of entrepreneurs, and stages in entrepreneurial process. (2)

Role of entrepreneurs in economic development, possible value creation by an enterprise - direct and indirect employment, government revenue, value to consumers in terms of quality products and services, export and import substitution. (6)

Challenges and opportunities of entrepreneurship – risk, return, professional fulfilment, spinoffs from academia – the Indian and global scenario, Factors Affecting Entrepreneurial growth. (6)

UNIT-II

FORMULATION OF BUSINESS UNIT:

Building and Leading Effective Team. Selecting a balanced team and related issues. important Tasks for Starting a New Business. (4)

Market Research, identification of business opportunities, Identifying the products and/ or services, deciding on geographical location Market Feasibility study; technical, financial, and social feasibility study. (8)

Enterprise in project mode; identification, selection, project report need and significance; Project Appraisal Methods, (2)

UNIT-III

STARTINGA BUSINESS UNIT: Form of business organization, naming and registering/ incorporating a company, (4)

Raising funds, Sources of Fund, Raising loan fund, seed fund, equity capital, sources of grants/subsidies and margin money, loan restructuring and other concessions available to financially weak business units.Banking sources; Non-banking Institutions and Agencies. (8)

Establishing distribution network, branding and acquiring strategic assets, product pricing (2)

Critical Success and Failure Factors. Legal Issues of Business, Corporate Governance and Business Ethics. (4)

UNIT-IVs

MICRO, SMALL AND MEDIUM ENTERPRISES (MSMEs): Definition and Significance in Indian Economy; MSME Schemes, Challenges and Difficulties in availing MSME Schemes. (4)

ENTREPRENEURSHIP DEVELOPMENT AND GOVERNMENT: Role of Central Government and State Government in promoting Entrepreneurship - Introduction to various incentives, subsidies and grants - Export Oriented Units - Fiscal and Tax concessions available; Central/State agencies in the Entrepreneurship development. (6)

WOMEN ENTREPRENEURSHIP:

Concept of women entrepreneurship-Reasons for growth of woman entrepreneurship-Problems faced by them and remedial measures (2)

SOCIAL ENTREPRENEURSHIP: Definition, types, examples, issues. (2)

TEXT BOOKS

1. Khanka. S.S., "Entrepreneurial Development" Chand& Co. Ltd., Ram Nagar, New Delhi, 2013.
2. Donald F Kuratko, "Entrepreneurship-Theory, Process and Practice", 9th Edition, Cengage Learning, 2014.
3. Raj Shankar, "Entrepreneurship: Theory and Practice",Vijay Nicole imprints Ltd in collaboration with Tata McGraw Hill Publishing Co. Ltd., New Delhi, 2012.

REFERENCE BOOKS

1. Rajeev Roy, "Entrepreneurship" 2nd Edition, Oxford University Press, 2011.
2. Parana Chandra - Projects: Planning, Analysis, Selection, Financing, Implementation and Review – McGraw Hill, India – 2014(8th Edition) – ISBN: 9789332902572
3. Robert D Hirsch, Michael P Peters, Mathew Manimala and Dean A. Shepherd - "Entrepreneurship" –McGraw Hill, India – 2014 (9th Edition) – ISBN: 9789339205386

Project - II
18MEP02
IV Year B. Tech. (Mech) Eigth Semester

Lectures	0	Tutorial	0	Practical	12	Credits	10
Continuous Internal Assessment				Semester End Examination (3 Hours)			

The Project - II Report has to be submitted at the end of the semester and marks will be awarded based on the Viva-voce examination