HAND BOOK

of

CURRICULUM STRUCTURE AND SYLLABUS

Bachelor of Technology in Mechanical Engineering

(Programme Code: 3106)

Batch: 2019-23

Institute of Engineering and Technology

IQAC Documentation

Document Name: Handbook of Curriculum Structure and Syllabus, Bachelor of Technology in Mechanical Engineering (Programme Code: 3106) - Batch 2019-2023

Document Creation Date: Jan 24, 2022

Document Description: This document supplements the document titled Curriculum Structure: BTech, MTech and BCA Programs and is prepared by the Institute of Engineering and Technology (IET), JKLU to serve as an information baseline for further planning and delivery of courses w.r.t Bachelor of Technology in Mechanical Engineering (B.Tech ME), Batch 2019-23.

It includes Program Education Objectives, Programme Outcomes, Programme Specific Outcomes, Desired minimum level of competence for POs and PSOs, Curriculum Structure, collation of Semester wise Course Description, and Course Articulation Matrix (CAM) of each course (including electives and additional courses, if any, opted by students) prepared by respective faculty members. The document also includes Programme Articulation Matrix (PAM).

This document is in compliance with BoS (upto 13th meeting) and approvals of the Academic Council (upto 20th meeting).

Document Creation Team:

Dr Ravi Shankar Prasad

Ms Deepika Mishra

Quality Checked by:

Dr Devika Kataria

Dr Umesh Gupta

Approved by:

DIRECTOR-IQAC
JK LAKSHMIPAT UNIVERSITY
JAIPUR

JK LAKSHMIPAT UNIVERSITY ★ JAIPUR ★ IQAC

Vice Chancellor
JK Lakshmipat University
Jaipur-302026

CONTENTS

Program Education Objectives

The B.Tech and M.Tech. Programs at IET, JKLU are designed to prepare students for continued learning and successful careers. Our alumni are expected to:

PEO1: Apply their technical knowledge, complex problem solving and research skills in professional practice.

PEO2: Continue their intellectual development through critical thinking, self-study, apprenticeship, higher education, professional development courses, as well as participation in research groups and professional networks.

PEO3: Serve as ambassadors for engineering and sustainability by exhibiting high professional standards with a deep sense of civic responsibility.

PEO4: Effectively communicate about technical and related issues.

PEO5: Embrace roles of team members and leaders in their career.

Program Outcomes

"*Competence is a demonstrated ability to apply knowledge, skills and attributes for achieving desirable results."* The graduates of B.Tech. and M.Tech. Programs at IET, JKLU will have following competencies:

PO 1: Life-long learning*:* Demonstrate inquisitiveness, open mindedness, and the ability to engage in independent and life-long learning in the broadest context of technological, organizational, economic, and societal changes.

PO 2: Citizenship, Sustainability, and Professional ethics

PO 2a: Demonstrate knowledge of constitutional values of liberty, equity, justice, and fraternity with understanding of the impact of the engineering solutions in societal and environmental contexts as well as a sense of responsibility for sustainable development.

PO 2b: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, cultural, and environmental issues and the consequent responsibilities relevant to the professional engineering practice.

PO 2c: Demonstrate commitment for professional integrity and excellence and respect for ethics, responsibilities and norms as prescribed for the engineering practice.

PO 3: Engineering knowledge and Modern tool usage

PO 3a: Demonstrate clear conceptual understanding of fundamentals of engineering specialization and cognitive flexibility to appropriately 'transfer' what has been learned in a context, to different situations.

PO 3b: Apply engineering thinking, computational thinking, and the knowledge of mathematics, natural and social sciences, engineering fundamentals, information technology, engineering specialization, and engineering management to the solution of complex engineering problems.

PO 3c: Create, select, modify, and apply appropriate techniques, best practices, standards, resources, and modern engineering and IT tools including prediction and modelling to engineering and social activities with an understanding of the limitations.

PO 4: Complex problem solving, Design and Research

PO 4a: Identify, formulate, review research literature, and analyze complex engineering problems to arrive at substantiated conclusions using critical thinking along with principles of mathematics, computing, engineering as well as natural and social sciences.

PO 4b: Use systems thinking and reflection to identify and consider underlying structures, patterns, volatility, uncertainties, complexities, ambiguities, complications, and risks to design and develop engineering solutions for complex problems to meet the specified and anticipated needs with appropriate concern for constraints, performance, sustainability, and professional ethics.

PO 4c: Use research-based knowledge and research methods including design of experiments, simulation, analysis and interpretation of data, and synthesis of the information to evaluate and improve the engineering solutions and practice.

PO 5: Individual & team work and Engineering management

PO 5a: Ability to work effectively as an individual and as a team member or leader in diverse and distributed teams, and in multidisciplinary settings.

PO 5b: Ability to apply engineering management principles to one's own and team's work to manage engineering projects and operations and in multidisciplinary environment.

PO 6: Communication: Ability to communicate effectively on complex engineering and technology activities, situations, problems, and solutions using verbal, textual, and pictorial elements with the colleagues, engineering community, users, clients, policy makers, and society at large with intellectual honesty, clarity, empathy, and compassion.

PO 7: Innovation and entrepreneurship:

PO 7a: Demonstrate enthusiasm and understanding to identify opportunities and translate research in engineering and other disciplines to conceive and design innovative engineering solutions for business, industry, and societal problems.

PO 7b: Demonstrate enthusiasm and understanding to conceive and plan technology based new ventures either as independent start-up businesses or within existing corporate structures.

Program Specific Outcome

The Mechanical Engineering graduates of JKLU will be able to:

MEPSO1: PSO1. Conceive, design, implement and manage mechanical systems, components, and processes by using principles of machine design, production engineering, thermal engineering, computing, automation, sustainability and contemporary materials and tools.

MEPSO2: PSO2. Serve in fields of engineering services, manufacturing, automobile, energy, EPC and mechatronics.

Desired minimum level of competence for POs and PSOs

PO/PSO	Competence Level
PO 1	Competent
PO 2a	Novice
PO 2b	Novice/Advanced Beginner
PO 2c	Novice
PO 3a	Competent
PO 3b	Advanced Beginner
PO 3c	Advanced Beginner
PO 4a	Advanced Beginner
PO 4b	Advanced Beginner
PO 4c	Novice
PO 5a	Advanced Beginner
PO 5b	Advanced Beginner
PO 6	Advanced Beginner
PO 7a	Advanced Beginner
PO 7b	Novice
MEPSO 1	Competent
MEPSO 2	Competent

Following process has been adopted to create Course Articulation Matrix (CAM) and Program Articulation Matrix (PAM).

- Course Outcome of each Course is mapped to Program Outcome (PO) / Program Specific Outcome (PSO) using three Levels viz., Low Correlation (1), Moderate Correlation (2) and Substantial Correlation (3).
- Average of these Levels of each Course Outcome w.r.t each specific PO/PSO is calculated and it indicates expectations laid in a course to attain different PO/PSO. In order to avoid over commitment of a course w.r.t its contribution to POs/PSOs, the following validation check is applied on the sum of PO/PSO wise averages in each course.

$$\sum (\text{Average}) <= \text{Min}(\text{Credits} * \text{Year}, 15)$$

In above equation, Credits are the credits assigned to the course, Year indicates the level of the students from 1st to 4th year. In case this sum exceeds the upper limit, CO-PO mappings are revised. This check ensures that early or low credit courses are not over burdened with very high expectations.

- For creation of Program Articulation Matrix, sum of these averages of different courses w.r.t each PO/PSO is calculated and interpreted as per following Table.

Competence Level *	B.Tech
Novice	<8
Advanced Beginner	8 - 16
Competent	>=16

Novice* (N): Knows objective facts, features, and rules for determining actions w.r.t this PO/PSO without being context-sensitive. The student has studied the basic concepts.

Advanced beginner* (AB): Recognizes common situations w.r.t this PO/PSO that help in recalling which rules should be exercised, starts to recognize and handle situations not covered by given facts, features and rules. The student has problem-solving and repeated practice experience for common situations w.r.t. this PO/PSO.

Competent* (C): Performs most standard actions w.r.t PO/PSO without conscious application of rules after considering the whole situation. Handles new situations through the appropriate application of rules, can design systems, and may lead. Has demonstrated this PO/PSO through repeated engagements in advanced problem-solving, projects, extensive practice in common and exception situations, and participated in professional networks.

JK Lakshmipat University, Jaipur
Institute of Engineering and Technology
Curriculum Structure
Bachelor of Technology in Mechanical Engineering (Batch 2019-2023)

Sem	Courses							Credits
I	Computational Data Analysis ES1101 (10s 2 0) 10	Design and Prototyping ES1102 (6s 0 0) 6	Experimental Science-I AS1101 (1 0 4) 3	Fundamentals of Communication CC1101 (2 0 1) 2				**21**
II	Calculus and Applied Mechanics ES1103 (6s 2 0) 6	Fundamentals of Automation Engineering ES1104 (6s 2 0) 6	Object Oriented Programming CS1101 (1 0 4) 3	Energy and Environmental Studies ES1105 (1 0 0) 1	Scientific Perspectives AS1102 (2 0 0) 2	Critical Thinking and Storytelling CC1102 (2 0 1) 2		**20**
III	Materials Engineering ME1101 (3 0 2) 4	Computational Engineering Analysis-I ES1106 (3 1 2) 5	Engineering Measurements and Machines ES1107 (3 0 4) 5	Engineering Thermodynamics ME1102 (3 0 2) 4	Management Perspectives IL1101 (2 0 0) 2	Perspectives on Contemporary Issues CC1103 (2 0 1) 2		**22**
IV	Transport Phenomena ME1104 (3 0 2) 4	Strength of Material and Analysis ME1105 (3 0 2) 4	Computational Engineering Analysis-II ES1109 (3 1 2) 5	Production Technology-I ME1106 (3 0 2) 4	Mechanical Engineering CAD Lab ME1107 (0 0 4) 2	Introduction to Design IL1102 2	Communication and Identity CC1104 (2 0 1) 2	**23**
Practice School-I (PS1101) – (4 to 6 Weeks Duration) - 4 Credits								
V	Theory of Machines ME1108 (3 0 2) 4	Production Technology-II ME1109 (3 0 2) 4	Introduction to IoT EE1111 (1 0 2) 2	Automation Project PR1101 2	Understanding and Managing Conflict CC1105 (2 0 0) 2	DE-I* 4	OE-I* 4	**22**
VI	Design of Machine Elements ME1110 (3 0 2) 4	Automobile Engineering ME1111 (3 0 2) 4	Emerging Tech Week 2	Critical Thinking for Decisions at Workplace CC1106 (2 0 0) 2	DE-II* (3 0 2) 4	DE-III/ OE-II* 4		**20**
VII	Minor Project PR1103 4	DE-IV* 4	DE-V* 4	DE-VI* 4	OE-III* 4			**20**
VIII	Practice School-II /Entrepreneurial Project/Research Project/Semester at a partner University PS1102/PR1105/PR1104/ 16							**16**
	Total Credits							**168**

- Minimum required credit – 160
- A student can choose to drop DE/OE and still complete the minimum credit requirement of 160 for completion of B.Tech.
- Credits can vary for specific (*) courses.
- 5th semester course details have been changed as per curriculum booklet.

List of Electives	
Sem V	
DE-I	**OE-I**
Computer Integrated Manufacturing- ME1212	Urban and Regional Planning- CE1215
Ventilation and Air Conditioning	Introduction to User Experience- IL1204
	Idea to Business Model- ED1102
	Energy Management System
	Speech Processing
	Computer Architecture and Operating Systems
	Numerical Methods- AS1204
Sem VI	
Emerging Tech week	
Robotic Process Automation Lab-CS1125	
Geographical Information Systems Lab-CE1114	**OE-II**
DE-II, III	Electric Vehicle Technology- EE1220
Computer Aided Product Design and Manufacturing- ME1210	Green Energy- IL1202
Refrigeration and Air-Conditioning- ME1205	Mechatronics- ME1207
Contemporary Production Technology- ME1214	Modern Physics
	Introduction to Nano Technology
	Introduction to Quantum Computing
	Engineering Optimisation
	Integral Transforms
	Algorithm Design and Analysis- CS1126
	Virtualisation and Cloud computing- CS1127
	Disaster Management- CE1206
Sem VII	
DE-IV, V, VI (Tentative)	**OE-III (Tentative)**
IC Engine- ME1201	Geographical Information System- CE1214
Power Plant Engineering- ME1203	Operations Research- AS1201
Vehicle Aerodynamics- ME1213	Fintech in Retail Banking and Insurance- FA1151
Modelling of Engineering Materials- ME1209	Advanced Statistics- AS1202
Industrial Robotics- IL2203	
Mechanical Vibrations- ME1208	

NOTE:

1. For every credit, in each course, every student is expected to put in a total work of 35-36 hours including the class time. The specified teaching scheme is applicable if the course is taught as full semester course. However, sometimes, a few courses may actually be completed in a shorter duration by increasing the weekly contact hours.
2. Students have the option for earning additional Minor certification from ME in Computer Aided Design and Manufacturing (through electives/minor project, 16 Credits) or a Concentration in Automobile Design and Engineering or Automation and Robotics (through electives, 12 credits).
3. Learning outcomes focus on higher order thinking and practical skills. Rote learning is completely de-emphasized and assessment scheme includes several components like assignments, labs, projects, reports etc. The exams are designed to assess problem solving ability through questions focusing on analysis, synthesis, and evaluation.
4. Emerging Tech Week in the VI semester is a slot in which the actual course is decided flexibly. The course has to be in an emerging technology area. Students have the option to replace the course on Emerging Tech Week by a Department elective or Open elective.
5. Relevant engineering standards and sustainability issues are incorporated in all engineering courses.
6. Student can optionally take up to four Independent Study courses with 2 credits each to complete their credit requirement.
7. Students can optionally undergo additional summer internship of 2 credits each after first year and third year to complete their credit requirement.
8. A student may sometimes be allowed to take a few additional courses for earning extra credits, fulfilling credit deficiency or completion of academically equivalent core course requirements in special cases, e.g., lateral entry/transfer cases, semester exchange at partner universities, medical cases, student detention, backlog, etc.

ES1101: Computational Data Analysis

L T P: (10s 2 0) **Credits: 10**

Course Objective: This course introduces computational analysis of data based on Linear Algebra Principles and Statistics. The computational analysis will include learning and utilizing Python as a programming language.

Course Outcomes

After course completion, the student will be able to

ES1101.1. Write Simple Python programs using various datatypes, control structures, decision statements, libraries, functions (M1)

ES1101.2. Develop Python programs using Objects, Classes and Files (M1, M2)

ES1101.3. Develop Programs for analyzing and interpreting Complex situations in various domains including sustainable development by combining various Linear Algebra, Statistics and Other Problem-Solving Techniques (M3)

ES1101.4. Model Complex systems as Linear simultaneous equations and analyze the same using Matrix methods (M1)

ES1101.5. Model Data as matrices and Find Eigen Values and Eigen Vectors and Apply the same for problem solving, e.g., ranking and performance analysis (M1)

ES1101.6. Summarize and Visualize different datasets (M2)

ES1101.7. Analyze and interpret different datasets using Discrete and Continuous Probability Distributions and Apply the same for problem solving, e.g., Goodness of Fit (M2)

ES1101.8. Formulate and validate hypothesis with reference to different datasets (M2)

ES1101.9. Apply correlation, regression, least square method and time series analysis for modeling, analysis, interpretation and forecasting (M2)

Evaluation Scheme

Sr. No	Specifications	Weightage (in percentage)
01	Attendance	Nil
02	Assignment	15
03	Class Participation	Nil
04	Quiz	15
05	Theory Exam (Mid Term I)	Nil
06	Theory Exam (Mid Term II)	20
07	Theory Exam	Nil
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	30
13	Project -3	Nil
14	Lab Evaluation 1	10
15	Lab Evaluation 2	10
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus

Introduction to Algorithms, Hardware Overview, Python as a Tool, Installing Python and Writing a Program, Variables & Expressions, Decision Statements, How to Debug? Control Structures: Loops & Iterations, Linear Data Structure: String, List, Tuple, Data Dictionary and Set, Python Library (Pandas, Numpy, PyPlot), Functions, Classes & Objects, Working with Files

Matrix Operations, Eliminations, Matrix Inversion, Transformation, Solution of Linear, Simultaneous Equation, Eigen Values & Eigen Vectors, Linear Transformation, Linear Combination, Vector Spaces and Subspaces

Probability, Baye's Rule, Sampling, Data Processing and Pre-processing, Random Variable, Discrete & Continuous Distribution, Hypothesis Formulation, Test of Hypothesis, ANOVA, Correlation, Curve Fitting, Regression

Reference Books

1. Allen B. Downey. Think Python. Green Tea Press, Massachusetts, USA.
2. Kenneth Hoffman and Ray Kunze. Linear Algebra. PHI Learning Private Limited, 2nd Edition, 2012.
3. Gilbert Strang. Introduction to Linear Algebra. Wellesley-Cambridge Press, 4th edition, 2009.
4. Allen B. Downey. Think Stats. Green Tea Press, Massachusetts, USA.
5. Douglas C. Montgomery and George C. Runger, Applied Statistics and Probability for Engineers, John Wiley & Sons, Inc., 3rd Edition (2004).
6. Rishard A. Johnson, Miller and Freund's probability and Statistics for Engineers, PH

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO -1	PSO-2
ES1101.1																	
ES1101.2											1						
ES1101.3					1	1					1			1			
ES1101.4			1		1	1				1	1						
ES1101.5			1		1	1				1	1			1			
ES1101.6					1	1		1			1		2				
ES1101.7		1	1		1	1		1			1		1	1			
ES1101.8		1	1		2	1		2			1		1	1			
ES1101.9		1	1		2	1		2		1	1		1	1			

Course Title and Course Code	**Design and Prototyping (ES1102)**
Hours per Week	**L T P: 6s 0 0**
Credits	**6**
Students who can take	**B. Tech Semester-I (Batch: 2019-2023)**

Course Objective:

The students will be trained to analyze an unknown situation through critical thinking and formulate it into a known problem so that solutions can be found. Once solution found, student will be able to use engineering tools to convert a conceptual product into a real product.

Course Outcomes:

On successful completion of this course, the students should be able to:

ES1102.1. Approach design challenges from the perspective of the user and offer innovative solutions effectively.
ES1102.2. Communicate and work in team towards a common goal.
ES1102.3. Think creatively towards a fun based, desirable solution.
ES1102.4. Develop the projection views of the products with dimensions and scales.
ES1102.5. Create the schematic diagram and isometric view of the parts using AutoCAD.
ES1102.6. Fabricate prototype by combining the different parts.

Prerequisites		**Basics of Physics**
Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	30
3	Class Participation	NIL
4	Quiz	10
5	Theory Exam-I	NIL
6	Theory Exam-II	NIL
7	Theory Exam-III	NIL
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	50
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	NIL
16	Course Portfolio	NIL
Total (100)		**100**

Evaluation scheme for Re-evaluation Semester II

Sr. No	**Specifications**	**Marks**
1	Project	50
Total		**50**

Syllabus of Design Thinking & Prototyping

Empathy:

Design thinking is a user-centered design process, and the empathy that comes from observing users enables design thinkers to uncover deep and meaningful needs (both overt & latent). Empathy, by definition, is the intellectual identification with or vicarious experiencing of the feelings, thoughts or attitudes of another. Three main techniques are used to gain empathy: interviewing, observation, immersion. The goal of the empathy mode is to discover gaps in between what people do and what people say they do. These gaps are the design opportunities.

a. User Experience (On ground experience)
b. Market Research
c. Benchmarking, Competitor or Comparative Study
d. Personal Experience (of the Designer)

e. Analysis
f. Revisiting the brief, make amendments (if brief is given by the client)

Define:

The Define mode is seen as a 'narrowing' part of the process. After collecting volumes of user information, it is time to distill down to one specific user group, their need and the insight behind that need so as to unify and inspire a team. The goal of this mode is to come up with at least one actionable problem statement (often referred to as Point of View (POV)) that focuses on the insights that you uncovered from real users**.**

a. How to create a brief
b. Setting parameters
c. Ideate

Ideation is the process of idea generation. Mentally it represents a process of "going broad" in terms of concepts and outcomes. Ideation provides the fuel for building prototypes and driving innovative solutions.

a. Brain storming
b. Mood Board and Theme Development
c. Concept Sketches(doodling) and Design Proposals
d. Final Sketches and Blueprints
e. Logistics, Material and Production feasibility check
f. Prototyping or Mock-up models

Prototyping is the iterative development of artifacts – digital, physical, or experiential – intended to elicit qualitative or quantitative feedback. The act of prototyping implies "building", testing, and iterating and is, itself, both a flaring and a narrowing process. The flaring represents the proliferation of low-resolution prototypes developed as different aspects of the prototype are evaluated. The narrowing represents the refinement of the lower resolution models into increasingly complex and resolved models based on feedback, which leads to an even better understanding of the user's needs.

a. Small and quick working models
b. Scale 1:1 working prototypes.
c. Product Testing, User Testing & Iterations and Changes

The test mode is another iterative mode in which we place our low-resolution artifacts in the appropriate context of the user's life. In regard to a team's solution, we should always prototype as if we know we're right, but test as if we know we're wrong— testing is the chance to refine our solutions and make them better.

a. Testing the product on field
b. Making relevant changes

Syllabus of Engineering Drawing,

Introduction to Engineering Drawing, Orthographic Projections

Principles of Engineering Graphics and their significance, usage of Drawing instruments, lettering, Scales – Plain and Diagonal Scales. Angle of projection.

Projection of line.

Projection of points. Projection of straight lines (only First angle projections) inclined to both the principal planes. Determination of true lengths and true inclinations by rotating line method and traces.

Projections of plane

Projection of planes (polygonal and circular surfaces) inclined to both the principal planes by rotating object method.

Projections of regular solid.

Projection of simple solids like prisms, pyramids, cylinder, cone and truncated solids when the axis is inclined to one of the principal planes by rotating object method and auxiliary plane method.

Sections of Regular Solids

Sectioning of above solids in simple vertical position when the cutting plane is inclined to the one of the principal planes and perpendicular to the other – obtaining true shape of section. Development

of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

Development of surface

Development of lateral surfaces of simple and sectioned solids – Prisms, pyramids cylinders and cones. Development of lateral surfaces of solids with cut-outs and holes

Isometric Projections

Principles of isometric projection – isometric scale –Isometric projections of simple solids and truncated solids - Prisms, pyramids, cylinders, cones- combination of two solid objects in simple vertical positions and miscellaneous problems. Perspective projection of simple solids-Prisms, pyramids and cylinders by visual ray method.

Syllabus of AutoCAD Lab

1. Introduction to Autocad software basic Sketch tool.
2. Advance sketch tool.
3. Editing tool.
4. Dimensioning.
5. Hatching, Layers, and block.
6. 3D Design in AutoCAD.

Syllabus of Workshop Practice

Carpentry, Welding, foundry, sheet metal work, fitting, 3D printing.

Text books.

1. K.C John, "Textbook of Machine Drawing", Phi Learning Pvt. Ltd. New Delhi, 2010
2. N.D Bhatt, "Elementary Engineering Drawing", Charotar Publishing House.
3. Vishnu P. Singh, "AUTOCAD 2019", ASIAN (2018).
4. Choudhury H S K, "Elements of Workshop Technology Vol-1", MPP pvt. Ltd.
5. SK Hajra Choudhury, Nirjhar Roy, Elements of Workshop Technology, Vol-II: Machine Tools, 15th Edition, Media Promotors & Publishers Pvt Ltd.

Reference books:

1. P.S Gill, "Engineering Drawing", S.K. Kataria & Sons.
2. Rajendra Singh, "Introduction to Basic Manufacturing Process & Workshop Technology", New Age International.
3. W.A.J. Chapman, "Workshop Technology Part 1, May 6th 2016" by Routledge.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1102.1	2	1	1	1										2			
ES1102.2											1	1	1				
ES1102.3	2				2	1	1	1						2			
ES1102.4					1	1	1										
ES1102.5	1				2	1	1										
ES1102.6	2				2	1	1				1	1	1				

Course Title and Code: Experimental Science-I: AS1101

Hours per Week **L-T-P: 1-0-4**

Credits **3**

Course Objectives:

This course is designed to familiarize the student with the fundamental concepts of different phenomenon related with optics, electrical & electronics, modern physics, properties of water and lubricants. This course will expose the students with experimental methods of physics, chemistry and integrates theoretical knowledge and concepts to practical experience.

Course Outcomes:

On successful completion of this course, the students will be able to:

AS1101.1. analyze ferromagnetic properties of any magnetic material and differentiate Soft and hard materials.

AS1101.2. analyze thermoelectric effect of metal junctions due to temperature differences.

AS1101.3. analyze nuclear radiation with respect to distance and thickness of absorbing media.

AS1101.4. measure electrical properties e.g., specific resistance, time constant of various electrical components.

AS1101.5. use Schroedinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials.

AS1101.6. differentiate hard and soft water by determining its hardness of different water samples.

AS1101.7. analyze conductivity of samples by different techniques such as volumetric titrations and conductometric.

AS1101.8. determine properties of the lubricant/oil samples by Pensky-Martens and Red Viscometer.

Prerequisites **Knowledge of Basic Science**

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	5
03	Class Participation	5
04	Quiz	10
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	20
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	10
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation-1 (Continuous)	20
15	Lab Evaluation-2 (Exam)	30
16	Course portfolio	Nil
	Total (100)	**100**

Syllabus:

Electromagnetism, B-H Curve, Thermo-emf, Nuclear radiation detection, Linear air track, charging discharging of capacitors, Conversion of galvanometer into ammeter/voltmeter, Specific and high resistance determination, Concept of quantum mechanics, Schrodinger equation and quantum mechanical approach to analyze behavior of the quantum particle under different potentials, Water analysis for hardness, PH, Alkalinity, oxygen & chloride content, conductometric titrations, Viscosity of lubricant oil, Science of solids.

Text Books:

1. Dattu R Joshi, “Engineering Physics”, Tata McGraw Hill Education Pvt. Ltd. New Delhi, I edn. 2010.
2. Neeraj Mehta, “Applied Physics for Engineers”, PHI, I edn. 2011.
3. Jain & Jain, “Engineering chemistry”, Dhanpat Rai Publication, Delhi, 16 edn. 2014.
4. Lab Manuals

Reference Books:

1. Arther Beiser, “Concept of Modern Physics” Tata McGraw-Hill, New Delhi, 5th edn. 1997.
2. Eyvind H Wichman, “Quantum Physics” Tata McGraw Hill, Volume 4.
3. B.K. Pandey, S. Chaturvedi, “Engineering Physics”, Cengage Learning, 2012.
4. D.K. Bhattacharya, Poonam Tondon, “Engineering Physics”, Oxford University Press, 2015.
5. O.G. Palana, “Engineering Chemistry”, Tata McGraw Hill, 2009.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO -1	PSO -2
AS1101.1	1				1									1			
AS1101.2	1																
AS1101.3	1										1						
AS1101.4	1				1						1						
AS1101.5	1																
AS1101.6	1		1		1	1	1				1		1		1		
AS1101.7	1		1				1				1		1				
AS1101.8	1																

Course Title –Fundamentals of Communication Course Code- CC1101
Credits 2 (2-0-1)
Course Objective
This course provides an introduction to the importance of effective communication, the consequences of poor communication, and the different elements of verbal and non-verbal communication. Students learn about, and enhance, the components of communication: kinesics, paralanguage (voice) and language.

Course Outcomes
The students will be able to:
CC1101.1. Identify different cultural differences and their impact on communication.
CC1101.2. Compose grammatically correct sentences and paragraphs.
CC1101.3. Deliver effective oral presentations following appropriate kinesics and paralinguistic features.
CC1101.4. Identify impact of cultural differences on communication.
CC1101.5. Apply appropriate communication skills across settings, purposes, and audiences.
Evaluation Scheme:

Sr. No	**Specifications**	**Weightage (in percentage)**
01	Attendance	Nil
02	**Assignments**	**30**
03	**Class Participation**	**10**
04	**Quiz**	**20**
05	Theory Exam I	Nil
06	**Theory Exam II**	**20**
07	**Theory Exam III**	**20**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil
13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Topics to be Covered
1. **Nature and importance of communication**
2. **Mehrabian's Communication Theory**
3. **Ethos, Pathos, Logos: The three pillars of persuasive communication**
4. **English as a Foreign Language**
5. **Consequences of poor communication**
6. **Writing Strategy**
7. **Basic of Effective Presentation**
8. **Influence of culture on communication**
9. **Formats of Public speaking (oral narration, conversational skills)**
10. **Common Errors in English**

SUGGESTED READINGS:
(i) Raman, Meenakshi and Sangeeta Sharma, 2011. Technical Communication: Principles and Practice. Second Edition. New Delhi: Oxford University Press.
(ii) Mohan, Krishna and Meenakshi Raman. 2010. Advanced Communicative English. New Delhi: Tata McGraw Hill.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1101.1									1		1		1				
CC1101.2																	
CC1101.3	1										1						
CC1101.4																	
CC1101.5	1										1		1				

Course Title and Code Calculus and Applied Mechanics ES1103
Hours per Week **L-T-P: 6-2-0**
Credits **6**
Students who can take **B. Tech Semester-II (Compulsory)**

Course Objective:

This course introduces the basic elements of calculus and mechanics through some engineering projects. The application of multivariable calculus in civil and mechanical engineering is also highlighted. This course will equip students with essential domain knowledge of calculus and applied mechanics in solving basic engineering problems.

Course Outcomes:

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

ES1103.1. apply analytical techniques to determine forces in structures
ES1103.2. use commercial software (STAAD Pro.) to simulate a structure/frame and determine force in the members
ES1103.3. model physical phenomena using calculus and solve using appropriate method
ES1103.4. apply Newton's laws of motion and understand the concepts of dynamics concepts (force, momentum, work and energy)
ES1103.5. interpret the geometrical significance of differential and integral calculus
ES1103.6. solve problems of vector differentiation and integration
ES1103.7. calculate the buoyant forces of objects with various shape and carryout the stability analysis
ES1103.8. apply the concept of partial differentiation to solve optimization problems

Evaluation Scheme:

Sr. No	**Specifications**	**Marks**
1	Attendance	--
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	30
8	Report-I	--
9	Report-II	--
10	Report-III	--
11	Project-I	15
12	Project-II	15
13	Project-III	--
14	Lab Evaluation-I	--
15	Lab Evaluation-II	--
16	Course Portfolio	--
	Total (100)	**100**
Provision of retest		
1	Theory Exam-III	**30**

Syllabus:

Vectors Algebra: basics of vector algebra, resultant vector, Application of vector equilibrium on structures.

Force systems basic concepts, equilibrium of system of forces, free body diagrams, equations of equilibrium of coplanar systems, structures (trusses), analysis of structures, method of joints, method of section, friction, virtual work, work energy principle, impulse-momentum (linear, angular).

Function of several variables, functions of one and several variables, partial differentiation, maxima-minima.
Vector Differentiation: Vector functions and derivatives, Arc length and unit tangent vector, Curvature and unit normal vector, Directional derivative and gradient vectors, Tangent plane, Divergence and curl of a vector field
Integral Calculus, area under curve, arc length, double integral, change of order and triple integrals, surface and volume integrals, solids of revolution, moment of inertia, floatation, buoyancy, centroid
Vector Integration: Line integral, flux, work done, circulation, path independence, potential function and conservative fields, Surface area and surface integral, Green's theorem in the plane, Stoke's theorem, Divergence theorem.

Text Books:

1. M.D. Weir and J. Hass, Thomas, Calculus, Pearson, India, 2016.
2. R.C Hibbeler, Engineering Mechanics, Pearson India, 2010.

Reference Books:

1. Goldstein et. al., Calculus and Its Applications, Pearson, India, 2018.
2. SS Bhavikatti, Engineering Mechanics, New Age International Publishers, 2019.
3. Beer and Johnston, Vector mechanics for engineers, McGraw Hill Education, 2009.
4. S Timoshenko, Engineering Mechanics, McGraw Hill Education, 2017.
5. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley, India, 2013.
6. Srimanta Pal and Subodh C. Bhunia, Engineering Mathematics, Oxford University Press, New Delhi, India, 2015.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1103.1						2					1		2				
ES1103.2						2	2				1						
ES1103.3	1				1	2	2		1		2		1				
ES1103.4	2				1	2	2				1						
ES1103.5	1				1	2	2										
ES1103.6						1	1										
ES1103.7						1	1		1		1		2				
ES1103.8						2	1				1		1				

Course Name: Fundamentals of Automation Engineering (ES1104)
Credit: 6; Design Studio – 6 Hrs/week; Tutorial Hours - 2 Hrs/week

Course Objective: This course aims at building key technical competencies needed by automation engineers.

Course Outcomes

On successful completion of this course, the students should be able to:

ES1104.1. Analyze electrical circuits using network theorems
ES1104.2. Measure electrical parameters of passive as well as active electrical components
ES1104.3. Design rectifier circuit using semiconductor devices.
ES1104.4. Design filters for power conditioning.
ES1104.5. Design and test a linear power supply for given specifications
ES1104.6. Design and build Printed Circuit Boards.
ES1104.7. Use electrical safety practices while working on electrical projects.
ES1104.8. Formulate mathematical models for basic mechanical, electro-mechanical and fluid systems.
ES1104.9. Design and simulate open-loop control system.
ES1104.10. Evaluate and simplify Boolean functions and design the minimized logic using logic gates.
ES1104.11. Design basic combinational and sequential circuits with minimum complexity
ES1104.12. Implement combinational circuit using simulation tools.

Evaluation Scheme

Sr. No	**Specifications**	Regular student(s)
01	Attendance	Nil
02	Assignment (03)	10
03	Class Participation & Attendance	Nil
04	Quizzes	10
05	Theory Exam I	10
06	Theory Exam II	10
07	Theory Exam III	20
08	Report -I	Included with Project 1
09	Report-II	Included with Project 2
10	Report-III	Included with Project 3
11	Project -I	10
12	Project -II	10
13	Project -III	10
14	Lab Evaluation I (End Term)	10
15	Lab Evaluation II	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Evaluation scheme for retest.		
1	Theory Exam III	20
2	Lab Evaluation (End Term)	10
	Total (30)	**30**

Unit 1 Introduction to Electrical Engineering – U1

1) Analyze electrical circuits using network theorems
2) Measure electrical parameters of passive as well as active electrical components

3) Design rectifier circuit using semiconductor devices.
4) Design filters for power conditioning.
5) Design and build Printed Circuit Boards.
6) Use electrical safety practices while working on electrical projects.

Unit 2 Introduction to Automation Engineering and Control Systems – U2

1) Design and implement open-loop control system
2) Formulate mathematical models for basic mechanical, electro-mechanical and fluid systems
3) Conduct analysis of dynamic control system.
4) identify the need for feedback in control systems

Unit 3 Introduction to Digital Circuits and Embedded Systems – U3
1) Evaluate and simplify Boolean functions and design the minimized logic using logic gates.
2) Design basic combinational and sequential circuits with minimum complexity
3) Implement various logic functions using software programming with micro controller, to make optimal utilization of resources.
4) Identify the key features of embedded systems in terms of hardware and software
5) Interface sensors and design low power embedded systems projects using microcontroller

Professional Skills
Collaboration, Leadership, Team-work, Social Responsibility.

Teaching Scheme and Credits

Hrs. per Week		Credits	Duration in Weeks
In Class	Out Class	6	6
6 (L) + 2 (T)	4		

Expectations from the Students:
1. To be punctual at sessions and be interactive during discussions
2. To strictly follow safety rules while working on electrical circuits, handle the sophisticated equipment with care and neatly place the tools and equipment in safe place.
3. To dedicate 4-6 hours a week for this course (for self-study and assignments)
4. To demonstrate teamwork by contributing to the overall success of the project.
5. To seek prior concern from instructor(s) is required for absentees.
6. Academic integrity is expected from students.

Expectations from the Faculty Members:
1. To assess student progress by continuous evaluation and provide feedback to students on their performance, fortnightly.
2. To help students to update on latest automation technology used in industry and develop new project ideas.
3. To guide students to work safely and systematically for projects.

Course Feedback: Online Every Fortnight

Project Evaluation Components –

Design of circuit	Skills demonstrated	Time Mgmt.	Sophistication/ neatness in work	Presentation	
				Presentation Skills	Viva
(20%)	(20%)	(10%)	(20%)	(20%)	(10%)

Syllabus: Element of DC network and circuits, Application of network Theorems, Concept of Phasors and power factor calculations. Single phase and three phase wiring and balancing of loads. Semiconductor devices and Rectifier circuit, Transformers and power supply. Safety in handling Electrical equipment.

Introduction to control system: open and closed loops. Block diagrams, Electro-Mechanical models. Simulation for dynamic model of a control system.

Digital circuits for automation: Boolean Algebra, Karnaugh map, Logic gates, Combinational and Sequential Circuits, Displays, Sensors and Microcontrollers for automation: Working principle of sensors. Architecture of ATMega328 (concepts on ALU, memory, ports). Applications on sensors interfacing with microcontroller.

Projects: The course involves three modules which ultimately lead to common goal of developing a dynamic model for cycles developed in course Design and Prototype.

Project 1: Power supply (Specifications:)
Domain Knowledge: AC and DC current, circuit theory, semiconductor pn junction, regulators, filters.

Project 2: Dynamic system modelling for cycle
Domain Knowledge: Control Systems, Dynamic models, Simulation.

Project 3: Digital tachometer for cycle
Domain Knowledge: Digital Logic, developing software for logical functions using microcontrollers.

Text Books:

- WH Hayt, J E Kemmerly, SM Durbin, Engineering Circuit Analysis, Eight Edition, 2013, Mc. Graw Hill, ISBN 978-0-07-352957-8.
- M. Morris Mano, Digital Logic and Computer Design, 1st Edition, 2016, Pearson India Publication, ISBN: 9789332542525.
- S Palani, Control Systems Engineering, 2nd edition,2 August, Mc. Graw Hill Education, ISBN-10: 0070671931.

Reference Books:

- C. L. Wadhwa, "Basic Electrical Engineering", New Age Int. (P) Limited, Publishers, ISBN: 9788122421521.
- Dhananjay Gadre and Nehul Malhotra, Tiny AVR Microcontroller Projects for the Evil Genius, Tata Mc Graw Hill Edition, ISBN: 9780071744546.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1104.1					2			1									
ES1104.2						2								1			
ES1104.3					1			1									
ES1104.4					2							1		1			
ES1104.5					1							1		1			
ES1104.6							1		1			1		1			
ES1104.7	2						2						1				
ES1104.8	2				2			2						2			
ES1104.9					1							1		1			
ES1104.10																	
ES1104.11	2				2							1					
ES1104.12						2			2			1	1	1			

Course Name: Object Oriented Programming **Course Code: CS1101**
L-T-P: 1-0-4 **Credits: 3**

Course Objective: This course teaches object-oriented programming to those who have learnt basic programming concepts and are ready to learn in-depth programming. It focuses on object-oriented programming using JAVA. The main concepts are: Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, Interfaces, Exception Handling, and Database Connectivity. This course also covers basic concepts for software design and reuse.

Course Outcomes:
On successful completion of this course, the students should be able to:

CS1101.1. Develop Java Programs with the concepts of primitive data types, strings and arrays.
CS1101.2. Develop Java Programs using Object Oriented Programming Principles such as Classes, Objects, Data Abstraction, Data Encapsulation, Overloading, Overriding, Polymorphism, Inheritance, and Interfaces.
CS1101.3. Design, develop and debug programs in Core Java using coding and documentation standards.
CS1101.4. Incorporate exception handling in Java Programs.
CS1101.5. Use JDBC API connectivity in between Java Programs and database.

Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	25
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	10
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
	Total (100)	**100**
Evaluation Scheme for Retest		
	Theory Exam-III	25
	Lab Evaluation-II	10
	Total	**35**

Basics of Java & Decision Statements - Introduction to Java**:** Features of Java, Byte Code and JVM, JDK, JRE; Data types and Operators: Lexical Tokens, Identifiers, Keywords, Literals, Comments, Primitive Datatypes, ADT, Operator types and precedence, Statements and Flow Control: Conditional statements, looping, return, etc., Abstract data types and their specification. How to implement an ADT. Concrete state space, concrete invariant, abstraction function.
Control Structures, Methods & Constructors - Object Oriented Programming in Java: Object Life time & Garbage Collection.
Methods & Constructors - Constructor & initialization code block, Parameterized Constructor, Loops, Methods.

Array & String - Defining an Array, Initializing & Accessing Array, Multi –Dimensional Array, Operation on String, Mutable & Immutable String, Collection Bases Loop for String, tokenizing a String, Creating Strings using StringBuffer.
OOP's Concept I - Class Fundamentals, Object & Object reference, Access Control, Modifiers, Methods in Java: Method Declarations, Method Signatures, Invoking Methods,
OOP's Concept II - Static vs. Instance Data Fields, Static vs. Instance Methods, Method Overloading, Encapsulation.
Inheritance, Composition, and Aggregation, Invoking Base Class Constructors, Overriding vs. Overloading, Polymorphism Overloading.
Interfaces - Inner Class & Anonymous Classes, Abstract Class, Interface**s.**
Exception Handling - Introduction to Exception handling.
JDBC Programming - The JDBC Connectivity Model, Database Programming: Connecting to the Database, Creating a SQL Query, Getting the Results, and Updating Database Data.
NOTE: ***Integrated Development Environments (IDEs) to be used in this Course are Eclipse or NetBeans – Both are compatible for Object Oriented Programming using Java.***

References

- Liang, Y. Daniel. Introduction to Java programming: comprehensive version. Pearson Education, 2018.
- Horstmann, Cay S., and Gary Cornell. Core Java 2: Volume I, Fundamentals. Pearson Education, 2016.
- Schildt Herbert. The Complete Reference, Java 2, Fourth Edition. TMH, 2017.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CS1101.1					1	1	1							1			
CS1101.2																	
CS1101.3					1	1					1	1		1			
CS1101.4																	
CS1101.5											1	1					

Course Title and Code Energy and Environment Studies ES1105

Hours per Week	**L-T-P: 1-0-0**
Credits	**1**
Students who can take	**B. Tech Semester-II (Compulsory)**

Course Objective:
To enhance the understanding of conventional and non-conventional energy sources and its relationship with the ecology and environment.

Course Outcomes:
On successful completion of this course, the student should be able to:
ES1105.1. Relate renewable energy with ecology & environment
ES1105.2. Explain the climate change and threat to biodiversity
ES1105.3. Describe the various pollution sources and their impacts on Environment

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	10
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	20
8	Report-I	20
9	Report-II	20
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for retest		
1	Theory Exam III	30

Syllabus (Theory):
Unit-1: Present Energy resources in India and its sustainability, Energy Demand Scenario in India- Advantage and Disadvantage of conventional Power Plants – Conventional vs non-conventional power generation.
Unit-2: Basics of Solar Energy, Wind energy- Environmental benefits and impacts, Biomass resources- Bioenergy, Geothermal Energy.
Unit-3: Understanding environment, global crisis, Basic Concepts Forest and Grassland ecosystems, Desert Ecosystems, Aquatic Ecosystems Introduction to Biodiversity, Biodiversity Conservation.
Unit-4: Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Greenhouse gases – effect, Global Warming, Acid Rain, and Ozone Depletion, Water Pollution-Sources and impacts, Noise pollution, Soil pollution, Pollution aspects of various power plants.

Reference:

- Rajagopalan, R., "Environmental Studies: From Crisis to Cure", Oxford University Press, New Delhi, 2e, 2011
- Ranjit Daniels & J. Krishnaswamy "Environmental Studies", Wiley India
- Davis & Cornwell "Environmental Engineering", McGraw Hill
- Gilbert M. Masters and Wendell P. ELA – Introduction to Environmental Engineering and Science
- W. Cunningham – Principles of Environmental Science, TMH
- P. Venugoplan Rao – Principles of Environmental Science and Engineering, PHI.
- Meenakshi – Environmental Science and Engineering, Prentice Hall India.
- Martin – Ethics in Engineering, TMH

Video Lectures:

- http://www.nptelvideos.in/2012/12/fundamentals-of-environmental-pollution.html
- http://www.nptelvideos.in/2012/11/energy-resources-and-technology.html
- https://nptel.ac.in/courses/122/102/122102006/
- https://nptel.ac.in/courses/127106004/

Websites (related to the course)

- http://www.cpcb.nic.in/
- http://www.rpcb.rajasthan.gov.in
- http://www.bis.org.in/
- http://www.who.int/en/
- http://www.moef.gov.in/

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
ES1105.1	1					1											
ES1105.2		1									1						
ES1105.3	1				1												

Course Title and Code Critical Thinking and Storytelling CC1102

Hours per Week **L T P: 2 1 0**

Credits **2**

Students who can take **B. Tech Semester-II (Compulsory)**

Course Objective:

The modern world offers confounding opinions and choices that need to be navigated judiciously. This course explores frameworks and processes to critically examine narratives, reconstruct them, and craft well-reasoned stories that can be told using impactful communication.

Course Outcomes:

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

CC1102.1. Formulate intelligent questions to investigate.

CC1102.2. Evaluate information and argument for correctness, consistency, relevance and validity.

CC1102.3. Compose well-structured and well-reasoned arguments.

CC1102.4. Articulate and evaluate the impact of narratives.

CC1102.5. Distinguish between facts, assumptions and opinion.

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	30
3	Class Participation	20
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	30 (10% weightage to MOOC course)
8	Report-I	20
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for retest		
1	Theory Exam III	30

Syllabus:

Introduction to Critical Thinking- Definitions of Critical Thinking, its applications and the methods to think critically. Paul & Elder model will be used.

Importance of questioning-The key to critical thinking is the ability to formulate intelligent questions. Students will be able to create, improve and prioritize their questions. They will be able to use different types of question by using Bloom's taxonomy to understand the root of any situation, problem or subject.

Examine data Critically-Students will be able to filter information, separate fact from opinion, identify cognitive biases and become aware of the ladder of inference. They will also be taught to conduct responsible research and basics of bibliography and citation.

Construct and reconstruct argument- Students will be taught to construct arguments with sound reasoning. They will be able to support their claims and opinions with compelling data and facts, and present well-informed arguments. Evaluate argument using logical fallacies.

Building a compelling Narrative- Stories that we create and narrate influence how we see ourselves and our association with others. The students will be able to observe, think, create and narrate their stories in an effective manner.

Text and Reference Books:

- Fisher, A. (2011). Critical thinking: An introduction. Cambridge University Press.
- Fisher, A., & Scriven, M. (1997). Critical Thinking. Its definition and evaluation.
- Dobelli, R. (2013). The art of thinking clearly: better thinking, better decisions. Hachette UK.
- Budden, L. (2007). Critical Thinking Skills: Developing Effective Analysis and Argument. Contemporary Nurse, 25(1-2), 174-175.
- Butterworth, J., & Thwaites, G. (2013). Thinking skills: Critical thinking and problem solving. Cambridge University Press.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1102.1			1					1									
CC1102.2			1			1							1				
CC1102.3											1						
CC1102.4													1				
CC1102.5													1				

Course Title and Code: Scientific Perspectives AS1102

Hours per Week **L-T-P: One week**

Credits **2**

Course Objective: This course aims to develop scientific temper in students and also improve their understanding of basic science fundamentals and their applications in industry and research.

Course Outcomes:

After course completion, the student will be able to:

AS1102.1. Distinguish between science, pseudo-science and other forms of knowledge.

AS1102.2. Distinguish between science, engineering, technology and mathematics and also identify the opportunities for integrating these disciplines.

AS1102.3. Use the scientific approach to identify and understand the societal problems

AS1102.4. Explain, Design and carry out Scientific studies

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	10
4	Quiz	20
5	Theory Exam-I	Nil
6	Theory Exam-II	30
7	Theory Exam-III	Nil
8	Report-I (poster)	25
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Contus.)	Nil
15	Lab Evaluation-II (exam)	15
16	Course Portfolio	Nil
	Total (100)	**100**

Evaluation Scheme for Retest		
Sr. No	**Specifications**	**Marks**
1	Theory Exam-II	30

Syllabus

The philosophical aspects of scientific activity, Introduction to the Philosophy of Science, What is a "scientific theory"? The structure of a scientific theory, the methodology used to obtain scientific knowledge, Requirements to achieve scientific results, Methodology of experiment in engineering studies, the purpose and structure of the experiment, Planning, Analysis of the results, some selected seminal scientific studies.

Reference Books:

- The Scientific Approach: Basic Principles of the Scientific Method by Carlo L. Lastrucci, Schenkman Publishing, 1963
- Trends in Bibliometrics and Scientometrics Studies by Praveen Kumar Jain, Jean-Charles Lamirel, Parveen Babbar, Athena Academic, 2017
- The Evaluation of Research by Scientometric Indicators by Peter Vinkler, Chandos Publishing
- John Stuart Mill's Philosophy of Scientific Method by John Stuart Mill; Ernest Nagel Hafner Press, 1950
- Logic, Inductive and Deductive: An Introduction to Scientific Method by Adam Leroy Jones Henry Holt, 1909
- The Path of Science by C. E. Kenneth Mees; John R. Baker John Wiley & Sons, 1946
- The Logic of Scientific Discovery by Karl R. Popper Basic Books, 1959
- Failure: Why Science Is So Successful by Stuart Firestein Oxford University Press, 2016

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
AS1102.1	1												1				
AS1102.2					1	1											
AS1102.3		1			1												
AS1102.4	1												1				

Course Title and Course Code	**MATERIALS ENGINEERING (ME1101)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-III (Batch: 2018-2022)**

Course Objective:

The main objective of the course is to impart knowledge of materials engineering so that students can able to identify crystal structure, crystal defects, select suitable material for application based components, and control their mechanical properties.

Course Outcomes:

On successful completion of this course, the students will be able to:

ME1101.1: Identify crystal structure, crystal defects and perform various mechanical tests as per ASTM standards to know properties of materials.

ME1101.2: Evaluate materials on the basis of their static and dynamic failure criteria as per ASTM standards.

ME1101.3: Perform various heat treatment processes to hold required mechanical properties in ferrous alloys.

ME1101.4: Prioritize other ferrous and non-ferrous alloys for various applications.

Prerequisites		**Basics of Physics**
Sr. No	**Specifications**	**Marks**
1	Attendance	5
2	Assignment	10
3	Class Participation	NIL
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	20
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
Total (100)		**100**

COURSE SYLLABUS (Theory):

UNIT - I

Crystal Structure: Unit cells, Metallic crystal structures, Ceramics.

Imperfection in Solids: Point, line, interfacial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress. **(6)**

Mechanical Property Measurement: Tensile, compression and torsion tests; Young's modulus, relations between true and engineering stress-strain curves, generalized Hooke's law, yielding and yield strength, ductility, resilience, toughness and elastic recovery;
Hardness: Rockwell, Brinell and Vickers and their relation to strength. **(6)**

UNIT - II
Static failure theories: Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normal stress, Mohr-Coulomb and Modified Mohr-Coulomb;
Fracture mechanics: Introduction to Stress-intensity factor approach and Griffith criterion.
Fatigue failure: High cycle fatigue, Stress-life approach, SN curve, endurance and fatigue limits, effects of mean stress using the Modified Goodman diagram; Fracture with fatigue, Introduction to nondestructive testing (NDT) **(8)**

UNIT - III
Phase Diagram: Alloys, substitutional and interstitial solid solutions- Phase diagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron Iron-carbide phase diagram and microstrctural aspects of ledeburite, austenite, ferrite and cementite, cast iron. **(6)**
Heat treatment of Steel: Annealing, tempering, normalising and spheroidising, isothermal transformation diagrams for Fe-C alloys and microstructure development. Continuous cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, vacuum and plasma hardening. **(6)**

UNIT - IV
Ferrous and Non Ferrous Alloys: Alloying of steel, properties of stainless steel and tool steels, maraging steels- cast irons; grey, white, malleable and spheroidal cast irons- copper and copper alloys; brass, bronze and cupro-nickel; Aluminium and Al-Cu – Mg alloys- Nickel based super-alloys and Titanium alloys **(8)**

COURSE SYLLABUS (Practical):

1. To evaluate microstructure of various metallic materials and prepare a comparative report.
2. To perform Tensile Test and know the tensile properties of the metallic materials
3. To perform Impact Test and know about the toughness of the metallic materials
4. To perform Hardness Test and know about the hardness value of the metallic materials
5. To perform Torsion Test on the metallic materials and calculate torsional rigidity of the materials.
6. To perform Fatigue Test on the metallic materials
7. To perform Compression Test on the metallic materials
8. To perform and compare various Heat Treatment (Anealing, Normalizing, Quenching) cycles.
9. To perform Heat Treatment cycle to understand Case Hardening.
10. Study of various ferrous and non-ferrous materials
11. Effect of strain rate on various properties of materials

Text Books:

1. W. D. Callister, 2006, "Materials Science and Engineering-An Introduction", 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.

3. V. Raghavan, “Material Science and Engineering’, Prentice Hall of India Private Limited, 1999.
4. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1101.1					1	1	1					1				1	1
ME1101.2					1	1		1	1		1	1				1	1
ME1101.3	1				1	1	1	1	1							1	2
ME1101.4	1				1	1		1	1		1	1				1	1

Course Title and Code: Engineering Thermodynamics ME1102	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	**B. Tech Semester-III (Core)**

Course Objective:

The objective of the course is to develop understanding of mass, energy, heat, work, efficiency, ideal and real thermodynamic cycles and processes. This also covers first and second laws of thermodynamics, perfect gas law, properties of real gases, and the general energy equation for closed and open systems.

Course Outcome:

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

ME1102.1: identify the basic thermodynamic processes in our day to day life and industrial processes

ME1102.2: judge the state of the pure substances such as compressed liquid, saturated liquid-vapor mixture and superheated vapour using property diagrams and tables.

ME1102.3: apply the first law of thermodynamics to analyse the working of the nozzles, diffusers, turbines, compressors, throttling valves, mixing chambers, heat exchangers, pipe and duct flow

ME1102.4: construct energy and mass balance for unsteady-flow processes.

ME1102.5: assess thermodynamic applications using second law of thermodynamics to power and refrigeration cycle.

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	10
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	15
7	Theory Exam-III	25
8	Report-I	NIL
9	Report-II	NIL

10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	20
15	Lab Evaluation-II	NIL
16	Course Portfolio	NIL
	Total (100)	**100**

Syllabus:

Areas of Application of Thermodynamics, Different Approaches in the study of Thermodynamics, SI Units, Definitions and Concepts: System, Energy, Work; Thermodynamic equilibrium, Properties, Heat & Work, System, Surroundings, Types of Systems, Intensive and Extensive Properties, Energy, Macroscopic modes of Energy, Microscopic modes of Energy, Thermodynamic Equilibrium, Process, Work, Thermodynamic Definition of Work , Heat, Introduction to state postulate, Zeroth Law of Thermodynamics, Temperature Scale , Perfect Gas Scale .

First-Law of Thermodynamics and Analysis of Closed Systems: First Law of Thermodynamics, Heat is a Path Function, Energy is a Property of the System, A Perpetual Motion Machine of First Kind, Analysis of Closed Systems, Characterisation of Reversible Adiabatic Process, Polytropic Process, Ideal Gas Model.

First-Law of Thermodynamics for the Flow Processes: Conservation of Mass applied to a control volume, Conservation of Energy applied to a Control Volume, Steady State Flow Processes, Application of Steady State Flow Processes, Throttling Process, Application of Throttling Process .

Thermodynamic Properties of Pure Substances: Thermodynamic Properties of Fluids, Pure substance, Equations of State, Ideal Gas, Thermodynamic diagrams and tables, phase-Change Process of Pure Substances, Specific internal energy and enthalpy, Steam Tables.

Second Law of Thermodynamics, Entropy and Availbility: Limitations of First Law of Thermodynamics, Heat Engine, Heat Pump, Refrigerator, Kelvin Planck Statement, Clausius Statement of the Second Law, Reversibility, Irreversibility and Carnot cycle Carnot's Principles (Theorems), Thermodynamic Temperature Scale, Reversible Cycles and Clausius Inequality

Entropy: Concept of Entropy, Principle of Entropy Increase, calculation of entropy change. Temperature Entropy Diagram & Second Law Analysis of a Control Volume:Temperature Entropy Diagram, Second law analysis of a control volume, Steady-state steady-flow processes, TdS Equations, Entropy change of an incompressible substance, criterion of equilibrium, Thermodynamic definition of temperature, pressure and chemical potential, Thermodynamic potentials.

Availability & Irreversibility: Availabilty Function and Irreversibility: Introduction, Availability Function for a non-flow Process, Availability Function of Flow Processes, Irreversibility.

Power and Refrigeration Cycles: Introduction, Practical Rankine Cycle, Reheat Cycle (continuation of Rankine cycle), Regenerative Cycle, Binary Vapor Cycle. Introduction to Gas Power Cycles: Introduction, Air standard Otto Cycle, Air standard Diesel Cycle. Air Standard Dual Cycle, Comparison of Otto, Diesel & Dual Cycles, Air Standard Brayton Cycle. Reversed Carnot Cycle as a

Refrigeration Cycle, Vapour Compression Cycle, Refrigerants, Absorption Refrigeration System, Heat Engine, Gas Refrigeration Cycle.
Thermodynamic Relations: Introduction, Important Mathematical Relations, Jacobian Method, Cyclic Rule, Maxwell Relations, Thermodynamic Relations involving Entropy Clapeyron Equations: Clapeyron Equations, Kirchhoff's equations, Change of Latent Heat with Temperature.

Text Books:

1. Yunus A Cengel, "Thermodynamics: An Engineering Approach" McGraw Hill Education; Eighth edition
2. PK Nag, "Engineering Thermodynamics" McGraw Hill Education
3. M. Achuthan, "Engineering Thermodynamics" Prentice-Hall of India

Reference Books:

1. P W Bridgman, "The Nature of Thermodynamics" Harvard University Press

Course Articulation Matrix:

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1102.1	1				1			1								2	2
ME1102.2					1											2	2
ME1102.3	1					1	1			1		1	1	1		2	2
ME1102.4		1			1	1		1								2	2
ME1102.5			1		1		1					1	1			2	2

Course Title and Code: Computational Engineering Analysis–I: ES1106

Teaching Scheme	**L T P: 3 1 2**
Credits	**5**

Course Objective

The course will cover the basic components of Ordinary Differential Equations (ODE), Complex analysis and Laplace transforms and modelling & simulation of various problems in engineering discipline. Few numerical methods will be introduced to find the numerical solutions of various problems. Various domain specific Engineering problems will be discussed, and appropriate simulation tools will be used for solving them.

Course Outcomes:

On successful completion of this course, the students will be able to:

ES1106.1. Solve ordinary differential equations through various techniques.
ES1106.2. Determine the structural behavior of the body by determining the stresses, strains produced by the application of load.
ES1106.3. Analyze the concept of buckling and be able to solve the problems related to column and struts.
ES1106.4. Model the problems of column and struts mathematically in terms of ordinary differential equations and solve them using the appropriate method.
ES1106.5. Simulate the solutions of the above-mentioned models of columns and struts.
ES1106.6. Analyze a function of complex variables in terms of analyticity, poles and zeroes.
ES1106.7. Find Laplace and inverse Laplace transforms of given function and use Laplace transform to solve ordinary differential equations.
ES1106.8. Design and Evaluate the LC, RC & RL Networks using Foster'sand Cauer Forms
ES1106.9. Analyze stability criteria for electrical network using pole zero plot and routh-hurwitz polynomials
ES1106.10. Model and simulate electrical networks using Proteus simulator/ Virtual lab.

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
01	Attendance	NA
02	Assignment	NA
03	Class Participation	10
04	Quiz	20
05	Theory Exam I	20
06	Theory Exam II	NA
07	Theory Exam III	30
08	Report-1	NA
09	Report-2	NA
10	Report-3	NA
11	Project -1	NA
12	Project -2	NA
13	Project -3	NA
14	Lab Evaluation-1	10
15	Lab Evaluation-2	10
16	Course portfolio	NA
	Total (100)	100
Evaluation Scheme for Re-Test		
1	Theory Exam-III	30
	Total	30

Syllabus

ODE: Ordinary differential equations of first order and first degree, higher order ODEs with constant coefficients, Differential equation of second order with variable coefficients, Numerical solution of ODEs.

Applications of ODE in structural analysis : column and struts - Definitions, Classifications, Assumptions made in the Euler's Column Theory, Expressions for crippling load of different cases like both the ends are hinged or pinned, one end is fixed and other is free, both ends are fixed, one end is fixed other is hinged, Effective length of column, Slenderness ratio, Crippling stress in terms of Effective length and radius of gyration, limitations of Euler's Formula, Rankine's Formula, Eccentric loading, Johnson's Formula for Columns, both straight line and parabolic formula for columns.

Functions of Complex variables: Complex numbers, complex conjugates, functions of complex variables, real and imaginary parts of a complex function, analytic functions, C-R equations, Poles and zeros of a complex function, Taylor's theorem and Taylor's expansion.

Laplace transform: Basic Laplace transform and inverse Laplace Transforms, solution of ODEs using Laplace transform, solution of system of ODEs using Laplace transform.

Network Functions: Concept of complex frequency, transform independence, network functions of one and two port network, concepts of poles and zeros, properties of driving point and transfer functions, time response stability from pole zero plot, Routh-Hurwitz polynomials.

Network Synthesis: Positive real functions, Basic syntheses procedure, method of syntheses, driving point syntheses of one port network (R-L and R-C and R-L-C).

Transient Analysis: Modeling of Resistors, Inductors, capacitors, operating temperature, transient sources and transient output variables. Complete response of RL, RC, and RLC circuits to step, sinusoidal, exponential, ramp, impulses and the combinations of excitations. Initial value and final value theorem.

Textbook:

- Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
- Hibbeler, R.C., "Mechanics of Materials", 6th SI edition, Prentice Hall

References:

- Thomas' Calculus, M.D. Weir and J. Hass, Pearson.
- Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.
- Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.
- T.K. Nagsarkar, M. S. Sukhija," Basic Electrical Engineering", Oxford University press, 2nd edition, 2011.
- Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.
- Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.
- Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata McGraw Hill, 6th edition, 2006.
- Beer, F.P., Johnston, E.R., DeWolf, J.T., "Mechanics of Materials", 4th edition, McGraw Hill. Craig, R.R., "Mechanics of Materials", 2nd edition, John Wiley and Sons.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1106.1					2	2	2	1	1		1	1					
ES1106.2					2			2									
ES1106.3					1			1							1		
ES1106.4		1			1	2	2	1	1	1	2	1					
ES1106.5							2	1		1							
ES1106.6					2												
ES1106.7					2	2	1	1	1		1	2					
ES1106.8					2	2		2			1	1		1			
ES1106.9					2	2		1			1	1					
ES1106.10	1						1		1								

Course Title and Course Code	**Engineering Measurements and Machines (ES1107)**
Hours per Week	**L T P: 3 0 4**
Credits	**5**
Students who can take	**B. Tech Semester-III**

Course Objectives:

The aim of this course is to impart the knowledge of mechanical and electrical machine used in industries. Students will learn the fundamental of engineering principles governing the engineering process and its use in real-world. Students will get the knowledge of sensors, actuators, and its selection process for any industrial application.

Course Outcomes:

On successful completion of this course, the students be able to:

ES1107.1. Evaluate suitable electrical and non-electrical instruments for measuring physical quantities.

ES1107.2. Analyze the construction, characteristics and applications of various types of rotating machines.

ES1107.3. Analyze the working of any mechanical and electrical machine using mathematical model.

ES1107.4. Integrate the sensors for monitoring and automation of electrical and mechanical systems.

ES1107.5. Design electro-mechanical machines as per Indian standards.

Prerequisites		**Basics of Physics**
Evaluation Scheme		
Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	5
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	10
7	Theory Exam-III	20
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	10
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio (MOOC Course)	10
Total (100)		**100**
Evaluation scheme for Retest		**Marks**
1	Theory Exam	20
2	Lab Evaluation (Exam)	10
Total		**30**

Syllabus (Theory):

Unit-I: Measurement, Instrumentation and Calibration

Introduction, types of applications of measurement instrumentation, performance characteristics, error in measurements, calibration and standards, static and dynamic characteristics of instrument, Measuring Instruments, Digital meters, Function Generators, AC Bridges, Electronic Instruments for Measuring Basic Parameters.

Unit-II: Transducers

Classification of transducers, Selection of transducers, measurement of physical quantities, Elements of data acquisition system, Smart sensors.

Unit-III: Transformers

Construction, principle of operation, equivalent circuit, losses, testing, efficiency and voltage regulation, auto transformer, three phase connections, parallel operation of transformers, tap changing.

Unit-IV: Rotating Machines

DC Machines

Construction, EMF and torque equation, circuit model, armature reaction, methods of excitation, characteristics of generators, characteristics of motors, starting and speed control, testing and efficiency.

Induction Motors: Construction, working principle, classification and applications, equivalent circuit, Torque - slip characteristics, starting and Speed control of induction motors.

Unit-V: Mechanical Machines

Turbines: Introduction to steam turbines, Impulse and Reaction turbines, turbine power and related calculations.

Pumps: Introduction of pumps, centrifugal pumps, working of centrifugal pumps, Cavitation and its effect on pump, working of reciprocating pumps, Application of pumps in industries.

Power Transmission Systems: Mechanical drives and their performance analysis.

List of Experiments:

Measurement

1. To Determine Output characteristics of LVDT and Measure of Displacement Using LVDT.
2. Measurement of Inductance using Maxwell's bridge.
3. Measurement of earth resistance by earth tester and measurement of Insulation resistance by Megger.

Electrical Machines

1. To perform Ratio, Polarity and Load test on a single-phase transformer.
2. To perform open circuit and Short circuit test on a single-phase transformer and hence determine its equivalent circuit parameters.
3. To find the relation between open circuit voltage and field current of:

(i) Separately excited DC generator, (ii) Self excited DC shunt generator

4. Speed control of DC shunt motor: (i) By varying field current with armature voltage constant. (ii) By varying armature voltage with field current kept constant.
5. To perform No load and blocked rotor test on a three-phase Induction Motor, and hence determine its equivalent circuit parameters.

Mechanical Machines

1. To study the performance of turbines used in steam power plant
2. To study the performance of belt drive system used for power transmission.

Text Books:

1. H S Kalsi, Electronic Instrumentation, McGraw Hill Education (India) Private Limited.
2. Nagrath I. J and Kothari D. P. 'Electric Machines', Tata McGraw Hill Publishing Company Ltd.
3. B. L. Theraja, and A. K. Theraja, Text of Electrical Technology, Vol -2; S. Chand Publication.
4. J B Gupta, Theory and Performance of Electrical Machines, S.K. Kataria and Sons.
5. Ashfaq Hussain, Electrical machines, Dhanpat Rai and Co.
6. P S Bimbhra, Generalised theory of rotating machines, Khanna Publishers.
7. R K Bansal, A Textbook of Fluid mechanics and Hydraulic machines, Laxmi Publication (P) ltd.
8. S S Ratan, Theory of Machines, Tata McGraw-Hill.

Reference Books:

1. Fitzgerald and C. Kingsley Jr., Electric Machinery, McGraw-Hill Book Co.
2. Chapman, Electric Machinery Fundamentals, The McGraw-Hill Companies, Inc.

Online sources:

Electrical Measurement and Electronic Instruments
https://nptel.ac.in/courses/108/105/108105153/
Sensors and Sensor Circuit Design
https://www.coursera.org/programs/j-k-lakshmipat-university-on-coursera-kzogk/browse?index=prod_enterprise_products&productId=487N_QqXEeeqsQo32tjRBA&productType=course&query=Sensor&showMiniModal=true

Electrical Machines
https://nptel.ac.in/courses/108/102/108102146/

Motors and Motor Control Circuits
https://www.coursera.org/programs/j-k-lakshmipat-university-on-coursera-kzogk/browse?index=prod_enterprise_products&page=3&productId=-i5RF2jdEeecwwoEvbWpsg&productType=course&query=Electrical+Machines&showMiniModal=true

Turbines and Pumps
https://nptel.ac.in/courses/112/103/112103249/

Power Transmission Systems
https://www.youtube.com/watch?v=3UaFeNm_ZF8

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ES1107.1	2				2	1	1				1	1	1	1			
ES1107.2		1			1	1	1	1									
ES1107.3					1	2	1	1	1		1						
ES1107.4	1	1	1		1	1	1	1	1		1		1				
ES1107.5	1		1	1	1	1	1	1	1		1	1					

Perspectives on Contemporary Issues
Course Code: CC1103
Credit: 2
L-T-P: 2-0-1
Course Objective:
In an era of globalization, there is an increasing need for the youth to be able to empathize with others, value diverse perspectives and cultures and understand how events around the world are intertwined. Global issues revolve around social, economic and environmental factors which ultimately add to the interconnectedness of countries. In this course, students will employ key critical thinking concepts to analyze contemporary issues from multiple perspectives. They will explore the impact at micro and macro levels.
Course Outcomes:
The students will be able to:
CC1103.1. Identify different perspectives objectively.
CC1103.2. Explain interconnectedness of the issues and their impact at micro and macro levels.
CC1103.3. Recognize their own beliefs, biases, claims and assumptions.
CC1103.4. Evaluate sources, argue and defend effectively.

Evaluation Scheme:

Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	20
3	Class Participation	20
4	Quiz	NIL
5	Theory Exam-I	Nil
6	Theory Exam-II	15
7	Theory Exam-III	25
8	Report-I	20
9	Report-II	NIL
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation Scheme for retest		
1	Theory Exam III	30

Teaching Pedagogy:
This course will be an amalgamation of brief lectures and activity-based learning i.e. films, group discussions, debates, and case studies. The objective behind utilizing activity-based learning is for the learners to have a more hand on experience. This will encourage and ensure active participation and longer retention. The idea is for learners to feel engaged and also express their views in a conducive environment. The takeaway from this course will not only be awareness about certain issues but equipping learners with skills of decision making and reasoning in alignment with certain global contexts.

Course Content:

- **Introduction to contemporary perspective**
- **Research, analysis & evaluation of a topic from local, national and global perspectives on:**
- **Climate Change and Sustainability**

Understanding the magnitude of the issue, its impact and future challenges.
How we can meet our current needs without diminishing the quality of the environment or reducing the capacity of future generations to meet their own needs.

- **Globalization**

With increasing development throughout the world, the focus of this theme will be on the impact of globalization in India**.**

- **Nationalist Movement**

There is a sense that excesses of globalization have created an identity crisis across the world, facilitating the rise of nationalist movements. Rising nationalism is seen everywhere, from the election of Donald Trump to Brexit, the success of far-right parties in Italian, German and Austrian elections in 2017 and 2018, nationalism appears to be on rise globally. We will look at its reasons and implication**.**

- **Technology**

Impact of unprecedented technological growth, challenges and opportunities.

- **Social justice and human rights**

An understanding of the impact of inequality and discrimination, the importance of standing up for our own rights and our responsibility to respect the rights of others

References for Reading:

1. Harari, Y. N. (2019). *21 Lessons for the 21st century*. Toronto: CELA.
2. Guha, R. (2019). *India After Gandhi: the history of the world's largest democracy*. NEW YORK: ECCO.
3. Rosling, H., Rosling, O., & Rönnlund Anna Rosling. (2019). *Factfulness: ten reasons were wrong about the world* - and why things are better than you think. London: Sceptre.
4. Kolbert, E. (2015). *The Sixth Extinction: An unnatural History*. Bloomsbury

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
CC1103.1	1		1					1			1	1					
CC1103.2						1					1	1	1				
CC1103.3											1	1	1				
CC1103.4	1		1									1	1				

MANAGEMENT PERSPECTIVES (IL1101)
COURSE CREDITS: 2

COURSE OBJECTIVE:
The present course is an introductory and integrative action encapsulated course designed for the engineering students to introduce them to management discipline and the core functional areas contributing to it. This course adopts the integrated problem-oriented approach via the use of cases and simulation. It implies that complex business problems, in the form of cases and simulations require students to understand different dimensions of the problem and come up with holistic solutions. The course will help students to be familiar with trending management issues and at the same time apply the knowledge gained.

COURSE OUTCOMES
After completion of this course, the students will able to:
IL1101.1. Comprehend the importance of management and its functional areas in businesses and also its interaction with technology.
IL1101.2. Highlight specific external and internal issues impacting businesses.
IL1101.3. Integrate and analyze multiple dimensions of management aspects to solve business problems.
IL1101.4. Evaluate the aspects that management might consider when evaluating technical and engineering projects such as planning and scheduling, personnel management, cost control etc. from a management perspective

ASSESSMENT MATRIX
The criteria for assess the course outcomes of this course are as follows:

S.No.	**Specification**	**Marks**
1	Attendance	**10**
2	Assignment	Nil
3	Class Participation	**10**
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	**40**
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	**40**
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total	**100**

TOPICS TO BE COVERED:
HR
1. Business organization- Current challenges
2. HR and its growing importance.
3. Overview of people management systems
4. Recent trends shaping HR.

Economics:

1. Introduction of important concepts of Micro and Macro Economics
2. Key Features of Indian Economy
3. Understanding of economic environment of business

Marketing:

1. Marketing Process
2. Elements of Marketing Mix
3. Segmentation, Targeting and Positioning

Finance and Accounts:

1. Understanding Accounting Terms
2. Overview of Financial Reports, viz., Balance Sheet, Income Statement, Cash Flow Statement
3. Interface of Balance Sheet and Income Statements
4. Types of Costs and assessing and ascertaining Costs

BOOKS FOR REFERENCE

- Aswathappa, K. (2008) - Human Resource Management Text and Cases,Tata McGraw Hill New Delhi.
- Rao VSP (2002)– Human Resource Management, Text and Cases,Excel Book, New Delhi
- Armstrong, G. and Kotler, P. (2017). Marketing: An Introduction. New Delhi: Pearson Education.
- Ramaswamy, V. S., & Namakumari, S. (2013). Marketing Management: Global Perspective, Indian Context. New Delhi: Macmillan (India) Limited.
- T. R. Jain (Latest Edition). Economics for Engineers. New Delhi: V K Publications.
- Ramachandran N & Kakani K.Ram.(2017). How to Read a Balance Sheet,2/e. New Dehi: Mc Graw Hill Publications.
- Mott Graham. (2008). Accounting for Non-Accountants: A Manual for Managers and Students. Kogan Publication.
- Goyal, V.K. & Goyal, Ruchi. (2016). Financial Accounting, 4/e, New Delhi: PHI Learning Pvt. Ltd. [ISBN. -978-81-203-4626-0]

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO -2
IL1101.1	0.5				0.2												
IL1101.2	0.5	1											0.5				
IL1101.3	1		0.2		0.2						1		0.5				
IL1101.4	1			0.2							1	2					

Course code	Course Title	Teaching Scheme				
		L	T	P	S	Credits
ES1109	Computational Engineering Analysis–II	3	1	2	0	5

Course Objectives: The course will develop ability to use Partial Differential Equations (PDE), Fourier transforms and Z-transform for a variety of Engineering applications from fluid dynamics, heat conduction and circuit design. It also aims to develop skills for using common simulation Platforms i.e., Virtual lab /Python/ MATLAB. Few numerical methods will also be introduced to find the numerical solutions of various problems.

Course Outcomes:

On successful completion of this course, the students should be able to:

ES1109.1. Classify various types of partial differential equations and solve them through various analytical and numerical methods.

ES1109.2. Formulate and analyze differential equations especially Navier stokes and energy equations and use numerical methods for solving the same.

ES1109.3. Use Numerical method for solving partial differential equations using finite difference method.

ES1109.4. Find Fourier and inverse Fourier transforms of given function and use Fourier transform to solve partial differential equations.

ES1109.5. Find Z-transform and inverse Z-transforms of given functions and use them to analyze control systems.

ES1109.6. Design and analyse various types of filters and attenuators to minimize power losses and improve signal quality.

ES1109.7. Solve problems involving vertex and edge connectivity, planarity and crossing numbers.

Evaluation Scheme:

Sr. No	Specifications	Marks
1	Attendance	-
2	Assignment	10
3	Class Participation	10
4	Quiz	15
5	Theory Exam-I	15
6	Theory Exam-II	-
7	Theory Exam-III	30
8	Report-I	-
9	Report-II	-
10	Report-III	-
11	Project-I	-
12	Project-II	-

13	Project-III	-
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	-
	Total (100)	**100**

Evaluation policy for retest

Theory Exam-III	30
Total	30

Course Syllabi (Theory):

PDE: Partial Differential Equations of First Order, Variable separable technique for solving PDE. Heat equation, wave equation, Laplace equation

Boundary value problems: Solution of boundary value problems using separation of variables technique. Numerical solution of PDE.

Application of PDE: Momentum and Energy Transport:

The governing equations of fluid dynamics- models of the flow, continuity equation, momentum equation, Energy equation, boundary conditions. Poisouli's flow, Couette flow, steady and unsteady conduction.

Fourier Transforms: Fourier transform and inverse Fourier transform, properties of Fourier transform, Applications in solving Partial differential equations.

Filter Circuits: Types of passive filters, design low-pass, High-pass, Band-pass, Band-reject filters as constant k type, design low-pass, High-pass, Band-pass, Band-reject filters as RC type, Advantages of active filters over passive filters.

Graph Theory: Introduction, Linear graph of a network, Tie-set and cut-set schedule, incidence matrix, cut-set, and tie-set. Graph theory application to a practical radial system.

Z-transform: Introduction, standard z- transform, properties of z – transform, initial and final value theorems, inverse z-transform, applications in control systems.

Textbook:

1. Advanced Engineering Mathematics, Erwin Kreysig, Wiley, India.
2. White F. M., "Fluid Mechanics" Tata McGraw-Hill, New Delhi.
3. Incropera F P "Principles of Heat and Mass Transfer", John Wiley & Sons.
4. Hayt W.H., Kemmerly J. E., Durbin S. M., "Engineering Circuit Analysis", Tata McGraw Hill, 6th edition, 2006.

Reference Books –

1. Thomas' Calculus, M.D. Weir and J. Hass, Pearson.

2. Engineering Mathematics, Srimanta Pal and Subodh C. Bhunia, Oxford University Press, New Delhi, India.

3. Higher Engineering Mathematics, B.V. Ramana, Mc Graw Hill Education.

4. Fox and McDonald, "Introduction to fluid dynamics", John Wiley & Sons.

5. Cengel Y. "Heat and Mass Transfer" Tata McGraw-Hill, New Delhi.

6. J. D. Anderson Jr. "Computational Fluid Dynamics" McGraw-Hill International Edition.

7. Roy Choudhary, "Network Theory", TMH, 3rd Edition, 2004.

8. Edminister Joseph A., "Electrical Circuits, Schaum's Outline Series", Tata McGraw Hill, 3rd edition, 2012.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO -1	PSO -2
ES1109.1	1				1	1		1			1						
ES1109.2	2		2		2	2	1	2			1		1	2			
ES1109.3						1	2										
ES1109.4					2	2		1			1						
ES1109.5	1		1		2	2		1			1			1			
ES1109.6		1				1	2			2				1			
ES1109.7						1	2	2						1			

Course Title	**Production Technology–I**
Course Code	**ME1106**
Hours per Week (L T P)	**3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-IV**

Course Objective:

To impart knowledge about principles/methods of casting with knowledge of pattern, molding, casting methods in order to get sound casting. To impart knowledge about welding processes in order to get sound permanent joints of metal and metal alloys. To impart knowledge of working principles of various non-conventional and advanced machining processes.

Course Outcomes:

On successful completion of this course, the students will be able to:

ME1106.1: Design molding system to obtain defect free cast.
ME1106.2: Analyze various welding processes for different applications.
ME1106.3: Identify non-conventional manufacturing process to manufacture intricate shaped product accurately.
ME1106.4: Identify latest manufacturing systems and processes for manufacturing of components.

Prerequisites: Basics of Materials Engineering

Sr. No	**Specifications**	**Marks**
1	Attendance	5
2	Assignment	10
3	Class Participation	NIL
4	Quiz	5
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	20
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
Total (100)		**100**

Evaluation scheme for Re-test

Sr. No	**Specifications**	**Marks**
1	Theory Exam-III (Re-test)	30
Total (30)		**30**

Course Syllabus (Theory)

Conventional Manufacturing processes:

UNIT-I

Casting and molding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, gating system design, riser design, casting defects and residual stresses.
Melting Practices: Cupola, Induction Furnaces

UNIT-II

Joining/fastening processes: Physics of welding, brazing and soldering; design considerations in welding, Solid and liquid state joining processes, welding defects; Adhesive bonding.

Unconventional Machining Processes:

UNIT-III

Abrasive Jet Machining, Water Jet Machining, Abrasive Water Jet Machining, Ultrasonic Machining, principles and process parameters.
Electrical Discharge Machining, principle and processes parameters, MRR, surface finish, tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish. Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining

UNIT-IV

Introduction to Flexible Manufacturing System, Additive manufacturing: Rapid prototyping and rapid tooling.

Course Syllabus (Practical):

1. To determine moisture content in molding sand,
2. To determine the clay content of molding sand,
3. To perform the Hardness Test to know hardness of molding/core sand.
4. To prepare wood/metal pattern for casting process.
5. To cast a liquid Aluminum metal by using sand molding.
6. Investigate the casting defects and suggest the remedial measures.
7. To make a component involving horizontal and vertical welding using gas welding.
8. To make a component using TIG welding setup.
9. To make a component using MIG welding setup.
10. To prepare a permanent joint on mild steel plate using gas welding.
11. To prepare a permanent joint on thin metallic sheet using spot welding.
12. To find out average grain fineness number using sieve shaker.

Text Book(s)

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)-Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems

3. Degarmo, Black & Kohser, Materials and Processes in Manufacturing
4. Amitabh Ghosh & Mallik, Manufacturing Science, Affiliated East-West Press Pvt Ltd, New Delhi.

Reference Book(s)

1. Rao P. N. "Manufacturing Technology: Foundry, Forming and Welding" TMH, 2013.
2. James S. Campbell "Principles of Manufacturing Materials and Processes", TMH.
3. G.E. Linnert, "Welding Metallurgy" AWS.
4. Cook "Manufacturing Analysis"Adisson-Wesley
5. R. K. Jain "Manufacturing Engineering Technology" Pearson Education
6. P. C. Pandey and C. K. Singh "Production Engineering Sciences" Standard Publishers Ltd.

Course Articulation Matrix:

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1106.1	1				1	1	1	1	1	1	1	1		1	1	1	2
ME1106.2	1					1	1	1	1	1		1				1	2
ME1106.3											1	1					1
ME1106.4	1				1	1	1										1

Course Title and Code: Communication and Identity: CC1104

Course Objective:

This course enables students to explore their personal and professional identities, to create their distinctive presence. It intends to help them gain an understanding of the basic purpose, benefits, and responsibilities of self-presence, and to begin the process of defining their values, strengths, and goals, which helps them enhancing their employability skills through exposing themselves through various activities.

Course Outcomes:

CC1104.1. Analyse their personal identities, both private and social
CC1104.2. Identify their different values, strengths and areas of professional interest
CC1104.3. Articulate their personal statement and use it to craft an influential pitch
CC1104.4. Express themselves through various communication formats on different platforms

Prerequisites		**N/A**
Hours per Week		**L-T-P: 2-0-1**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	**NIL**
02	Assignment	**30**
03	Class Participation	**30**
04	Viva	**20**
05	Theory Exam	Nil
06	Theory Exam	Nil
07	Theory Exam	**20**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Project -1	Nil
12	Project -2	Nil

13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Module	**Topics/ Session no.**	**Topics to be Covered**
Identifying Self	Factor that shape our identity	The 3 Types of Diversity That Shape Our Identities. Three things: demographic diversity (our gender, race, sexual orientation, and so on), experiential diversity (our affinities, hobbies, and abilities), and cognitive diversity (how we approach problems and think about things).
	Internal confidence or "principle-centred living"	Living a principle-centred life is the key to excelling in all other areas of our living. A principle is based on the fundamental idea that there is learned behavior that governs human effectiveness.
	Personal Statement	Use of story map to create a personal statement.
Persuasive Communication	Steps to build a Personal Brand	Personal branding: meaning, importance and how to create and use it; the three Cs' of personal branding and
	Online presence	Creating an online presence for professional and personal branding through social media. (LinkedIn, Facebook etc.)
	Elevator Pitch, Cover Letter	Elevator Pitch: Meaning and use of an elevator pitch in interview and workplace; techniques to craft and improve their pitch Purpose of a cover letter, types of the cover letter, the structure of a cover letter and tips on the cover letter, to craft their cover letter to be used for placements
	Presence in Group Discussion and Personal Interviews	Practice different types of group discussions, dos and don'ts of group discussions and use of techniques to perform well in GDs
Assessments		

1. Self- identity

1. *When Your Job Is Your Identity, Professional Failure Hurts More*

   Timothy O'Brien

   Pub Date: Jun 18, 2019

   Source: Harvard Business School Publishing - HBD

   Product #: H050HO-PDF-ENG

   Discipline: General Management

   Length: 1106 words

2. *The 3 Types of Diversity That Shape Our Identities*

   Celia de Anca; Salvador Aragón

   Pub Date: May 24, 2018

   Source: Harvard Business School Publishing – HBD

   Product #: H04BSY-PDF-ENG

   Discipline: Human Resource Management

   Length: 1004 words

3. *Coaching Makena Lane*

   Ethan S. Bernstein; Om Lala

   Pub Date: Oct 1, 2017

   Source: HBS

   Product #: 418031-PDF-ENG

   Discipline: Organizational Behavior

   Length: 24 p

4. *The Talent Curse*

   Jennifer Petriglieri; Gianpiero Petriglieri

Pub Date: May 1, 2017

Source: Harvard Business School Publishing - HBD

Product #: R1703E-PDF-ENG

Discipline: General Management

Length: 8 p

2. Personal Statement

1 *From Purpose to Impact*

Nick Craig; Scott A. Snook

Pub Date: May 1, 2014

Source: Harvard Business School Publishing - HBD

Product #: R1405H-PDF-ENG

Discipline: General Management

Length: 9 p

3. Internal confidence or "principle centered living"

1 *Cultivating Everyday Courage*

James R. Detert

Pub Date: Nov 1, 2018

Harvard Business School Publishing - HBD

Product #: R1806K-PDF-ENG

Discipline: General Management

Length: 9 p

4. Steps to build Personal Brand

1 *A Strategic Marketing Plan to Successfully Deliver Your Professional Brand*

Kimberly A Whitler

Pub Date: Oct 20, 2015

Source: University of Virginia Darden School Foundation

Product #: UV7572-PDF-ENG

Discipline: Marketing

Length: 7 p

2 *Sadiq Gillani's Airline Career Takes Off: Strategy in Action*

Jeffrey Pfeffer

Pub Date: Nov 30, 2018

Source: Stanford University

Product #: OB95-PDF-ENG

Discipline: Organizational Behavior

Length: 17 p

3 *How Women Can Develop - and Promote - Their Personal Brand*

Dorie Clark

Pub Date: Mar 2, 2018

Source: Harvard Business School Publishing - HBD

Product #: H046PA-PDF-ENG

Discipline: Human Resource Management

Length: 1419 words

5. Online presence

1 *What's Your Personal Social Media Strategy?*

Soumitra Dutta

Pub Date: Nov 1, 2010

Source: Harvard Business School Publishing - HBD

Product #: R1011L-PDF-ENG

Discipline: Organizational Behavior

Length: 6 p

6. Resume, Elevator Pitch, Cover Letter

1 *The Art of the Elevator Pitch*

Carmine Gallo

Pub Date: Oct 3, 2018

Source: Harvard Business School Publishing - HBD

Product #: H04KFL-PDF-ENG

Discipline: General Management

Length: 992 words

2 *Writing Your Résumé When Your Job Title Doesn't Reflect Your Responsibilities*

Jane Heifetz

Pub Date: May 16, 2017

Source: Harvard Business School Publishing - HBD

Product #: H03NAN-PDF-ENG

Discipline: Human Resource Management

Length: 1243 words

3 *Improve Your Résumé by Turning Bullet Points into Stories*

Jane Heifetz

Pub Date: May 4, 2016

Source: Harvard Business School Publishing - HBD

Product #: H02UR4-PDF-ENG

Discipline: Human Resource Management

Length: 1481 words

7. Presence in Personal Interviews

1. *15 Rules for Negotiating a Job Offer*

   Deepak Malhotra

   Pub Date: Apr 1, 2014

   Source: Harvard Business School Publishing - HBD

   Product #: R1404K-PDF-ENG

   Discipline: General Management

   Length: 5 p

2. *How to Show You're Passionate in a Job Interview*

   Sabina Nawaz

   Pub Date: Apr 24, 2019

   Source: Harvard Busines School Publishing - HBD

   Product #: H04WSV-PDF-ENG

   Discipline: Human Resource Management

   Length: 724 words

   How to Highlight Your Talents in a Job Interview Without Showing Off

   Tomas Chamorro-Premuzic PhD.

   Pub Date: Dec 28, 2017

   Source: Harvard Business School Publishing - HBD

   Product #: H0436N-PDF-ENG

   Discipline: Human Resource Management

Length: 1139 words

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1104.1													1	1			
CC1104.2	1		2	1										2			
CC1104.3													1				
CC1104.4													2				

Course Title and Code: Introduction to Design IL1102

Hours per Week	30
Credits	2
Students who can take	2nd Year B. Tech

Course Objective: The students are going to explore the world of hand-crafted toys and animation during this week. Thus, taking an idea forward from an intangible thought to a material-based product or communicating it visually. The toys we explore will be designed in relevance to the audience group that the students choose.

Course Outcome:

On successful completion of this course, the students should be able to:

IL1102.1. Identify the user and build its persona.
IL1102.2. Sketch their ideas on paper to visualize and assess viability.
IL1102.3. Create a plan for process and management to materialize the desired idea.
IL1102.4. Test the material for possibilities and capabilities.
IL1102.5. Develop skills of joinery, material manipulation and various hand tools.
IL1102.6. Develop technical and narrative skills useful for both film and animation.
IL1102.7. Develop troubleshooting and problem-solving skills.

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	Nil
2	Assignment	20
3	Class Participation	10
4	Quiz	Nil
5	Theory Exam I	Nil
6	Theory Exam II	Nil
7	Theory Exam III	Nil
8	Report-1	Nil
9	Report-2	Nil
10	Report-3	Nil
11	Project -1	35
12	Project -2	35
13	Project -3	Nil
14	Lab Evaluation1	Nil
15	Lab Evaluation2	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Course Contents:

1. Introduction to Design Process for making Toys.
2. Material properties – Cardboard, Epoxy Putty, Wire, Thread
3. Material joinery
4. Use of tools – Plier, Paper Cutter, Basic Stationery
5. Developing creative thinking.
6. Basic drawing and visualisation skills including 2D to 3D - Form exploration.
7. Principles of animation.
8. Technical aspects of animation and film making (Frame rate, persistence of vision).
9. Building a Narrative – Start, Middle and End of a story.
10. Mediums of animation.

Suggested Reading Materials:

1. https://en.wikipedia.org/wiki/Toy
2. https://en.wikipedia.org/wiki/Category:Traditional_toys (Hover over the categories to see the thumbnail)
3. https://fashion.mithilaconnect.com/6-popular-traditional-toys-in-india/
4. Simple wooden toymaking by Mathias, available at MP Ranjan LRC Call number: 745.592
5. https://www.etsy.com/market/toys_handmade
6. https://www.dutchcrafters.com/Amish-Toys-Games-Hobbies/cat/98
7. https://www.walmart.com/cp/toys/4171 (Toys that we are not interested in)
8. https://www.target.com/c/toys/-/N-5xtb0 (Toys that we are not interested in)
9. https://in.pinterest.com/pin/12807180177802375/
10. https://www.youtube.com/watch?v=_ppedXZHhE0 (Stop Motion Basics)
11. https://www.youtube.com/watch?v=p5SygzMSLhM (Stop Motion in Movies)
12. https://www.youtube.com/watch?v=GcryIdriSe4 (12 principles of animation)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO -1	PSO -2
IL1102.1	1								1	1			1	1			
IL1102.2	2						1						2				
IL1102.3	1						1	1						2			
IL1102.4	1						1	1									
IL1102.5							1	1									
IL1102.6	2						1						1				
IL1102.7	1		1			1	1										

Course Title and Code: Transport Phenomena ME1104	
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	**B. Tech Semester-IV (Core)**

Course Objective:

The objective of this course is to introduce the concepts of transport phenomena, which deals with the movement of different physical quantities such as momentum, energy and mass in any chemical or mechanical process and combines the basic principles (conservation laws) and laws of various types of transport. The topics included in this course are aimed to prepare a student to build a good fundamental background useful in the application-intensive courses covering hydraulics and energy transfer equipment design in later semesters.

Course Outcomes:

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

ME1104.1: identify the basic transport processes in our day to day life and industrial processes

ME1104.2: apply the continuity, momentum and energy principles and dimensional analysis

ME1104.3: formulate and analyse a heat transfer problem involving any of the three modes of heat transfer

ME1104.4: apply the appropriate correlations to calculate heat transfer coefficient and heat flux for a range of heat transfer situations (Steady and unsteady)

ME1104.5: design and model a real life low energy heat transfer equipment as per ASME standard

ME1104.6: Analyse the combined effect of heat, mass and momentum transport in a typical chemical engineering equipment (heat exchanger, catalyst bed, chemical reactor, etc.)

Sr. No	**Specifications**	**Marks**
1	Attendance	--
2	Assignment	5+5
3	Class Participation	--
4	Quiz	5+5
5	Theory Exam-I	15
6	Theory Exam-II	15
7	Theory Exam-III	25
8	Report-I	--
9	Report-II	--

10	Report-III	--
11	Project-I	--
12	Project-II	--
13	Project-III	--
14	Lab Evaluation-I	10
15	Lab Evaluation-II	15
16	Course Portfolio	--
	Total (100)	**100**
Evaluation for retest		
1	Theory Exam-III	25
2	Lab Evaluation-II	15
	Total	**40**

Syllabus:

Momentum Transport:

Basic Concepts and Definitions – Distinction between a fluid and a solid; Density, Specific weight, Specific gravity, Kinematic and dynamic viscosity, Newton law of viscosity, vapour pressure, boiling point, cavitation, surface tension, capillarity, Bulk modulus of elasticity, compressibility.

Fluid Statics - Fluid Pressure, Pascals law, pressure variation with temperature, density and altitude. Piezometer, U-Tube Manometer, Single Column Manometer, U Tube Differential Manometer, Micromanometers, Hydrostatic pressure and force: horizontal, vertical and inclined surfaces. Buoyancy and stability of floating bodies.

Fluid Kinematics-Classification of fluid flow: steady and unsteady flow, uniform and non-uniform flow, laminar and turbulent flow, rotational and irrotational flow, compressible and incompressible flow, ideal and real fluid flow, one, two and three dimensional flows, Stream line, path line, streak line and stream tube, stream function, velocity potential function. One-, two- and three -dimensional continuity equations in Cartesian coordinates

Fluid Dynamics- Surface and body forces, Equations of motion - Euler's equation, Bernoulli's equation – derivation, Energy Principle, Practical applications of Bernoulli's equation, venturimeter, orifice meter and pitot tube, Momentum principle, Forces exerted by fluid flow on pipe bend, Vortex Flow – Free and Forced, Dimensional Analysis and Dynamic Similitude - Definitions of Reynolds Number, Froude Number, Mach Number, Weber Number and Euler Number, Buckingham's π-Theorem.

Energy Transport

Energy equation, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins.

Convection: basic equations, boundary layers- Forced convection, external and internal flows, Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer- Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection. Radiation**:** Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method

Mass Transport:

Introduction mass transfer, Diffusion mass transfer, Fick's law of diffusion, Steady state molecular diffusion, Convective mass transfer and mass transfer coefficient, Interphase mass transfer, Momentum, heat and mass transfer analogy.

Distillation: Vapour liquid equilibrium, Flash vaporization, steam distillation, batch distillation, and continuous multistage fraction of binary mixtures.

Drying of wet solids: Physical mechanism of drying, drying equilibria, drying rate curve, calculation of the drying time from the drying rate data, classification of drying equipment. Adsorption: Commercial adsorbents and their applications, characteristics and properties of adsorbent, Adsorption equilibria, selection of adsorbents, adsorbent equipments.

Lab Experiments:

Measurement of viscosity, Study of Pressure Measuring Devices, Stability of Floating Body, Hydrostatics Force on Flat Surfaces/Curved Surfaces, Verification of Bernoulli's Theorem, Venturimeter, Orifice meter, Impacts of jets, Flow Visualisation -Ideal Flow Length of establishment of flow, Velocity distribution in pipes, Laminar Flow, Convective heat transfer (Numerical). Solid/ liquid in air diffusion.

Text Books:

1. Cengel Y. and Cimbala J., "Fluid Mechanics" Tata McGraw-Hill, New Delhi, 2014.
2. White F. M., "Fluid Mechanics" Tata McGraw-Hill, New Delhi, 2011.
3. Bird, Stewart and Lightfoot, "Transport Phenomena"', John Wiley & Sons, 2002.
4. Incropera F P "Fundamentals of Heat and Mass Transfer", John Wiley & Sons, 2011.
5. Cengel Y. "Heat and Mass Transfer" Tata McGraw-Hill, New Delh, 2014i.

Reference Books:

1. Fox and McDonald, "Introduction to fluid dynamics", John Wiley & Sons, 2018.
2. Holman J.P. "Heat Transfer" Tata McGraw-Hill, New Delhi, 2008.
3. Robert T., "Mass Transfer Operations" Tata McGraw-Hill, New Delhi, 1995.
4. Binay K. Dutta, Principles of Mass Transfer and Separation Processes, PHI Learning Pvt.Ltd. Delhi, 2007.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1104.1	1				1		1	1								2	
ME1104.2					1	1		1								2	2
ME1104.3	1				1		1	1		1						2	2
ME1104.4		1						1				1				2	2
ME1104.5		1				1						1	1	1		2	2
ME1104.6	1		1		1							1	1	1		2	2

Course Title and Course Code	**Strength of Material & Analysis (ME1105)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-IV ME**

Course Objective:
The key objective of this course is to acquaint the students with fundamentals of stress and strain for 1-D, and 2-D systems, factors cause failure and theories to avoid failure.

Course Outcomes:

On successful completion of this course, the students will be able to:

ME1105.1: identify stress and strain present in a mechanical system.
ME1105.2: analyze and evaluate 1-D and 2-D stress tensor in a specimen.
ME1105.3: analyze shear force and bending moment diagrams for a beam under different loading conditions.
ME1105.4: design shafts against torsion load for different application.
ME1105.5: design columns against buckling load for various end conditions.

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	NIL
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	20
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I (Continuous)	10
15	Lab Evaluation-II (Exam)	10
16	Course Portfolio	NIL
Total (100)		**100**
Evaluation scheme for Retest		**Marks**
1	Theory Exam-Retest	30
Total (30)		**30**

COURSE SYLLABUS (Theory):

UNIT 1 Stresses and Strains

Simple Stresses and Strain: Introduction, Definition and concept and of stress and strain. Hooke's law, Stress-Strain diagrams for ferrous and non-ferrous materials, factor of safety, Elongation of tapering bars of circular and rectangular cross sections, Elongation due to self-weight. Saint-Venant's principle,

Compound bars, Temperature stresses, Compound section subjected to temperature stresses, state of simple shear, Elastic constants and their relationship.

Unit II Multiaxial Stress-Strain System

Introduction to Biaxial stresses, state of stress at a point, General two-dimensional stress system, Principal stresses and principal planes, Mohr's circle of stresses and Introduction to Theories of Failure.

Thin and Thick Cylinders (Cartesian Coordinates): Introduction, Thin cylinders subjected to internal pressure; Hoop stresses, Longitudinal stress and change in volume. Thick cylinders subjected to both internal and external pressure; Lame's equation, radial and hoop stress distribution.

UNIT III Theory of Beams

Introduction to types of beams, supports and loadings. Definition of bending moment and shear force, Sign conventions, relationship between load intensity, bending moment and shear force. Shear force and bending moment diagrams for statically determinate beams subjected to points load, uniformly distributed loads, uniformly varying loads, couple and their combinations, Deflection of beams by Double integration method–Macaulay's method–Area moment theorems for computation of slopes and deflections in beams –Conjugate beam method.

UNIT IV Bending and Torsion

Theory of simple bending –bending stress and shear stress in beams, assumptions, bending equation, modulus of rupture, section modulus, flexural rigidity, Bending and shear stress distribution diagrams for circular, rectangular, 'I', and 'T' sections.

Introduction, pure torsion, Assumptions, Torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a shaft, combined bending and torsion.

UNIT V Column and Struts and Introduction to 3-D stresses

Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory. Rankine-Gordon's formula for columns. Fundamentals of theory of elasticity.

COURSE SYLLABUS (Practical):

1. To evaluate stress strain curve for tension test on a standard Mild Steel specimen on Universal Testing Machine UTE-20.
2. To evaluate stress strain curve for compression test on a standard Mild Steel specimen on Universal Testing Machine UTE-20.
3. To conduct impact test on a mild steel specimen, IT-30.
4. To conduct torsion test on a mild steel specimen, TTE-10.
5. To conduct Rockwell Hardness Test.
6. To conduct Brinell's Hardness Test.
7. To conduct Vickers Hardness Test, VM-50.
8. To conduct fatigue test on Fatigue Testing machine, FTG 8(D).
9. To conduct bending stress in a beam, STR 5.
10. To write a MATLAB program to generate principle stress, shear stress of a given element and plot the same.
11. To write a MATLAB program to generate 2-D principle stress, shear stress of a given element and plot the same.
12. To write a MATLAB program to generate Mohr's Circle of a given element and plot the same.
13. To develop a CAD Simulation model of Mild steel specimen for conducting simulation.

14. To develop a CAD Simulation model of Aluminum specimen for conducting simulation.

Text Books:

1. S. S. Rattan “Strength of Materials” McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
2. Popov, Egor Paul. Engineering mechanics of solids. Prentice Hall, 1990.
3. R. K. Bansal, “A Textbook of Strength of Materials”, 4th Edition, Laxmi Publications, 2010.

Reference Books:

1. Timoshenko, S. and Goodier, J. N., "Theory of Elasticity", Tata McGraw Hill, New Delhi, 3rd edition, 1970
2. Srinath, L. S., “Advanced Mechanics of Solids”, Tata McGraw Hill, New Delhi, 3rd edition, 2010
3. Ferdinand P. Beer, E. Russell Johnston and Jr. John T. DeWolf “Mechanics of Materials”, Tata McGraw-Hill, Third Edition, SI Units.
4. D.H. Young, S.P. Timoshenko “Elements of Strength of Materials” East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
5. Vazirani, V. N., Ratwani M. M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1105.1			1		1	1										1	
ME1105.2			1		2	1											
ME1105.3	1		1		1	1											
ME1105.4			1		1												
ME1105.5	1		1		1											1	1

Course Title and Course Code	**Mechanical Engineering CAD Lab (ME1107)**
Hours per Week	**L T P: 0 0 4**
Credits	**1**
Students who can take	**B. Tech Semester-IV ME**

Course Objective:
To develop competencies in machine drawing to create blue prints.

Course Outcomes:

On successful completion of this course, the students will be able to:

ME1107.1: identify surface roughness number and symbol, symbols of machine elements and welded joints limit.
ME1107.2: assess limits, fits and tolerance for machine elements in engineering drawings.
ME1107.3: develop geometrical models for different machine components.
ME1107.4: develop assembly and detailed drawings of engine parts.

Prerequisites		**Basics of Physics**
Sr. No	**Specifications**	**Marks**
1	Attendance	5
2	Assignment	25
3	Class Participation	NIL
4	Quiz	NIL
5	Theory Exam-I	NIL
6	Theory Exam-II	NIL
7	Theory Exam-III	NIL
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	40
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	15
15	Lab Evaluation-II	15
16	Course Portfolio	NIL
Total (100)		**100**
Evaluation Scheme for Retest		**Marks**
1	Lab Evaluation-Retest	30
Total		**30**

COURSE SYLLABUS (Theory):

UNIT - I

Conventional representation of surface finish, Roughness number symbol, Symbols of Machine elements and welded joints.

Limits, Fits and Tolerances: General aspects, Nominal size and basic dimensions, Definitions, Basis of fit or limit system, Systems of specifying tolerances, Designation of holes, Shafts and fits, commonly used holes and shafts.

Fasteners: Drawings of various views of Screw threads, metric and BSW threads, Square thread and multi start threads. Nuts & bolts, Washers, Setscrew, Locknuts and foundation bolts.

UNIT - II

Drawings of various views of:

Shaft joints: Cotter joint and Knuckle joint.

Keys & Shaft coupling: Muff, Flanged, Flexible, Universal and Oldham's coupling.

Shaft bearing: Solid and bush bearing, Plummer block.

Pipe Joint: Flanged joint, Socket and Spigot joint, Hydraulic joint, Union joint, Expansion joint.

Pulley: V-belt pulley.

Gears: Spur gear in mesh with approximate construction of tooth profile, Rack and pinion.

UNIT – III

Assembly and detailed drawings of Engine Parts: Piston, stuffing box, cross head, Vertical & Horizontal engine, Connecting rod, Crank.

Valves: Steam stop valves.

Text & Reference Books:

1. Engineering Drawing: N.D.Bhatt & M.Panchal 37th Edition 1996, charotar publishing House Gujarat
2. Machine Drawing – P. S. Gill S.K. Kataria & Sons Delhi.
3. Engineering Drawing & Design: Cencil Jensen, Jay D. Helsel, Dennis R. Short, Seventh Edition, Tata Mcgraw Hill 2012
4. "Engineering Graphics" by K.L. Narayana and P.Kannaiah, scitech publications (india) pvt.ltd. october 2008
5. Engineering Drawing: K.R. Gopal Krishna, 24 th Edition 1999 Subhash publications, Bangalore

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1107.1																	1
ME1107.2									1							1	
ME1107.3									1		1						
ME1107.4							1		1		1		1				1

Course Title and Course Code	**Theory of Machines (ME1108)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
O Students who can take	**B. Tech Semester-V (Batch: 2019-2023)**

Course Objective:

This course aims to impart knowledge on design and analysis of mechanism for the specified type of motion in a machine and transmission systems. This course builds upon the foundations laid in the first year course Calculus and Applied Mechanics to understand advanced courses like Machine Design, Dynamics of Machines, Robotics, Automobile, etc.

Course Outcomes:

On successful completion of this course, the students should be able to:

ME1108.1: Compare and develop various application based linkages and mechanisms.

ME1108.2: Analyze velocity and acceleration polygon of different types of mechanisms.

ME1108.3: Analyze the cam and follower mechanism in order to optimize the power consumption.

ME1108.4: Prioritize among various mechanisms like belt, rope and chain drive systems in order to minimize energy consumption.

Evaluation Scheme:

Sr. No	Specifications	Marks
1	Attendance	NIL
2	Assignment	10
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	10
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
Total (100)		**100**

Evaluation scheme for Re-test

Sr. No	Specifications	Marks

1	Theory Exam-III (Re-test)	30
Total (30)		**30**

COURSE SYLLABUS (Theory):

UNIT - I

Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains- Limit positions- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms **(8 lectures)**

UNIT - II

Kinematic Analysis of Mechanisms:

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics Coincident points- Coriolis component of acceleration- introduction to linkage synthesis three position graphical synthesis for motion and path generation.

(12 lectures)

UNIT - III

Cams: Classification of cams and followers- Terminology and definitions- Displacement diagrams-Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers. **(12 lectures)**

UNIT – IV

Belts, Ropes and Chains: Mechanism of belt, rope and chain drive, power transmitting capacity, effect of centrifugal forces, material used for Belts, rope and chain.

(4 lectures)

Vibration: Introduction to vibration, single degree of freedom (free Vibration)

(4 lectures)

COURSE SYLLABUS (Practical):

1. (i) To study the various types of link, and pair mechanism.
   (ii) To study the inversions of four bar mechanism.
2. To determine whirling speed of shaft theoretically and experimentally.
3. To determine the position of sleeve against controlling force and speed of a Hartnell governor and to plot the characteristic curve of radius of rotation.
4. To determine the natural frequency of un-damped torsional vibration of a single rotor shaft system.
5. To determine the natural frequency of un-damped torsional vibration of two rotor shaft system.
6. To Analyze the motion of a motorized gyroscope when the couple is applied along its spin axis.

7. To determine the frequency of un-damped free vibration of an equivalent spring mass system.
8. To determine the frequency of damped force vibration of a spring mass system/related case study.
9. To study the static and dynamic balancing using rigid blocks/related case study.
10. To plot follower displacement Vs cam rotation graph for various cam follower arrangement.

Text Books:

1. Rattan S.S, "Theory of Machines" Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2nd edition -2005.
2. Sadhu Singh, "Theory of Machines," Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2ND Edi. 2006.
3. Jagadish Lal, 'Theory of Machine', Dhanpat Rai Publications, New Delhi.

Reference Books:

1. Shigley. J. V. and Uickers, J.J., "Theory of Machines & Mechanisms" OXFORD University press.2004
2. "Theory of Machines -I", by A.S.Ravindra, Sudha Publications, Revised 5th Edi. 2004.
3. "Theory of Machines ", by Thomas Bevan, CBS Publishers and Distributors.

Reference Courses:

1. Kinematics of Mechanisms and Machines https://nptel.ac.in/courses/112/105/112105268/
2. Introduction to mechanical vibration https://swayam.gov.in/nd1_noc20_me66/preview
   (Note: only week 1, week 2, and week 7)

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
ME1108.1	1				1	1	1				1	1		1		2	2
ME1108.2	1				1	1	1		2			1		1		2	2
ME1108.3	1				1	1	1	1	1					1		2	2
ME1108.4	1				1	1	1	1	1		1	1		1	2	2	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title	**PRODUCTION TECHNOLOGY–II**
Course Code	**ME1109**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-V (Batch: 2019-2023)**

Course Objective:

The main objective of the course is to impart knowledge of production technology so that students are able to design and perform various forming and machining processes to shape materials for different applications. This course builds upon the foundations laid in the second year course Materials Engineering and Production Technology-I to understand the application of manufactured components, for manufacturing of Automobiles, Robots, Airplanes, etc.

Course Outcomes:

On successful completion of this course, the students will be able to:

ME1109.1: Design load capacity of forming equipment to perform various bulk forming and sheet forming operations.

ME1109.2: Design of machining tools, forming tools and holding tools for various forming and machining processes.

ME1109.3: Calculate force required for machining metallic materials using appropriate cutting tool materials and cutting fluids.

ME1109.4: Use cutting, milling, and finishing operations to shape materials and evaluate their surface finish using conventional and automatic machines.

Prerequisites	**Materials Engineering, PT-I**

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	20
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	10
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
Total (100)		**100**

Evaluation Scheme for Re-test		
Sr. No	**Specifications**	**Marks**
1	Theory Exam-III	30
Total (30)		**30**

Course Contents:

UNIT - I

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria; fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending), principles of powder metallurgy. **(8)**

UNIT - II

Tooling for conventional and non-conventional machining processes: Mold and die design, Press tools, Cutting tools; **(6)**

Holding tools: Jigs and fixtures, principles, applications and design; press tools – configuration, design of die and punch; principles of forging die design. **(6)**

UNIT - III

Metal cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life, cutting tool materials, Cutting fluids.

(10)

UNIT - IV

Turning, Drilling, Milling and finishing processes, Surface finish and integrity, Coating. **(8)**

Introduction to CNC machining. **(2)**

Course Syllabus (Practical)

1. Study of single point cutting tool geometry & grind the tool as per given tool geometry / related case study.
2. To prepare a job using lathe machine / related case study.
3. To prepare a gear using Milling Machine / related case study.
4. Study the milling machine, milling cutters, indexing heads and indexing methods / related case study.
5. Prepare a hexagonal / octagonal nut using indexing head on milling machine / related case study.
6. To cut external metric threads & to meet it with the nut / related case study.
7. To prepare the job by eccentric turning on lathe machine / related case study.
8. To prepare a job on shaper from given MS rod / related case study.
9. To prepare a job on surface grinder and measure the various parameters of the finished piece / related case study.
10. Disassembly and assembly of small assemblies such as three jaw chuck, four jaw chuck, tail stock, bench vice, screw jack etc. / related case study.

Text Books and Reference Books:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems
3. Degarmo, Black & Kohser, Materials and Processes in Manufacturing

4. Amitabh Ghosh & Mallik, Manufacturing Science, Affiliated East-West Press Pvt Ltd, New Delhi.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
ME1109.1	2		1		1	1	1	1	1	1	1			1	1	1	1
ME1109.2	1		1		1	1	1	1						1	1	1	1
ME1109.3	2		1		1	1	1	1	1	1	1			1	1	1	1
ME1109.4	1		1		1	1	1	1						1	1	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Understanding and Managing Conflict|CC1105**
Hours per Week	**L-T-P: 2-0-0**
Credits	**2**
Students who can take	B.Tech - Sem V

Course Objective-

In today's increasingly complex and fragmented world, it is important to be able to resolve conflicts and build healthy relationships. Understanding and Managing Conflict is a course designed to prepare students to identify conflicts, manage emotions, analyze the situation and characters, and practice different frameworks to deal with conflicts.

Course Outcome :

On successful completion of this course, the students should be able to:

CC1105.1: Define a group and explain the stages of group development.
CC1105.2: Describe conflict and explain types and causes of conflict.
CC1105.3: Use inquiry and advocacy to engage with groups.
CC1105.4: Give and receive feedback effectively.
CC1105.5: Identify sources of conflict and manage them using difference conflict handling styles.

Prerequisites		
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	30
03	Class Participation	20
04	Quiz	20
05	Theory Exam-I	Nil
06	Theory Exam-II	Nil
07	Theory Exam-III	30
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30

Syllabus (Theory):

1. Introduction to the stages of group development
2. Introduction to Personality, Perception and Learning as source of differences in individual and groups
3. Nature, Types and sources of Conflict
4. Conflict Resolution Strategies
5. Emotional Intelligence
6. Empathy and Feedback
7. Inquiry & Advocacy – Concept of silence (Masking, Avoiding, Withdrawing) and violence (Controlling, Labeling, Attacking)

References for Reading:

1. Fisher, R., & Ury, W. (2011). Getting to yes: Negotiating agreement without giving in. Toronto, ON: Penguin Random House.
2. Harper, G. (2004). The joy of conflict resolution: Transforming victims, villains and heroes in the workplace and at home. Gabriola Island, BC: New Society Publishers.
3. Miles, E. W. (2013). Developing strategies for asking questions in negotiation. Negotiation Journal, 29(4): 383–412. doi: 10.1111/nejo.12034.

MOOC Reference Course:

(Certificate is not mandatory, this course is used for reference)

a. Course Title: Conflict Management Specialization
b. Offered by: University of California, Irvine
c. Duration and Course Load: 4 months, 1-2 hours/week
d. Platform: Coursera

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1105.1	1										2		1				
CC1105.2	1							1									
CC1105.3	1		1						1		2	1	1				
CC1105.4	1										1		1				
CC1105.5	1										1	1	1				

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Introduction to IoT; EE1111**
Hours per Week	**L-T-P: 1-0-2**
Credits	**2**
Students who can take	B.Tech Sem V All Branches

Course Objective- The course aims to develop understanding of Internet of Things concepts and also develop skills for working on IoT development boards to interface sensors and actuators. The course will enable the students to upload data from sensors on a web server and to use this data for analytical purposes or to actuate some transducers.

Course Outcome:

On successful completion of this course, the students should be able to:

EE1111.1: Interface the Analog and Digital sensors to Node-MCU
EE1111.2: Develop Embedded C programs to read sensor data and upload to public cloud platform.
EE1111.3: Use Python-based IDE (integrated development environments) for the interfacing of I/O devices with Raspberry Pi.
EE1111.4: Implement communication protocols for interfacing sensors to microcontrollers.
EE1111.5: Visualize sensor data uploaded on public cloud.
EE1111.6: Apply standard protocol(s) for implementation of IoT Systems.
EE1111.7: Analyze and Improve existing systems with innovative IoT based approaches.

Prerequisites		Basic Programming
Sr. No	**Specifications**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	10
5	Theory Exam-I	10
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I (Continuous)	35
15	Lab Evaluation-II	Nil
16	Course Portfolio (MOOC certificate)	Nil
	Total (100)	**100**

Retest

1	Theory Exam-III	30
2	Lab Evaluation-II	0
	Total (30)	**30**

Syllabus (Theory):

UNIT 1: Introduction to IoT Fundamentals: Definition, Characteristics, Applications, Connectivity Layers, Addressing, Networking.

UNIT 2**:** Sensors and Actuators: Sensors and Transducers, Sensor Classes, Sensor Types, Actuator Basics, Actuator Types,

UNIT 3**:** Basics of IoT Networking & Protocol: IoT Components, Inter-dependencies, SoA, Wireless Networks, Protocol Classification, MQTT, Secure MQTT, CoAP, XMPP, AMQP (Advanced Message Queuing Protocol)

UNIT 4**:** Connectivity Technologies: IEEE 802.15.4, ZigBee, 6LoWPAN, RFID, HART, NFC, Bluetooth, Zwave.

UNIT 5**:** Introduction to NodeMCU and Server: Basic Concepts of Arduino Platform, Examples of Arduino Programming, Interfacing different sensors with NodeMCU. Introductio to Blynk App, Uploading and downloading data from server using Blynk App. Intoduction to ThingSpeak Server, Uploading and downloading data from ThingSpeak server.

UNIT-6 Raspberry Pi: Basic functionality of the Raspberry Pi B+ board, Setup and Configuring Raspberry Pi, programming on the Raspberry Pi using Python, Python functions to access the Raspberry Pins, how Raspberry Pi interact with online services through the use of public APIs and SDKs.

Reference Books:

1. "The Internet of Things: Enabling Technologies, Platforms, and Use Cases", by Pethuru Raj and Anupama C. Raman (CRC Press)
2. "Internet of Things: A Hands-on Approach", by Arshdeep Bahga and Vijay Madisetti (Universities Press)
3. Rajkamal, Internet of Things, Architecture and Design Principles, Mc. Graw Hill Education (India) Pvt Ltd.
4. IoT fundamentals: networking technologies, protocols, and use cases for the internet of things: Hanes, David | Salgueiro, Gonzalo | Grossetete, Patrick | Barton, Robert Henry, Jerome, Pearson, 2018, ISBN: 9789386873743.
5. IOT (Internet of Things) Programming: A Simple and Fast Way of Learning IOT by David Etter.

Video lectures:

1. Introduction to internet of things By Prof. Sudip Misra, IIT Kharagpur

https://swayam.gov.in/nd1_noc20_cs66/preview

MOOC course

The Arduino Platform and C Programming

https://www.coursera.org/learn/arduino-platform?specialization=iot

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
EE1111.1								1		1	1						
EE1111.2							1	1	1		1						
EE1111.3								1		1							
EE1111.4								1	1	1	1		1	1			
EE1111.5							1	1		1	1			1			
EE1111.6									1	1			1	1			
EE1111.7									1	1	1						

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**PR1101 Automation Project**
Credits	2
Students who can take	B.Tech. (All programs)

Course Objectives: This course aims to develop skills for designing, implementing and testing solutions for automation using IoT.

Learning Outcomes:

On successful completion of this course, the students should be able to:

PR1101.1 design and implement a complete project in IoT/Automation using microcontroller/SOC interfaced with sensors or any other automation hardware/tools,

PR1101.2 apply standard IoT protocol(s),

PR1101.3 use cloud servers for data streaming and analysis,

PR1101.4 implement algorithms using the data at edge/cloud,

PR1101.5 deploy techniques to conserve bandwidth/energy/other resources and achieve cost economy for project.

Assessment Scheme:

Sr. No.	Evaluation Component	Marks
1	Attendance	Nil
2	Assignment	Nil
3	Class Participation	Nil
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	Nil
8	Report I (Synopsis)	30
9	Report II (Midterm Progress Presentation and Viva)	30
10	Report III	Nil
11	Project I (with Report)	40
121	Project II	Nil
13	Project III (With Report)	Nil
14	Lab Evaluation I	Nil
15	Lab Evaluation II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**
Evaluation scheme for retest.		
	Project III (with Report)	**40**
	Total (100)	**40**

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
PR1101.1	2				2					2		2		3			
PR1101.2						2											
PR1101.3							2										
PR1101.4	2								2								
PR1101.5					2		2										

Course Title and Code: Practice School–I (PS-I), PS1101	
Total Duration	45 Days
Credits	**04**
Students who can take	B.Tech Semester-V

Course Objective:

The purpose of Practice School-I is to give an opportunity to re-understand their theoretical knowledge in the context of real-life situations.

After course completion, the student will be able to:

PS1101.1 Identify skills and capabilities that interconnect effectively with the needs of industry.
PS1101.2 Demonstrate problem solving skills in the context of some real-life situation.
PS1101.3 Reflect and evaluate on future employment opportunities.

Evaluation Scheme:

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignments	Nil
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	Theory Exam-3	Nil
08	Report-1(Reporting Activity Fortnightly by faculty supervisor)	10
09	Report-2 (By faculty supervisor)	20
10	Report-3	Nil
11	Project-1 (Day to day task record by External supervisor)	10
12	Project-2	Nil
13	Project-3 (Presentation & Viva)	20
14	Lab Evaluation-1	Nil
15	Lab Evaluation-2	Nil
16	Course portfolio (Traits and Competencies)	40
	Total (100)	**100**

Course Articulation Matrix: (Mapping of COs with POs)

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
PS1101.1	1		2	1	2		2				2						
PS1101.2	1			1	3	2	2	2					1				
PS1101.3	1		2	2			1	1			3	2	1	1			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Course Code	**Computer Integrated Manufacturing (ME1212)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester- V (Batch: 2019-2023)**

Course Objective:

To understand the application of computers in the advanced manufacturing industries. This course compliments Production Technology-II to build upon the foundations laid in the earlier courses Design and Prototyping, CAD Lab, as well as Production Technology–I.

Course Outcomes:

On successful completion of this course, the students should be able to:

ME1212.1: Implement concept of CAD/CAM in industry.
ME1212.2: Apply cost reduction technique for manufacturing processes.
ME1212.3: Design cellular manufacturing system
ME1212.4: Identify requirement and application of AGVs and robots for FMS

Evaluation Scheme

Sr. No	Specifications	Marks
1	Attendance	NIL
2	Assignment	10
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	10
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	10
16	Course Portfolio	10
Total (100)		**100**

Evaluation scheme for Re-test

Sr. No	Specifications	Marks
1	Theory Exam-III (Re-test)	30
Total (30)		**30**

COURSE SYLLABUS (Theory):

UNIT I:

Brief introduction to CAD and CAM – Manufacturing Planning, Manufacturing control-Introduction to CAD/CAM – Concurrent Engineering-CIM concepts – Computerized elements of CIM system – Types of production. Basic Elements of an Automated system – Levels of Automation – Lean Production and Just-In-Time Production.

UNIT II

Process planning – Computer Aided Process Planning – Logical steps in Computer Aided Process Planning – Aggregate Production Planning – Material Requirement planning – Capacity Planning-Control Systems-Shop Floor Control-Inventory Control.

UNIT III

Group Technology(GT), Part Families – Parts Classification and coding – Part Coding system – Production flow Analysis – Cellular Manufacturing –Composite part concept – Machine cell design and layout.

UNIT IV

Types of Flexibility - FMS – FMS Components – FMS Application & Benefits, Automated Guided Vehicle System (AGVS) – AGVS Application, Robot Anatomy and Related Attributes – Classification of Robots- Robot Control systems.

Course Syllabus (Practical):

1. To manufacture any 3D designed CAD model using 3D printer.
2. To manufacture any part using CNC Machine.
3. To study a computer integrated manufacturing system (a case study).
4. To study a flexible manufacturing system (a case study)

Books:

1. David F.Rogers and Alan Adams.J, “Mathematical Elements for Computer Graphics”, McGraw –Hill Publishing Company International Edition, 1990.
2. P N Rao, “CAD/CAM: Principles and Applications”, Tata McGraw –Hill Ed., 2004
3. Groover M.P., Automation, “Production Systems and Computer Integrated Manufacturing”, Prentice-Hall of India Pvt.Ltd, New Delhi, 1996.
4. Sadhu Singh, :Computer Aided Design and Manufacturing”, Khanna publications,2000
5. Warren S Seames,Computer Numerical Control Concepts and Programming, Thomson Delmar, fourth Edition, 2002
6. Ibrahim Zeid, “Mastering CAD/CAM”, Tata McGraw –Hill Ed., 2007
7. HMT, “Mechatronics”, Tata McGraw –Hill Ed., 1998
8. P Radhakrishnan, S Subramanyan, “CAD/CAM/CIM”, New Age Publishers, 1994.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
ME1212.1	1				1	1	2							1	2	2	2
ME1212.2	1					1	2		2			1		1		2	1
ME1212.3						1	2	1	1		1	1		1		2	2
ME1212.4	1					1	2	1	1		1	1		1		2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Urban and Regional Planning CE1215**
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	B. Tech (V Sem) OE

Course Objective- To introduce the issues, concept and frameworks for urban and regional development and planning.

Course Outcome:

On successful completion of this course, the students should be able to:

CE1215.1 Demonstrate a broad concept in urban and regional planning, including deep understanding of underlying principles and concepts.

CE1215.2 Address land-use and built-environment problems in a range of social, economic and environmental contexts.

CE1215.3 Analyze the various components of water supply, sanitation, transportation and waste management.

CE1215.4 Analyze the various types of plans and their execution.

CE1215.5 Plan and design various types of social infrastructure projects.

Prerequisites		None
Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	10
03	Class Participation	10
04	Quiz	10
05	Theory Exam-I	Nil
06	Theory Exam-II	20
07	Theory Exam-III	30
08	Report-I	10
09	Report-II	10
10	Report-III	Nil
11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

Evaluation scheme for retest	
Theory Exam III	30
Total	**30**

Syllabus (Theory):

Introduction to Planning: Defining planning as a discipline, multidisciplinary nature, role of a planner, fields of planning, Urban, regional, environmental, transport and infrastructure, Concepts of garden City, City beautiful, linear city, Various definitions of town and country planning; Goals and objectives of planning; Components of planning; Benefits of planning; Arguments for and against planning. Economics and social planning as bases of physical planning. Planning Process. Levels of planning in India.

Types of Plans: Definition of development plan; Types of development plans: Master plan, City development plan, Structure plan, District plan, Action area plan, Subject plan, Comprehensive planning, Zonal plans, special area development plan e.g. SEZ (special economic zones), SIR (special investment regions).

Water Supply System: Water supply systems and networks, water sources, quality and quantity requirements, collection and water requirement for various land uses; Factors affecting water demand; Storage facilities; Distribution Systems; rainwater harvesting system.

Sanitation, Sewer system and SWM: Sanitation and Sewer System, types of sewers: General considerations, Sewage Disposal and treatment, Low-cost appropriate technologies for sanitation, Elements of Solid Waste Management, Best practices for solid waste management.

Transport System Types and characteristics of transport systems; Principles of transport infrastructure planning and, pedestrian and cyclist infrastructure; parking facilities; principles of traffic management, urban mass transport systems

Regional planning: definition, need and importance, function, objective, concept of region, types of regions, types and contents of regional planning for block, district, state, national, NCR, resource region, agro–climatic region, topographic region and sectoral planning, major regional problems and their solutions.

Text books:

1. Hutchinson, B.G., Principles of Urban Transport Systems Planning, Scripta,McGraw-Hill, New York, 1974.
2. Claire, Hand Book of Urban Planning, Van Nostrand Book Company, 1974.
3. Gallian, B. Arthur and Simon Eisner, The Urban Pattern - City Planning andDesign, Affiliated Press Pvt. Ltd., New Delhi, 1985.
4. RobertsM., An Introduction to Town Planning Techniques, Hutchinson,London, 1980.
5. Hiraskar, G. K., Fundamentals of Town Planning, Dhanpat Rai Publications,1992
6. Grigg, Neil, Infrastructure Engineering and Management, Wiley, (1988).
7. Kopardekar & Diwan (1994), 'Urban and Regional Planning-Principles, Practice and Law' S.H.
8. Kopardekar, Talegaon – dabhade.

8 . Kulshrestha S.K. (Ed. 2006), 'Dictionary of Urban and Regional Planning', Kalpaz Publications, Delhi.

Course Articulation Matrix: (Mapping of COs with POs)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CE1215.1	2	2	1										1				
CE1215.2	2	1	1									1					
CE1215.3	1				1			1	2		1						
CE1215.4	1	1	2		2	2		2	1		1	2		1	1		
CE1215.5	1	1	2		1	2		2	2		2	2	2	1	2		

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code	Design of Machine Elements ME1110	
Hours per Week	**L-T-P: 3-0-2**	
Credits	**4**	
Students who can take	**B. Tech Semester-VI**	
Course Objective: This course aims to equip students with the concepts, procedure, and standards for designing and evaluating shafts, bearings, springs, and gears for different applications.		
Course Outcomes: **After course completion, the student will be able to:** ME1110.1: Design and evaluate shafts to work under different service loading conditions as per ASTM/BIS standards. ME1110.2: Design bearings for various applications as per ASTM/BIS standards. ME1110.3: Design, evaluate gears for various applications as per ASTM/BIS standards. ME1110.4: Design springs for various systems as per ASTM/BIS standards.		
Prerequisites	Strength of Materials and Engineering Mechanics.	
Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	10
3	Class Participation	NIL
4	Quiz	10
5	Theory Exam I	10
6	Theory Exam II	10
7	Theory Exam-III	30
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	10
12	Project-II	Nil
13	Project-III	Nil

14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	Nil
	Total (100)	**100**
Re-Test		
1	Theory Exam-III	30

Syllabus (Theory)

UNIT-I

Design for Fluctuating Loads- Theory of failures, cyclic stress, fatigue and endurance limit, stress concentration factor, notch sensitivity, design for finite and infinite Life, Soderberg, Goodman & Gerber criteria.

Shafts- Material for shaft, stresses in shaft, design of shaft subjected to twisting moment, bending moment and combing twisting and bending moments, shaft subjected to fatigue load.

UNIT-II

Bearing- Classification of bearing, hydrodynamic lubrication, sliding contact bearing, design of journal bearing, thrust bearing-pivot and collar bearing, hydrodynamic thrust bearing.

Rolling contact bearing, types of rolling contact bearing, Bearing life, Selection of ball and roller bearings with ABMA Standards.

UNIT-III

Spur Gears- classification of gear, tooth forms, system of gear teeth, design consideration, Beam strength of gear tooth, dynamic tooth load, wear strength of gear tooth, failure of gear tooth, design of spur gears, AGMA standards.

Helical Gears: Terminology, forces components on a tooth of helical gear, virtual number of teeth, beam strength & wear strength of helical gears, dynamic load on helical gears.

UNIT-IV

Springs- Types of springs, design for helical springs against tension, compression and fluctuating loads, Design of leaf springs, Surging phenomenon in springs.

Syllabus (Lab)

1. Design an Oldham coupling and develop a 3D model.
2. Design a roller bearing and develop a 3D model.
3. Design a sliding contact bearing and develop a 3D model.
4. Design a spur gear and develop a 3D model.
5. Design a helical gear and develop a 3D model.
6. Design of spring under given condition and develop a 3D model.

Text Book(s)

1. Joseph Edward Shigley. “Mechanical Engg. Design” Tata Mc Graw Hill Book Co., 2006.
2. Bhandari, V B “Design of Machine Elements” Tata McGraw Hill, New Delhi., 2000.
3. PSG College of Engg. “PSG Design Data Book”. PSG Publication.
4. K. Balveera Reddy & K. Mahadevan. “Design Data Handbook”. 4th ed. CBS Publishers & Distributors, 497 pages, 2013.

Reference Book(s)

1. Dieter, G.E. and L.C. Schmidt, Engineering Design, 5th ed., McGraw-Hill Book Co, 825 pages, 2012.
2. Chitale, A. K., and R. C. Gupta. Product design and manufacturing. PHI Learning Pvt. Ltd., 2011.
3. Norton, Robert L. Machine Design An Integrated Approach. Pearson., 2006.
4. Kulkarni, S G . Machine Design. New Delhi: Tata Mcgraw Hill., 2008.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1110.1	1	1			1	1	1	1						1		2	2
ME1110.2			1	1	1	1	1	1						1		2	2
ME1110.3	1			1	1	1	1	1	1					1	1	2	2
ME1110.4	1			1	1	1	1	1	1					1	1	2	2

Course Title and Course Code	**Automobile Engineering (ME1111)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-VI**

Course Objective:

The main objective of the course is:-

1. To make the student conversant with fundamentals of automotive systems
2. To develop competencies in performance analysis of vehicles

Course Outcomes:

On successful completion of this course, the students should be able to:

ME1111.1 Identify different part of the automobile.

ME1111.2 Design and explain the working of various parts like engine, transmission, clutch and brakes.

ME1111.3 Design a steering and suspension system.

ME1111.4 Identify Euro6 standards for automobile emissions.

Prerequisites		**Thermodynamics**
Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	20
3	Class Participation	NIL
4	Quiz	5
5	Theory Exam-I	25
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
Total (100)		**100**
Evaluation scheme for Retest		**Marks**
1	Theory Exam-Retest	**30**
	Total(30)	**30**

UNIT-I **(10 Hours)**

Introduction: Layout of automobile – introduction chassis and body components. Types of Automobile engines. – Power unit – Introduction to engine lubrication – engine servicing

Fuel System: S.I. Engine: Fuel supply systems, Mechanical and electrical fuel pump – filters – carburetor – types – air filters – petrol injection. Introduction to MPFI and GDI Systems.

C.I. Engines: Requirements of diesel injection systems, types of injection systems, DI Systems IDI systems. Fuel pump, nozzle, spray formation, injection timing, testing of fuel pumps. Introduction CRDI and TDI Systems.

Unit II **(10 Hours)**

Cooling System: Cooling Requirements, Air Cooling, Liquid Cooling, Thermo, water and Forced Circulation System – Radiators – Types – Cooling Fan - water pump, thermostat, evaporative cooling – pressure sealed cooling – antifreeze solutions.

Ignition System: Function of an ignition system, battery ignition system, constructional features of storage, battery, auto transformer, contact breaker points, condenser and spark plug – Magneto coil ignition system, electronic ignition system using contact breaker, electronic ignition using contact triggers – spark advance and retard mechanism.

Electrical System: Charging circuit, generator, current – voltage regulator – starting system, bendix drive mechanism solenoid switch, lighting systems, Horn, wiper, fuel gauge – oil pressure gauge, engine temperature indicator etc.

UNIT-III **(10 Hours)**

Transmission System: Manual transmission and types of gear box, sliding-mesh, constant-mesh and synchromesh gear boxes, types of dog clutches, gear shift mechanism, principles of automatic transmission. Clutch operation and types, multi-plate and cone clutches, clutch construction and lining. Propeller shafts, universal joints, slip joint, Hotch-Kiss drive and torque tube drive, transaxle and transfer case, radius rods, four wheel drive arrangement. Automobile emissions, their harmful effects, pollution control measures, catalytic converters, exhaust system layout, mufflers, and resonators. Engine parameters, brief discussion of testing devices, engine service, engine tuning, engine re-boring, cyaniding, nitriding, de-carbonization.

UNIT-IV **(10 Hours)**

Braking System: Braking systems, layouts for mechanical braking, hydraulic braking, pneumatic braking, master cylinder, wheel cylinder, tandem cylinder, shoe brakes, disc brakes, requirements of brake fluid, power brakes, concept of ABS and traction control, parking brakes. Steering system, principles and need of steering, components parts, steering gear, steering ratio, steering lock, turning radius, centre point. Steering, wheel geometry, power steering principle and typical schemes.

Suspension System: Suspension system, functions of suspension, component parts, coil springs, leaf springs, air springs, shock absorbers, torsion bars, stabilizer bars, typical combinations of components in suspension systems, MacPherson strut suspension, its merits.

Wheel and tyres, wheel assembly and parts, pressed wheels and cast wheels, wheel rim, tyres, aspect ratio, tyres with tubes and tubeless tyres, advantages, construction of a tyre, plies, radial plies, tyre treads and tyre specifications.

Text Books:

1. Automotive Chassis- Heldt .P. M, Chilton Co., (Nyack, N.Y., P.M. Heldt, 1945) Literary Licensing, LLC, 2012.
2. Automotive Mechanics- N.K. Giri, 8th Edition, Khanna Publications, New Delhi, 2008.
3. Automobile Engineering / William H Crouse
4. Text Book Automobile Engineering–Manzoor, .Nawazish Mehdi & .Yosuf Ali, Frontline Publications.
5. Kamaraju Ramakrishna, “Automobile Engineering”, PHI Learning, New Delhi, 1st Print, 2012.
6. Jain &Asthana, “Automobile Engineering”, Tata McGraw-Hill, New Delhi, 2002.

Reference Books:

1. Text Book of Automobile Engineering by R K Rajput. Laxmi Publications.
2. Automotive Mechanics / Heitner
3. Automotive Engineering / Newton Steeds & Garrett
4. Automotive Engines / Srinivasan
5. Text Book of Automobile Engineering By Khalil U Siddiqui New Age International
6. Heinz Heisler, "Advanced Vehicle Technology", Elsevier, New Delhi, 2011.
7. Crouse &Anglin, "Automotive Mechanics", Tata McGrawHill, New Delhi, 10th Edition 2007.

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1111.1	1		1	1	1	1	1				1			1	1	2	2
ME1111.2	1	1	1	1	1	1					1			1	1	2	2
ME1111.3	1	1	1	1	1									1	1	2	2
ME1111.4	1	1		1	1		1							1	1	2	2

Course Title and Code: Critical Thinking for Decisions at Workplace CC1106

Course Objective: In today's world, the idea of right and wrong is being challenged by businesses, use of technology, economic conditions, and norms of societies. The relevance of a well-reasoned decision is crucial. This course intends to make students take better decisions keeping in mind purpose, context, and ethics.

Course Outcomes

The students will be able to:

CC1106.1. Apply techniques of Critical Thinking to analyse organisational problems through positive inquiry

CC1106.2. Describe and analyse appropriate problem-solving and ethical decision-making processes

CC1106.3. Choose the most effective and logical decision among multiple alternatives

CC1106.4. Evaluate solutions and anticipate likely risks based on purpose, context and ethics

Pre-requisites		**N/A**
Hours per Week		**L-T-P: 2-0-0**
Credits		**2**
Sr. No	**Specifications**	**Weightage**
01	Attendance	Nil
02	Assignment	**20**
03	Class Participation	**20**
04	Quiz	Nil
05	Theory Exam-1	Nil
06	Theory Exam-2	Nil
07	End term Viva	**30**
08	Report-1	Nil
09	Report-2	Nil
10	Report-3	Nil
11	Presentation	**30**
12	Project -2	Nil

13	Project -3	Nil
14	Lab Evaluation	Nil
15	Lab Evaluation	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Evaluation scheme for re-test

Sr. No	**Specifications**	**Weightage**
01	Theory Exam-3	**30**
	Total (30)	**30**

SYLLABUS

	Topic	**Sub-topics**
1	Decision Making: Definition and Type	• Organisational decision-making • Concept of thinking triangle • Importance of decision-making at work place
2	Barriers to Sound Reasoning	• Identifying barriers to Critical Thinking • Biases, prejudices, facts, opinions, assumptions. • Overcoming the obstacles
3	Steps of Decision Making	• Factors impacting decision-making • Concept of enquiry circle • Understanding arguments in business parlance
4	Ethics and Decisions	• Theories of ethics (Teleological, Deontological, Virtue Ethics, Conduct Ethics, Rights based, Utilitarianism, Hedonism, Egoism) • Concept of Moral reasoning • Role of ethics and values in Decision Making
5	Importance of purpose and context	• Role of Stakeholders in decision making.
6	Problem analysis best practices	• Root cause analysis • Identifying questions at the heart of a problem • Thinking checklist

7	Decision Implementation Techniques	• Developing intellectual virtues • Paul Elder's model (Intellectual humility, courage, empathy, integrity and confidence.
8	Comparing alternative solutions	• Ladder of Inference • Meta-thinking • Perspectives

Suggested Readings

1. Jonah Lehrer, 2009: **How we Decide.** Houghton Mifflin Harcourt, Boston, New York
2. Chip Heath and Dan Heath, 2013. **Decisive: How to Make Better Choices in Life and Work.** Crown Business, ISBN 0307956393
3. John S. Hammond, Howard Raiffa, Ralph L. Keeney, 2002. **Smart Choices: A Practical Guide to Making Better Decisions.** Crown Business, ISBN 0767908864
4. Ramesh K. Arora, **Ethics, Integrity and Values in Public Service.** New Age International Publishers, New Delhi.
5. Bradley H. Dowden, 1993. **Logical Reasoning.** Wadsworth Publishing Company, Belmont, California, ISBN 0534176887

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
CC1106.1	1										2		2				
CC1106.2	2					1		2					1				
CC1106.3									1		1	2	1				
CC1106.4							1	2				2					

Course Title and Code **Geographical Information Systems Lab (GIS): CE1114**	
Hours per Week	**L-T-P: 1 0 2**
Credits	**2**
Students who can take	B. Tech Sem VI sem (B Tech CSE, EEE and ME)
Course Objective: This course aims to develop understanding of various methods of remote sensing, satellite images data acquisition, data format, data analyze and data output. It also explains the major applications of GIS i.e. climate change, natural resources management and water resources management.	
Course Outcomes: **On completion of the course, the student should be able to:** CE1114.1 Asses the various sources for remote sensing data. CE1114.2 Analyze the data from various type of images. CE1114.3 Analyze the data acquisition and data output through GIS. CE1114.4 Incorporate GIS in resources management and climate changes.	

Prerequisites		
Teaching Scheme (Hours per Week)		L-T-P: 1 0 2
Credits		2
Sr. No.	**Evaluation Component**	**To be Announced Later**
1	Attendance	5
2	Assignment	Nil
3	Class Participation	10
4	Quiz (2)	20
5	Theory Exam-I	Nil
6	Theory Exam-II	Nil
7	Theory Exam-III	Nil
8	Report-I	Nil
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	10
12	Project-II	15
13	Project-III	Nil
14	Lab Evaluation-I	10
15	Lab Evaluation-II	20
16	Course Portfolio	Nil
17	Presentation	Nil
18	Viva	10
	Total (100)	
	Evaluation scheme for retest	
	Quiz	10
	Lab Evaluation-II	20

Syllabus (Theory)

1. Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves and resolution, Satellite Image - Characteristics and formats, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Supervised Classification

2. Basic concepts of geographic data, GIS and its components, Data acquisition, Raster and Vector formats, topology and Data models, Spatial modelling, Data output
3. Application of GIS: Climate change, Natural resources management, Forest management, Water Resources management, Drought Management

Syllabus (Practical)

1. Creating and Exploring a Basic Map
2. Classifying and Creating Vector Data
3. Laying Out of the Maps
4. Classifying and Creating Raster Data
5. Terrain Analysis
6. Raster to Vector Conversion
7. Hydrologic Analysis

Text /Reference Books:

1. Bhatta B., "Remote sensing and GIS", Oxford University Press, 2011.
2. Satish G., "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson, 2011.
3. Joseph George, "Fundamentals of Remote Sensing", University Press, 2011.
4. Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. GPS Theory and Practice. Springer, 1994. ISBN: 9780387824772.

https://nptel.ac.in/courses/105/108/105108077/

Course Articulation Matrix: (Mapping of COs with POs) (ME)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CE1114.1					1	1	2	2	1	2	1	2					
CE1114.2					2	1	2	2	2	1				1	1		
CE1114.3	2	1	2		2	1	3	1	1	2				2	2	1	1
CE1114.4	2		2		2	2	2				2	2		1	2	1	1

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title	**Contemporary Production Technology**
Course Code	**ME1214**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-VI (Batch: 2019-2023) as DE**

Course Objective:
The main objective of the course is to impart knowledge of other technologies that can be adopted to support manufacturing of any product in order to improve on productivity and usefulness of product.

Course Outcomes:
On successful completion of this course, the students will be able to:

ME1214.1. Identify joining processes like brazing, soldering, adhesive bonding, and mechanical fastening for various application.
ME1214.2. Identify surface roughness and lubricants that effects product quality.
ME1214.3. Design surface quality of product to improve performance.
ME1214.4. Design various inspection processes.

Prerequisites	**Basics of Materials Engg, PT-I and PT-II**

Evaluation Scheme

S. No	Specifications	Marks
1	Attendance	NIL
2	Assignment	20
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	10
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
17	Presentation	NIL
18	Viva	NIL
Total (100)		**100**

Evaluation Scheme for Re-test

Sr. No	Specifications	Marks
1	Theory Exam-III	30
Total (30)		**30**

Course Syllabus:

UNIT–I

Other Joining Processes: Introduction, Brazing, Soldering, Adhesive Bonding, Mechanical Fastening, Joining of Plastics, Ceramics and Glasses.

UNIT–II

Surface roughness and measurement: Introduction, Surface structure and integrity, Surface texture and roughness, friction, wear, lubrication, metal working fluids and their selection

UNIT–III

Surface treatments: Introduction, Mechanical surface treatments, mechanical plating and cladding, case hardening and hard facing, thermal spraying, vapor deposition, electroplating and hot dipping, cleaning of surfaces.

UNIT–IV

Quality Assurance and Inspection: Introduction, Product Quality, Quality Assurance, Total Quality Management, Taguchi Methods, Statistical Methods for Quality Control, Statistical Process Control, Reliability of products and processes.

Course Syllabus (Practical):

1. To prepare specimen surface using grinding machine and analyze its surface roughness / related case study.
2. To prepare specimen surface using CNC turning machine and analyze its surface roughness / related case study.
3. To analyze the effect of surface roughness on the tensile strength / related case study.
4. To analyze the effect of surface roughness on the toughness / related case study.
5. To analyze the effect of surface roughness on the fatigue strength / related case study.

REFERENCES:

1. Integrated Product Development / M. M .Anderson and L. Hein/ IFS Publications
2. Design for Concurrent Engineering/ J Cleetus/ CE Research Centre, Morgantown,
3. Concurrent Engineering Fundamentals/ Prasad / Prentice hall India Integrated Product Development
4. Concurrent Engineering in product Design and Development/ I. Moustapha / New age International
5. Product Life Cycle Management/ John Stark/ Springer –Verlag/ UK
6. Product Lifecycle Management/ Michael Grives/ Mc Graw Hill
7. Concurrent Engineering: Automation tools and Technology/Andrew Kusiak/ Wiley Eastern Technology

Course Articulation Matrix:

CO	CORRELATION WITH PROGRAM OUTCOMES															CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
ME1214.1	1				1	1	1										
ME1214.2	1				1	1	1										
ME1214.3					3	3	2	1	2	2				1	1	2	2
ME1214.4					3	3	3	2	2	2				1	1	2	2

Course Title and Code: Disaster Management: CE1206	
Hours per Week	**L-T-P: 3-1-0**
Credits	**4**
Students who can take	B.Tech SemVI sem (2019-2023) (OE)
Course Objective: This course aims to develop understanding of various natural and manmade disasters. Natural disasters include earthquake, Tsunami, Flood, forest fires and Land Slides. Manmade disasters include fire, Industrial Pollution, embankment failure, structural failure and due to electric supply. Topics includes the causes for these disasters and remedial measures which can minimize the losses to the life and property. The course also includes the identification and description of electric supply resilience and restoration.	

Course Outcomes

On completion of the course, the student should be able to:

CE1206.1 Asses the types of disasters, causes and their impacts.
CE1206.2 Assess vulnerability and various methods of risk reduction measures and mitigation.
CE1206.3 Draw the hazard and vulnerability profile of a given region.
CE1206.4 Analyze the impact of Storms and Severe Weather on electric utility.
CE1206.5 Plan and execute framework to black start and restoration procedure with considering security criteria and power system reliability.

Prerequisites		
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment	10
3	Class Participation	5
4	Quiz	Nil
5	Theory Exam-I	Nil
6	Theory Exam-II	15
7	Theory Exam-III	35
8	Report-I/ Case Study	5
9	Report-II/Case Study	5
10	Report-III/Case Study	5

11	Project-I	Nil
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
17	Presentation	10
18	Viva	10
	Total (100)	
	Evaluation scheme for retest	
	Theory Exam III	35

Syllabus (Theory)

Unit-1 Introduction to Disasters, Various types of disaster, Natural: Flood, Earthquake, cyclone, Land slide, Manmade: Fire, Industrial Pollution, embankment failure, structural failure, Loss of resources.

Unit-2

Risk and Vulnerability:

Risk: Its concept and analysis, Risk reduction, Vulnerability: Its concept and analysis, strategic development for vulnerability reduction

Unit 3

Disaster Management in Electrical Systems:

Causes of Extended Outages, System Impact of the Loss of Major Components, Methods to Reduce Energy System Vulnerability, Development of an On-Site and Off-site Disaster management Plan, Accident prevention techniques and Reporting procedures, Investigation reports, Impacts of Blackouts.

Unit 4

Management- Objectives, Processes, Events, analysis, base-line data, forecasting and Warnings. Disaster preparedness plan concept and nature, Emergency operation center and IT aids- physical environment, Applications. Public-private agency co-ordination- federal, state and local disaster response organization and network, Citizen and community role in disaster response and recovery.

Case Studies

1. A Case study on flood Hazard
2. A case study on Tsunami Hazard
3. A case study on Earthquake
4. A case study on Forest fire
5. A case study on structural failure
6. A case study on Electrical Disaster Recovery Operations for a Hospital
7. A Case study of Impacts of Cyclones on the Power Sector in India.

8. Impact assessment of Storms and Severe Weather on electric utility infrastructure.

Text /Reference Books:

1. M. Pandey, “Disaster Management” Wiley India Pvt. Ltd.
2. Tushar Bhattacharya, “Disaster Science and Management” McGraw Hill Education (India) Pvt. Ltd.
3. Crisis and disaster management plan for power sector by central electricity authority of India
4. N. Malla, S. Poudel, N. R. Karki and N. Gyawali, "Resilience of electrical power delivery system in response to natural disasters," 2017 7th International Conference on Power Systems (ICPS), Pune, 2017, pp. 806-811.doi: 10.1109/ICPES.2017.8387400
5. Sahni, Pardeepet. al. (Eds.),” Disaster Mitigation Experiences and Reflections”, Prentice Hall of India, New Delhi.

Course Articulation Matrix: (Mapping of COs with POs) (ME)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CE1206.1	2	2	2					2	2		2	2		1	1		
CE1206.2	2	2	2	1				1	1	1	2	2		1	1	1	1
CE1206.3		1	1	1	1	1	1	2	2	2	2	2		1	1		
CE1206.4					1	1	1										
CE1206.5					2	2	2										

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Course Title and Code:	**Minor Project; PR1103**
Hours per Week	**L-T-P: 0-0-2**
Credits	**4**
Students who can take	B.Tech Sem VII

Course Objective- This course offers an opportunity to apply and extend knowledge learned throughout the program to solve real world issues. The minor projects undertaken span a diverse range of topics, including design, simulation, and experimental studies. The course emphasizes, facilitating student learning in technical, project implementation and presentation spheres.

Course Outcome:

On successful completion of this course, the students should be able to:

PR1103.1:	Identify and formulate industrial and societal problems.
PR1103.2:	Design engineering solutions for complex problems.
PR1103.3:	Develop/fabricate, and implement solutions for identified problem.
PR1103.4:	Demonstrate the knowledge, skills and attitudes of a professional engineer.

Operation Procedure:

Students are expected to achieve the objective of the project work. The students are expected to submit a synopsis at the beginning of the semester for approval from the departmental committee in a specified format. The students are expected to report to their mentor(s) frequently and will be evaluated continuously. Department committee will evaluate the work through seminars and progress reports as per the evaluation scheme. At the end there would be a demonstration of the solution and possible future work for the work done.

- Student must devote full semester for Minor Project.
- Student must report to the mentor(s) regularly.
- Seminar evaluation must be carried out in the presence of at least two-committee members.
- Experts in the relevant area constituted by the supervisor.
- Final Seminar Report to be submitted must be in formal hard bound cover bearing of the Institute emblem.
- Assessment is by means of a synopsis presentation, submission of a thesis, and a public demonstration of work undertaken.

Prerequisites

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	Nil
03	Class Participation	Nil
04	Quiz	Nil
05	Theory Exam (Mid Term)	Nil
06	Theory Exam	Nil
07	Theory Exam (Final)	Nil
08	Report-1 (Synopsis) (Panel)	15
09	Report-2	Nil
10	Report-3	Nil
11	Project -1 (Mid Term) (Panel)	20
12	Project -2 (Day to Day work) (Demo, Presentation, Viva, Report)	25
13	Project -3 (End Term) (Panel) (Demo, Presentation, Viva, Report)	40
14	Lab Evaluation – I	Nil
15	Lab Evaluation – II	Nil
16	Course portfolio	Nil
	Total (100)	**100**

Course Articulation Matrix: (Mapping of COs with POs) (ME)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO 1	PSO 2
PR1103.1	1			2	1	2	1	2	2							1	1
PR1103.2			1	2	2	1		1	2		1	2		2	2	2	2
PR1103.3	1			2	1		1									2	1
PR1103.4			1	2	2	1	2				1	2		2	2	2	2

Course Title and Course Code	**IC Engine (ME1201)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-VII**

Course Objective:
This course builds upon the foundations laid in the second year course of Thermodynamics to understand advanced courses like Automobile, I.C Engines, etc. The main objective of the course is to give the students an introduction to reciprocating internal combustion engines. It also aims to develop competencies among students for analyzing the performance parameters of the engines.

Course Outcomes:
On successful completion of this course, the students should be able to:
ME1109.5: Design different types of reciprocating internal combustion engines (ICE), their typical design features and performance characteristics.
ME1109.6: Analyze power cycle efficiencies of internal combustion engines for ideal gas cycles, and air-fuel cycles.
ME1109.7: Design various components of exhaust emissions and demonstrate the mechanisms of emission formation.
ME1109.8: Analyze exhaust emission systems for fuel quality and engine performance.

Prerequisites	**Thermodynamics, Heat Transfer**

Evaluation Scheme

Sr. No	**Specifications**	**Marks**
1	Attendance	NIL
2	Assignment	20
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	NIL
6	Theory Exam-II	20
7	Theory Exam-III	30
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
17	Presentation	NIL
18	Viva	NIL
Total (100)		**100**
Evaluation scheme for Retest		**Marks**
1	Theory Exam-Retest	**30**
Total (30)		**30**

COURSE SYLLABUS (Theory):

UNIT - I

Air standard cycles: Internal and external combustion engines; classification of I.C. Engines, Cycles of operation in four stroke and two stroke I.C. Engines, Assumptions made in air standard cycle; Otto cycle; diesel cycle, dual combustion cycle, comparison of Otto, diesel and dual combustion cycles; sterling and Ericsson cycles; air standard efficiency, specific work output, specific weight; work ratio; mean effective pressure; deviation of actual engine cycle from ideal cycle. Problems. **(10)**

UNIT - II

Carburetion, fuel Injection and Ignition systems: Mixture requirements for various operating conditions in S.I. Engines; elementary carburetor, Requirements of a diesel injection system; types of injection systems; petrol injection, Requirements of ignition system; types of ignition systems, ignition timing; spark plug. **(4)**

Combustion in S. I. Engines: Ignition limits, Stages of combustion in SI engine, effect of engine variables on ignition lag, effect of engine variables on flame propagation, rate of pressure rise, abnormal combustion, detonation or knocking, effects of detonation. **(4)**

Combustion in C. I. Engines: Stages of combustion, air-fuel ratio in CI engines, delay period or ignition lag, variables affecting delay period, diesel knock, and methods of controlling diesel knock. **(2)**

UNIT - III

Lubrication and Cooling Systems: Lubrication principles, hydrodynamic lubrication, Functions of the lubricating system, Properties of the lubricating oil, SAE rating of lubricating oils, Service rating of oils, Types of lubrication systems; mist, wet sump and dry sump lubrication systems; engine performance and lubrication, Necessity of engine cooling; disadvantages of overcooling; cooling systems; air-cooling, water cooling; radiators. **(6)**

UNIT – 1V

Engine Testing and Performance: Performance parameters: BHP, IHP, mechanical efficiency, brake mean effective pressure and indicative mean effective pressure, torque, volumetric efficiency; specific fuel consumption (BSFC, ISFC), thermal efficiency; heat balance; Basic engine measurements; speed, fuel and air consumption, brake power, indicated power and friction power, heat going to cooling water and exhaust gases; performance curves. Problems. **(8)**

Air pollution from I.C. Engine and Its remedies: Pollutants from S.I. and C.I. Engines, Mechanism of formation of pollutants in SI engines, Exhaust emission, emission of unburnt hydrocarbon. Mechanism of formation of pollutants in CI engines. Methods of emission control; alternative fuels for I.C. Engines. **(8)**

COURSE SYLLABUS (Practical):

1. To study the constructional details & working principles of two-stroke or four stroke petrol engine/related case study.
2. To study the constructional detail & working of two-stroke or four stroke diesel engine/ related case study.
3. To draw valve timing diagram of two stroke/four stroke petrol and diesel engines/ related case study.
4. To find the indicated horse power (IHP) on multi-cylinder petrol engine by Morse Test/ related case study.
5. To perform constant speed performance test on a single cylinder diesel engine & draw curves of bhp vs fuel rate, air rate, bhp vs mep, mechanical efficiency & sfc/ related case study.
6. To perform variable speed performance test of a single cylinder diesel engine and prepare the curves (i) bhp, ihp, fhp, vs. speed (ii) volumetric efficiency & indicated specific fuel consumption vs. speed.
7. To perform constant speed performance test on a single cylinder petrol engine & draw curves of (i) bhp vs fuel rate, air rate and (ii) bhp vs mep, mechanical efficiency & sfc.
8. To perform variable speed performance test of a single cylinder petrol engine and prepare the curves (i) bhp, ihp, fhp, vs. speed (ii) volumetric efficiency & indicated specific fuel consumption vs. speed.
9. To prepare heat balance sheet on multi-cylinder petrol engine/ related case study.
10. To prepare heat balance sheet on single cylinder diesel engine/ related case study.

Text Books:

1. Willard W. Pulkrabek, Engineering Fundamentals of the Internal Combustion Engine, 2nd Edition, Pearson Prentice Hall, 2004.
2. Internal Combustion Engines –V. Ganesan, Pub.- McGraw-Hill.
3. Internal combustion engines-- M. L. Mathur, R. P. Sharma, Dhanpat Rai Publications, 2014
4. Internal Combustion Engines and Air Pollution-- R. Yadav, Central Publishing House, Allahabad 2012
5. Internal Combustion Engines Fundamentals- John B. Heywood, Pub.-McGraw Hill, New York.

Course Articulation Matrix:

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1201.1	1		1		1	1	1	1	1	1	1			1	1	1.5	1.5
ME1201.2	1	1	1	1		1		1	1	1	1			2	1	1.5	1.5
ME1201.3		1	1	1	1	1			1	1				1	2	1.5	1.5
ME1201.4	1	1		1	1		1	1	1	1				2	1	1.5	1.5

Course Title and Course Code	**Modelling of Engineering Materials (ME1209)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-VII**

Course Objective:

The objective of this course is to get good exposure for the students to model the behavior of an engineering materials when subjected to a loading system.

Course Outcomes:

On successful completion of this course, the students should be able to:

ME1209.1: model and predict behavior of Engineering Materials under various loading conditions.
ME1209.2: model and predict deformation in the engineering materials under various loading conditions.
ME1209.3: identify types of composites for various applications.
ME1209.4: design various application based metal matrix composites.

Evaluation Scheme:

Sr. No	Specifications	Marks
1	Attendance	NIL
2	Assignment	20
3	Class Participation	NIL
4	Quiz	20
5	Theory Exam-I	10
6	Theory Exam-II	NIL
7	Theory Exam-III	30
8	Report-I	10
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	NIL
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
17	Presentation	NIL
18	Viva	NIL
Total (100)		**100**

Evaluation scheme for Re-test

Sr. No	Specifications	Marks
1	Theory Exam-III (Re-test)	30
Total (30)		**30**

COURSE SYLLABUS (Theory):

UNIT – I Modelling of Engineering Materials
Introduction to material modelling, Complexity of material response in engineering, Classification of modelling of material response, Coordinate frame and system, Tensors, Continuum Mech**,** Kinematics, Balance laws, Constitutive relations

Unit 2: Linear Mechanical Models of Material Deformation
Introduction to LMMMD, Linear elastic solid models, Classes of elastic constants, Materials with single plane of elastic symmetry, Isotropic materials, Maxwell model, Kelvin-Voigt model, Time temperature superposition

Unit-3: Introduction to composite
Define Composites, Reinforcements and matrices, Types of reinforcements, Types of matrices, Types of composites, Carbon Fiber composites, Properties of composites in comparison with standard materials, Applications of metal, ceramic and polymer matrix composites.
Stiffness and Strength of composite: Geometrical aspects – volume and weight fraction. Unidirectional continuous fiber, discontinuous fibers, Short fiber systems, woven reinforcements Mechanical Testing: Determination of stiffness and strengths of unidirectional composites; tension, compression, flexure and shear.

Unit 4: Metal Matrix Composites
Characteristics of MMC, various types of metal matrix composites alloy vs. MMC, advantages of MMC, limitations of MMC, Reinforcements – particles – fibers. Effect of reinforcement volume fraction rule of mixtures. Processing of MMC, powder metallurgy process, diffusion bonding, stir casting, squeeze casting, a spray process, Liquid infiltration, measurement of interface properties- applications of MMC in aerospace, automotive industries
Lamina Constitutive Equations, basic assumptions of laminated anisotropic plates. Laminate Constitutive Equations Coupling Interactions, Balanced Laminates, Symmetric Laminates, Angle Ply Laminates, Cross Ply Laminates. Laminate Structural Moduli. Evaluation of Lamina properties from Laminate Tests.

COURSE SYLLABUS (Practical):

1. Study the mechanical behavior (under tensile loading) of fly ash composites
2. Study the mechanical behavior (under fatigue loading) of fly ash composites
3. Study the mechanical behavior (under impact loading) of fly ash composites
4. Study the mechanical behavior (under tensile loading) of aluminum alloy
5. Study the mechanical behavior (under fatigue loading) of aluminum alloy
6. Study the mechanical behavior (under impact loading) of aluminum alloy

Text Books:

1. Autar K. Kaw, Mechanics of Composite materials, CRC Taylor & Francis, 2nd Ed, 2005.
2. Composite Material Science and Engineering, Krishan K. Chawla, Springer, 3e, 2012.
3. Robert M. Jones, Mechanics of Composite Materials, Taylor & Francis, 1999.

Reference Books:

1. MadhijitMukhopadhay, Mechanics of Composite Materials & Structures, Universities Press,2004.
2. Michael W, Hyer, Stress analysis of fiber Reinforced Composite Materials, Mc-Graw Hill International, 2009.
3. Fibre Reinforced Composites, P.C. Mallik, Marcel Decker, 1993.
4. Hand Book of Composites, P.C. Mallik, Marcel Decker, 1997.

Reference courses:

1. Introduction to Composites https://swayam.gov.in/nd1_noc20_me95/preview

Course Articulation Matrix:

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1209.1	1		1		1	1	1	1	1	1	1			1	1	1.5	1.5
ME1209.2	1	1	1	1		1		1	1	1	1			2	1	1.5	1.5
ME1209.3	1	1	1	1	1	2	1	1	1	1				2	2	1.5	1.5
ME1209.4	1	1		1	1				1	1				2	2	1.5	1.5

Course Title and Course Code	**POWER PLANT ENGINEERING (ME1203)**
Hours per Week	**L T P: 3 0 2**
Credits	**4**
Students who can take	**B. Tech Semester-VII**

Course Objective:
Providing an overview of Power Plants and detailing the role of Mechanical Engineers in their operation and maintenance.

Course Outcomes:
On successful completion of this course, the students should be able to:

ME1203.1: Model and compare different boiler's based on high pressure or low pressure
ME1203.2: Draw and construct different power plants based on the working fluid used (diesel, water, etc.)
ME1203.3: Demonstrate various functions of different accessories of boilers
ME1203.4: Critic what would be a sustainable power plant out of all different power plants studies
ME1203.5: Analyze and solve energy and economic related issues in power sectors

Prerequisites		**Basics of Physics**
Sr. No	**Specifications**	**Marks**
1	Attendance	5
2	Assignment	10
3	Class Participation	NIL
4	Quiz	5
5	Theory Exam-I	20
6	Theory Exam-II	NIL
7	Theory Exam-III	40
8	Report-I	NIL
9	Report-II	NIL
10	Report-III	NIL
11	Project-I	NIL
12	Project-II	NIL
13	Project-III	NIL
14	Lab Evaluation-I	10
15	Lab Evaluation-II	10
16	Course Portfolio	NIL
17	Presentation	NIL
18	Viva	NIL
Total (100)		**100**

Evaluation scheme for Retest		**Marks**
1	Theory Exam-Retest	**30**
	Total(30)	**30**

COURSE SYLLABUS (Theory):

UNIT – I
Introduction to power plants and Steam Power Plant: Conventional and Non-Conventional Energy Sources, Load-duration curves and definitions, selection of site for steam power plants, Boiler performance, Rankine cycle, Reheat cycle, Regenerative cycle, Surface condenser performance.

UNIT – II
Diesel Power Plant: Diesel engine performance and operation, Power and mechanical efficiency, m.e.p., s.f.c., volumetric efficiency, Thermal efficiency, relative efficiency, Heat balance.

UNIT – III
Gas Turbine Power Plant: Sterling Cycle, Ericson cycle, Brayton cycle, Advantages and Disadvantages of Gas Turbine Plant, Reheating, Regeneration, Intercooling

UNIT – IV
Solar Energy Power Plant: Solar constant, Solar energy collectors, Photovoltaic power system, solar thermal energy power plant, solar central receiver system, PVsyst project design calculation.
Other Power Plants and economics of power plants: Geo-thermal power plant, OTEC power plant, Tidal wave power plant. Cost of Electric Energy - Fixed and operating Costs - Energy Rates - Types of Tariffs.

COURSE SYLLABUS (Practical):

1. To study low pressure boilers and their accessories and mountings.
2. To study high pressure boilers and their accessories and mountings.
3. To prepare heat balance sheet for given boiler.
4. To find power output & efficiency of a steam turbine.
5. To find the condenser efficiencies.
6. To study and find volumetric efficiency of a reciprocating air compressor.
7. To conduct variable speed performance test of a single cylinder diesel engine and prepare the curves (i) bhp, ihp, fhp, vs. speed (ii) volumetric efficiency & indicated specific fuel consumption vs. speed.
8. PVsyst based designing of a solar PV cell project.

Text Books:

1. Nag P.K., "Power plant Engineering", Tata McGraw-Hill, 2008.
2. R. Yadav, "Fundamentals of power plant engineering", Central Publishing House, Allahabad, 2011.

Course Articulation Matrix:

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
ME1203.1	1		1		1	1	1	1	1	1	1			1	1	1.5	1.5
ME1203.2	1	1	1	1		1		1	1	1	1			2	1	1.5	1.5
ME1203.3	1	1	1	1	1			1	1	1				1	2	1.5	1.5
ME1203.4	1	1		1	1		1	1	1	1				1	1	1.5	1.5
ME1203.5	1		1		1	1	1	1	1	1	1			2	1.5	1.5	1.5

Course Title and Code:	**Advanced Statistics; AS1202**
Hours per Week	**L-T-P: 3-0-2**
Credits	**4**
Students who can take	B.Tech Sem VII (Open Elective)

Course Objective- To familiarize students with concepts of probability theory and random variables and use them to analyze real life problems. This course also focuses on developing an understanding of regression models, data analysis, model building, interpretation of results and statistical computation.

Course Outcome:

On successful completion of this course, the students should be able to:

AS1202.1. Identify and formulate fundamental probability distributions and density functions.

AS1202.2. Analyze continuous and discrete-time random variables and processes.

AS1202.3. Analyze system of multiple random variables.

AS1202.4. Compute cumulative distribution function and normalizing constant for the probability density function of one or more random variables.

AS1202.5. Apply the concept of algebra of random variables to analyze various linear systems.

AS1202.6. Design experiments as processes and analyze these using appropriate statistical tool.

Sr. No	**Specifications**	**Marks**
01	Attendance	Nil
02	Assignment	**5**
03	Class Participation	**10**
04	Quiz	**15**
05	Theory Exam-I	**Nil**
06	Theory Exam-II	**20**
07	Theory Exam-III	**30**
08	Report-I	Nil
09	Report-II	Nil
10	Report-III	Nil
11	Project-I	**20**
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	Nil
15	Lab Evaluation-II	Nil
16	Course Portfolio	Nil
	Total (100)	**100**

Retest

1	Theory Exam	30

Syllabus (Theory):

RANDOM VARIABLES

Random variables, Distribution and density functions of random variables, Discrete and continuous random variables, Gaussian, Exponential, Rayleigh, Uniform, discrete Uniform and conditional distributions, distribution mean, variance, moments and characteristics functions.

MULTIPLE RANDOM VARIABLES

Function of two random variables, Distributions of two random variables, correlation coefficient, Joint moments, Joint characteristics functions, Conditional distributions, conditional expected values, statistical independence. Multiple random variables, distribution of sums of random variables, Central limit theorem.

OPERATIONS ON MULTIPLE RANDOM VARIABLES

Mean or expected value of multiple random variables, Variance, standard deviation, moments, Chebyshev's Inequality, moment generating function, characteristic function, covariance, variance of a linear combination of random variables.

REGRESSION ANALYSIS

Introduction to regression model, Types of regression models, Estimation of the regression coefficients and error variance, Inferences for the regression coefficients, Predicting future observations, Inverse prediction and regulation. An introduction to multiple linear regression models.

DESIGN OF EXPERIMENTS

Analysis of variance, one way classification, two-way classification.

Reference Books:

- J. Susan Milton and Jesse C. Arnold, 'Introduction to Probability and Statistics', McGraw Hill Education.
- Papoulis, 'Probability, Random Variables and Stochastic Processes', TMH.
- VK Rohatgi and AK Saleh, 'An Introduction to Probability and Statistics', Wiley India.
- Ross, 'Stochastic Processes', 2ed, Wiley.
- Shumway & Stoffer (2011) Time Series Analysis and its applications, with examples in R, 3rd edition, Springer.
- K. L. Chung, 'Introduction to Probability Theory with Stochastic Processes', Springer International Student Edition.
- Applied Linear Statistical Models by Kutner, Nachtsteim, Neter and Li (5th edition).

Course Articulation Matrix: (Mapping of COs with POs and PSOs (ME))

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO -1	PSO -2
AS1202.1						1		1									
AS1202.2					1	1		1		1						1	1
AS1202.3		1			1	1	1	1		1			1	1		1	1
AS1202.4						2		1									
AS1202.5						2		2	1	2						1	
AS1202.6	1	1	1		2	2	1	2		2	1		1	2	1	2	1

Course Title and Code: Geographical Information System (GIS): CE1214	
Hours per Week	**L-T-P: 3 0 2**
Credits	**4**
Students who can take	B. Tech Sem VII sem (All Branches)
Course Objective: This course aims to develop understanding of various methods of remote sensing, satellite images data acquisition, data format and data output. It also explains the major applications of GIS i.e., climate change, natural resources management and water resources management.	
Course Outcomes: **On completion of the course, the student should be able to:** CE1214.1. Asses the various sources for remote sensing data. CE1214.2. Analyze the data from various type of images. CE1214.3. Analyze the data acquisition and data output through GIS and GPS. CE1214.4. Incorporate GIS in resources management and climate changes.	

Prerequisites		
Teaching Scheme (Hours per Week)		3 0 2
Credits		4
Sr. No.	**Evaluation Component**	**Marks**
1	Attendance	Nil
2	Assignment	5
3	Class Participation	5
4	Quiz (2)	10
5	Theory Exam-I	15
6	Theory Exam-II	Nil
7	Theory Exam-III	30
8	Report-I	5
9	Report-II	Nil
10	Report-III	Nil
11	Project-I	10
12	Project-II	Nil
13	Project-III	Nil
14	Lab Evaluation-I	20
15	Lab Evaluation-II	Nil
16	Course Portfolio	
	Total (100)	
	Evaluation scheme for retest	
	Theory Exam III	30

Syllabus (Theory)

1. Remote sensing satellites and their data products, Sensors and orbital characteristics, Spectral reflectance curves and resolution

2. Satellite Image - Characteristics and formats, Image histogram, Introduction to Image rectification, Image Enhancement, Land use and land cover classification system, Supervised Classification

3. Basic concepts of geographic data, GIS and its components, Data acquisition, Raster and Vector formats, topology and Data models, Spatial modelling, Data output

4. Application of GIS: Climate change, Natural resources management, Forest management, Water Resources management, Drought Management

5. GPS: Introduction, coordinates and time system, Satellites, Mathematical model of GPS observables, Methods of processing GPS data

Syllabus (Practical)

1. Creating and Exploring a Basic Map
2. Classifying and Creating Vector Data
3. Laying Out of the Maps
4. Classifying and Creating Raster Data
5. Terrain Analysis
6. Raster to Vector Conversion
7. Hydrologic Analysis

Text /Reference Books:

1. Bhatta B., "Remote sensing and GIS ", Oxford University Press, 2011,
2. Satish G., "Advanced Surveying: Total Station, GIS and Remote Sensing", Pearson, 2011,
3. Joseph George, "Fundamentals of Remote Sensing", University Press, 2011.
4. Hofmann-Wellenhof, B., H. Lichtenegger, and J. Collins. GPS Theory and Practice. Springer, 1994. ISBN: 9780387824772.

https://nptel.ac.in/courses/105/108/105108077/

Course Articulation Matrix: (Mapping of COs with POs) (ME)

CO		CORRELATION WITH PROGRAM OUTCOMES														CORRELATION WITH PROGRAM SPECIFIC OUTCOMES	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO 1	PSO 2
CE1214.1					1	1	2	2	1	2	1	2				1	1
CE1214.2					2	1	2	2	2	1				1	1	1	
CE1214.3	2	1	2		2	1	3	1	1	2				2	2	2	1
CE1214.4	2		2		2	2	2				2	2		1	2		2

Course Title: Fintech in Retail Banking and Insurance
Course Code: FA1151
Credits: 3
Semester: V BBA, VII B Tech

Course Objective:

The course provides overview of how fintech is transforming retail banking and insurance in India.
It provides an overview of various retail banking products (liabilities, 3rd party sales, assets) and insurance products covering in brief product features, sales channels and associates risks.
The course will help prepare students for career in retail financial services industry,

Course Outcomes:

FA1151.1. Introduction to retail banking & its various facets
FA1151.2. Introduction to insurance and its various facets
FA1151.3. How Fintech is transforming functions across insurance and retail banking and opportunities ahead

Course Content/Topics to be covered:

- Chapter 1: History of banking and evolution of retail banking
- Chapter 2: History of Insurance and introduction to Insurance business
- Chapter 3: Evolution of Fintech and introduction to Fintech
- Chapter 4: Retail liability products
- Chapter 5: Third party products
- Chapter 6: Loan calculator
- Chapter 7: Retail asset products
- Chapter 8: Credit Bureau
- Chapter 9: Life insurance products & roadmap
- Chapter 10: General insurance products and roadmap
- Guest lecture by Insurance experts
- Chapter 11: Fintech… payment gateways
- Chapter 12: Fintech… lending
- Chapter 13: Fintech… third party products brokerage, insurance, mutual funds
- Guest lecture by Fintech industry experts
- Chapter 14: Life journey of an individual… saving, insurance and retirement planning
- Chapter 15: Introduction to financial inclusion, small finance banks, microfinance and guest lecture by Small Finance Bank/ MFI expert… Optional
    - Presentation by students

Evaluation Scheme:

Component	Weightage (100)
Minor Projects (5, 10% each)	50%
Mid Term Quiz (30th Sep)	10%
End Term Exam	40%

References (Textbooks/case studies/articles):

Retail Banking by Indian Institute of Banking by Mocmillan Education… 2018 edition
India Fintech Report 2020-> presentations shared with students Project works assigned.

Course Articulation Matrix

Course Outcome	Correlation with program outcomes															Correlation with program specific outcomes	
	PO 1	PO 2a	PO 2b	PO 2c	PO 3a	PO 3b	PO 3c	PO 4a	PO 4b	PO 4c	PO 5a	PO 5b	PO 6	PO 7a	PO 7b	PSO-1	PSO-2
FA1151.1	1				1								1	1			
FA1151.2	1				1								1	1			
FA1151.3	1				1		1	1	1				1	1			

Course Material presented by the instructor Praveen Arora

PS1102/ PR1105/ PR1104

Practice School-II/ Industrial Project-II/ Entrepreneurial Project/ Research Project

Course Syllabus:

This course is for five four and half months (summer and one semester) in VII or VIII Semester. The objective of this programme is to provide the students, an opportunity to work on live projects of corporate world in various fields. During this programme, they will work on real world applications of their curricula through organizational function of their choice. The students are expected to be involved directly in problem solving efforts of specific interest to the host organization. The learning of PS-I will help them in completing PS-II successfully. PS-II duration of internship is 4 - 4.5 months. PS -II Winter internship Dec to May.

Course Code	Course Title	Teaching Scheme	
		Total Duration	Credits
PS1102/ PR1105/ PR1104	Practice School-II/ Industrial Project-II/ Entrepreneurial Project/ Research Project	4 months	16

Evaluation Scheme:			
Expert Evaluation	Evaluation Component	Mid-Term	Final Term
Industry Expert	Day to Day Task Record	20	40
	Report Content & Presentation	10	30
JKLU faculty	Reporting Activity Fortnightly	8	18
	Presentation, Viva, Report	20	50
	PS-2 Coordinator Feedback	2	2
	Total	**60**	**140**

Program Articulation Matrix - (B. Tech ME) Batch 2019-23

S.No.	Course Code	Course Title	Credit	Year	Semester	PO1	PO2a	PO2b	PO2c	PO3a	PO3b	PO3c	PO4a	PO4b	PO4c	PO5a	PO5b	PO6	PO7a	PO7b	PSO1	PSO2
1	**AS1101**	**Experimental Science**	**3**	**1**	**1**	1.00	0.00	0.25	0.00	0.38	0.13	0.25	0.00	0.00	0.00	0.50	0.00	0.25	0.13	0.13	0.00	0.00
2	**CC1101**	**Fundamentals of Communication**	**2**	**1**	**1**	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.20	0.00	0.60	0.00	0.40	0.00	0.00	0.00	0.00
3	**ES1101**	**Computational Data Analysis**	**10**	**1**	**1**	0.00	0.33	0.56	0.00	1.00	0.78	0.00	0.67	0.00	0.33	0.89	0.00	0.56	0.56	0.00	0.00	0.00
4	**ES1102**	**Design and Prototyping**	**6**	**1**	**1**	1.1667	0.1667	0.1667	0.1667	1.1667	0.6667	0.6667	0.1667	0	0	0.3333	0.3333	0.3333	0.6667	0	0	0
5	**AS1102**	**Scientific Perspective**	**2**	**1**	**2**	0.50	0.25	0.00	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00
6	**CC1102**	**Critical Thinking & Storytelling**	**2**	**1**	**2**	0.00	0.00	0.40	0.00	0.00	0.20	0.00	0.20	0.00	0.00	0.20	0.00	0.60	0.00	0.00	0.00	0.00
7	**CS1101**	**Object Oriented Programming**	**3**	**1**	**2**	0.00	0.00	0.00	0.00	0.40	0.40	0.20	0.00	0.00	0.00	0.40	0.40	0.00	0.40	0.00	0.00	0.00
8	**ES1103**	**Calculus and Applied Mechanics**	**6**	**1**	**2**	0.50	0.00	0.00	0.00	0.38	1.75	1.38	0.00	0.25	0.00	0.88	0.00	0.75	0.00	0.00	0.00	0.00
9	**ES1104**	**Fundamentals of Automation Engineering**	**6**	**1**	**2**	0.50	0.00	0.00	0.00	0.92	0.33	0.25	0.33	0.25	0.00	0.00	0.50	0.17	0.67	0.00	0.00	0.00
10	**ES1105**	**Energy and Environment Studies**	**1**	**1**	**2**	0.67	0.33	0.00	0.00	0.33	0.33	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00
11	**ME1101**	**Materials Engineering**	**4**	**2**	**3**	0.50	0.00	0.00	0.00	1.00	1.00	0.50	0.75	0.75	0.00	0.50	0.75	0.00	0.00	0.00	1.00	1.25
12	**ES1106**	**Computational Engineering Analysis - I**	**5**	**2**	**3**	0.10	0.10	0.00	0.00	1.40	1.00	0.80	1.00	0.40	0.20	0.60	0.60	0.00	0.10	0.10	0.00	0.00
13	**ES1107**	**Engineering Measurements and Machines**	**5**	**2**	**3**	0.80	0.40	0.40	0.20	1.20	1.20	1.00	0.80	0.60	0.00	0.80	0.40	0.40	0.20	0.00	0.00	0.00
14	**ME1102**	**Engineering Thermodynamics**	**4**	**2**	**3**	0.40	0.20	0.20	0.00	0.80	0.40	0.40	0.40	0.00	0.20	0.00	0.40	0.40	0.20	0.00	2.00	2.00
15	**CC1103**	**Perspectives on Contemporary Issues**	**2**	**2**	**3**	0.50	0.00	0.50	0.00	0.00	0.25	0.00	0.25	0.00	0.00	0.75	1.00	0.75	0.00	0.00	0.00	0.00
16	**IL1101**	**Management Perspectives**	**2**	**2**	**3**	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.50	0.00	0.00	0.00	0.00	0.00
17	**ME1104**	**Transport Phenomena**	**4**	**2**	**4**	0.50	0.33	0.17	0.00	0.67	0.33	0.33	0.67	0.00	0.17	0.00	0.50	0.33	0.33	0.00	2.00	1.67
18	**ME1105**	**Strength of Materials and Analysis**	**4**	**2**	**4**	0.40	0.00	1.00	0.00	1.20	0.60	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.40	0.20
19	**ES1109**	**Computational Engineering Analysis - II**	**5**	**2**	**4**	0.57	0.14	0.43	0.00	1.00	1.43	1.00	1.00	0.00	0.29	0.57	0.00	0.14	0.71	0.00	0.00	0.00
20	**ME1106**	**Production Technology-I**	**4**	**2**	**4**	0.75	0.00	0.00	0.00	0.50	0.75	0.75	0.50	0.50	0.50	0.50	0.75	0.00	0.25	0.25	0.50	1.50
21	**CC1104**	**Communication and Identity**	**2**	**2**	**4**	0.25	0.00	0.50	0.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.00	0.75	0.00	0.00	0.00
22	**IL1102**	**Introduction to Design**	**2**	**2**	**4**	1.14	0.00	0.14	0.00	0.00	0.14	0.86	0.43	0.14	0.14	0.00	0.00	0.57	0.43	0.00	0.00	0.00
23	**ME1107**	**Mechaical Engineering CAD Lab**	**2**	**2**	**4**	0.00	0.00	0.00	0.00	0.00	0.00	0.25	0.00	0.75	0.00	0.50	0.00	0.25	0.00	0.00	0.25	0.50
24	**ME1108**	**Theory of Machines**	**4**	**3**	**5**	1.00	0.00	0.00	0.00	1.00	1.00	1.00	0.50	1.00	0.00	0.50	0.75	0.00	1.00	0.50	2.00	1.75
25	**ME1109**	**Production Technology – II**	**4**	**3**	**5**	1.50	0.00	1.00	0.00	1.00	1.00	1.00	1.00	0.50	0.50	0.50	0.00	0.00	1.00	1.00	1.00	1.00
26	**CC1105**	**Understanding and Managing Conflict**	**2**	**3**	**5**	1.00	0.00	0.20	0.00	0.00	0.00	0.00	0.20	0.20	0.00	1.20	0.40	0.80	0.00	0.00	0.00	0.00
27	**EE1111**	**Introduction to Internet of Things (IoT)**	**2**	**3**	**5**	0.00	0.00	0.00	0.00	0.00	0.00	0.29	0.71	0.57	0.86	0.71	0.00	0.29	0.43	0.00	0.00	0.00
28	**PR1101**	**Automation Projects**	**2**	**3**	**5**	0.80	0.00	0.00	0.00	0.80	0.40	0.80	0.00	0.40	0.40	0.00	0.40	0.00	0.60	0.00	0.00	0.00
29	**ME1110**	**Design of Machine Elements**	**4**	**3**	**6**	0.75	0.25	0.25	0.75	1.00	1.00	1.00	1.00	0.50	0.00	0.00	0.00	0.00	1.00	0.50	2.00	2.00
30	**ME1111**	**Automobile Engineering**	**4**	**3**	**6**	1.00	0.75	0.75	1.00	1.00	0.50	0.50	0.00	0.00	0.00	0.50	0.00	0.00	1.00	1.00	2.00	2.00
31	**CC1106**	**Critical Thinking for Decisions at Workplace**	**2**	**3**	**6**	0.75	0.00	0.00	0.00	0.00	0.25	0.25	1.00	0.25	0.00	0.75	1.00	1.00	0.00	0.00	0.00	0.00
32	**ME1212**	**DE-I**	**4**	**3**	**5**	0.75	0.00	0.00	0.00	0.25	1.00	2.00	0.50	1.00	0.00	0.50	0.75	0.00	1.00	0.00	2.00	1.75
33	**ME1214**	**DE-II**	**4**	**3**	**6**	0.50	0.00	0.00	0.00	2.00	2.00	1.75	0.75	1.00	1.00	0.00	0.00	0.00	0.50	0.50	1.00	1.00
34	**PR1103**	**Minor Project**	**4**	**4**	**7**	0.50	0.00	0.50	2.00	1.50	1.00	1.00	0.75	1.00	0.00	0.50	1.00	0.00	1.00	1.00	1.75	1.50
35	**DE (4)**	**DE-IV**	**4**	**4**	**7**	*TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	1.50	1.50
36	**DE (5)**	**DE-V**	**4**	**4**	**7**	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	1.50	1.50
37	**DE (6)**	**DE-VI**	**4**	**4**	**7**	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	1.50	1.50
					Total	19.70	3.51	7.41	4.37	21.38	20.09	18.22	13.58	10.26	4.59	14.02	10.43	9.49	12.92	4.98	22.40	22.62
Desired Competence Level (N - Novice, AB - Advanced Beginner, C - Competent)						C	N	N	N	C	C	C	AB	AB	N	AB	AB	AB	AB	N	C	C

Note:
- The above-mentioned contributions of the already taught emerging tech and department elective courses is the minimum contribution out of multiple options given to students.
- AB is the desired competence level for PO3b an PO3c.
- Contribution of courses to be taught is specified as minimum expected contribution.
- Open Electives, Practice School 1 and Practice School 2 are excluded from above calculation and their contribution towards attainment of PO and PSO is in addition.
- * TBD: To be decided.