2017-19

HAND BOOK MECHANICAL ENGINEERING

Bachelor of Engineering

Department of Mechanical Engineering

JORHAT ENGINEERING COLLEGE, JORHAT

GARMUR, JORHAT-785007

ASSAM

Content

	Title		Page No
1	**Introduction**		1
2	**Vision and Mission of the College**		1
3	**Vision, Mission, POs, PEOs and PSOs of the Department**		1
	3.1	Vision and Mission	1
	3.2	PO-Program Outcomes	1
	3.3	Programme educational objectives (PEOs)	2
	3.4	PSO-Program Specific Outcomes	3
4	**Program Curriculum**		3
	4.1	Course Structure	3
		4.1.1 Course Structure of the New Course of Assam Science and Technology University (2018 batch)	3
		4.1.2 Course Structure of the New Course of Dibrugrah University (2016 and 2017 Batches)	4
		4.1.3 Course Structure of the Old Course of Dibrugrah University (2015 Batch)	8
	4.2	Detailed Syllabus with COs and COs-POs Mapping	10
		4.2.1 1st Year Syllabus of Assam Science and Technology University	10
		4.2.2 3rd, 4th and 5th Semesters New Syllabus of Dibrugarh University	33
		4.2.3 6th, 7th and 8th Semester Old Syllabus of Dibrugarh University	71
5	**Laboratories and Workshops of the Department**		97
	5.1	Laboratory	97
	5.2	Workshop	99
6	**Students of the Department**		101
7	**Faculty and Staff of the Department**		102
	7.1	Detailed Profile of Faculty Member	102
	7.2	Staff of the Department	107
8	**List of Students Recruited in the Campus Recruitment Drive**		108
9	**List of GATE 2018 and MAT 2018 Qualifying Students**		109
10	**Achievements of the Students of the Department**		109
11	**Publications of Project Works in Journal and Conference by B.E Final Year Students**		110
12	**Some of the Distinguish Alumni and Alumni as Faculty Members in National Level Institutes of Higher Learning**		111

1. Introduction

The department of Mechanical Engineering was introduced in the college in the year 1962 with an initial intake capacity of 30 students per year. It was subsequently increased to present class size of 105 students. Over the years, the department has earned a place of high repute through its quality teaching and rigorous practical training.

The department has a strength of three Professors, six Asst. Professors, thirteen Lecturers and six technicians. The faculties comprise of specialised persons in Designs, Dynamics, Fluid machineries, Nonconventional energy, Quality control, Fluid dynamics, Operation research, Industrial Engineering, Pollution, Production Systems, Computer Integrated Manufacturing, Robotics, etc.

2. Vision and Mission of the College

The Vision of Jorhat Engineering College is

Development of quality human resources for sustainable industrial and societal growth through excellence in technical education and research.

The Mission of Jorhat Engineering College is

M1: To impart quality technical education at UG, PG and PhD levels through good academic support facilities.

M2: To provide an environment conducive to innovation and creativity, group work and entrepreneurial leadership.

M3: To develop a system for effective interactions among industries, academia, alumni and other stakeholders.

M4: To provide a platform for need-based research with special focus on regional development.

3. Vision, Mission, POs, PEOs and PSOs of the Department

3.1 Vision and Mission

The Vision of the department of Mechanical Engineering is

In pursuit of a centre of excellence in mechanical engineering and maintain it through a continuous effective learning-teaching process and need-based research.

The Mission statements of the department of Mechanical Engineering are

M1: To adopt effective learning-teaching processes to build students capacity and enhance their skills.

M2: To nurture the students to adapt to the changing academic needs and industrial expectations.

M3: To develop professionals to meet industrial and societal challenges.

M4: To motivate students for entrepreneurial ventures for nation-building.

3.2 PO-Program Outcomes

Engineering graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

3.3 Programme Educational Objectives (PEOs)

PEO1: Competency in domain knowledge, expertise and self-confidence for professional carrier, advanced studies, R&D, entrepreneurial ventures activities, and facing challenges in professional life.
PEO2: Design, develop, and improve effective domain based systems, tools and techniques that are socio-economically feasible and acceptable, and transfer those technologies/developments for improving quality of life.
PEO3: Demonstrate professionalism through effective communication skill, ethical and societal commitment, team spirit, leadership quality through life-long learning to realize career and organisational goal and participate in nation building.

3.4 PSO-Program Specific Outcomes

The Programme specific Objectives of Department of Mechanical Engineering are given below:

PSO1: Capable to establish a career in Mechanical and interdisciplinary areas with the commitment to the society and the nation.

PSO2: Graduates will be armed with engineering principles, analysing tools and techniques and creative ideas to analyse, interpret and improve mechanical engineering systems.

4. **Program Curriculum**

4.1 Course Structure

This college is affiliated under Dibrugarh University, Dibrugrah, Assam. The Mechanical Engineering Curriculum is affiliated to Dibrugarh University. The university has changed its curriculum from session 2016-17 and shifted to Credit-Based Assessment from the traditional percentage marks based system. The curriculums are also modified after the introduction of Credit-Based System. So, two curriculums are now running under Dibrugarh University. Moreover, the present newly admitted batch of 2017-18 is affiliated to Assam Science & Technology University as per Govt. of Assam instruction. So, three different curriculums are running in Mechanical Engineering department.

A. A course under Assam Science & Technology University, Guwahati, Assam running in a Credit-Based Assessment System.
B. New Course under Dibrugarh University running in a Credit-Based Assessment System.
C. Old course under Dibrugarh University running in a percentage marks-based system.

4.1.1 Course Structure of the New Courses of Assam Science and Technology University (2018 batch)

SEMESTER-1

Sl. No.	Course Code	Course Title	L	T	P	Credits
1	CY181101	Chemistry	3	1	0	4
2	MA188102	Mathematics-1	3	1	0	4
3	CS188106	Programme solving through	2	0	2	3
4	EE 188107	Basic Electrical Engineering	3	0	0	3
5	HS 188108	Communication and professional skills	1	0	2	2
6	CY181111	Chemistry -101	0	0	2	1
7	EE 188117	Basic Electrical Engineering Lab	0	0	2	1
Total			12	2	8	18
Total contact hour per week 22						

SEMESTER-II

Sl. No.		Course Title	L	T	P	Credits
1	PH181201	Physics-201	3	1	0	4
2	MA181202	Mathematics-II	3	1	0	4
3	CE181103	Engineering Graphics and	1	0	4	3
4	ME181104	Engineering Mechanics	3	0	0	3
5	HS181105	Sociology	2	0	0	2
6	PH181211	Physics-201 Lab	0	0	2	1
7	ME181114	Engineering Mechanics Lab	0	0	2	1
8	ME181216	Workshop	0	0	4	2
Total contact hour per week 22			12	2	12	20

4.1.2 Course Structure of the New Courses of Dibrugrah University (2016 and 2017 Batches)

SEMESTER – I

Sl No.	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credit
01	HS 101	Sociology	2	0	0	2	2
02	HS 102	Business Communications	2	0	0	2	2
03	MA101	Mathematics I	3	1	0	4	4
04	PH101	Applied Physics I	3	0	0	3	3
05	CH101	Engineering Chemistry I	3	0	0	3	3
06	CE101	Engineering Graphics	2	0	2	4	3
07	EE101	Basic Electrical Engineering	3	1	0	4	4
08	PH102	Applied Physics Laboratory I	0	0	2	2	1
09	CH102	Engineering Chemistry Laboratory I	0	0	2	2	1
10	EE102	Basic Electrical Engineering Laboratory	0	0	2	2	1
11	ME101	Engineering Workshop I	0	0	2	2	1
Total						**30**	**25**

SEMESTER- II

Sl No.	Course Code	Course Title	L	T	P	Contact Hrs/Week	Credit
01	HS201	Economics for Engineers	2	0	0	2	2
02	HS202	Presentation Skills	1	0	2	3	2
03	MA201	Mathematics II	3	1	0	4	4
04	PH 201	Applied Physics II	3	0	0	3	3
05	CH201	Engineering Chemistry II	3	0	0	3	3

06	ME201	Engineering Mechanics	3	1	0	4	4
07	CS201	Computer Programming	3	0	0	3	3
08	PH202	Applied Physics Laboratory II	0	0	2	2	1
09	CH202	Engineering Chemistry Laboratory II	0	0	2	2	1
10	CS202	Computer Programming Laboratory	0	0	2	2	1
11	ME202	Engineering Workshop II	0	0	2	2	1
Total						**30**	**25**
12	MC201	Environmental studies	3	0	0	3	0

SEMESTER –III

SI No	**Course Code**	**Course Title**	**L**	**T**	**P**	**Contact Hrs/Week**	**Credits**
1	MA 301	Mathematics-III (BS)	3	1	0	4	4
2	ME 301	Engineering Materials and Metallurgy (PC)	3	1	0	4	4
3	ME 302	Thermodynamics (PC)	3	1	0	4	4
4	ME 303	Mechanical Drawing (PC)	1	0	2	3	2
5	CS 303	Electronic Devices & Circuit (ES)	3	0	2	5	4
6	ME 304	Mechanics of Materials (PC)	3	1	0	4	4
7	ME 305	Material Testing Laboratory (PCL)	0	0	2	2	1
8	ME 306	Thermodynamics Laboratory (PCL)	0	0	2	2	1
		Total				**28**	**24**
9	AC 301	Language Laboratory	0	0	4	4	0

SEMESTER- IV

SI No	Course Code	Course Title	L	T	P	Contact Hrs/ Week	Credits
1	MA 401	Mathematics-IV (BS)	3	1	0	4	4
2	ME 401	Mechanism and Machines (PC)	3	1	0	4	4
3	ME 402	Advanced Mechanics of Solids (PC)	3	0	0	3	3
4	ME 403	Fluid Mechanics (PC)	3	1	0	4	4
5	ME 404	Primary Manufacturing Process (PC)	3	0	0	3	3
6	ME 405	Applied Thermodynamics-I (PC)	3	0	0	3	3
7	ME 406	Fluid Mechanics Laboratory + (PCL)	0	0	2	2	1
8	ME 407	Applied Thermodynamics-I Laboratory (PCL)	0	0	2	2	1
9	ME 408	Workshop (PCL)	0	0	2	2	1
		Total				**27**	**24**
10	AC 401	Language Laboratory	0	0	4	4	0

SEMESTER- V

SI No	Course Code	Course Title	L	T	P	Contact Hrs/ Week	Credits
1	MA 501	Engineering Mathematics-V (BS)	3	1	0	4	4
2	ME 501	Machine Tools and Machining (PC)	3	0	0	3	3
3	ME 502	Advanced Fluid Mechanics (PC)	3	0	0	3	3
4	ME 503	Design of Machine Element-I (PC)	3	1	0	4	4
5	ME 504	Heat Transfer-I (PC)	3	0	0	3	3
6	ME 505	Applied Thermodynamics-II (PC)	3	0	0	3	3
7	ME 506	Dynamics of Machines Laboratory(PCL)	0	0	2	2	1
8	ME 507	Production Process Laboratory (PCL)	0	0	2	2	1
9	ME 508	HMT Laboratory (PCL)	0	0	2	2	1
		Total				**26**	**23**

SEMESTER- VI

SI No	Course Code	Course Title	L	T	P	Contact Hrs/ week	Credits
1	HS 601	Introduction to Accountancy & Management (HS)	3	0	0	3	3
2	ME 601	Dynamics of machinery and control Engineering (PC)	3	1	0	4	4
3	ME 602	Design of Machine Element-II(PC)	3	1	0	4	4
4	*OE-1	Open Elective -I	3	0	0	3	3
5	ME603	Mechanical Measurement (PC)	3	0	2	5	4
6	ME 604	Heat Transfer-II (PC)	3	0	0	3	3
7	ME 606	Mini Project (EEC)	0	0	4	4	2
		Total				**26**	**23**

*The code and course shall be decided from the list of courses under **OPEN ELECTIVE-1 (OE-1)**

SEMESTER –VII

SI No		Course Title	L	T	P	Contact hrs/ week	Credits
1	ME 701	IC Engines (PC)	3	0	0	3	3
2	ME 702	Turbo Machinery (PC)	3	0	0	3	3
3	*PE-1	Professional Elective-1	3	0	0	3	3
4	*PE-2	Professional Elective-2	3	0	0	3	3

5	ME 703	Seminar (EEC)	0	0	2	2	1
6	ME 704	Project I (EEC)	0	0	12	12	6
7	*OE-2	Open Elective –II	3	0	0	3	3
	Total					**29**	**22**
8	AC 701	Industrial Training	0	0	0	0	0

*The code and course shall be decided from the list of courses under **Professional Elective (PE-1 & PE-2) and Open Elective-2 (OE-2)**

SEMESTER –VIII

SI. No.	**Course Code**	**Course Title**	**L**	**T**	**P**	**Contact Hrs/ week**	**Credits**
1	ME 801	Industrial Engineering (PC)	3	0	0	3	3
2	*PE-3	Professional Elective-3	3	0	0	3	3
3	*PE-4	Professional Elective-4	3	0	0	3	3
4	*PE-5	Professional Elective-5	3	0	0	3	3
5	ME 802	Project II (EEC)	0	0	20	20	10
	Total					**32**	**22**

*The code and course shall be decided from the list of courses under **Professional Elective (PE-2, PE-3, PE-4 & PE-5)**

Open Electives	**Professional Electives**
Open Elective -I ➢ Finite element method ➢ Statistical quality control ➢ Design and analysis of experiments **Open Elective -II** ➢ Total quality management ➢ Operations research ➢ Industrial safety and hazard management	**Professional Elective- I:** ➢ Mechanical vibration ➢ Computational fluid dynamics ➢ Rotor Dynamics **Professional Elective- II:** ➢ Refrigeration and air-conditioning ➢ Mechanics of composite materials ➢ Advanced Welding Technology **Professional Elective- III:** ➢ Non-traditional & computer aided manufacturing ➢ Reliability engineering ➢ Tool Design **Professional Elective- IV:** ➢ Power plant engineering ➢ Flexible manufacturing systems ➢ Cryogenic engineering **Professional Elective- V:** ➢ Non - conventional energy resources ➢ Energy systems and Management ➢ Industrial robotics

4.1.3 Course Structure of the Old Courses of Dibrugrah University (2015 Batch)

SEMESTER –I

Sl. No	Course Code	Course Title	Theory	Sessional	Practical
1	HU-11	Humanities-1	100	50	--
2	PH-11	Physics-I	100	50	--
3	PH-11L	Physics-I laboratory	--	--	50
4	CH-11	Chemistry-I	100	50	
5	CH-11L	Chemistry –I laboratory	--	--	50
6	MA-11	Mathematics -I	100	50	--
7	CE-11	Engineering Graphics	100	100	--
8	ME-11	Thermal Science	100`	50	--
9	ME-12	Workshop practice -1	--	--	100

SEMESTER-II

Sl. No	Course Code	Course Title	Theory	Sessional	Practical
1	HU-21	Humanities-II	100	50	--
2	PH-21	Physics-II	100	50	--
3	PH-21L	Physics-II laboratory	--	--	50
4	CH-21	Chemistry-II	100	50	
5	CH-21L	Chemistry-II laboratory	--	--	50
6	MA-21	Mathematics-II	100	50	--
7	ME-21	Engineering Mechanics	100	50	--
8	ME-21L	Engineering Mechanics Laboratory	--	--	--
9	ME-22	Workshop practice -2	--	--	100
10	EE-21	Electrical Science	100	50	
11	EE-21L	Electrical science laboratory	--	--	50
12	ES-21	Environmental studies	Grade	--	--

SEMESTER-III

Sl. No	Course Code	Course Title	Theory	Sessional	Practical
1	MA-31	Mathematics-III	100	50	--
2	ME-31	Applied thermodynamics -I	100	50	--
3	ME-32	Mechanical Drawing	100	50	--
4	CS -31	Fundamental of computing	100	50	--
5	EE-31	Basic Electronics	100	50	50
6	EE-31L	Basics Electronics laboratory	--	--	50
7	EE-32	Electrical Engineering	100	50	--
8	EE-32L	Electrical Engineering Laboratory	--	--	50

SEMESTER-IV

Sl. No	Course Code	Course Title	Theory	Sessional	Practical
1	MA-41	Mathematics-IV	100	50	--
2	ME-41	Manufacturing Science -I	100	100	--
3	ME-42	Dynamics of Machinery-I	100	50	--
4	ME-43	Mechanics of Materials-I	100	50	--
5	ME-44	Fluid Mechanics-I	100	100	--
6	ME-45	Material Science	100	50	--

SEMESTER-V

Sl. No	Course Code	Course Title	Theory	Sessional	Practical
1	MA-51	Mathematics-V	100	50	--
2	ME-51	Manufacturing Science -II	100	50	--
3	ME-52	Machine design-I	100	50	--
4	ME-53	Mechanics of Materials-II	100	50	--
5	ME-54	Advanced Fluid Mechanics	100	50	--
6	ME-55	Workshop Practice	--	--	25
7	ME-56	Mechanical Engineering Laboratory	--	--	25
8	CS-51	Object Oriented Programming	100	50	--

SEMESTER-VI

Sl. No	Course Code	Course Title	Theory	Sessional	Practical
1	HU-61	Principles of Economics and Accountancy	100	50	--
2	ME-61	Applied thermodynamics-II	100	50	--
3	ME-62	Dynamics of machinery -II	100	50	--
4	ME-63	Manufacturing Methods	100	50	--
5	ME-64	Machine Design-II	100	50	--
6	ME-65	Mechanical Engineering laboratory	--	--	50
7	ME-66	Workshop Practice	--	--	50

SEMESTER-VII

Sl. No	Course Code	Course Title	Theory	Sessional	Viva
1	ME-71	Industrial Organisation and Management	100	50	--
2	ME-72	Fluid machinery	100	50	--
3	ME-73	Dynamics of machinery -III	100	50	--
4	ME-74	Heat and Mass transfer-I	100	50	--
5	ME-75	Elective-I	100	50	--
6	ME-76	Project-I		100	50

SEMESTER-VIII

Sl. No	Course Code	Course Title	Theory	Sessional	Viva
1	ME-81	Industrial Engineering	100	50	--
2	ME-82	Measurements	100	50	--
3	ME-83	Heat and Mass transfer-II	100	50	--
4	ME-84	Elective-II	100	50	--
5	ME-85	Project-II	--	150	50
6	ME-86	General Viva-Voce	--	--	100

4.2 Detailed Syllabus with COs and COs-POs Mapping

4.2.1 1st Year Syllabus of the courses of Assam Science and Technology University

COURSE : CHEMISTRY
Course Code : CY181101
Credits` : 4
L – T - P 3 – 1- 0

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

CO1	To apply molecular orbital theory along with electronic configuration on the basis of Schrodinger wave equation for simple homonuclear and heteronuclear diatomic molecules (NO, CO).
CO2	To illustrate the different aspects of polymer chemistry and its uses in different purposes along with brief idea of nanomaterial as well as sustainable chemistry with applications.
CO3	To apply the idea of corrosion along with control and preventive measures.
CO4	To apply the fundamental principles and applications of analysis using UV-Visible, Flame photometry, AAS, IR, NMR, mass spectroscopy and chromatography.
CO5	To infer about engineering materials e.g. cement, refractories with lubricants and their properties and applications.

Detailed Syllabus

Module	Contents	Lecture Hr
1	**Atomic Structure :**Schrodinger's wave equation, Physical significance of Ψ and Ψ^2, Hydrogen atom wave Functions-Radial and Angular wave function, Eigen value, Eigen function, Molecular orbital theory-electronic configurations of molecules in terms of the MO-Homonuclear diatomic molecule, Heteronuclear diatomic molecule. (Eg. CO, NO)	5
2	**Polymer Chemistry**: Classification, Functionality, Determination of molecular weights, Polydispersity index (PDI). Types of polymerization (Addition and Condensation). Structure-property-application of few commodity polymers (eg. PE, PP, PS, PMMA, PVC, Isoprene), Biopolymer-properties and its applications (polylactic acid), Conducting polymer-properties and its applications (polyacetylene).	6
3	**Nano-chemistry:** Introduction, Synthesis of nanomaterials (Top-down and Bottom-up approach). Fullerenes, Carbon nanotube (Characteristic, properties & application), Nanowire, Application of Nanomaterial in catalysis, Medicine, Energy science, Bio nanomaterials.	5
4	**Sustainable Chemistry:** Principles of green chemistry, Idea of green synthesis, Carbon footprint and sequestration, Carbon trading. Brief idea of alternative solvents–Water, ionic liquids, supercritical fluid system (Carbon dioxide), Waste management**:** Solid, electronic & industrial wastes, Waste management procedures and relevant standards.	6
5	**Corrosion Science:** Definition and scope of corrosion. Dry chemical corrosion and electrochemical corrosion and their mechanisms. Types of electrochemical corrosion (Differential aeration, Galvanic, Concentration cell), Typical electrochemical corrosion like Pitting, Inter-granular, Waterline. Factors affecting corrosion, Protection against corrosion.	6
6	**Instrumental Methods of Chemical Analysis:** Spectroscopy: Principle of spectroscopy, Principle and applications of UV-Visible spectroscopy. Applications of Flame photometry, Atomic absorption spectroscopy, Infrared spectroscopy, NMR spectroscopy, Mass spectroscopy. Principle and applications of different Chromatographic Techniques-Gas, HPLC, GPC.	8
7	**Advanced Engineering Materials:** Cement (Raw materials, chemical composition, setting and hardening of cement), Refractories (Classification and properties), Lubricants (Types of lubricants, Properties, Mechanism of lubrication).	6

Text / Reference Books:

1. Engineering Chemistry-Jain & Jain (Dhanpat Rai & Company)

2. Engineering Chemistry-Shashi Chawla (Dhanpat Rai & Company)
3. Industrial Chemistry-B. K. Sharma
4. A text book of Engineering Chemistry-Dr S. Rattan
5. Wiley Engineering Chemistry
6. Atomic Structure and Chemical bond-Manas Chandra (TMH edition)
7. Quantum Chemistry-B.K. Sen
8. Quantum Mechanics-L. Pauling & E. Wilson (McGraw Hill Book Company)
9. Physical Chemistry-P. W. Atkins (Oxford University Press)
10. Advance Inorganic Chemistry- Cotton et. Al. (John Willey)
11. Inorganic Chemistry-Shriver, Atkins, Langford (ELBS)
12. Green Chemistry-Paul T Anastas, John C. Warner
13. Introduction to Polymers-R. J. Young
14. Polymer Science-V.R. Gowarikar (New Age International)
15. Fundamentals of Molecular Spectroscopy-C. N. Banwell & E. N. McCash
16. Atomic & Molecular Spectroscopy-Chatwal & Anand (Himalayan Publishing House)

COURSE : MATHEMATICS-I
Course Code : **MA181102**
Credits : 4
L – T - P 3 – 1- 0

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

CO1	Apply the techniques of differential and integral calculus to solve simple Engineering problems.
CO2	Interpret the significance of Beta and Gamma functions.
CO3	Apply Rolle's Theorem, power series and Fourier series to Engineering problems.
CO4	Apply multi-functional variables, matrices and linear algebra as tools to solve Engineering problems.

Detailed Syllabus

Module	Contents	Lecture Hr
1	**Calculus:** Reduction formulae, applications of definite integrals to evaluate surface areas and volumes of solids of revolution, idea of improper integrals, Beta and Gamma functions and their properties.	8
2	**Calculus**: Successive differentiation, standard forms, Leibnitz's theorem (without proof), Taylor's and Maclaurin's theorem with remainders, indeterminate forms and L' Hospital's rule, Curvature and Radius of curvature (both in Cartesian and Polar co-ordinates).	8
3	**Sequences and series:** Idea of convergence of sequence and series, Fourier series, Half range sine and cosine series, Parseval's theorem.	6
4	**Multivariable Calculus**: Partial derivatives, Euler's theorem, Total derivatives, Maxima, Minima and saddle points, Method of Lagrange	8

	multipliers, Double and Triple Integrals and its applications to find areas and volumes.	
5	**Linear Algebra**: Inverse and rank of a Matrix, Linear independence of vectors, rank-nullity theorem, system of linear equations, Symmetric, skew-symmetric and orthogonal matrices, Eigen values and eigen vectors, Diagonalization of matrices, Cayley-Hamilton theorem (without proof), Orthogonal Transformation	10

Text Books:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
3. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

Reference Books:

1. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

COURSE : PROBLEM SOLVING THROUGH PROGRAMMING USING C
Course Code : **CS181106**
Credits : 2
L – T - P : **2-0-2**

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

CO1	To design, represent and analyse algorithms for logical and numerical problems
CO2	To develop modular programs using functions and recursion
CO3	To create programs using static built-in and user defined data types for storage
CO4	and processing of data
CO5	To develop programs for dynamic storage and processing of data
CO6	To develop solution for a computing problem through team work

Detailed syllabus

Module	Contents	Lecture Hr
1	**Introduction to Programming:** Introduction to components of a computer system (disks, memory, processor, where a program is	3

	stored and executed, operating system, system software, application software, compilers, interpreter etc. Idea of Algorithm: Steps to solve logical and numerical problems Representation of Algorithm: Flowchart/Pseudo code with examples. From algorithms to programs; source code, compilation, object and executable code, Syntax and Logical Errors in compilation, storage of data inside program using variables, data types, modular programming, structure of a C program.	
2	**Expressions and precedence:** Writing C expressions using operators (arithmetic, relational, logical, dereferencing, arrow operator, period operator, conditional operator, subscript operator etc.), identifiers and literals, precedence of operators, evaluation of expressions using precedence and associatively rules.	2
3	**Conditional Branching and Loops: Writing** and evaluation of conditionals and consequent branching using if else and switch.. case statements, Iteration and loops using for loop, while loop and do, while loop. Arrays (1-D, 2-D), Character arrays and C Strings.	4
4	**Basic Algorithms:** Searching (sequential and binary), Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definitions for asymptotic analysis required).	4
5	**Function:** User defined functions and built in libraries, function prototype, parameter passing in functions, call by value, passing arrays to functions: idea of call by reference (1-D and 2-D), scope rules for C language.	3
6	**Recursion**, as a different way of solving problems, example programs, such as Finding Factorial, Fibonacci series.	2
7	**Structure**: Structures, defining structures, Accessing members, Array of Structures.	2
8	**Pre-processor Directives:** #define, #include, #ifdef etc., conditional compilation.	1
9	**Pointers:** Idea of pointers, defining pointers, pointer and arrays, pointer to structure, pointer to function, passing addresses of variables to functions (elementary and user defined), double indirection, Use of Pointers in self-referential structures, dynamic allocation/deallocation of memory blocks data types like elementary data types, arrays, structures, accessing elements of dynamically allocated memory, notion of linked list (no implementation).	4

Text Books:

1. Byron Gottfried, Schaum's Outline of Programming with C, McGraw-Hill
2. Yashavant Kanetkar, Let us C, BPB Publication
3. E. Balaguruswamy, Programming in ANSI C, Tata McGraw-Hill

4. Yashavant Kanetkar, Understanding Pointers in C, BPB Publication

Reference Books:

1. Brian W. Kernighan and Dennis M. Ritchie, The C Programming Language, Prentice Hall of India

Laboratory - Programming for Problem Solving Total: 26 contact hours, 2 hours of lab/week [to be evaluated for Continuous Evaluation (CE): 30 marks]

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

CO1	To translate a given algorithm to C program and become familiarized with programming environments
CO2	To build programs using modular programming and recursion
CO3	To build programs using built-in and user defined data types for data processing
CO4	To build programs for data processing using dynamic memory management
CO5	To solve a computational problem through team work
CO6	To exhibit self-learning by writing programs for solving problems in differentiation and integration by numerical methods

Detailed Syllabus

Lab No.	Laboratory	Lecture Hr
1	Familiarization with programming environment (editors, compilation, debugging etc.)	2
2	Simple computational problems using expressions and precedence	2
3	Problems involving using if-then-else and switch statements	2
4	Iterative problems e.g., sum of series, factorial, Fibonacci series etc.	4
5	1D, 2D Array manipulation: summation, finding odd/even in a set, string handling etc.	4
6	Matrix problems (addition, multiplication etc.), String operations (finding length, concatenation, comparing etc.)	4
7	Simple function illustrating the concepts, call by value	2
8	Recursive functions for summation, Fibonacci series, and factorial	2
9	Pointers, call by reference, passing arrays to functions, passing address of structure to function, passing array of structure to function, pointers and arrays, function pointer, dynamic allocation of block of memory and accessing the elements	4
10	File operations on text files, binary files	2

COURSE : BASIC ELECTRICAL ENGINEERING
Course Code : **EE181107**
Credits : 2
L – T - P : **3-0-0**

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

CO1	Identify and analyze network theorems / a. c fundamentals and apply them to the solution of electrical engineering problems.
CO2	Gain basic idea of electrical quantities, such as current, voltage, power, energy, phase, frequency etc. and co-relate these concepts in various fields of electrical engineering.
CO3	Understand the principle of operation of different types of electrical machines.
CO4	Understand the basic principle of operation and use of different types of measuring instruments.
CO5	Get concrete idea about electrical installations and importance of the safety measures to be taken in this regard.

Detailed Syllabus

Module	Contents	Lecture Hr
1	**DC Circuits:** Definitions of active, passive, linear, nonlinear circuit elements and networks. Kirchoff's laws, nodal & mesh analysis, voltage & current sources, network theorems- superposition, Thevenin's, Norton's and maximum power transfer theorems.	8
2	**AC Circuits:** Waveforms of alternating voltages and currents, instantaneous, average and RMS values, form factor & peak factor, forms of representation of alternating quantities, concept of phasor phasor diagrams, Concept of lead & lag, reactances & impedances, AC circuits-resistive, inductive, capacitive, RL, RC & RLC series, parallel and series parallel combination, impedance triangle, admittance, active & reactive power & power factor. Concepts of 3-phase AC, connections, phase & line values in star & delta connections, solutions of simple 3-phase balanced circuits with resistive & reactive loads, 3-phase power, and phase sequence	12
3	**Electrical Machines Single Phase Transformers:** Principle of operation, EMF equation, losses and efficiency, Basic idea of an auto-transformer. **DC machines:** Electromechanical Energy Conversion, EMF and torque equations, Classification, characteristics and applications of various types of d.c. motors. **Induction Motors:** Principle of operation of single phase and three phase induction motors, Application of Induction motors	12
4	**Instruments** Classification of instruments, essentials of indicating type instruments- deflecting torque, controlling torque, damping; types of	4

	indicating instruments, MC & MI type ammeters & voltmeters, extension of range- use of shunt & multipliers.	
5	**Basics of Electrical Installations** Basic knowledge of domestic wiring, types of cables (names only), types of wiring; circuit layouts- single phase AC mains to DB; 3 phase connections; accessories- main switch, ceiling rose, fuse, MCB etc. Earthing- purpose & methods.	4

Text/Reference Books:

1. Basic Electrical Engineering--- Nagrath.
2. Basic Electrical Engineering---Mittle.
3. B.E.E. Science—Sahadev & Rana.
4. Electro-Technology—H. Cotton.
5. A text book of Electro-technology- B. L. Theraja.

COURSE : COMMUNICATION AND PROFESSIONAL SKILL
Course Code : **HS181108**
Credit : **2**
L-T-P : 1-0-2
SEE : 100 Marks

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

CO1	Expand and develop basic understanding of the importance of communication.
CO2	Familiarise with different aspects of accurate and effective communication.
CO3	Demonstrate different writing skills i.e. technical, non-technical and other texts.
CO4	Prepare and present technical reports.
CO5	Acquire a basic knowledge of various. job oriented communication skills.

Detailed Syllabus

Module	Module details	Lecture Hr.
1	**Basic Communication:** Concept and meaning of communication; Importance of communication, Objectives of communication, Process of communication, Characteristics of communication, Forms of communication, Barriers to communication, Communication Breakdown, Effective communication.	4
2	**Audience Analysis:** Audience awareness, Audience analysis, Types of audience, Importance of audience analysis, Audience Profile, Analysing individual and group of audience, Adapting message to audience.	3
3	**Job Oriented Communication:** Introduction to soft skills, Antiquity of soft skills, Classification of soft skills, Combating stage fright, Pre-presentation preparation, Guidance for effective delivery, Creating and designing of Power Point slides, Presentation Delivery,	5

	Organizational group discussion, Group discussion as part of selection process, Conferences, Symposia and Seminars, Job Interview, Objectives of interviews, Types of interview, Ground work before interview, Internship and Campus placement.	
4	**Technical report writing:** Concept of report writing, Importance of report, Characteristics of a report, Categories of report, Formats, Structure of a technical report, Planning, Drafting, Referencing and Styling.	4
5	**Academic writing and Comprehension skills:** Précis writing, Presenting Research paper and articles. Miscellaneous grammar.	3
6	**Job oriented writing skill:** Official letters- Formats, Types and Language, Memo writing, Emails, Resume and Curriculum Vitae-- the first step forward and Job application.	5

Text Books:

(i) Effective Technical Communication, M. Ashraf Rizvi. Tata McGraw Hill
(ii) Technical Communication: Principles and Practice, Meenakshi Raman and Sangeeta Sharma. OUP
(iii) Personality Development and Soft Skills, B. K. Mitra, OUP
(iv) Technical Communication for Engineers, S. Verma, VIKAS Publishing House Pvt. Ltd.

Language Laboratory: [*To Be Evaluated For Continuous Evaluation (Ce): 30 Marks*]

Objectives of the Practical Course:

1. Practical classes in the Language Lab on sounds of English language, its word stress and intonation and on the silent letters in English words attempt to neutralize the learner's accent drawing their attention to the wrong pronunciation commonly made by the non-native speakers while interacting in English and facilitate them to do better in telephonic interviews conducted in English and have good intelligibility between them and the teachers when they go abroad for higher studies in the medium of English language.

2. Practical classes on Communicative English, Essential English Grammar, Building Vocabulary, Common Errors in English and Reading and Listening exercises attempt to introduce the learners to speech mannerism both formal and informal, strengthen their grammatical knowledge of English, enrich their word stock, make them aware of common mistakes made by non- native speakers while interacting in English and develop their reading, comprehension and listening skills.

3. Interactive sessions in the lab such as Presentation, Group Discussion, JAM, Role Playing and Describe People/Object/Place work as ice-breaking activities, participation in which enables the students to overcome their inhibitions while speaking; invigorate their presence of mind; enhance their critical focus; boost their confidence level; develop their team spirit, leadership quality and problem solving ability; hone their

presentation skill and assist them to have effective communication in English (both verbal and non-verbal) and be skilled in time management.

4. Writing home assignments with the aid of given guidelines gives the students the scope to enhance their writing skills in English and become aware of various societal issues and problems.

5. The Practical Course aims to develop the communicative skills of the students in English and make a growth of different facets of their personalities to enable them to fare better and have dynamic sustenance in today's academic, social and professional lives.

Detailed Syllabus

Module	Module details	Lecture Hr.
1	**Computer/ software aided lessons for practical classes**: 1. Pronunciation: Vowels, Diphthongs and Consonants sounds, Stress and Intonation and Silent Letters in English words. 2. Communicative English - Exercises on situational dialogues/ role play in both formal and informal contexts. 3. Essential English Grammar 4. Building Vocabulary – synonyms, antonyms and phrases and idioms 5. Common Errors in English **6.** Developing reading, comprehension and listening skills with the aid of language lab devices of reading and listening exercises.	**28**
2	**Activities/ Interactive sessions for practical:** 1. Paper Presentation (Manuscript/ Power Point) 2. Group Discussion 3. Just a Minute' Session (JAM) 4. Role Playing **5.** Describing Object/People/Place.	**20**
3	**Home Assignments:** Each student has to submit two home assignments following the guidelines given with a view to enhance their writing skills as well as make them aware of various ethical and environmental issues, social problems, current affairs etc. on the topics of which the writings are to be submitted.	

Books recommended in addition to the software installed in the systems with the objective to add to the students' knowledge of the different units of the syllabus and to aid them in interactive sessions:

1. Marks, Jonathan. *English Pronunciation in Use: Elementary.* Cambridge: CUP, 2009.

2. Hewings, M. *English Pronunciation in Use. Advanced.* Cambridge: CUP, 2009.
3. Rottanji. *A Book on Silent Letters in English*. Web
4. *English Language Communication Skills (ELCS) Lab Manual- cum-Work Book.* New Delhi: Cengage Learning India Pvt., 2013.
5. Murphy, Raymond. *Essential English Grammar: A Self Study Reference and Practice*

***Book for Elementary Students of English 2nd edition*. Cambridge: CUP.**

Hewings, Martin. *Advanced English Grammar: A Self Study Reference and Practice Book for Advanced South Asian Students*. Cambridge: CUP.

Reference Books

1. Merriam-Webster. The Merriam-Webster Dictionary of Synonyms and Antonyms. US: Merriam-Webster.1984.
2. Gulland, Daphne M and David G. Hinds- Howell. Dictionary of English Idioms 2nd Revised Edition. UK: Penguin. 2001.
3. Kumar, Sanjay and Pushp Lata. Communication Skills, Second Edition. OUP. 2015.
4. Chin, Peter, Samuel Reid et al. Academic Writing Skills Student's Book 2. Cambridge: CUP.
5. Cholji, Mark. Towards Academic English: Developing Effective Writing Skills.
6. Cambridge: CUP.
7. Spoken English (CIEFL) in 3 volumes with 6 cassettes, OUP.

COURSE	**:**	**CHEMISTRY-101 LAB**
Course Code	:	**CY181111**
Credit	:	**1**
L-T-P	:	0-0-2
SEE	:	50 Marks

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

CO1	Measure molecular/system properties such as surface tension, co-efficient of viscosity, conductivity of electrolyte, pH of acid and bases, available chlorine content in bleaching powder, hardness of water, copper content in brass, estimation of iron etc.
CO2	Get expose for analysis of basic radicals qualitatively in given salt mixture
CO3	Expose the students to the students to the paper chromatography technique for detection of components from a mixture of components.

Detailed Syllabus

Exp. No	Experiment
1	Determination of surface tension of a given liquid at room temperature by Stalagmometer.
2	Determination Co-efficient of viscosity of a given liquid at room temperature by Ostwald's Viscometer.

3	Measurement of conductivity of an Electrolyte.
4	Determination of pH of strong and weak acid & bases by using pH meter.
5	Determination of available chlorine in bleaching powder.
6	Determination of total hardness of water by EDTA method.
7	Estimation of percentage of copper in brass sample
8	Estimation of iron.
9	Salt analysis.
10	Separation of components of a mixture by paper chromatography.

Reference books:

1. Vogels text book of quantitative inorganic analysis, revised by J. Bassett, R.C. Denny, G.H.Jeffery, 4th Ed.
2. Practical Engineering chemistry by Sunitha and Rathna.

COURSE : BASIC ELECTRICAL ENGINEERING LAB
Course Code : **EE181117**
Credit : **1**
L-T-P : 0-0-2

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

CO1	Be familiar with switching on and taking precautionary measures while handling electrical equipment.
CO2	Apply knowledge of different types of electrical circuits, components and instruments to relate theoretical concepts with experimentation.
CO3	Organize and write an engineering report including graphs and tables after performing an experiment.

Detailed syllabus

Exp. No	Laboratory
1	Basic safety precautions, Introduction and use of measuring instruments.
2	Calibration of measuring instruments.
3	Verification of Thevenin's Theorem.
4	Verification of Maximum Power Transfer Theorem.
5	Measurement of power in a single phase AC circuit using Wattmeter.
6	Measurement of circuit parameters under steady-state condition for RLC circuits.
7	Demonstration of cut-out sections of Electrical Machines.
8	Characteristics of incandescent lamp.
9	Study of balanced three phase circuits.
10	Demonstration of layout of house wiring`
11	Demonstration of measurement of insulation resistance.

Text / Reference Books:

1. D. P. Kothari and I. J. Nagrath, ―Basic Electrical Engineering‖, Tata McGraw Hill, 2010.

2. D. C. Kulshreshtha, ―Basic Electrical Engineering‖, McGraw Hill, 2009.
3. L. S. Bobrow, ―Fundamentals of Electrical Engineering‖, Oxford University Press, 2011.
4. E. Hughes, ―Electrical and Electronics Technology‖, Pearson, 2010.
5. V. D. Toro, ―Electrical Engineering Fundamentals‖, Prentice Hall India, 1989.
6. B. L. Theraja, A. K. Theraja, ―A Text Book of Electrical Technology Vol I, II, IV‖, S. Chand & Co., 2015.
7. Abhijit Chakrabarti, Sudipta Nath and Chandan Kumar Chanda, ―Basic Electrical Engineering‖, Tata McGraw-Hill, 2017

SEMESTER –II

COURSE : PHYSICS-201
Course Code : **H181201**
Credit : 4
L-T-P : 3-1-0

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

CO1	Apply the fundamentals of mechanics to solve simple Engineering problems.
CO2	Explain the basic principles of Fluid Mechanics along with their applications.
CO3	Apply the principles of Acoustics to solve related simple Engineering problems.
CO4	Explain the different types of aberration in lenses along with their minimization.
CO5	Explain the fundamentals of nanomaterials and advanced materials.

Detailed Syllabus

Module	Module details	Lecture Hr.
1	**Mechanics**: Conservative & non-conservative forces, Central forces, Conservation of angular momentum, Non-inertial frames of reference; Rotating co-ordinate system- Centripetal and Coriolis acceleration. (6)	17
2	Harmonic Oscillator, damped harmonic motion – over-damped, critically damped and under damped oscillators; forced oscillation and resonance.	5
3	Elasticity, Hooke's law, factors affecting elasticity, Poisson's ratio, Relations in elasticity, twisting couple on a wire, bending of beams with symmetric cross-section, Cantilever.	6
4	**Fluid Mechanics:** Bernoulli's Theorem and its important applications, Viscosity, Co-efficient of Viscosity, Streamline and Turbulent flow, Reynolds Number, Critical velocity, Poiseuille's equation for flow of liquid through a tube, Motion of a Rigid body in a viscous medium, Rotational viscometer.	5
5	**Acoustics**: Decibel level of sound, Weber–Fetchner law, Reverberation & Reverberation time, Sabine's formula for reverberation time (Derivation not required), Absorption co-efficient,	6

	Factors affecting acoustics of buildings and their remedies, Acoustic design of a hall. Production and properties of ultrasonic waves, Applications of Ultrasonic.	
6	**Optics** Aberration in lenses, Spherical and Chromatic Aberration, Method of minimization of Spherical and Chromatic Aberration.	3
7	**Nanomaterial and Advanced materials** :Introduction to Nanomaterials, Properties of Nanomaterials, Potential Well and Quantum Confinement (qualitative), Types of Nanomaterials and their applications.	7
8	Advanced materials: Shape memory alloys and Biomaterials	

Note: *The syllabus of Physics PH181201 for Group A is designed as per the AICTE directives to teach different topics of Physics to different branches of Engineering to cater to their specific needs. However, in order to give the students a complete essence of Physics, the following topics may be taught in brief (maximum 4 hours) in tutorial classes, or may be encouraged to learn these topics by using online resources e.g. NPTEL lectures etc. and assignments may be given to ensure their learning. These topics, however, are not to be included in end semester examinations:*

- Principle of production of LASER beams (Qualitative only), properties and uses of LASER beams;
- Classification of magnetic materials (qualitative only) and their properties;
- Definition of Electric Dipole, Dipole moment and Dielectric constant.

Text Books:

1. Engineering Physics – V. Rajendran (Tata McGraw Hill education Pvt. Limited)
2. Engineering Physics – D.K. Bhattacharya and Poonam Tandon (Oxford University Press)

Reference Books:

1. Elements of Properties Matter – D.S. Mathur (S. Chand and Company Pvt. Limited)
2. Applied Physics for Engineers – Neeraj Mehta (PHI Learning Pvt. Limited)

COURSE : MATHEMATICS-II
Course Code : **MA181202**
Credit : 4
L-T-P : 3-1-0

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

CO1	Apply techniques for evaluating multiple integrals, ordinary and partial differentiation equations and that of complex variables to deal with varied Engineering problems.

CO2	Make use of advanced level of Mathematics as tools for solving problems related to modelling of physical processes.

Detailed Syllabus

Module	Module details	Lecture Hr.
1	Differentiation of vectors, Gradient, Divergence and Curl, Directional Derivatives, Line, Surface and volume Integrals; Green, Gauss and Stokes Theorems (without proof) and their applications.	10
2	**First order ordinary differential equations:** Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.	6
3	**Ordinary differential equations of higher orders:** Second order linear differential equations with constant co-efficient, Power series solutions: Legendre Polynomials, Bessel functions of first kind and their properties.	10
4	**Complex Variable – Differentiation:** Differentiation, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Finding harmonic conjugate; Elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	6
5	**Complex Variable – Integration:** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.	8

Text Books:

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
7. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.

8. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

COURSE : ENGINEERING GRAPHICS AND DESIGN
Course Code : **CE181103**
Credit : **3**
L-T-P : 1-0-4

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

CO1	Explain the basic principles of Engineering Graphics.
CO2	Apply the principles of orthographic and isometric problems to represent simple Engineering objects.
CO3	Apply the principle of sectioning to represent different views of Right Angular Solids.
CO4	Create simple shapes like Circle, parabola, geometric solids etc. using CAD software.
CO5	Demonstrate team work spirit through creation of Engineering models and their presentations.

Detailed Syllabus

Module	Module details	Lecture Hr.
1	**Introduction to Engineering Drawing: 1**. Principles of Engineering Graphics and their significance, usage of Drawing instruments. Lettering: Single stroke letter – Vertical and inclined capital and small letter, Scales: Plain scale and Vernier scale. Curves: Conic sections – Ellipse, parabola, hyperbola, different methods of construction of conic sections, tangents and normal to conics.	8
2	**Orthographic Projections :**Principles of Orthographic Projections-Conventions a. Projection of points: Introduction of projection, quadrants, 1st, 2nd, 3rd and 4th angle projection of points. b. Projection of lines (First angle only): Line parallel to one or both planes, line perpendicular to a plane, line inclined to one plane and parallel to other, line inclined to both plane. c. Projections of planes (First angle only): Plane perpendicular to one plane and parallel to other, plane perpendicular to both plane, plane inclined to one plane and perpendicular to other. d. Projection of solids (First angle only): Axis perpendicular to one plane and parallel to other, axis parallel to both plane, axis inclined to one plane and parallel to other, axis inclined to both plane.	14

3	**Sections and Sectional Views of Right Angular Solids: Section** of solids: Section plane parallel to one plane and perpendicular to other, section plane inclined to one plane and perpendicular to other.	4
4	**Isometric Projections :**Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.	4
5	**Introduction of Computer Graphics :**Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines(extend/lengthen). Drawing simple shapes such as circle, parabola, etc. Drawing geometric solids; Drawing annotation, solid, surface, and wireframe models.	6
6	**Demonstration of simple team design (Students Project as group work)** Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids; meshed topologies for engineering analysis. Drawing of floor plans, front elevation and sectional elevation showing floor level to ceiling of a simple two storied building with doors and windows.	4

NOTE: Assessment of student based on above syllabus comprises of three parts

a. Theory examination covering Module 1 to Module 4
b. Practical Examination covering Module 5
c. Project covering Module 6

Text/Reference Books:

1. Bhat, N. D. & M. Panchal (2008), Engineering Drawing, Charotar Publishing House
2. Shah, M. B. & B. C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Dhawan, R. K. (2007), A Text Book of Engineering Drawing, S. Chand Publications
4. Narayana, K. L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. Shah, M. B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education

COURSE : ENGINEERING MECHANICS
Course Code : **E181104**
Credit : **3**
L-T-P : 3-0-0

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

CO1	Explain the construction of Free Body Diagrams of rigid bodies in equilibrium, subjected to coplanar concurrent and non-concurrent forces.
CO2	Analyse structures by the method of joints, sections and graphically.
CO3	Apply the concepts of C.G. and M.I. to find the C.G. and M.I. of simple and composite bodies.
CO4	Explain the working principle of Lifting Machines.
CO5	Apply the principle of Virtual work and Work-Energy Conservation to solve simple Engineering problems.

Detailed Syllabus

Module	Module details	Lecture Hr.
1	**Equilibrium of Rigid Bodies :**Introduction, Free body diagram (FBD), Types of supports and their reactions, System of forces, Resultant of coplanar concurrent forces and non-concurrent force systems, Conditions of equilibrium, (i) concurrent forces in space (ii) non-concurrent forces in space.	6
2	**Analysis of Structures**: Method of joint, method of sections, graphical methods.	3
3	**Friction:** Introduction, laws of Coulombs friction, equilibrium of bodies involving dry friction; inclined plane, ladder friction, wedge friction.	3
4	**Centre of Gravity and Moment of Inertia :**Centre of gravity and centroid; location of centroid and centre of gravity (ii) Moment of inertia of plane area, Parallel axis theorem, perpendicular axis theorem, mass moment of inertia, polar moment of inertia, radius of gyration, product of inertia, M.I. of simple and composite bodies.	6
5	**Lifting Machines**: Introduction, Principles of machines, and reversibility of machines, lever, pulley, and simple wheel and axle.	4
6	**Virtual Work and Energy** Introduction, virtual displacement, principle of virtual work, application of virtual work.	4
7	**Impulse, Momentum, Work and Energy:** Linear impulse and momentum, Principle of work-energy conservation.	4

Text Books:

1. Engineering Mechanics by IH Shames, PHI.
2. Engineering Mechanics, Mariam and Craig, Wiley.

Reference Books:

1. Engineering Mechanics by S. Timoshenko and D.H. Young, McGraw Hill Int.
2. Engineering Mechanics by R. K. Banshal, Laxmi Publication (P) Ltd.
3. Engineering Mechanics by K. L. Kumar, McGraw Publishing Co.
4. Engineering Mechanics by Hibbler.
5. Engineering Mechanics by D. P Sharma, Pearson.
6. Engineering Mechanics Statics and Dynamics by A Nelson, McGraw Hill.
7. Engineering Mechanics by S. S. Bhavikatti, New Age International Publishers.

COURSE	**:**	**SOCIOLOGY**
Course Code	:	**HS181105**
Credit	:	**2**
L-T-P	:	2-0-0

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

CO1	Develop their sociological thinking to demonstrate sociological understandings of phenomena, for example, how individual biographies are shaped by social structures, social institutions, cultural practices, and multiple axes of difference and/or inequality.
CO2	Identify the major concepts and perspectives of sex-gender systems and practices in contemporary society.
CO3	Develop the ability of critical thinking through the ability to analyze and evaluate social, political, and/or cultural changes in society.
CO4	Exhibit the knowledge of sociological perspective of industry, conflict resolution and labour/management relation in industry.
CO5	Analyse the significance of human resources and its participation in various sectors of society.

Detailed Syllabus

Module	Module details	Lecture Hr.
1	**Understanding of Sociology**: Introduction to sociology: Meaning and definition of sociology, nature and scope of sociology, significance of sociology; understanding of society and social institutions: family, community, group, culture and civilization, marriage, family, religion.	5
2	**Gender and Society:** Concept of gender, differences between sex and gender, changing gender roles in society, gender equality and inequality, gender and poverty, gender discrimination.	4
3	**Social Change**: Meaning and definition of social change, nature and characteristics of social change, modernization, industrialization, information and technology. Social disorganization and social	5

	problems (over population, poverty, unemployment, corruption and black money.	
4	**Industrial Disputes: Meaning** and definition of industrial disputes, causes and methods of settlement of industrial disputes. Trade union-definition of trade union, functions of trade union, problems of trade union in India. Indian factories Act, 1948.	5
5	**Human Resources: Meaning** of human resources, significance of human resources, meaning of manpower planning, concept of productivity, factors of productivity, factors affecting productivity, workers' participation in management, unilateral and cooperative participation.	5

Text/ References Books:

1. C. N. Shankar Rao: Principles of Sociology, New Delhi: S. Chand & Co. Ltd., 2006.
2. Mamoria C. B. Mamoria S and Gankar. Dynamics of Industrial Relations in India, Himalaya Publishing House, New Delhi.
3. John, Mary E. Women's studies in India. New Delhi: Penguin, 2008.
4. Tong, R. Feminist Thought. Colorado: Westview Press, 2009.
5. Ram Ahuja - Social Problems in India, Jaipur: Rawat Publications, 2001.
6. M. N. Srinivas: Caste in Modern India, Oxford University Press, 1992.
7. Principles of Sociology by R. N. Sharma.
8. Labour problems and social welfare by R. C. Saxena.
9. Labour problems and social welfare by U. C. Kulshrestha.

COURSE : PHYSICS-201 LAB
Course Code : **PH181211**
Credit : **1**
L-T-P : 0-0-2

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

CO1	Carry out experiments to determine Modulus of rigidity of a rod using Vertical Twisting apparatus/Horizontal Twisting apparatus
CO2	Determine Moment of Inertia and Coefficient of Viscosity of water
CO3	Determine Refractive Index of the material of prism and specific heat of a given liquid
CO4	Determine the ratio of two low resistance using potentiometer and average resistance of the Meter Bridge wire
CO5	Determine Refractive Index of water using Convex lens and a mirror
CO6	Carry out experiments to determine Plank's Constant and velocity of Ultrasonic waves in a given liquid.

Detailed Syllabus

Exp. No	Experiments
1	To find the value of the modulus of rigidity of the material of a rod by using: Vertical Twisting apparatus / Horizontal Twisting apparatus.
2	To find the Moment of Inertia of a given body by using the Moment of Inertia Table.
3	To find the coefficient of viscosity of water by capillary flow method.
4	To find the refractive index of the material of a prism using a spectrometer (by finding the angle of the prism and the angle of minimum deviation of the prism).
5	To find the specific heat of a given liquid by the method of cooling.
6	To find the ratio of two low resistances by using a potentiometer.
7	To find the average resistance of the Meter Bridge wire by Carey Foster's method.
8	To find the refractive index of water by using a convex lens and a mirror.
9	Determination of Planck's constant. To find the velocity of ultrasonic waves in a given liquid.

Text Books:

1. A Text Book on Practical Physics – K.G. Mazumdar and B. Ghosh (Sreedhar Publishers).
2. A Text book of Practical Physics - Samir Kumar Ghosh (New Central Book Agency).

COURSE : ENGINEERING MECHANICS LAB
Course Code : **ME181114**
Credit : **1**
L-T-P : 0-0-2

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

CO1	Establish the law of polygon of forces and equilibrium of forces through experimentation.
CO2	Determine the reactive forces at support and its relationship with the distance of the point of application of loads from support.
CO3	Determine the co-efficient of Rolling and Sliding friction on an inclined plane through experimentation.
CO4	Determine the velocity ratio, Mechanical advantage and efficiency of a square threaded screw jack.
CO5	Verify the law of moments by using a Bell crank lever.

Detailed Syllabus

Exp. No	Experiment
1	To verify the law of polygon of forces for a numbers of coplanar forces in equilibrium.
2	Parallel Forces Apparatus: A. To show experimentally the inverse relationship between reactive forces at support and the distance of the point of application of loads from supports. B. To find the reactive forces at the supports using: (i) Experimentally, (ii) Analytical method
3	Rolling Friction Apparatus: Experimental Computation of Co-Efficient of Friction between an Inclined Plane (Glass) and Trolley (Iron).
4	Square Threaded Screw Jack: A. To determine the Velocity Ratio, Mechanical Advantage and Efficiency of a Square Threaded Screw Jack B. To construct the Curves showing relations of P – W, MA – W, η - W.
5	To verify the Law of Moments by using a Bell Crank Lever
6	To verify the equilibrium of forces with the help of force polygon apparatus
7	To determine the co-efficient of friction between the slider and the inclined plane (sliding friction).

COURSE : WORKSHOP
Course Code : **ME181216**
Credit : **2**
L-T-P : 0-0-4

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

CO1	Demonstrate the different types, working principle, different operations and attachments of lathe and semi-automatic lathe.
CO2	Differentiate the different types along with parts, mechanisms and operations of shaper, planar, broaching and slotting machines
CO3	Differentiate the different types of drilling machines, drills and reamers along with the different operations
CO4	Explain the different types of milling machines, milling cutters, along with milling operations
CO5	Explain the basic principles of grinding, different types of grinding machines, grinding operations, specifications, dressing and truing of grinding wheels.

Detailed Syllabus

Exp. No	Experiments
1	**Lathe:** **(a) Lathe** – Functions, Classification and Specification, Different parts, Drive mechanisms for speed, feed, depth of cut, Taper turning, other operations, Machining time. Lathe accessories and Attachments.

	(b) Semi-Automatics – Capstan and Turret Lathes – Different parts – Tools – Work and Tool holding devices. Indexing and Bar Feeding mechanism, Tool layout and Tool schedule chart.
2	**Shaper, Planar, Slotting and Broaching Operations** **(a) Shaper -** Function, Classification and Specification, Different part of a shaper – Quick return and feed mechanism – Shaper Operations, Cutting speed and Machining time calculations. **(b) Planar -** Function, Classification and Specification, Difference between shaper and planar - Table drives and field mechanism – Planar operations – Machining time. **© Broaching –** Purpose, Broaching tool and machine **(d) Slotting Machine –** Purpose, Slotting tool and machine.
3	**Drilling:** (a) Drilling machines – Classification – Specification – Parts drilling machine – Spindle drive mechanism – tool and work holding devices. (b) Types of Drills and twist drill nomenclature, drill size and designation of drills. © Deep hole drilling operation. (d) Speed, feed and depth of cut and machining time in drilling. (e)Reaming operation, Reaming tools, Reaming allowances. (f) Tapping operation, tap drill size, difference with die (solid and adjustable).
4	**Milling:** Introduction – Classification – Principal parts of a column and knee type Milling machine – Specifications, Spindle drive and feed mechanism, elements of a milling cutter, Milling processes – Up Milling – down milling – face milling – end milling, cutting speed, feed and depth of cut – machining time, indexing and dividing head, indexing methods, spur and helical gear milling operations – Selection of cutter for gear cutting.
5	**Grinding:** Introduction – Kinds of Grinding – Grinding processes – Centerless Grinders – Surface Grinders – Tool and cutter Grinder – Specification Grinding wheel – Abrasives – Bonding Processes – Grid , Grade and Structure – Marking System of Grinding wheel – Selection of Grinding wheel, Mounting, Dressing, Truing and Balancing of grinding wheel.
6	**Pattern making and Foundry:** Pattern making and sand casting – Pattern materials – Types – Pattern allowances, Coreprints, Moulding sand – Ingredients – Classification – Sand additives – Properties of Moulding sand – Sand preparation and testing, Green sand mould preparations, Cores and core making – Types of Cores.

Text books:

1. Elements of Workshop Technology – Vol. I and II, S. K. Hajra Choudhury and A. K. Hajra Choudhury.
2. A course in Workshop Technology (Vol. I and Vol. II) – B. S, Raghuwanshi.
3. Manufacturing Technology – P. N. Rao – Tata McGraw Hill.

4. Workshop Technology – I – P. K. Sapra and R. K. Kapur – Bikas Publishing.
5. Elements of Manufacturing Processes – B. S. Nagendra Parasar and R. K. Mittal – PHI
6. Introduction to Machining Science – G.K. Lal, New Age International Ltd.

4.2.2 3rd, 4th and 5th Semesters New Syllabus courses of Dibrugarh University

SEMESTER-III

COURSE : MATHEMATICS
Course Code : **MA 301**
Credit : 4
L-T-P : 3-1-0
SEE : 100 Marks

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

CO1	Distinguish Bessel's differential equations and Legendre's Differential equations with the solutions of its problems.
CO2	Apply first order linear and non-linear partial differential equations for solving the boundary value problems.
CO3	Explain different statistical distributions, and method of line and curve fittings.
CO4	Solve problems related to probability theory, various theoretical statistical distributions, sampling theory and testing of hypothesis.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO3	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CO4	3	2	-	-	-	-	-	-	-	-	-	1	-	1

Detailed Syllabus

Module	Module details	Lecture Hr.	Marks
1	**Special Functions**: Series solution of ordinary differential equations. Bessel's differential equation and function, Legendre's differential equation and polynomial, some applications.	11	25

2	**Partial differential equations:** First order linear equations .Four standard forms of non-linear equations. Linear equations with constant coefficients. Solution by separation of variables, Heat equation, Wave equation and Laplace equation. Solutions of boundary value problems.	15	25
3	**Module 3: Probability and Statistics:** Review of Measures of central tendency (mean, median, mode), Measures of dispersions, variance, moments, skewness and kurtosis Theory of probability – addition law, multiplication law, conditional probability, independent events. Baye's theorem .Theoretical discrete distribution –Binomial, Poisson and Normal distribution, Correlation and regression, regression line and linear curve fitting. Sampling: Purpose and nature of sampling, Types of sampling, sampling distribution of mean and variance, Testing of hypothesis, null hypothesis, Chi-square (χ^2) test. Degree of freedom.	22	50

Test Books/Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreysig (Willy)
2. Higher Engineering Mathematics by B.S. Grewal
3. A Text book of Engineering Mathematics by Bali and Saxena
4. Probability, Statistics and Random processes by T. Veerarayan, (Mc Graw-Hills)
5. Statistics: Concepts and Applications by H. Frank, S. C. Altheon,(Cambridge Low Priced Edition.)
6. Theory and Problems of Probability and Statistics by M. R. Spiegel, Schaum's outline series, (McGraw-Hills)

COURSE : ENGINEERING MATERIALS AND METALLURGY (PC)
Course Code : **ME 301**
Credit : 4
L-T-P : 3-1-0
SEE : 100 Marks

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

CO1	Explain various mechanical properties of materials and deformation mechanisms.
CO2	Interpret phase diagrams.
CO3	Identify suitable heat treatment processes for different metals and alloys.
CO4	Explain the role of different alloying elements to impart specific metallurgical properties to ferrous and non-ferrous metals.
CO5	Select different non-metallic materials for various industrial applications.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	**12**	1	2

CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO4	2	1	1	1	-	1	1	-	-	-	-	1	1	1
CO5	2	1	1	1	-	1	1	-	-	-	-	1	-	1

Detailed Syllabus:

Module	Module details	Lecture Hr.	Marks
1	**Mechanical Properties and Deformation Mechanisms :** Mechanisms of plastic deformation, slip and twinning – Types of fracture – Testing of materials under tension, compression and shear loads – Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Impact test lzod and charpy, fatigue and creep failure mechanisms.	7	15
2	**Alloys and Phase Diagrams:** Constitution of alloys – Solid solutions, substitution and interstitial – phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron – carbon equilibrium diagram. Classification of steel and cast Iron microstructure, properties and application.	10	22
3	**Heat Treatment :** Transformation in plain carbon steel: TTT diagram, Different heat treatment processes: Hardening, Tempering, Annealing, Normalizing, Hardenability, Jominy end quench test - Austempering, martempering – case hardening, carburizing, Nitriding, cyaniding, carbonitriding – Flame and Induction hardening – Vacuum and Plasma hardening.	8	20
4	**Ferrous And Non-Ferrous Metals:** Effect of alloying additions on steel- α and β stabilisers– stainless and tool steels – HSLA, Maraging steels – Cast Iron -Grey, white, malleable, spheroidal – alloy cast irons, Copper and copper alloys – Brass, Bronze and Cupronickel –Aluminium and Al-Cu – precipitation strengthening treatment – Bearing alloys, Mg-alloys, Ni-based super alloys and Titanium alloys.	12	25
5	**Non-Metallic Materials :** Polymers – types of polymer, commodity and engineering polymers Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, Polymers – Urea and Phenol formaldehydes)- Engineering Ceramics – Properties and applications of Al 2O3, SiC, Si3N4, PSZ and SIALON – Composites -Classifications- Metal Matrix and FRP - Applications of Composites.	8	18

Text Books:

1. Introduction to Physical Metallurgy by Avner, S. H., McGraw Hill Book Company, 1994.
2. Material Science and Engineering by Williams D Callister, Wiley India Pvt Ltd, Revised Indian Edition 2007.

References Books:

1. James K. Wessel, "Handbook Of Advanced Materials", John Wiley & Sons, Inc., Hoboken, New Jersey. ISBN: 978-0-471-45475-5, 2004
2. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 1999.
3. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th Indian Reprint 2010.
4. Gupta, K.M, "Engineering Materials: Research, applications and Advances" , CRC Press, ISBN 9781482257977 - CAT# K24121, 2014
5. *Smith* WilliamF, "*Materials Science* & Engineering", Tata McGraw Hill Education Private Limited, ISBN: 9780070667174, 0070667179, Edition: 4th, 2008.

COURSE	**:**	**THERMODYNAMICS (PC)**
Course Code	:	**ME 302**
Credit	:	4
L-T-P	:	3-1-0
SEE	:	100 Marks

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

CO1	Explain thermodynamic systems, properties, process, cycles thermodynamic equilibrium, point function, path function, thermodynamics work, heat transfer and Zeroth law of thermodynamics
CO2	Analyse thermal systems applying the first law of thermodynamics such as nozzle, compressor, heat exchanger, turbine etc.
CO3	Analyse thermal systems such as nozzle, compressor, heat exchanger, turbine etc. applying the second law of thermodynamics
CO4	Apply the ideal gas equations of state in the solution of problems
CO5	Solve problems on heating and expansion processes of steam in nozzle, steam turbine, boiler etc.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	**12**	1	2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	3	2	-	-	1	-	-	-	-	-	-	1	-	1
CO3	3	2	-	-	1	-	-	-	-	-	-	1	-	1
CO4	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO5	2	2	-	-	1	-	-	-	-	-	-	1	-	1

Detailed Syllabus

Module	Module details	Lecture Hr.	Marks
1	**Introduction:** Basic concepts, system, control volume, surrounding, boundaries, universe, macroscopic and microscopic view points, continuum, thermodynamic equilibrium, state, property, process, cycle, reversibility, Quasi-static process, irreversible process, intensive and extensive properties, work, heat, point and path function, illustrative problems, temperature and Zeroth law of thermodynamics, thermometry, illustrative problems.	5	10
2	**First law of Thermodynamics:** First law applied to a system undergoing a cyclic process and a change of state, concept of energy, nature of energy, First law applied to a control volume, general energy equation, steady flow energy equation on unit mass and time basis, application of SFEE for devices such as boiler, turbine, heat exchangers, pumps, nozzles, etc. Illustrative problems	7	20
3	**Second law of Thermodynamics:** Kelvin Planck and Clausius statements and their equivalence and corollaries, PMM of second kind, Carnot's principle, Carnot cycle, its specialities, Thermodynamic scales of temperature, Illustrative problems. **Entropy:** Clausius theorem, Clausius inequality, entropy, principles of entropy increase, Application of entropy principles, entropy transfer mechanism, entropy generation in a closed and open systems, Illustrative problems, irreversibility, Third law of Thermodynamics.	7	20
4	**Availability and Exergy analysis:** Concept of available energy, exergy or availability, exergy analysis of closed and open system, exergy balance, first law and second law efficiencies, Illustrative problems.	7	20
5	**Ideal Gas and Real Gas:** Ideal gas, relation among the specific heats, internal energy, enthalpy. Analysis of isochoric, isobaric, isothermal, isentropic, isenthalpic processes, representation of the above processes on P-v, T-s planes. Determination of work, heat, entropy and enthalpy changes during the above processes, problems. Characteristic gas equations of a real gas, virial coefficients, law of corresponding states, compressibility factor, generalized compressibility chart, problems, Concept of Thermodynamics relations	9	20

6	**Properties of pure substance:** Phase transformation, generation of steam, quality of steam, concept of enthalpy of different steam, p-v and T-s diagrams, use of steam tables and Mollier chart, Illustrative problems	5	10

Text Books:

1. Engineering Thermodynamics: P. K. Nag
2. Thermodynamics, an Engineering Approach: Yunus Cengel and Michale Boles
3. Thermodynamics: YVC Rao

COURSE : MECHANICAL DRAWING (PC)
Course Code : **ME 303**
Credit : 2
L-T-P : 1-0-2
SEE : 100 Marks

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

CO1	Identify orthographic, Sectional views of a machine component.
CO2	Show the representation of materials used in machine drawing.
CO3	Illustrate the machine elements including keys, couplings, cotters, riveted, bolted and welded joints.
CO4	Construct an assembly drawing using part drawings of machine components.
CO5	Represent tolerances and the levels of surface finish of machine elements as per standard code.

Mapping of COs with POs

COs	POs												PSO	
	1	2	3	4	5	6	7	8	9	10	11	**12**	**1**	**2**
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	1	1	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	1	-	-	1	-	-	-	-	1	-	1	1	1
CO5	2	2	-	-	1	-	-	-	-	1	-	1	1	1

Detailed Syllabus

Module	**Module details**	**Lecture Hr.**	**Marks**
1	Orthographic Projections and views of machine elements	3	15
2	Sectional views and projection of machine elements	3	15
3	Production Drawings :Detail or Part Drawings, Working Assembly Drawings	3	10

4	Temporary Fastenings-Representation of screw threads, threaded fastening, locking devices, foundation bolts, keys and cotters	3	10
5	Permanent fastenings, Rivets and Riveted joints, welding symbols and welded joints	3	10
6	Making of assembly and workshop drawings of engineering components such as knuckle joints, cotter joints, plumber block, valves, cross head, staffing box, eccentric etc. including sectional and half sectional, views	5	40

Text Books:

1. Machine Drawing – Dr. K.L. Narayanan ,
2. Machine Drawing − N. D. Bhatt

COURSE : MECHANICS OF MATERIALS (PC)
Course Code : **ME 304**
Credit : 4
L-T-P : 3-1-0
SEE : 100 Marks

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

CO1	Explain the fundamental concepts of stress, strain and relationship between the elastic constants.
CO2	Analyse the compound stresses theoretically and graphically.
CO3	Construct the shearing force and bending moment diagrams for different loading conditions.
CO4	Illustrate the variation of bending and shear stress in simple beam sections.
CO5	Apply the different methods for determination of slope and deflection of beams under various loading conditions.
CO6	Solve for stresses developed due to torsion in shaft and in thin walled pressure vessel.

Mapping of COs with POs

COs	**POs**												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	**12**	**1**	**2**
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO3	3	3	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO5	3	3	-	-	-	-	-	-	-	-	-	1	-	1
CO6	2	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module details	Lecture Hr.	Marks
1	**Simple Stress and Strain**: Stress, Shear Stress, Strain, Modulus of Elasticity and Modulus of Rigidity, Elongation of A Bar, Principle of Superposition, Bars of Tapering Section, Elongation Due to Self-Weight, Stresses in A Compound Bar, Temperature Stresses, Stresses due to Shrinking on (Hoop Stress), Poisson's Ratio, Net Strain in Two-Dimensional and Three-Dimensional Stress Systems, Volumetric Strain, Tensile Test Diagram, Factor of Safety, Elastic Constants, Relation Between Elastic Constants.	7	15
2	**Compound Stress and Strain:** Stress Analysis in Direct, Bi-axial, Pure Shear and Bi-axial and Shear Stresses Conditions, Principal Stress, Mohr's Stress Circle, Ellipse of Stress, Principal Stresses from Principal Strains, Strain Analysis, Mohr's Strain Circle.	5	15
3	**Shear Force and Bending Moment:** Types of Supports and Beams, Shear Force, Bending Moment, Relation between Load, Shear Force and Bending Moment, S.F. and B.M. diagrams for Cantilevers, Simply Supported Beams and Overhanging Beams with Concentrated Loads, Uniformly Distributed Loads, Uniformly Varying Loads, Inclined Loads and Couples, Points of Contraflexture, Loading and B.M. Diagrams from S.F. Diagram.	5	15
4	**Bending Stress in Beams:** Theory of Simple Bending, Section Modulus, Moment of Resistance, Moment of Inertia, Parallel Axis Theorem, Beams with Uniform Bending Strength, Composite Beams, Reinforced Concrete Beams. Shear Stress in Beams: Variation of Shear Stress, Shear Stress Variation in Different Sections, Built-up Beams.	6	15
5	**Slope and Deflection:** Beam Differential Equation, Sign Convention, Slope and Deflection at a Point for Cantilevers, Simply Supported and Overhanging Beams with Concentrated and Uniformly Distributed Loads – Double Integration Method, Macaulay's Method, Moment-area Method and Conjugate Beam Method, Castigliano's First Theorem, Introduction of Maxwell's Reciprocal Deflection Theorem and Betti's Theorem of Reciprocal Deflections.	5	15
6	**Torsion:**	7	15

	Theory of Torsion, Circular Shafts, Power Transmission, Shafts in Series and Parallel, Combined Bending and Torsion.		
7	Thin Cylinders and Spheres: Thin Cylinders, Hoop Stress, Longitudinal Stress, Maximum Shear Stress, Hoop and Longitudinal Stresses with Efficiency of Joints, Circumferential and Longitudinal Strains, Thin Spherical Shell, Thin Cylinder with Spherical Ends, Volumetric Strain of Thin Cylinders and Thin Spherical Shell (Neglecting and Considering the Effect of Internal Pressure), Wire Winding of Thin Cylinders.	5	10

Text Books:

1) Strength of Materials by R. K. Rajput (S. Chand & Company Ltd.)
2) Strength of Materials by Dr. R. K. Bansal (Laxmi Publications Pvt. Ltd.)
3) Strength of Materials by S.S. Rattan (Tata McGraw-Hill)
4) Strength of Materials by Dr. Sadhu Singh (Khanna Publishers)
5) Strength of Materials by W. A. Nash (Tata McGraw Hill Education Pvt. Ltd.)
6) Mechanics of Materials by F. P. Beer, E. R. Johnston & J. T. DeWolf (Tata McGraw-Hill Publishing Company Ltd.)

COURSE : ELECTRONICS DEVICE AND CIRCUIT
Course Code : **ME 303**
Credit : 3
L-T-P : 3-0-2
SEE : 100 Marks

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

CO1	Explain the Semiconductor material, charge carriers, p-n junction diodes, Clipper, Clamper, Voltage Multipliers, Rectifiers, Zener diode, LED, photodiode, SCR.
CO2	Illustrate the Construction & Operation of BJT (CB, CE& CC configuration), JFET, MOSFET & CMOS.
CO3	Analyse Transistor Amplifiers (Common Emitter) Circuits, Biasing Circuits, Stabilization, Feedback Amplifiers & Oscillators.
CO4	Explain 555 timer IC, Astable and Monostable Multivibrator, Analog–to-Digital (ADC) and Digital-to-Analog (DAC) Conversion, Resistor Ladder Type DAC, Specifications of ADC and DAC.
CO5	Interpret Binary Number Systems, Logic Gates and Truth Tables, Boolean algebra, Flip-Flops, Counters, Shift Registers & Applications.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	-	-	-	-	-	1	-
CO2	3	2	-	-	-	-	-	-	-	-	-	-	1	-
CO3	3	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	3	-	-	-	-	-	-	-	-	-	-	-	1	1
CO5	3	2	-	-	-	-	-	-	-	-	-	-	1	-

Detailed syllabus

Module	Module details	Lecture Hr.	Marks
1	Diodes and Applications covering, Semiconductor Diode Ideal versus Practical, Resistance levels, Diode Equivalent Circuits, Load Line Analysis; Diode as a Switch, Diode as a Rectifier, Half Wave and Full Wave Rectifiers with and without Filters; Breakdown Mechanisms, Zener Diode - Operation and Applications; Opto-Electronic Devices -LEDs, Photo Diode and Applications; Silicon Controlled Rectifier, (SCR) -Operation, Construction, Characteristics, Ratings, Applications.	10	
2	Transistor Characteristics covering, Bipolar Junction Transistor (BJT) -Construction, Amplifying Action, Common Operation, Base, Common Emitter and Common Collector Configurations, Operating point, Voltage Divider Bias Configuration; Field Effect Transistor (FET) Construction, Characteristics of Junction FET, Depletion and Enhancement type Metal Oxide Semiconductor (MOS) FETs, Introduction to CMOS circuits.		
3	Transistor Amplifiers and Oscillators covering, Classification, Small Signal Amplifiers Basic Features, Common Emitter Amplifier, Coupling and Bypass Capacitors, Distortion Feedback Amplifiers - Principle, Advantages of Negative Feedback, Topologies, Current Series and Voltage Series Feedback Amplifiers; Oscillators- Classification, RC Phase Shift, Wien Bridge, High Frequency LC and Non-sinusoidal type oscillators.		
4	Timers and Data Converters covering, IC 555 Timer Block Diagram, Astable and MonostableMultivibrator Configurations; Data Converters - Basic Principle of Analogue-to-Digital (ADC) and Digital-to-Analogue (DAC) Conversion, Flash type, Counter-ramp type and Successive		

	Approximation type ADCs, Resistor Ladder Type DAC, Specifications of ADC and DAC;		
5	Binary Number Systems and Codes; Basic Logic Gates and Truth Tables, Boolean Algebra, DeMorgan's Theorems, Logic Circuits, Flip-Flops - SR, JK, D type, Clocked and Master-Slave Configurations, Counters -Asynchronous, Synchronous, Ripple, Non-Binary, BCD Decade types; Shift Registers-Right-Shift, Left-Shift, Serial-In-Serial-Out and Serial-In-Parallel-Out Shift Registers; Applications		

Text/Reference Books:

1. Salivahanan, Electronic Devices and Circuits, 2nd Edition, Tata McGraw Hill 2011
2. Neil Storey, Electronics: A Systems Approach, 4th Edition, Pearson Education, 2009
3. Integrated Electronics Analog and Digital Circuits and Systems 1991 J. Millman and C. C. Halkias TMH R. L. Boylestad & Louis Nashlesky (2007), Electronic Devices &Circuit Theory, Pearson Education
4. Santiram Kal, Basic Electronics- Devices, Circuits and IT Fundamentals, Prentice Hall, India, 2002
5. David A. Bell, Electronic Devices and Circuits, Oxford University Press, 2008
6. Thomas L. Floyd and R. P. Jain, Digital Fundamentals, Pearson Education, 2009
7. R. S. Sedha, A Text Book of Electronic Devices and Circuits, S. Chand & Co., 2010
8. R. T. Paynter, Introductory Electronic Devices & Circuits - Conventional Flow Version, Pearson Education, 2009
9. Digital Electronics: Principles. Devices and Applications 1st Ed 2007- Anil K Maini, Wiley
10. Fundamentals of Digital Circuits 4h Ed 2016 - A. Anand Kumar, PHI
11. Digital Principles and Applications 5th Ed 1994-Don Leach and Albert Malvino, McGraw Hill

COURSE	**:**	**MATERIAL TESTING LABORATORY (PCL)**
Course Code	:	**ME 305**
Credit	:	1
L-T-P	:	0-0-2
SEE	:	50 Marks

Course Outcomes: Upon successful completion of the laboratory, students should be able to:

CO1	Determine the hardness of materials by Brinell and Rockwell hardness testing machines.
CO2	Determine the toughness of materials by Charpy Pendulum Impact Testing machine.
CO3	Determine the compressive strength of materials by Compression testing machine.
CO4	Determine the torsional strength of materials by pendulum Torsion Testing machine.
CO5	Determine the tensile strength of materials by Universal testing machine.

Mapping of COs with POs

CO	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	**12**	**1**	**2**
CO1	2	2	-	2	1	-	-	1	-	1	-	1	1	2
CO2	2	2	-	2	1	-	-	1	-	1	-	1	1	2
CO3	2	2	-	2	1	-	-	1	-	1	-	1	1	2
CO4	2	2	-	2	1	-	-	1	-	1	-	1	1	2
CO5	2	2	-	2	1	-	-	1	-	1	-	1	1	2

Detailed Syllabus

Exp. No.	Title of the Experiment	Objective of the Experiment
1	Rockwell Hardness Test	To determine hardness of a mild steel and high carbon steel specimen.
2	Brinell Hardness Test	To determine hardness of a mild steel and high carbon steel specimen.
3	Pendulum Impact Test	To determine impact resistance of an assigned specimen in the form of notched bar flexure specimen.
4	Compressive Stress Test	To determine the compressive test of a given specimen.
5	Torsion Test	To determine Modulus of Rigidity, Breaking Torque and Ultimate Shear Stress of a mild steel specimen by conducting Torsion Test.
6	Tension Test	To determine the following parameters of the given specimen: 1. Elongation 2. Maximum stress 3. Breaking stress 4. % age of reduction of Area

COURSE : THERMODYNAMICS LABORATORY (PCL)
Course Code : **ME 306**
Credit : 1
L-T-P : 0-0-2
SEE : 50 Marks

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

CO1	Identify the different types of boilers, mounting and accessories.
CO2	Identify the different parts of 2-stroke and 4-stroke Petrol and Diesel engines.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	**12**	**1**	**2**
CO1	2	1	-	-	-	-	-	1	-	1	-	-	1	2
CO2	2	1	-	-	-	-	-	1	-	1	-	-	1	2

Detailed Syllabus

Exp. No.	Title of the Experiment	Objective of the Experiment
1	Study of a Locomotive boiler	a) To make a neat pencil sketch of the boiler and label all the parts. b) To make a list of the mountings and accessories provided in the boiler. c) To describe the working principle of the boiler.
2	Study of a Cochran boiler	a) To make a neat pencil sketch of the boiler and label all the parts. b) To make a list of the mountings and accessories provided in the boiler. c) To describe the working principle of the boiler.
3	Study of a Lancashire boiler	a) To make a neat pencil sketch of the boiler and label all the parts. b) To make a list of the mountings and accessories provided in the boiler. c) To describe the working principle of the boiler.
4	Study of a Babcock and Wilcox boiler	a) To make a neat pencil sketch of the boiler and label all the parts. b) To make a list of the mountings and accessories provided in the boiler. c) To describe the working principle of the boiler.
5	Study of 2-Stroke and 4-Stroke cycle Petrol Engine	a) To make neat pencil sketches showing the different strokes in each case and level all the parts. b) To prepare a list of all the important parts. c) To describe the working principles of each cycle
6	Study of 2-Stroke and 4-Stroke cycle Diesel Engine	a) To make neat pencil sketches showing the different strokes in each case and level all the parts. b) To prepare a list of all the important parts. c) To describe the working principles of each cycle

SEMESTER –IV

COURSE	**:**	**MATHEMATICS**
Course Code	:	**MA 401**
Credit	:	4
L-T-P	:	3-1-0
SEE	:	100 Marks

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

CO1	Apply Green's, Gauss, Stokes theorem with the background of vector fundamentals in solving line, surface and volume integrals.
CO2	Explain transformation of co-ordinates, algebra of tensors, Christoffel symbols and their transformation.
CO3	Solve linear programming problems using graphical and simplex method.
CO4	Apply Fuzzy Mathematics to decision making problems.

Mapping of COs and POs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CO4	2	-	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	**Module details**	**Lecture Hr.**	**Marks**
1	**Vector Calculus:** Vector functions, variable vectors and preliminaries. Differentiation, differential operators, identities, gradient, divergence, curl and their physical meanings. Line, surface and volume integrals. Gauss, Green and stoke's theorem. Simple application to Engineering problems.	14	1
2	**Tensor Analysis:** Introduction: Summation convention, Transformation of co-ordinates, Tensor of order zero, Kronecker delta. contravariant and covariant vectors, contravarient and covariant tensor of order two, symmetric and skew symmetric tensors. Addition of tensors, outer product and inner product of tensors, quotient law. Riemannian space, metric tensor, conjugate tensor. Christoffel symbols, transformation of Christoffel symbols.	10	1

3	**Linear Programming :** Linear programming problems and its formulation, graphical method of solution, canonical and standard form of LPP. Simplex method, Artificial variables Techniques. Complimentary slackness theorem, Fundamental theorem of Duality, Degenerate solution, Cycling, Transportation problem, Elements of Dynamic programming problems.	12	1
4	**Fuzzy Mathematics** : Fuzzy Set: Introduction, Crisp sets and Fuzzy sets, basic concepts of Fuzzy sets versus Crisp sets, operations on Fuzzy sets, Fuzzy arithmetic ,Arithmetic operations on Fuzzy numbers, Fuzzy relations, Composition of Fuzzy relation. Fuzzy Logic: An overview, multi-valued logics, Fuzzy propositions, Fuzzy quantifiers, Fuzzy Decision making problems. Fuzzy Engineering Applications.	12	1

Books/Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreysig (Willy)
2. Higher Engineering Mathematics by B.S. Grewal, Khanna publishers
3. A Text book of Engineering Mathematics by Bali and Saxena, Laxmi publications
4. Linear programming by G. Hadley, Narosa Publishing House.
5. Linear Programming and Game Theory; by-Dipak Chatterjee, Prentice Hall.
6. Fuzzy Algebra, Vol-I by Rajesh Kumar, University of Delhi.
7. Fuzzy Sets and Fuzzy Logic By George J. Klir/Bo Yuan, Prentice Hall.
8. Fuzzy Set Theory And its Applications by H. J. Zimmermann, Allied Publishers

COURSE : MECHANISM AND MACHINES (PC)
Course Code : **ME 401**
Credit : 4
L-T-P : 3-1-0
SEE : 100 Marks

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

CO1	Explain kinematic links, kinematic pairs, kinematic chain, mechanism, inversion of mechanism.
CO2	Construct velocity and acceleration diagram of different mechanisms.
CO3	Solve problems on different types of friction drives.
CO4	Estimate fluctuation of speed and energy, turning moment diagrams and flywheel dimensions.
CO5	Solve problems on gears and gear trains.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO3	3	3	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO5	3	3	-	-	-	-	-	-	-	-	-	1	-	1
CO6	2	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module details	Lecture Hr.	Marks
1	Kinematics links, kinematics pair, kinematic chain, mechanism, inversion of mechanism, velocity and acceleration mechanism, relative velocity method, instantaneous centre method, acceleration and velocity diagrams	15	20
2	Friction drives- Transmission of power by belt, rope and chain drives, pivots and collars, power screws, plate and cone clutch, Rope and block brakes, friction in journal bearing and lubrication	15	30
3	Fly wheels, fluctuation of speed, fluctuation of energy, turning moment diagram, calculation of flywheel size	8	15
4	Gear Trains- Simple, compound and planetary gear train, velocity ratio	7	15
5	Gears- Classification of gears and basic terminology, fundamental law of gearing, geometric and kinematic characteristics of involutes and cycloidal tooth profiles, undercutting and interferences – minimum no of teeth velocity of sliding arc and size of constant (approach and recesses)	5	20

Text Books:

1. Theory of Machines by Thomas Bevan
2. Theory of Machines by J.E. Shinglay
3. Theory of Machine by A. Ghosh and Malik
4. Theory of machines by V. P. Singh.

COURSE : ADVANCED MECHANICS OF SOLIDS (PC)

Course Code : ME 402
Credit : 3
L-T-P : 3-0-0
SEE : 100 Marks

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

CO1	Explain the stresses induced due to different types of loading in columns and strut, curved bars, rotational disc and unsymmetrical bending.
CO2	Apply theories of elastic failure in mechanical components.
CO3	Explain the fundamentals of finite element method and its applications
CO4	Solve problems of columns and strut, curved bars, rotational disc and unsymmetrical bending.

Mapping of COs and POs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	-	-	-	-	-	1	-	-	-	1	1	1
CO3	2	1	-	-	1	-	-	-	-	-	-	1	-	1
CO4	3	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	**Module details**	**Lecture Hr.**	**Marks**
1	Column and Struts: Failure of a Column, Euler's Column theory, Effective length of a column, Slenderness ratio, Rankine's formula, Formula by I.S. code for Mild Steel, Columns with eccentric load.	6	20
2	Bending of Curved Bars: Expression for stresses in a curved bar, Determination of Factor h^2 for various sections, resultant stress in a curved bar subjected to direct stresses and bending stresses, resultant stress in a hook, stresses in Circular Ring.	8	20
3	Stresses Due to Rotation: Expression for stresses in rotating Ring, Rotating thin disc, Disc of uniform strength.	8	20
4	Unsymmetrical Bending and Shear Center: Product of inertia, Principal Axes and principal Moment of Inertia, Stresses and deflection of beam due to Unsymmetrical Bending, Shear center for channel section.	6	20
5	Strain Energy and Theories of Failure: Strain Energy, Resilience, Proof Resilience, Modulus of Toughness, Strain Energy in Three-Dimensional System, Shear Strain Energy, Shear Strain Energy in Three-Dimensional System, Stresses due to Various Types of Loading, Strain Energy due to Bending, Strain Energy due to Torsion, Theories of Failures,	5	10

	Graphical Representation of Theories of Failures.		
6	Introduction to finite element method (FEM) and its application using ANSYS: Introduction, historical background, stresses and equilibrium, boundary conditions, strain-displacement relations, stress-strain relations, temperature effects, The Eayleigh-Ritz Method, Galerkin's Method, Saint Venant's Principle, Von Mises stress, axial rod and beam problem (direct FEM formulation), power of FEM, difference between FEM and FDM, comparison of differential equation, weighted residual and weak forms, one-dimensional bar finite element, one-dimensional heat transfer element, introduction to stress analysis using an FEM package (ANSYS)	7	10

Text Books:

1. Strength of Materials by R. K. Rajput (S. Chand & Company Ltd.)
2. Strength of Materials by Dr. R. K. Bansal (Laxmi Publications Pvt. Ltd.)
3. Strength of Materials by S.S. Rattan (Tata McGraw-Hill)
4. Finite Element Methods for Engineer by U. S. Dixit (Cengage Learning)
5. Textbook of Finite Element Analysis by P. Seshu (PHI Learning Pvt. Ltd.)
6. Introduction to Finite Elements in Engineering by T. R. Chandrupatla & A. D. Belegundu (Pearson Education)

COURSE : FLUID MECHANICS (PC)
Course Code : **ME 403**
Credit : 4
L-T-P : 3-1-0
SEE : 100 Marks

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

CO1	Explain fluid properties and governing laws.
CO2	Solve problems relating to floating and submerged bodies under the influence of hydrostatic forces.
CO3	Analyze the kinematic characteristics of fluids.
CO4	Apply the principles, equations relating to dynamics of fluid flow.
CO5	Illustrate the flow measuring devices and equipment.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	1

CO3	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CO4	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CO5	2	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module details	Lecture Hr.	Marks
1	Introduction: Flow properties-density, specific weight, specific volume, relative density, viscosity, Newton's law of viscosity, classification of fluids, continuum.	5	8
2	Fluid Static's: Introduction, pressure at a point, Pascals law, Pressure variation in a fluid at rest, measurement and scales of pressure, pressure measuring devices, hydrostatic force on a horizontal, vertical, inclined planes and rough surface, buoyancy stability of floating and submerged bodies, metacentre and metacentric height, conditions of equilibrium of a floating and submerged bodies.	9	20
3	Kinematics of Fluids: Flow field and description of fluid motion, velocity and acceleration, stream line path line, streak line, stream tube, steady, unsteady flow uniform and non-uniform flow, rotational and irrational flows, translation, vorticity, stream function, velocity potential function, flow net, source, sink, vortex flow, free and forced vortex, doublet, continuity and its analysis based on integral form.	10	25
4	Dynamics of Fluid Flow: Euler's equation of motion, its vectorial approach, Euler's eq. along a streamline, analytical and vectorial approach of Bernoulli's equation, energy equation and momentum equation and its vectorial approach, application of Bernoulli's eq. to real fluid flow, dynamic forces on plain and curved surfaces due to impingement of liquid jets.	10	25
5	Flow measurement: Concept of static and Stagnation pressure, application of pitot tube, hot wire anemometer, venturimeter, orificemeter ,the phenomenon of jet contraction, hydraulic co-efficient of an orifice, factors affecting orifice coefficients.	5	10
6	Dimensional analysis and Dynamic Similitude: Buckingham Pi theorem, dimensionless numbers, distorted models.	6	12

Text Books:

1. Introduction to Fluid Mechanics by Robert W. Fax, Philip J. Pritchard, Alan T. McDonald. Wiley India Edition. (Wiley Student Edition Seventh 2011).
2. Fluid Mechanics by Franck .M White Tata McGraw Hill Publication 2011.
3. Mechanics of Fluids by Shames, "McGraw Hill Book Co., New Delhi, 1988

COURSE	**:**	**PRIMARY MANUFACTURING PROCESS (PC)**
Course Code	:	**ME 404**
Credit	:	3
L-T-P	:	3-0-0
SEE	:	100 Marks

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

CO1	Explain different types of manufacturing processes and plant layouts.
CO2	Illustrate different types of casting processes, riser and gating systems of metals and non-metals.
CO3	Explain the principles and techniques of powder metallurgy in fabrication of simple PM parts.
CO4	Illustrate different types of forming processes and techniques.
CO5	Explain different types of welding processes and defects.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	-	-	-	-	-	-	1	-	-	1	-	1
CO2	3	2	-	-	-	-	1	-	1	-	-	1	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CO4	3	2	-	-	-	-	-	-	-	-	-	1	1	1
CO5	2	2	-	-	-	-	1	-	1	-	-	1	1	1

Detailed Syllabus

Module	**Module details**	**Lecture Hr.**	**Marks**
1	**Introduction to Manufacturing-** Introduction, Origin and History of Manufacturing, Types of Manufacturing ,Difference of manufacturing and Production, Types of Production, Process Layouts, Design cycle, Process selection, Introduction to Computers in Manufacturing.	4	10
2	**Casting &Plastic Processing**-Introduction, Pattern & Mould, Preparation of Mould, Melting, Gases in mould, Types of Pattern& Allowances, Green sand moulding and Casting, Furnaces, Gating Design, Cooling and Solidification, CFR, Types of Gates and Riser, Their Designing, Placement, Caine's, Chvorinov's rule, Effective Parasitic Volumes, Defects in Casting, Special Casting Processes- Shell Moulding, Investment(Lost Wax),Gravity,Die,Centrifugal,Slush,CO_2 Casting; Defects and Inspection of Casting .	15	35

	Plastic Processing- Classification of Polymers, Thermosetting and Thermo-Plastics, Plastic Processing methods- Compression, Transfer and Injection Moulding.		
3	**Powder Metallurgy**-Introduction, Production of metal Powders, Compaction, Sintering Theories and Stages of Sintering, Surface and Bulk Transport Mechanism, Secondary operations of PM parts, Design consideration for PM Parts and applications.	4	10
4	**Forming**- Introduction, Cold and Hot Forming, Plastic Deformation and Yield Criteria, Tresca's and Von Mises' Criteria, Relationship between Tensile and Shear Yield Stresses, Mechanics of Rolling, Forging, Drawing, Deep Drawing, Extrusion, Punching & Blanking; Design of Dies, Introduction to Bending, Coining, Thread Rolling, Tube Piercing, Spinning, Stretch Forming; Calculation of various Forming forces. Advantage and Disadvantage of Hot and Cold Forming, Friction and Lubrication, Defects in Forming.	10	25
5	**Welding**- Introduction; Types of jointing; Solid, Liquid and Solid/Liquid State Welding, Heat sources, Arc Structure, Voltage ,Current and Power Characteristics; Welding Position, Welding Symbols, Modes of Metal Transfer, Heat Flow Characteristics, Cooling and Solidification; Arc Welding, Oxy acetylene Gas Welding and Gas Cutting, Soldering Brazing and Adhesive Bonding; Special Welding- GMAW, GTAW, SAW; Various Resistance Welding Processes, Ultrasonic Welding, Electron Beam Welding, Laser Beam Welding, Cold Welding, Welding Defects and Inspection.	8	20

Text Books:

1. Manufacturing Science- by Ghosh & Mallick.
2. Production Technology (Manufacturing Processes) by PC Sharma
3. Engineering and Technology by Kalpakjian & Schmid.
4. Casting Technology and Cast Alloys by A. K. Chakrabarti
5. Welding and Welding Technology by RL Little
6. Principles of Powder Metallurgy by PS Gill
7. Powder Metallurgy by A K Sinha.

COURSE : APPLIED THERMODYNAMICS-I (PC)
Course Code : **ME 405**
Credit : 3
L-T-P : 3-0-0
SEE : 100 Marks

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

CO1	Explain the components and working principle of Steam Power Plants.
CO2	Analyse the thermodynamics properties of steam flowing through nozzle and steam turbines.
CO3	Explain fuel properties, principle of combustion, steam generator with accessories and mountings.
CO4	Solve illustrative problems on steam condenser.

Mapping of COs and POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	**12**	**1**	**2**
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO3	3	2	-	-	-	-	1	-	-	-	-	1	1	1
CO4	2	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module details	Lecture Hr.	Marks
I	**Combustion of fuels:** Solid, liquid, and gaseous fuels, properties of fuels (density, specific gravity, viscosity, flash and fire points, pour points, calorific value, sulphur content, ash content, water content), proximate and ultimate analyses of solid fuels, principle of combustion, combustion reactions, heat formation, heat of combustion, 3T's of combustion, Illustrative problems.	7	20
2	**Steam generators:** Classification, uses, components, mountings and accessories, evaporation capacity, equivalent evaporation, boiler efficiency, draught, chimney height calculation Steam Generator: subcritical and supercritical boilers, fluidized bed boilers, fire-tube and water tube boilers, mountings and accessories;	7	15
3	**Vapour power cycle:** Carnot cycle and its limitations, Rankine cycle, its application, methods used to improve Rankine cycle efficiency, Illustrative problems, Binary vapour cycle back-pressure and extraction turbines and cogeneration, low temperature power cycles, ideal working fluid and binary/multi-fluid cycles;	7	20
4	**Steam Nozzles and steam turbine**: Types, velocity of steam leaving nozzles, critical pressure ratio, area of cross section of throat, maximum discharge, length of nozzle, effect of friction in nozzle, Illustrative problems. Impulse and Reaction turbines, velocity diagrams, output, axial thrust, diagram efficiency, stage	10	25

	efficiency, overall efficiency, turbine blade height, Illustrative problems reheat factor, condition curve, compounding of Impulse turbine.		
5	**Steam condensers**: Types, comparison, sources of air leakage, vacuum efficiency, condenser efficiency, air pumps. Cooling Tower: hygrometry and psychometric chart, Illustrative problems.	7	20

Text Books:

1. Basic and Engineering Thermodynamics by P. K. Nag
2. Thermodynamics, an Engineering Approach by Yunus Cengel and Michael Boles
3. Thermodynamics by Y V C Rao
4. Engineering thermodynamics by Domkundwar

COURSE : FLUID MECHANICS LABORATORY (PCL)
Course Code : **ME 406**
Credit : 1
L-T-P : 0-0-2
SEE : 50 Marks

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

CO1	Measure the dynamic and kinematic viscosity of liquids.
CO2	Determine the friction factor both for Laminar Flow and Turbulent Flow.
CO3	Determine the coefficient of discharge of Venturimeter and Orifice meter.
CO4	Verify the Bernoulli's Theorem.
CO5	Identify the type of Flow through Reynolds Number.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	-	1		1	-	1	-	1
CO2	2	1	-	-	-	-	-	1		1	-	1	-	1
CO3	2	1	-	-	-	-	-	1		1	-	1	-	1
CO4	2	1	-	-	-	-	-	1		1	-	1	-	1
CO5	2	1	-	-	-	-	-	1		1	-	1	-	1

Detailed Syllabus

Exp. No.	Title of the Experiment	Objective of the Experiment
1	Measurement of Kinetic and Dynamic Viscosity of Oil	To measure the dynamic and kinematic viscosity of mineral oil, liquid fuel and other similar liquids using Redwood Viscometer.
2	Laminar Flow	To compare the theoretical friction factor f = 64 / R and experimental friction factor
3	Turbulent Flow	To determine the friction factor for a pipe and loss coefficient K for a fitting using turbulent flow apparatus.
4	Flow Through Venturimeter	To determine the coefficient of discharge of venturimeter.
5	Flow Through Orifice meter	To determine the coefficient of discharge of Orifice meter
6	Bernoulli's Apparatus	To verify the Bernoulli's Theorem
7	Reynold's Experiment	To determine the Reynolds Number and hence the Type of Flow

COURSE : APPLIED THERMODYNAMICS LABORATORY (PCL)
Course Code : **ME 407**
Credit : 1
L-T-P : 0-0-2
SEE : 50 Marks

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

CO1	Measure the BHP and air fuel ratio of the engine at given condition of engine load and RPM.
CO2	Measure the flash point and fire point of a given oil.
CO3	Determine the specific fuel consumption and performance of a four stroke diesel engine at varying loads.
CO4	Measure the area of an indicator diagram using Planimeter for IHP calculation of an engine
CO5	Illustrate the crank position for valve timing of four stroke diesel engine.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	-	-	-	-	1	-	1	-	-	-	1
CO2	2	1	-	-	-	-	-	1	-	1	-	-	-	1
CO3	2	2	1	-	-	1	-	1	-	1	-	-	1	1
CO4	2	-	-	-	-	-	-	1	-	1	-	-	-	1
CO5	1	1	-	-	-	-	-	1	-	1	-	-	-	1

Detailed Syllabus

Exp. No.	Title of the Experiment	Objective of the Experiment
1	Study of a two stroke petrol engine	a) To measure the BHP of the engine using a hydraulic dynamometer and hence calculate the Brake Thermal Efficiency of the Engine. b) To determine the air fuel ratio at given condition of engine load and RPM
2	Flash point and fire point of oil	To determine the flash point and fire point of the given oil
3	Pressure gauge calibration.	To calibrate a pressure gauge against known weight placed on the weighing pan of a dead weight type pressure gauge tester
4	Planimeter	a) To determine the Planimeter Constant b) To measure the area of the indicator diagram and calculate IHP of a single acting single cylinder, 4 stroke diesel engine.
5	Valve setting diagram of an oil engine	To find out the crank positions for opening and closing of admission and exhaust valves and also the point of injection with respect two dead centers.

COURSE : WORKSHOP (PCL)
Course Code : **ME 408**
Credit : 1
L-T-P : 0-0-2
SEE : 50 Marks

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

CO1	Apply the skills in making complex machine components
CO2	Develop models of sheet metal using sheet metal operations
CO3	Select automobile parts to assemble and disassemble of engine.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	2	2	-	-	-	-	1	1	-	-	1	-	1
CO2	2	2	2	-	-	-	-	1	1	1	-	1	1	1
CO3	2	1	1	-	-	-	-	1	2	-	-	1	1	1

Detailed Syllabus

Exp. No	List of Experiments
1	Machine shop : a) Study of machine tools in particular Lathe machine (different parts, different operations, study of cutting tools) b) Demonstration of different operations on Lathe machine c) Practice of Facing, Plane Turning, step turning, taper turning, knurling and parting. Study of Quick return mechanism of Shaper.
2	Carpentry: a) Study of Carpentry Tools, Equipment and different joints. b) Practice of Cross Half lap joint, Half lap Dovetail joint and Mortise Tenon Joint
3	Foundry Trade: a) Introduction to foundry, Patterns, pattern allowances, ingredients of moulding sand and melting furnaces. Foundry tools and their purposes b) Demo of mould preparation c) Practice – Preparation of mould by using split pattern.
4	Welding: a) Introduction, Study of Tools and welding Equipment (Gas and Arc welding) b) Selection of welding electrode and current, Bead practice. c) Practice of Butt Joint, Lap Joint.

Text Books:

1. Raghuwanshi B.S., Workshop Technology Vol. I & II, Dhanpath Rai & Sons.
2. Kannaiah P. and Narayana K.L., Workshop Manual, 2nd Edn, Scitech publishers.
3. John K.C., Mechanical Workshop Practice. 2nd Edn. PHI 2010.
4. JeyapoovanT.andPranitha S., Engineering Practices Lab Manual, 3rd Edn. Vikas Pub.2008.

SEMESETER –V

COURSE	**:**	**MATHEMATICS - V**
Course Code	:	**ME 501**
Credit	:	4
L-T-P	:	4-0-0
SEE	:	100 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Solve problems in different fields of engineering applying the knowledge of interpolation and root finding techniques.
CO2	Solve problems on numerical differentiation and integration, simultaneous equations and differential equations numerically.
CO3	Solve engineering problems on analytic functions, harmonic functions and Conformal Transformations.

CO4	Apply the concept of complex integrations and contour integration for evaluating real definite integrals occurring in different fields of Engineering.

Mapping of COs with POs

	POs												PSOs	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO2	1	-	3	-	-	-	-	-	-	-	-	-	-	-
CO3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO4	1	2	-	-	-	-	-	-	-	-	-	-	-	-

Detailed syllabus

Module	Module details	Lecture Hr.
1	Numerical Analysis: Interpolation, Finite differences, Newton-Gregory forward and backward interpolation, Newton's and Lagrange's formulae for unequal intervals, Sterling's and Bessel's interpolation formulas. Numerical differentiation, Numerical Integration: Trapezoidal and Simpson's $1/3^{rd}$ and $3/8^{th}$ rules for numerical integration. Solution of Transcendental and polynomial equations, Bisection, Regula-Falsi and Newton-Raphson method. Solution of simultaneous linear equations: Gauss elimination and Gauss-seidel iterative method. Solution of ordinary differential equation: Taylor's series, Runge-Kutta (4^{th} order) and Milne's predictor-corrector methods.	25
2	Complex Variables: Functions of complex variables, Elementary functions, Analytic functions, Cauchy-Riemann equations, Harmonic functions and their application to two-dimensional problems. Conformal transformation, Complex line integral, Cauchy's integral theorem Cauchy-Goursat theorem (without proof), Cauchy's integral formula, Liouville's theorem, Morera's theorem. Taylor's theorem, Laurent's theorem (without proof). Singularities, Residue theorem and its applications.	25

Text Books:

1. Advanced Engineering Mathematics by Erwin Kreysig (Willy)
2. Higher Engineering Mathematics by B.S. Grewal, Khanna publishers
3. A Text book of Engineering Mathematics by Bali and Saxena, Laxmi publications
4. Linear programming by G. Hadley, Narosa Publishing House.

COURSE : MACHINE TOOLS AND MACHINING(PC)
Course Code : **ME 501**
Credit : 3
L-T-P : 3-0-0
SEE : 100 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Explain Mechanics of Plastic Deformation, Plain-Strain Deformation. Stress-Strain Curves of various metals, Tool nomenclature systems and properties of cutting tool materials.
CO2	Interpret tool life, machinability, surface finish & surface integrity, tool life-tool wear relationship, temperature and effect of cutting fluids at different cutting conditions
CO3	Analyze cutting forces in machining in single point cutting operation using Merchant's circle diagram and force dynamometer
CO4	Select conventional machine and their operations for various machining requirements of parts and components.
CO5	Evaluate cutting speed, feed and depth of cut to optimize production cost and production.

Mapping of COs with POs

	POs												**PSOs**	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO2	2	2	2	-	-	-	3	-	-	-	-	1	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	-	1
CO4	2	3	1	2	-	1	1	1	-	-	-	1	1	1
CO5	2	3	2	2	-	1	1	1	-	-	-	1	1	1

Detailed syllabus

Module	**Details of module**	**No. of Lectures**	**Module**
1	Introduction to Machining: Introduction to Metal removal processes, Classifications, Mechanics of Plastic Deformation, Plain-Strain Deformation. Stress-Strain Curves of various metals.	4	10
2	Machining Operations-Turning, Shaping, Planning, Drilling, Boring, Reaming, Tapping, Grinding, Milling, Broaching, Super-finishing.	2	5
3	Cutting Tools: Cutting Tools Materials, System of tool Nomenclature-ASA, British, Continental and International Systems and their conversions, Tool Geometry-Single Point, Multi-Point Cutting Tool, Tool Signature.	6	15

4	Forces in Machining: Basic Principles, Orthogonal /Oblique cutting, Cutting Ratio, Force Calculation in Orthogonal and oblique cutting Operations, Merchant circle Diagram. Lee and Shaffer and related theories, force dynamometer	14	30
5	Thermal Aspects & Cutting Fluids: Heat generations in cutting tools, Factors of heat generations, Tool Failures, Temperatures measurements, Tribology- Friction, Wear and Lubrication, Cutting Fluids-Types, Functions and methods of applications, Selection of Cutting Fluids.	4	10
6	Surface Finish and Surface Technology Surface Treatments: Definition, Types of Surface Finish, ISO Symbols, Surface Structures, Textures, Roughness, Surface Integrity, Measurement of Surface Finish, Determination of Surface Roughness-Ra (Avg),Ra(Mean), Ra(rms) values, Tally Surf Instrument; Surface Treatments- Treatments with Thermal, Vapour, Ion, Diffusion, Electro Plating, Anodising, Hot Dipping Methods	4	10
7	Machinability: Definition, Machinability Criteria-Based on tool life, Cutting Forces and Surface finish, Variables affecting Machinability, Short term test, Long Term Test.	4	10
8	Economics of Machining: Costs associated with Machining, Optimization of Process parameters for different economic criteria.	4	10

Text Books:

1. Manufacturing Science-Ghosh & Mallick
2. Production Technology-HMT
3. Production Engineering –PC Sharma
4. Fundamental of Metal Cutting and Machine Tools –Juneja, Shekkon and Seth

Reference Books:

1. Introduction to Machining Science –GK Lal
2. 2 Manufacturing Technology-PN Rao
3. Production Technology (Manufacturing Processes)-PC Sharma
4. Metal Cutting (Theory & Practice)-A Bhattacharyya

COURSE	**:**	**ADVANCED FLUID MECHANICS**
Course Code	:	**ME 502**
Credit	:	3
L-T-P	:	3-0-0
SEE	:	100 Marks

Course Outcomes: Upon completion of the course, students shall be able to-

CO1	Analyze fluid flow cases with application of the appropriate continuity and momentum equations.
CO2	Summarize features of a turbulent flow with application of its governing equations on problems of duct flows.
CO3	Analyze the discharge through a nozzle for compressible flow.
CO4	Compare the types of shocks using mathematical relations.
CO5	Analyze problems of open channel flows.

Mapping of COs with POs

	POs												**PSOs**	
COs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	1	-	1	-	-	-	-	-	-	1	2	1
CO2	2	3	2	1	-	-	-	-	-	-	-	1	1	2
CO3	2	2	1	1	-	-	-	-	-	-	-	1	2	1
CO4	2	2	1	1	1	-	-	-	-	-	-	1	2	1
CO5	2	2	1	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	**Details of module**	**No. of Lectures**	**Module**
1	Viscous flow: Fluid deformation, Navier-Stokes momentum equation, vorticity transport equation, laminar flow through pipes, Hagen Poisseullie's equation, flow between parallel boundaries-fixed and movable.	10	25
2	Turbulent flow: Characteristics, classification, theories of turbulent mean motion and fluctuation, governing equation for turbulent flow, boundary conditions, Prandtl mixing length theory, universal velocity distribution law, friction factor in duct flow fo very large Reynold number, Karman's similarity hypothesis, velocity distribution in rough pipes, Karman-Prandtl resistance equation., internal flow friction factor, Darcy-Weisbach and Fannings friction factor, Moody's diagram.	9	20
3	Compressible flow:1-D compressible flow, energy equation, subsonic, supersonic and sonic flows, Mach number, Mach cone, pressure velocity relation in isentropic flow, flow in ducts of varying cross sectional area, stagnation properties and relations in terms of Mach number, discharge through nozzles, condition of maximum discharge, relation of maximum discharge with air.	10	25

4	Shock waves-Normal shock, Rankine-Hugoniot relation, condition of occurrence of normal shock, Prandtl-Meyer relation, Fanno and Rayleigh lines, isothermal flow, Pitot-static tube,oblique shock	8	20
5	Open channel flow: classification, Chezy's equation, Manning formula, most economical section.	5	10

Text Books:

1. Fluid Mechanics & Hydraulic Machines by Subramanya, Tata McGraw-Hill Education, 2001
2. Fluid Mechanics- by Yunus Cengel and John Cimbala,
3. Fluid Mechanics & Hydraulic Machines- by R.K.Rajput, S Chand & Company Limited, 1998

References Books:

1. Introduction to Fluid Mechanics, Robert W. Fax, Philip J. Pritchard, Alan T. McDonald. Wiley India Edition. (Wiley Student Edition Seventh 2011).
2. Fluid Mechanics Franck .M White Tata Mc GrawHill Publication 2011.
3. Shames, "*Mechanics of Fluids*", McGraw Hill Book Co., New Delhi, 1988

COURSE	**:**	**DESIGN OF MACHINE ELEMENT- I (PC)**
Course Code	:	**ME 503**
Credit	:	4
L-T-P	:	3-1-0
SEE	:	100 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Explain the concepts of material properties and material selection, factor of safety, stress strain diagram and stress concentration.
CO2	Design key, shaft and couplings.
CO3	Apply failure criterion to riveted joints in bracket, bridge and boiler shell.
CO4	Assess stress distribution in arms and rim of flywheel and pulley.
CO5	Design helical spring under tensile and compressive load.

Mapping of COs with POs

COs	**POs**												**POs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	3	2	2	-	-	-	1	1	-	-	-	1	1	1
CO3	3	2	2	-	-	-	1	1	-	-	-	1	1	1
CO4	2	2	2	-	-	-	-	1	-	-	-	1	-	1
CO5	2	2	2	-	-	-	1	1	-	-	-	1	1	1

Detailed Syllabus

Module	Details of module	No. of Lectures	Marks
1	**Fundamentals of design :** a) design process – computer aided design – optimum design – factor influencing machine design, selection of materials based on mechanical properties, types of loads – stresses –static, varying, thermal, impact and residue – factor of safety – stress concentration factors b) steady stresses and variable stresses in machine members.	10	10
2	**Design of basic machine elements:** Design of shafts, keys,: design of solid and hollow shafts based on strength, rigidity and critical speed – design of keys and key ways - design of rigid and flexible couplings,.	15	40
3	Design of joints :Cotter joints, knuckle joints, riveted joints, welded joints, threaded fasteners - design of bolted joints including eccentric loading – design of welded joints for pressure vessels. Design of springs: Design of helical springs compression and tension – leaf springs	15	50

Text Books:

1. V.B. Bhandari, ―Design of Machine Elements‖, Tata McGraw-Hill Publishing Company Ltd.
2. Dr. P. C.Sharma & Dr. D.K. Aggarwal- Machine Design ,KASTON BOOKS
3. R. S. Khurmi & J. K. Gupta, ―A Text book of Machine Design‖, S. Chand & Company.

Reference Books:

1. Bernard J. Harmrock, B O Jacobson, ―Fundamentals of Machine Elements‖, McGraw-Hill,
2. Sharma C.S., Kamlesh Purohit, ―Design of Machine Elements‖, PHI.
3. T. J. Prabhu, ―Design of Transmission Elements‖, Mani Offset Printers.
4. V. B. Bhandari, ―Design of Machine Elements‖, Tata McGraw-Hill Publishing Company Ltd.
5. Norton R. .L. ―Design of Machinery‖, Tata McGraw-Hill Book Co. Spotts M.F., Shoup T.E ―Design and Machine Elements‖ Pearson Education.

COURSE : HEAT TRANSFER- I (PC)
Course Code : **ME 504**
Credit : 3
L-T-P : 3-1-0
SEE : 100 Marks

Course Outcomes: Upon completion of the course, students shall be able to-

CO1	Explain Fourier law for steady state 1-dimensional heat conduction through different geometries
C02	Analyse the temperature distribution for steady state heat conduction with heat generation for different geometries.
CO3	Analyse the temperature distribution in case of unsteady state heat flow.
CO4	Analyse radiated heat exchange between different surfaces using basic concept of thermal radiation.

Mapping of COs with POs

COs	**POs**												**POs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	2	2	-	-	-	-	-	-	-	1	2	1
C02	3	2	1	1	-	-	-	-	-	-	-	1	2	1
CO3	3	2	2	1	-	-	-	-	-	-	-	1	2	1
CO4	3	2	1	2	-		-	-	-	-	-	1	1	1

Detailed Syllabus

Module	**Details of module**	**No. of Lectures**	**Module**
1	General modes of heat transfer, applications in engineering. Conduction Heat Transfer: Fourier law, thermal conductivity of solid, liquid and gases, factor affecting thermal conductivity, electrical analogy,1D steady state conduction, conduction through homogeneous and composite surfaces,-flat, cylindrical, spherical, variable thermal conductivity, shape factors, overall heat transfer coefficient, critical radius of insulation, problems.	10	25
2	Conduction: Heat Transfer-3-D heat conduction, differential equation, different boundary conditions, concept of thermal diffusivity, Fourier equation, poisson's equation, Laplace equation,1-D heat conduction with heat generation-slab cylinder and sphere(plane and composite),problems.	9	20
3	Transient conduction-concept, lumped system analysis, mixed boundary conditions, Biot number, Fourier number, use of Heisler charts.	8	15
4	Radiation Heat Transfer: Nature of thermal radiation, definitions, concepts of monochromatic and total emissive power, absorptivity, reflectivity, transmissivity, black, gray and heat surfaces, concept of black body, intensity of	9	20

	radiation, laws of black body radiation, radiation to and from real surfaces.		
5	Radiation heat exchange between surfaces: radiation between two black bodies, radiation shape factor and properties, shape factors for different geometries, radiation between two infinitely lo0ng parallel plates, between two infinitely long concentric cylinders, radiation between non-black bodies, electrical network analogy, radiation shields, problems.	9	20

Text Books:

1. Heat & Mass Transfer by P.K. Nag, McGraw Hill
2. Heat and Mass Transfer: Fundamentals and Application by Yunus Cengel, McGraw Hill
3. Fundamental of Heat and Mass Transfer by Incropera and Dewitt, Wiley Publication
4. Heat Transfer by Mills and Ganesan, Pearson Education
5. Heat and Mass Transfer by R K Rajput, S. Chand Publication
6. Heat Transfer: Principles and Applications by Dutta, Binay K, PHI Publication

Reference Books:

1. M. Necati Ozasik , Heat Transfer: A Basic Approach , McGraw-Hill Inc
2. Jack Holman , Heat transfer by Holman, McGraw Hill Education

COURSE	**:**	**APPLIED THERMODYNAMICS- II (PC)**
Course Code	:	ME 505
Credit	:	3
L-T-P	:	3-0-0
SEE	:	100 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Solve thermal engineering problems related to air compressor.
CO2	Solve thermal engineering problems related to gas turbine cycles.
CO3	Solve thermal engineering problems related to refrigeration cycles and Psychrometry.
CO4	Solve problems related to air standard cycle, IC engine and performance parameters of IC engine.
CO5	Explain solar thermal systems, fuel cells, biomass gasifier, energy storage, organic Rankine cycle, heat pipe.

Mapping of COs with POs

COs	POs												POs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO2	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO3	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO4	2	2	-	-	-	-	-	-	-	-	-	-	1	1
CO5	1	1	-	-	-	-	-	-	-	-	-	-	1	1

Detailed Syllabus

Module	Details of module	No. of Lectures	Module
1	Air compressors: Application of compressed air, Compressed air system, types of compressor, reciprocating compressor, capacity of compressor, compressor performance (isothermal efficiency, volumetric efficiency), effect of clearance volume, multistage compression with intercooling, ideal intermediate pressure, elementary constructional details, rotary compressors, applications, axial flow compressor, centrifugal compressor, characteristics, charging and chocking.	7	20
2	Gas turbine cycle : Open and closed cycle, Air standard cycle of gas turbine (Brayton cycle), methods of improving thermal efficiencies of gas turbine, optimal performance of various cycles, combined gas and steam cycles, cogeneration Combustion Chambers; Jet Propulsion: turbojet, turboprop, turbofan, ramjet, thrust and propulsive efficiency; Rocket Propulsion;	7	20
3	Refrigeration: Refrigeration cycles, air cycles, vapour compression, vapour absorption system (LiB_2 +H_2O; NH_3+H_2O) , refrigerants and environmental issues; COP analysis	7	20
4	Air conditioning: Psychrometry properties, Psychometric charts and basic Psychometric processes, Air conditioning processes, different air conditioning system, load calculations.	7	15
5	Introduction: IC Engines: Classification - SI, CI, two-stroke, four-stroke Engine components, Air-standard cycle, the efficiency of air standard cycle, Carnot cycle, Otto cycle, Diesel cycle, Dual cycle, Comparison between Otto, Diesel and Dual Cycle, Stirling cycle, Atkinson cycle	7	15

6	Miscellaneous topics :Solar thermal systems, Fuel cells, biomass gasifier, energy storage, organic Rankine cycle, heat pipe.	7	10

Text Books:

1. Basic and Applied thermodynamics: P. K. Nag
2. Refrigeration and Air conditioning: C. P Arora
3. Solar energy Principles of thermal collection and storage; S. P. Sukhatme and J. K Nayak
4. Engineering thermodynamics: Domkundwar

Reference Books:

1. Fuels Cells, Modelling, Control and Applications, Bei Gou, Woon Ki Na, Bill Diong.

COURSE : DYNAMICS OF MACHINE LABORATORY (PCL)
Course Code : **ME 506**
Credit : 1
L-T-P : 0-0-2
SEE : 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Measure radius of gyration, moment of inertia for different components.
CO2	Analyse the dynamic behaviour of the machine/components like Gyroscope and Vibration parameters.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	2	1	-	-	1	1
CO2	2	2	-	-	-	-	-	-	2	1	-	-	1	1

List of experiments

Exp. No.	Title of the Experiment	Objective of the Experiment
1	Oscillation of Compound Pendulum	To verify the relation: $$T = \sqrt{\frac{K_e^{\,2} + OG^2}{g \times OG}} \times 2\pi$$
2	Study of Longitudinal Vibration of Helical Spring.	To determine the frequency or period of vibration theoretically and experimentally.
3	Torsional Pendulum	To determine the Mass Moment of Inertia of a circular disc and compare it with the calculated value.

4	Torsional Damping System	To determine the damping coefficient of a torsional damping system for different levels of oil.
5	Gyroscopic Couple	To determine percentage variation of theoretical and experimental variation of Gyroscopic couple.

COURSE : PRODUCTION PROCESS LABORATORY (PCL)
Course Code : **ME 507**
Credit : 1
L-T-P : 0-0-2
SEE : 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Construct a single point cutting toolto be used for machining a job on turret lathe.
CO2	Make use of tool-makers microscope for precise measurements of single point cutting tools.
CO3	Calibrate Micrometer and Vernier Calliper using Slip Gauges.
CO4	Measure the surface roughness of given specimen using the surface roughness tester.
CO5	Make use of tool-makers microscope for precise measurements of single point cutting tools.

Mapping of COs with POs

COs	POs												PSos	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	-	-	-	-	1	1	-	-	-	-	1
CO2	2	1	-	1	-	-	-	1	1	-	-	-	-	1
CO3	2	2	-	-	-	-	-	1	1	-	-	1	1	1
CO4	2	2	-	-	-	-	-	1	1	-	-	1	1	1
CO5														

List of Experiments

Exp. No.	Title of the Experiment	Objective of the Experiment
1	Sharpening a single point cutting tool.	To sharpen a single point cutting tool to a given signature (ASA System) on a tool and cutter grinder.
2	Machining of job as shown in the sketch on a turret lath	a. To prepare an operation sheet and b. To sketch the following layout compatible to the operation sheet.
3	CNC milling	To perform milling operation
4	CNC turning	To perform turning operation

COURSE	**:**	**HMT LABORATORY (PCL)**
Course Code	:	**ME 508**
Credit	:	1
L-T-P	:	0-0-2
SEE	:	50 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Apply Fourier's law to validate the theoretical over all heat transfer coefficient.
CO2	Apply Stefan-Boltzmann law of radiation and emissivity relation.
CO3	Determine thermal properties of material by applying 1-D steady state heat transfer equation.
CO4	Apply non-dimensional numbers to evaluate and validate heat transfer parameters.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	1	2	-	-	-	1	1	1	-	1	2	2
CO2	3	2	1	1	-	-	1	1	1	1	-	1	1	1
CO3	3	2	1	1	-	-	-	1	1	1	-	1	1	1
CO4	3	2	2	2	-	-	1	1	1	1	-	1	1	2

List of Experiments

Exp. No.	**Title of the Experiment**	**Objectives**
1	Heat transfer through composite walls apparatus	To determine the overall heat transfer co-efficient for the composite wall and to compare the same with that calculated from the equations
2	Critical heat flux apparatus	To study the formation of bubbles under pool boiling process and to draw the graph of heat flux vs bulk temperature upto burnout (critical value) point
3	Emissivity measurement apparatus	To determine the emissivity of a grey surface at different temperatures
4	Stefan-Boltzmann apparatus	To determine the value of Stefan — Boltzmann constant for radiation heat transfer.
5	Thermal conductivity of insulating powder	To determine the thermal conductivity of insulating powder at various heat inputs.
6	Heat transfer in natural convection	To determine the convective heat transfer co-efficient for heated vertical cylinder losing heat to the ambient by free or natural convection To find the theoretical convective heat transfer co-efficient and to compare with the experimental value.

7	Heat transfer in forced convection	To determine the convective heat transfer co-efficient for a horizontal pipe through which air flows under forced convection. To find the theoretical heat transfer for the above condition and to compare with the experimental valve.
8	Heat transfer from a pin-fin apparatus	To study the temperature distribution along the length of a pin fin in forced convection, the procedure is as under
9	Heat transfer through lagged pipe apparatus	To plot the radial temperature distribution in the composite cylinder and to determine the thermal conductivity of the pipe insulation.

4.2.3 6th, 7th and 8th Semesters Syllabus of Old Courses of Dibrugarh University

SEMESTER-VI

COURSE : PRINCIPLES OF ECONOMICS AND ACCOUNTANCY
Course Code : **HU-61**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Explain the fundamental concepts of economics.
CO2	Apply the basic concepts of managerial economics.
CO3	Explain banking, nature and different sources of public revenue and five years plan.
CO4	Explain the basic accounting terms, procedure of recording transactions, the preparation of bank reconciliation statement and cash book.
CO5	Outline the procedure of preparation of trial balance, trading account, profit & loss account and balance sheet.
CO6	Explain cost estimation procedure by preparing cost statement.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	1	-	-	-	-	-	-	-	-	-	2	1	-	1
CO2	1	-	-	-	-	-	-	-	-	-	2	1	-	1
CO3	1	-	-	-	-	-	-	-	-	-	2	1	-	1
CO4	2	-	-	-	-	-	-	-	-	-	2	1	1	1
CO5	2	1	-	-	-	-	-	-	-	-	2	1	1	1
CO6	2	1	-	-	-	-	-	-	-	-	2	1	1	1

COURSE : APPLIED THERMODYNAMICS-II
Course Code : **ME-61**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the basic components and systems of IC engine and their functions, combustion phenomenon, performance parameters of IC engine.
CO2	Analyse combustion process of solid, liquid and gaseous fuels.
CO3	Apply thermodynamics laws and principle for explaining air compressor, gas turbine cycles, refrigeration cycles, and Psychrometry.
CO4	Solve thermal engineering problems related to air compressor, gas turbine and refrigeration cycles.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CO2	2	1	-	-	-	-	1	-	-	-	-	1	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	1	1
CO4	2	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	**Module Details**	**Lect. Hr**	**Marks**
1	Internal Combustion Engines: Ideal and actual cycles, working principle of different types of S.I. and C.I. engines, carburettor, fuel injection systems, methods of ignition, engine cooling systems, power measurement - I.P.,B.P., effiencies: mechanical, thermal, relative, M.E.P., specific fuel consumption, delay period, knocking, detonation, knock rating of fuels - cetane and octane numbers, Turbo-charging, supercharging, scavenging.	10	25
2	Combustion of Fuels: Solid, liquid and gaseous fuels and their characteristics, flash and fire points, calorific value, combustion reactions, heat formation heat of combustion.	6	9
3	Air Compressors: Reciprocating-effect of clearance volume, compression ratio, intercooling, volumetric efficiency, elementary constructional details, types of rotary compressors, applications, axial flow and centrifugal	10	25

	compressor, compressor characteristics, charging and chocking.		
4	Gas Turbines: Open and closed cycle, Brayton cycle, methods of improving thermal efficiencies, gas turbine vs I.C. engines.	8	10
5	Refrigeration and Air Conditioning: Refrigeration cycles, air cycles, vapour compression and vapour absorption, COP analysis. Psychrometric, basic terms and processes, psychrometric charts, psychrometric and basic principles of air-conditioning.	9	21

Text Books

1. Basics and Applied Thermodynamics by P.K. Nag, McGraw Hills publications
2. Thermal Engineering by D. K. Domkundwar, Dhantpat Rail & Co
3. Thermal Engineering by R. K. Rajput, Lakxmi Publications (P) Ltd.

Reference Books

1. Thermodynamics, An Engineering Approach by Y. A. Cengel and M.A. Boles, McGraw Hill Companies

COURSE : DYNAMICS OF MACHINERY –II
Course Code : **ME-62**
Theory : 100 Marks
Sessional : 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to

CO1	Explain the principles and functions of various Governors.
CO2	Explain gyroscopic couple with its effect on aeroplane, naval ship and vehicles.
CO3	Develop the profile of cam according to the type and motion of follower.
CO4	Assess the balancing of multi cylinder engine.
CO5	Determine the stability of a linear control system.

Mapping of COs with POs-

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO3	2	1	1	-	1	-	-	-	-	-	-	1	1	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO5	2	1	1	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module Details	Lecture Hr	Marks
1	Governor: Functions of governor, governor characteristics, types of governors, sensitiveness and stability, isochronisms, hunting, effort and power, controlling force, effect of friction and insensitiveness.	10	20
2	Gyroscopic Motion: Introduction, gyroscopic couple and reaction, effect of gyroscopic couple on aero plane, navalship, vehicle etc.	8	20
3	CAM: Introduction, types of cams, types of followers, motion of followers, constant velocity, simple harmonic and constant acceleration and retardation, cam profile.	7	20
4	Balancing: Causes of unbalance, static and dynamic balancing, balancing of revolving masses, primary and secondary forces, couple concept of direct and reverse cranks, balancing of radial and V- engines. Locomotive engines, hammer blow, swaying couples, tractive force.	10	20
5	Control Engineering: Concept of automatic control system, open and close loop systems, differential equations, transfer functions. Stability, Routh's criterion, polar and logarithmic plot, Bode and Nyquest stability criterion	10	20

Text Books:

1. Theory of Machines by Thomas Bevan
2. Theory of Machines by J.E. Shinglay
3. Theory of Machine by A. Ghosh and A.K. Malik
4. Theory of machines by V. P. Singh.
5. Control system engineering by I. J. Nagrath and M. Gopah
6. Automatic control by B. C. Kuo.

COURSE : MANUFACTURING METHODS
Course Code : **ME-63**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the concept of machinability of different materials under different machining conditions.
CO2	Illustrate the principles and techniques of finishing operations in terms of their surface finish and surface integrity.
CO3	Explain different non-traditional machining processes and their applications.

CO4	Illustrate the basic principles of numerical controls and NC programming.
CO5	Explain the basic steps of powder metallurgy and principles of Jigs and Fixtures.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	2	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	3	2	2	-	-	-	-	-	-	-	-	1	1	1
CO4	2	1	1	-	1	-	-	-	-	-	-	1	1	1
CO5	2	1	2	-	-	-	-	-	-	-	-	1	-	1

Detailed Syllabus

Module	Module Details	Lect. Hr	Marks
1	Machinability aspects of machining: Criteria of machinability, variables affecting machinability, evaluation of machinability, long and short term tests.	7	15
2	Surface finish and surface integrity: Machining parameters and surface finish, cost of surface finish, dimensional tolerance, surface integrity, methods of improving surface integrity, post processing surface treatments	7	15
3	Grinding: Wheel specification and selection, mechanism of cylindrical grinding, temperature and grinding fluids.	7	15
4	Lapping: Mechanism, laps, and abrasives, technological parameters, honing- kinematics parameters, super finishing and burnishing	4	10
5	Powder Metallurgy: processing of plastics and ceramics	7	10
6	Jigs and Fixtures: Principles and design of Jigs and fixtures	4	10
7	Numerical control and computer aided manufacturing: Modern developments, CAM, FMS and CIM, the unmanned factory, components of NC machines.	4	10
8	Non-conventional Machining processes: Need, history and topology, AJM, USM, CAM, CHE, ECG, ECM, EDM, EBM, LBM, PAM. Comparative analysis of the processes. Nanotechnology - Recent developments and future scope.	7	10

Text Books:

1. Manufacturing Science by Ghosh and Malik
2. Production Technology by H.M.T

3. Production Engineering by P.C. Sharma
4. Technology of Machining Systems by B K Mullick
5. Fundamentals of Metal Cutting and M/C tools by Juneja

COURSE : MACHINE DESIGN- II
Course Code : **ME-64**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the concepts of principal stresses, stress concentration and fatigue failure.
CO2	Design gears, pressure vessels, power screw, brakes, clutches and temporary joints.
CO3	Interpret the pressure distribution and failure of journal bearings.
CO4	Select rolling contact bearing.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	2	-	-	-	-	1	-	1	-	1	1	1
CO3	3	2	2	1	-	-	-	1	-	-	-	1	1	1
CO4	2	2	2	1	-	-	-	1	-	1	-	1	1	1

Detailed Syllabus

Module	**Module Details**	**Lecture Hr**	**Marks**
1	Design of Gears: Design of gears – Spur, Helical, Bevel and Worm gears –Design of multistage speed reducers.	10	25
2	Bearings: Journal bearings, Lubrication in journal bearings, Selection of rolling element bearings- Ball and Roller Bearings	10	25
3	Design of Engine Parts: Design of Clutch, Brakes, Flywheels	10	25
4	Design of Fasteners & Joints: Threaded fasteners - Design of bolted joints including eccentric loading – Design of welded joints for pressure vessels and structures, Power screws	10	25

Text Books:

1. Design of Machine Elements by V. B. Bhandari, Tata McGraw-Hill Publishing Company Ltd, 1998
2. A Text book of Machine Design by R. S. Khurmi & J. K. Gupta, S. Chand & Company, 2004.

3. Fundamentals of Machine Elements by Bernard J. Harmrock, B O Jacobson,", McGraw-Hill, 1999.
4. Design of Machine Elements by C. S. Sharma & Kamlesh Purohit, PHI 2003.
5. Design of Machinery by R.L. Norton Tata McGraw-Hill Book Co, 2004.
6. Design and Machine Elements Spotts by M.F., Shoup T. E , Pearson Education, 2004.

COURSE : MECHANICAL ENGINEERING LABORATORY
Course Code : **ME-65**
Practical : 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Measure mean-effective pressure and valve setting angle of an internal combustion engine.
CO2	Analyse the dynamic behaviour of the machine elements/ components like Governor, Gyroscope, journal bearing and vibration parameters.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	1	-	-	1	1
CO2	2	2	-	-	-	-	-	-	-	1	-	1	1	1

List of equipment

Exp. No.	Title Of Experiment
1	Universal Governor Apparatus; (a) Watt Governor (b) Porter Governor (c) Proell Governor
2	Compound Pendulum Apparatus
3	Torsional Pendulum
4	Study of Longitudinal Vibration of Helical Spring
5	Gyroscopic Couple
6	Journal Bearing Apparatus
7	Coriolis Component Of Acceleration Apparatus
8	Cam Analysis Apparatus
9	Balancing Apparatus
10	Polar Planimeter.
11	Valve Setting Diagram of an Oil Engine.

COURSE : WORKSHOP PRACTICE
Course Code : **ME-66**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the sequence of machining operations required for making helical gears and tapered threaded mandrel
CO2	Make use of the machining processes to manufacture the machine elements

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	1	-	1	-	1
CO2	2	2	-	-	-	-	-	-	-	1	-	1	-	1

List of Equipment:

Sl. No	List of Equipment
1	Power Saw machine
2	Centre lathe machine
3	Grinding machine
4	Column and Knee type universal milling machine
5	Column and knee type vertical milling machine
6	Planner machine
7	Shaper machine

SEMESTER-VI

COURSE : INDUSTRIAL ORGANIZATION AND MANAGEMENT
Course Code : **ME- 71**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to

CO1	Demonstrate the concept of group dynamics, industrial psychology, organization, types of organization, and functions of management.
CO2	Explain plant layout and location, locational economics and scheduling, routing & dispatching in production planning.
CO3	Make use of decision and productivity improvement tools in SME- enterprises and entrepreneurial ventures.
CO4	Explain quality management, maintenance management, project management, inventory management and the safety norms to be adopted in workplace.

CO5	Explain the meaning and importance of management, functions and principle of management, material management.
CO6	Illustrate the meaning and importance of financial planning, concept of capital, sources of finance, budget and budgetary control system.
CO7	Apply the meaning and concept of cost relevance to management decisions and control, breakeven point, break even analysis.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	-	-	-	-	-	-	1	-	-	-	1	-	1
CO2	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO3	2	1	-	-	-	1	-	-	1	1	-	1	1	1
CO4	2	-	-	-	-	-	1	-	1	1	1	1	1	1
CO5	2	-	-	-	-	1	-	1	-	-	1	-	-	1
CO6	2	-	-	-	-	1	-	1	-	-	1	-	1	1
CO7	2	-	-	-	-	1	-	1	-	-	1	-	-	1

Detailed Syllabus

Module	**Module Details**	**Lecture Hr**	**Marks**
1	Concept of Group Dynamics, Industrial Psychology, Organization, Types of Organization, Functions of Management	**5**	**5**
2	Plant Location and Locational Economics, Methods of Locational Analysis, Plant Layout- Types, Scheduling, Routing and Dispatching	15	10
3	Decision Tools, Decision Tree, Productivity: Definition, Factor Productivity, Productivity Improvement Tools, SME-Entrepreneurship, Government Initiatives for Development of SMEs	5	**5**
4	Quality Management: Concept of Quality, Control Charts, Latest Trend in Quality Management, TQM, ISO 9000 Series Maintenance Management: Different types, Latest Trend in Maintenance Management, TPM Project Management: Definition of Project, Network Analysis, PERT and CPM Inventory Management: Concept, EOQ Model Safety in Workplace, Fire and Safety	15	**30**

Text Books:

1. Work Study by R.C. Patel
2. Plant Layout and Design by J. M. Moore Inventory Control by Starr and Miller
3. Mass Production by M.L. Riggs
4. Hand Book of Industrial Engineering by L. Grant Industrial Engineering

Detailed Syllabus

Module	Module Details	Lecture Hr	Marks
I	**Management:** Concept, importance, principle, function of Management in brief. **Industrial Finance :** Importance and characteristic of a sound financial plan, methods and principles of determining the requirements, concept of capital, fixed and working capital, meaning of capitalization, over capitalization and under capitalization, sources of finance. **Budgeting:** Business Budgeting, definition and importance, Master Budget and its components, fixed and flexible budget, benefits of budgetary control system. **Material Management:** Meaning, objectives, aspects and benefits of scientific management of materials. **Managerial Economics** : Concept of costs, relevance to managerial decisions and control, standard cost and standard costing, opportunity cost, fixed and variable cost, marginal cost and marginal costing, break event analysis, problem of break event analysis.	**25**	**50**

Text books

1. Business Administration and Management by S.C. Saxena
2. Management Accounting by R.K. Sharma and S.K. Gupta
3. Cost Accounting Principle and Practice by S.P. Jain and K.L. Narang
4. Business organization and management by S.S. Sarkar, R.K. Sarma, S.K. Gupta

COURSE : FLUID MACHINERY
Course Code : **ME- 72**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the working principle of turbines and pumps and phenomenon like cavitation, priming, and draft tube theory.
CO2	Solve problem related to Impact of jets, hydraulic turbines and pumps.

CO3	Describe the similarity relations, specific speed and unit quantities for pump and turbine.
CO4	Analyse characteristic curves for turbine and centrifugal pump.
CO5	Explain the construction and working principle of different pumping devices and hydraulic systems.

Mapping of COs and POs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	2	2	1	-	-	-	-	-	-	-	1	1	1
CO5	2	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	**Module Details**	**Lecture Hr**	**Marks**
1	Review of Euler equations of Turbo-machinery, Impact of jet on stationery flat, fixed curved blades, flow over radial vanes, velocity triangles. Problems.	**6**	**10**
2	Turbines: i) Pelton Wheel: Wheel diameter, jet diameter, bucket shape, size, speed control, use, efficiency, specific speed and specific diameter, problems. ii) Francis: Runner, flow and speed ratio, casing guide, vanes, flow control, speed control, specific speed (dimensional and non-dimensional), runner shape variation with the change of speed, draft tube, surge tank, penstock, cavitation, cavitation parameters, Thomas cavitation factor, performance characteristics, problems. iii) Axial flow turbine and Kaplan turbine: Properties, discharge, number of blades, problems.	**15**	**35**
3	**Rotodynamic Pumps**: i) Centrifugal pumps: Single, multistage, vector diagrams, specific speeds, heads, power, and principle of similarity. Efficiencies: hydraulic, overall. Loss in pumps, speed ratio, pump characteristics, surging, cavitation, priming, self-priming, applications, and problems. ii) Positive displacement pump: Indicator diagram, slip, effect of friction, acceleration theory of air vessels, pressure variation effect of the acceleration in the suction and delivery pipes. Applications, problems.	**12**	**25**
4	**Miscellaneous Pumping devices:** Propeller or axial flow pumps, air lift pump, vane pump, gear wheel pump,	**12**	**30**

	applications. Hydraulic systems: Accumulator, intensifier, coupling, ram, lift, press, crane		

Text Books:

1. A **Textbook** of **Fluid Mechanics** and Hydraulic **Machines** by R.K. Bansal.
2. Hydraulics and **Fluid Mechanics** Including Hydraulics **Machines** by P. N. Modi.

COURSE : DYNAMICS OF MACHINERY-III
Course Code : **ME: 73**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to:

CO1	Explain the causes and effects of vibration in mechanical systems.
CO2	Develop schematic models for Mechanical systems and hence governing equations of motion.
CO3	Interpret the role of damping, vibration isolation, transmissibility and critical speeds.
CO4	Analyze the vibration of rotating and reciprocating machine.
CO5	Design machine supporting structures and dynamic vibration absorbers.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	2	-	-	-	-	-	-	-	-	1	-	1
CO3	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO4	2	2	2	-	-	-	-	-	-	-	-	1	1	1
CO5	2	2	2	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	**Module Details**	**Lecture Hr**	**Marks**
1	Vibration and its causes, degree of freedom, simple harmonic motion, free and forced vibration,, types of damping, equivalent springs, method of analysis, D' Alembert's method, energy method, equation of motion.	4	10
2	Single degree free vibration with and without damping, longitudinal, transverse and torsional vibration, harmonic and constant force, force unbalance, reciprocating, rotary, critical or whirling speed, vibration isolation,	20	40

	force and motion transmissibility, absorbs, self-excited vibration		
3	Two degree freedom systems, normal modes and natural frequency, torsional vibration, dynamics vibration absorbers, response to harmonic excitation Multi degree freedom systems, solution of vibration problems, longitudinal, transverses and torsional, solution of vibration problems, matrix method,	10	30
4	Holtzer's method Rayleigh method, etc.,	7	20
5	Vibration measuring Instruments-frequency, displacement, velocity, acceleration Measuring instruments, seismic types.	4	10

Text Books:

1. Mechanical Vibration by G. K. Grover
2. Vibration for engineer by Keaeal K Peejara
3. Mechanical Vibration by V. P Singh
4. Theory of vibration with application by Oilliam T Thomson.

COURSE : HEAT AND MASS TRANSFER-I
Course Code : **ME: 74**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to:

CO1	Explain the basic principles and modes of heat transfer.
CO2	Analyze steady state heat conduction for temperature distribution and rate of heat transfer for different geometries.
CO3	Analyze unsteady state heat conduction in solids.
CO4	Solve problems involving view factors and radiative exchange between surfaces.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO3	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module Details	Lecture Hr	Marks
1	General modes of heat transfer, applications in engineering	1	5
2	Conduction Heat Transfer: Fourier law, thermal conductivity of solid, liquid and gases, factor affecting thermal conductivity, electrical analogy,1D steady state conduction, conduction through homogeneous and composite surfaces,-flat, cylindrical, spherical, variable thermal conductivity, shape factors, overall heat transfer coefficient, critical radius of insulation, problems.	9	20
3	Transient conduction-concept, lumped system analysis, mixed boundary conditions, Biot number, Fourier number, use of Heisler charts.	8	15
4	Radiation Heat Transfer: Nature of thermal radiation, definitions, concepts of monochromatic and total emissive power, absorptivity, reflectivity, transmissivity, black, gray and heat surfaces, concept of black body, intensity of radiation, laws of black body radiation, radiation to and from real surfaces..	9	20
5	Radiation heat exchange between surfaces: radiation between two black bodies, radiation shape factor and properties, shape factors for different geometries, radiation between two infinitely lo0ng parallel plates, between two infinitely long concentric cylinders, radiation between non-black bodies, electrical network analogy, radiation shields, problems.	9	20

Text Books:

1. Heat and Mass Tranfer by P.K. Nag

2. Fundamentals of Engineering Heat and Mass Transfer by R.C Sachdeva

References Books

1. Heat transfer by M. Necati Ozasik
2. Heat transfer by Frank Kreith
3. Heat transfer by Holman

COURSE	**:**	**INTERNAL COMBUSTION ENGINE (ELECTIVE- I)**
Course Code	:	**ME: 75A**
Theory	:	100 Marks
Sessional		50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to:

CO1	Describe the working and performance of IC Engines with the help of thermodynamic cycles.
CO2	Explain the different types of fuel injection systems, ignition systems and cooling systems.
CO3	Explain the combustion phenomena in SI and CI engines along with factors influencing combustion chamber specification and methods to control pollution.
CO4	Examine different types of fuels with respect to their advantages and limitations and the effect of engine parameters on performance.
CO5	Evaluate performance of IC engine.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	1	-	-	-	-	-	-	-	-	1	-	1
CO3	2	1	1	-	-	-	1	-	-	-	-	1	1	1
CO4	2	2	-	1	-	-	1	-	-	-	-	1	-	1
CO5	2	2	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module Details	Lecture Hr	Marks
1	Engine types and their operation: introduction, engine classification, engine components, stratified charge engine, turbo charging and supercharging.	5	10
2	Carburetion: introduction, definition factors affecting carburetion, air-fuel mixtures, working principle of carburettor, simple carburettor, essential parts of modern carburettor, automobile carburettor. fuel injection system for c.i. engine: introduction, fuel injection system: air injection, solid injection, fuel pump and fuel injector: fuel pump, fuel injector.	10	25
3	Combustion and combustion chambers: introduction, homogeneous and heterogeneous mixtures, stages of combustion in SI engine, flame front propagation, abnormal combustion, knocking in SI and CI engine.	8	20
4	Engine lubrication and cooling systems: determination of engine friction, types of lubricants, lubrication systems, necessity of engine cooling, different cooling systems.	6	15
5	Ignition systems (si engine): introduction, basic ignition system, battery ignition system, magneto ignition system, firing order, ignition timing, spark plug.	6	15
6	Testing and performance of ic engine: performance	5	10

	parameters, basic measurements, engine performance curves.		
7	Introduction to software used in automobile industries: Catia, unigraphics		

Text Books

1. A Course in Internal Combustion Engine by M. L. Mathur, R. P. Sharma (Dhanpati Rai & Sons)
2. Internal Combustion Engine by R. K. Rajput (Laxmi Publications Ltd)
3. Internal Combustion Engine by V. Ganesan (Tata McGrow Hills)
4. Automotive Mechanics by William H. Crouse, Donald L. Anglin (Tata McGrow Hills)

COURSE : STATISTICAL QUALITY CONTROL (ELECTIVE-I)
Course Code : **ME- 75B**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to:

CO1	Explain the philosophy and basic concepts of product/service quality and phases of quality planning, quality control and quality improvement.
CO2	Interpret the concept of quality of cost and COQ as a cost reduction technique.
CO3	Interpret control charts for variables and attributes.
CO4	Utilise acceptance sampling plans for attributes.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	3	-	-	-	-	-	-	1	-	-	-	1	1	1
CO2	3	2	2	-	-	-	-	1	-	-	-	1	1	1
CO3	2	2	2	2	-	-	-	1	-	1	-	1	1	1
CO4	2	2	2	1	-	-	-	1	-	1	-	1	1	1

Detailed Syllabus

Module	**Module Details**	**Lecture Hr**	**Marks**
1	Introduction : The history and Background of Quality Control, Need for Quality Control, Evolution of Quality Control and different Quality Management Philosophies(Overview), Quality Assurance Phases of Quality Assurance. Quality Definition: Characteristics / dimensions of quality, Juran's Quality Trilogy Quality Spiral, Causes of Variation-change and assignable Causes. Quality Costs : Reason for Quality Costs Analysis,	**8**	**20**

	Categories of Quality Costs(Cost of poor Quality), Concept of Optimum Quality Cost Model. Statistical Concelots: Sample Parameters and Universe Parameters, Central Tendency and Dispersion and their measures, Data Representation Frequency Distribution Curves, Continuous and Discrete Distributions, normal curve and its characteristics, Normal Table, Hypothesis Testing , Chi-square distribution		
2	**Inspection:** Types of Inspection, Inspection Error, Inspection and Quality, Samples Inspections- Its Importance and Application Theory of Sampling: Population and Sample, Sample Statistics and Population Parameters, Rational Sub Grouping, Shewhart Normal Bowl Experiment.	**7**	**15**
3	**Statistical Process Control:** Statistical Aspects of Quality Control,Type I and Type II Error in Statistical Analysis, Shewart Control Charts- Variable and Attribute Charts(X,R-charts, b-chart, cchart,up-chart) Control Charts for Variables: X Bar and R Charts, X Bar and Sigma Charts construction of the charts. Interpretation of the Charts. Manufacturing and Non-Manufacturing Application of the Charts. Control Charts for Attributes : p Chart, 100p Chart, n-p Chart, Chart, U chart Interpretation of the Charts, Application	**10**	**25**
4	Acceptance Sampling Plans for Attributes: Introduction, Importance, Situation leading to Economic use Sampling Plans, Concept of AQL and relevant terms, OC Curves-Type A and Type B OC Curves, Different types of Sampling Plans, ASN Curve, ATI Curve. Sampling Schemes-MIL STD105D-Rules for Switching Dodge and Romig Tables: Acceptance Sampling Plans for Variables: Introduction, Sampling Plans for Sigma Known and Sigma Unknown, Application.	**10**	**25**
5	Concept of Total Quality Management : Introduction, Tools and, Techniques of TQM, Brief Introduction Reliability : Distinction between Reliability and Quality, Relevant Terms, The Characteristics Curve(Bath-Tub Curve), Failure Types, Causes of Failure, Reliability Function in terms of Failure Rate and its characteristics, Reliability improvement- Series and parallel Systems	**7**	**15**

Text Books

1. Statistical Quality Control by H. L. Grant.

2. Quality Management by Juran.

COURSE : PROJECT-I
Course Code : **ME: 76**
Viva : 50 Marks
Sessional 100 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the role of Under Graduate Engineering project, components of such projects, phases of project and identification & collection of resources for project implementation.
CO2	Demonstrate the capability of team work and project management through information, knowledge and skill sharing to achieve the goal of the project assigned.
CO3	Apply common, special and interdisciplinary engineering knowledge and modern tools and techniques for system investigation and/or research method for system development to meet industrial and social needs.
CO4	Communicate effectively through project presentation, report preparation and writing of research paper.

Mapping of COs with POs

COs	**POs**												**PSOs**	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	2	-	-	-	1	-	1
CO2	2	-	-	-	-	-	-	-	3	1	2	1	-	1
CO3	2	2	3	2	2	2	2	1	-	-	-	1	1	1
CO4	2	-	-	-	-	1	-	2	1	3	2	1	-	1

SEMESTER –VIII

COURSE : INDUSTRIAL ENGINEERING
Course Code : **ME: 81**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the techniques of productivity improvement, method study and work measurement.
CO2	Solve problems on plant layout, assembly line, value engineering, method and time study.
CO3	Apply concept of production planning and control and inventory control techniques in solving problems encountered in manufacturing organisation

CO4	Formulate project schedule using project management technique and maintenance program for economic maintenance of plants and machines.

Mapping of COs with POs:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	2	-	-	-	1	1	-	-	2	1	1	1
CO2	2	2	2	-	-	-	1	1	-	1	2	1	1	1
CO3	3	2	2	-	-	-	1	1	-	-	2	1	2	1
CO4	3	2	1	1	-	-	1	1	-	-	2	1	2	1

Detailed Syllabus

Module	Module Details	Lecture Hr	Marks
1	Introduction to Industrial Engineering: Definition, Objectives, Techniques of Industrial Engineering Productivity: Definition & Concept, Dynamics of productivity change, productivity measures, Factors influencing productivity, Techniques of productivity improvement.	5	10
2	Work Study: Importance, Work study procedure. Method Study: Objectives, Scope, Steps involved Method Study Symbols, Charts: Operation process chart, Flow process chart, Two handed Process chart, Multiple activity chart. Micro -motion study: Therbligs, Simochart. Objectives, Techniques, Performance rating, Factors affecting performance rating, Allowances, Computation of standard time. Job evaluation and Merit Rating: Objectives, Procedure job specification Method of job evaluation, Merit rating.	10	15
3	Plant layout and Line Balancing: Principles of plant layout, Different types of layout, Moodie and young and RPW method of assembly line balancing, Group layout.	5	15
4	Production planning and Production Control: Functions and Principles of Production control, Types of production activities and processes, demand fore casting, Manufacturing methods and PPC, Information requirement of PPC. Production Control: Outline of Production control, Loading, Sequencing and Scheduling, Sequencing problems, Assignment model. Production Cost Concept and Break-even Analysis: Costs of Production, Cost classification, Analysis of Production costs, Break-even analysis, Make & Buy decisions, Factors affecting Make & Buy decisions	10	15

5	Value Engineering and Value Analysis: Origin, Definition, Value analysis Vs Value Engineering; Value Engineering & other cost reduction techniques, Steps in Value Analysis, Techniques	10	10
6	Inventory Control : Inventory classification, ABC, VED analysis, EOQ model, Modifications of EOQ model, Reorder point, P-policy and Q-policy, Static inventory problem under risk, Dynamic inventory problem with varying demand and also with certainty of annual demand.	5	15
7	Maintenance and equipment Replacement Policy : Objectives, Types of maintenance, Economics of preventive maintenance, Replacement of equipment, Methods for selection of alternatives	5	10
8	Project Management : Project concept and definition, Characteristics of project, Project feasibility, Tools and Techniques of Project Management, Project Scheduling with CPM and PERT	5	10

Text Books:

1. Work Study by R.C. Patel
2. Plant layout and Design by J. Mo. Moore
3. Inventory Control by Starr and Miller
4. Mass Production by M.L. Riggs
5. Hand Book of Industrial Engineering by L. Grant Industrial Engineering

COURSE : MEASUREMENTS
Course Code : **ME-82**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Illustrate different types of angular velocity measuring instruments.
CO2	Apply the concepts of Lisajous diagram for determination of frequency and phase relationships.
CO3	Explain pressure measuring devices for measurement of high and low pressure.
CO4	Explain various types of temperature measuring equipment and their method of calibration.
CO5	Illustrate different types of flow meters and their applications.
	Explain the application and methods of calibration of different types of strain gauges.

Mapping of COs with POs:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO2	2	1	1	-	-	-	-	-	-	-	-	1	-	1
CO3	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO4	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO5	2	1	1	-	-	-	-	-	-	-	-	1	1	1
CO6	2	1	1	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus:

Module	Module Details	Lecture Hr	Marks
1	Applied Mechanical Measurement: Tachometers, Stroboscope, Use of Lisajous diagram for determination of frequency and phase relations, measurement of angular motion.	05	15
2	Pressure Measurement: Introduction, Pressure standards, Pressure measuring systems, Pressure Measurement of low and high Pressures	08	20
3	Temperature Measurement: Methods of measuring temperature, Use of bi-metallic thermometers, different types of thermistors, thermocouples, pyrometer, method of measurement of low and high temperature, calibration of temperature measuring devices, measurement of temperature of gases.		
4	Flow Measurement: Flow measurement methods, flow characteristics, obstruction meters, and variable area flow meter, measurement of fluid velocity, anemometers, special flow measuring methods and devices, turbine flow meters, magnetic flow meters, ultrasonic type flow meters.	10	25
5	Strain gauges and strain measurement: Strain gradient, mechanical, optical and electrical strain gauge, bonded wire strain gauge, calibration of strain gauge, problems associated with the use of strain gauge,	05	15

Text Books:

1. Mechanical Measurement by R.S. Sirohi & H.C. Radhakrishna
2. Mechanical & Industrial Measurement by Er. R.K. Jain
3. A Course in Mechanical Measurement & Instrumentation by A.K. Sawheny
4. Measurement Systems Application and Design by Ernest O. Doeblin.
5. Mechanical Measurement and Instrumentation by R.K. Rajput

COURSE : HEAT AND MASS TRANSFER-II
Course Code : **ME-83**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes: Upon completion of the course, students shall be able to:

CO1	Explain the fundamentals of convective heat transfer, mass transfer and diffusional processes.
CO2	Solve problems on heat transfer coefficient and heat flux using empirical correlations for free and forced convection.
CO3	Explain the concept of thermal boundary layer.
CO4	Solve problems on heat dissipation through extended surface.
CO5	Design heat exchanger by using LMTD and NTU methods.
CO6	Explain boiling and condensation heat transfer.

Mapping of COs with POs

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	-	-	-	-	-	-	1	-	1
CO2	2	2	2	-	-	-	-	-	-	-	-	1	-	1
CO3	2	1	-	-	-	-	-	-	-	-	-	1	-	1
CO4	2	2	1	-	-	-	-	-	-	-	-	1	1	1
CO5	2	2	2	-	-	-	-	-	-	-	-	1	1	1
CO6	2	1	-	-	-	-	-	-	-	-	-	1	1	1

Detailed Syllabus:

Module	**Module Details**	**Lecture Hr**	**Marks**
1	Convective Heat Transfer: Introduction, the basic law, convective heat transfer coefficient.	1	5
2	Forced convection: application of dimensional analysis, over a flat plate (external flow), in circular duct (internal flow),empirical correlations for different geometries, laminar tube flow with constant heat flux at the wall, various N-D numbers associated and their physical significance, thermal boundary layer over a flat plate, problems.	10	25
3	Free convection: Dimensional analysis, convection over a vertical flat plate, various N-D numbers associated and their physical significance, empirical correlations for different geometries, problems.	9	20
4	Heat transfer from extended surfaces: Application to	9	20

	straight, rectangular, circular and triangular fins, efficiency, effectiveness, condition for maximum heat transfer, problems.		
5	Boiling and condensation: Concepts, laminar film condensation theory, drop wise condensation, and pool boiling heat transfer phenomena, boiling correlations.	6	10
6	Mass Transfer: Introduction, Fick's law of diffusion, analogy between mass, momentum and heat transfer, convective mass transfer, evaporation of water into air, application of dimensional analysis to free and forced convection, empirical correlations, problems.	7	20

Text Books:

1. Heat transfer by M. Necati Ozisik
2. Heat transfer by Frank Kreith
3. Heat transfer by Holman

COURSE : POWER PLANT ENGINEERING (ELECTIVE II)
Course Code : **ME- 84A**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to:

CO1	Explain working principle of nuclear, hydroelectric, thermal, gas turbine and diesel engine power plant
CO2	Solve problems on gas turbine cycles, diesel engine and boiler efficiency.
CO3	Design technical components of micro hydroelectric power plants.
CO4	Explain different coal handling and ash handling methods in a coal based thermal power plant, high pressure boilers, cooling tower.

Mapping of COs with POs:

COs	POs												PSOs	
	1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	2	2	-	-	-	1	1	-	-	-	-	1	-	1
CO2	2	2	-	-	-	1	1	-	-	-	-	1	1	1
CO3	2	2	2	-	2	1	1	-	-	-	-	1	2	1
CO4	2	2	-	-	-	1	1	-	-	-	-	1	1	1

Detailed Syllabus

Module	Module Details	Lecture Hr	Marks
1	Fundamental of Power Plant: Concept of power plant, classification, Power development in India, Resources for power generation, present power position in India. Power plant Economics and Variable Load Problem: Terms and factors, factors affecting power plant design, Load curve, Ideal and realized load curve, Effect of variable load on power plant design.	6	15
2	Hydroelectric Power Plant: Introduction, Hydrograph and flow duration graph, site selection for hydro-electric power plants, classification, general arrangements of hydroelectric power projects, its operation, advantages of hydroelectric power plants. Design, construction and operation of different components of hydroelectric power sections, Reservoirs, dams, spillways, canals and penstocks, water hammer and surge tank power house and turbine setting, prime movers, governing water turbines.	10	25
3	Thermal Power Plant: Setting of thermal power plant, general layout of modern thermal power plants (TMP), Site selection for TMP. Fuels for thermal power plant, in-plant handling of coal, coal feeding and burning methods, related equipment's, and pulverized fuel system. Ash handling system, dust collection and its disposal, dust disposal systems. Steam generation: high pressure boiler, economizer, superheater, reheater, regenerator, air preheater. Cooling tower and ponds. Steam Turbine: Principle of operation of steam turbine, classification, Installations, testing and maintenance, trouble shooting.	10	25
4	Nuclear Power Plant: Introduction, Safety measure of nuclear power plant, site selection and commissioning procedure, Nuclear reactor, classification of nuclear reactor, Nuclear power plant in India.	4	10
5	Diesel Power Plant: Introduction, Plant layout, Engine Performance, Heat Balance, Advantages/disadvantages of diesel power plant.	5	10
6	Gas Turbine Plant: Classification, Elements of gas turbine power plant, Site selection, layout, operation and maintenance performance, Waste heat boiler.	5	15

Text Book:

1) Power Plant Technology by Wakil (Tata-McGrow Hills)
2) Power Plant Engineering by P. K. Nag (Tata-McGrow Hills)
3) Power Plant Engineering by Dr. P. C. Sarma (S. K. Kataria & Sons)
4) Power Plant Engineering by A. K. Raja, Amit Prakash Srivastava, Manish

COURSE : OPERATIONS RESEARCH TECHNIQUES (ELECTIVE-II)
Course Code : **ME-84B**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to:

CO1	Design LP models applicable to different real-life problems.
CO2	Solve TP, AP, and IPP problems
CO3	Apply the OR techniques to resource management (Man, Machine, Material and Money)
CO4	Extend the concept of Decision Theory and Game Theory for solving problems of different decision making situations and in situation of competition and conflict.

Mapping of COs with POs:

COs	**POs**												**PSOs**	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	3	2	-	-	-	1	-	-	-	-	-	1	-	1
CO2	3	2	2	-	1	-	-	-	-	-	-	1	1	1
CO3	2	3	2	-	1	1	-	-	-	-	-	1	1	1
CO4	3	2	2	-	1	1	-	-	-	-	-	1	-	1

Detailed Syllabus

Module	**Module Details**	**Lecture Hr**	**Marks**
1	Introduction : Optimization, Classification of beginning and Progress of O.R, Mathematical modelling in O.R. Optimization Problems The Linear Programming: Introduction, Formulation of L.P. models graphical solution for L.P.P., Simplex method, Duality in LPP, Importance of dual, Dual simplex method, Sensitivity Analysis in LP, Introduction to Special LP Models	12	30
2	Transportation Model/ Problems: Initial solution by NWCM, VA.M. Optimization of the solution, degeneracy in transportation problem, alternate solutions Assignment Model/ Problems : Hungarian Method and relevant problems	8	20

3	Integer Programming: Branch and Bound technique, Gomory's Cutting plane method. Dynamic Programming: Introduction investment problem, Stagecoach problem, Equipment replacement problems.	8	15
4	Decision Theory: Introduction, Minimax decision procedure, Bayes decision procedure with / without data, Regret function Vs loss function. Game Theory: Introduction, Minimax, Maximin procedure, Pure strategy, Mixed strategy, Expected pay off, Solution of 2 X 2 games, Dominance rules.	10	20
5	Queuing Theory: Introduction, Queuing system, Characteristics of queuing systems, Queuing models with Poisson input, Exponential service time, Single channel infinite population / finite population model, Multi-channel finite / infinite population model, Queuing problems for formulated as a Markov chain.		

Text books:

1. Introduction to O.R. by Billey E. Gillet, Tata MC Hill
2. Optimising Theory and Applications by S.S. Rao
3. Operations Research by Kanti Swarup
4. Optimisation Techniques by Phillips and Ravindran

COURSE : PROJECT-II
Course Code : **ME- 85**
Theory : 100 Marks
Sessional 50 Marks

Course Outcomes (COs): Upon completion of the course, students shall be able to:

CO1	Explain the role of Under Graduate Engineering project, components of such projects, phases of project and identification & collection of resources for project implementation.
CO2	Demonstrate the capability of team work and project management through information, knowledge and skill sharing to achieve the goal of the project assigned.
CO3	Apply common, special and interdisciplinary engineering knowledge and modern tools and techniques for system investigation and/or research method for system development to meet industrial and social needs.
CO4	Communicate effectively through project presentation, report preparation and writing of research paper.

Mapping of COs with POs

COs	POs												PSOs	
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	2	2	-	-	-	-	-	2	-	-	-	1	-	1
CO2	2	-	-	-	-	-	-	-	3	1	2	1	-	1
CO3	2	2	3	2	2	2	2	1	-	-	-	1	1	1
CO4	2	-	-	-	-	1	-	2	1	3	2	1	-	1

5. Laboratories and Workshops of the Department

5.1 Laboratories

The different laboratories available in the department with experimental setup and equipment are given below:

A. Engineering Mechanics

- Polygon Law of Forces apparatus
- Equilibrium Force apparatus
- Friction force apparatus (for rolling friction)
- Friction force apparatus (for sliding friction)
- Parallel force apparatus
- Screw Jack
- Bell Crank Lever apparatus

B. Material Testing Lab

- Rockwell Hardness Test apparatus
- Brinell Hardness Test apparatus
- Pendulum Impact Test apparatus
- Compressive Stress test apparatus
- Torsion Test apparatus
- Universal Testing Machine (tension test)

C. Applied thermodynamics

- Single Cylinder Horizontal 4-stroke diesel engine
- Planimeter

D. Fluid Mechanics

- Redwood Viscometer
- Bernoulli's apparatus
- Apparatus for loss co-efficient in pipe fittings
- Orifice meter & Venturimeter apparatus
- Reynolds' apparatus

E. Mechanics of Materials

- Rockwell Hardness Test apparatus
- Brinell Hardness Test apparatus
- Pendulum Impact Test apparatus
- Compressive Stress test apparatus
- Torsion Test apparatus
- Universal Testing Machine (tension test)

F. Production and Measurement

- Tool grinder
- Turret Lathe
- CZ Tool Maker's Microscope
- HMT precision lathe type NH 26/1000
- Modular CNC machines

G. **Measurement Lab.**

- Slip Gauges
- Digital Micrometer
- Digital Vernier Calliper
- Telesurf Surface roughness tester
- Profile projector
- Digital height gauge
- Digital indicator dial gauge with flexible magnetic stand
- Sine bar

H. Dynamics of Machinery-II

- Universal Governor Apparatus
- Watt Governor
- Porter Governor
- Proell Governor
- Hartnell Governor
- Compound Pendulum Apparatus
- Torsional Pendulum Apparatus
- Helical Spring Apparatus
- Gyearsoscope
- Journal Bearing Apparatus
- Coriolis Component Apparatus
- Cam Analysis Apparatus
- Balancing Apparatus

I. Fluid Machinery

- Impact of vanes apparatus
- Pelton wheel water turbine
- Centrifugal pump test rig
- Reciprocating pump test rig

J. Heat and Mass Transfer

- Stephen-Boltzmann apparatus
- Heat transfer from a pin-fin apparatus
- Heat transfer through lagged pipe apparatus
- Heat transfer through composite wall apparatus
- Emissivity measurement apparatus
- Thermal conductivity of insulating powder
- Heat transfer in natural
- Heat transfer in forced convection apparatus
- Critical heat flux apparatus

K. Other Laboratory Equipment

- 3D Printer
- Modular CNC (3 nos.)
- Optical Metallurgical Microscope
- Poratble Measuring Equipment: Pyranometer, Digital pressure gauge, Orifice meter, Hot wire anemometer, Infrared Thermometer, data acquisition system, Wind anemometer

L. Additional facilities

- A Smart Class room: seating capacity 30, equipped with a smart TV, a computer, air conditioners and white board.
- A Seminar Hall: Seating Capacity 100, equipped with Lecture Capture Solution, a Computer, a LCD projector, Smart Board, Air conditioners, a Mic and Speaker, LED and a Podium.
- Department library

5.2 Workshops

The department has a full-fledged workshop with eight different shops. The following is the family of shops housed in the workshop:

A. Machine Shop

- Centre Lathe machine
- Grinding machine
- Power Saw machine

- Centre lathe machine
- Power Saw machine
- Grinding machine
- Column and Knee type Universal Milling machine
- Centre lathe machine
- Power Saw machine
- Grinding machine
- Column and Knee type universal milling machine
- Column and knee type vertical milling machine
- Planner machine
- Shaper machine

B. Fitting Shop

- Bench drill machine
- Chope Saw machine
- Chop Saw machine

C. Carpentry Shop

- Circular saw machine
- Band saw machine

D. Pattern Making Shop

- Circular saw machine
- Wood Turning lathe machine

E. Foundry Shop

- Electric arc furnace

F. Welding Shop

- Step down welding transformer (Air or Oil cooled)
- Hand Shearing machine
- Grinding machine

G. Automobile Shop

- I.C. Diesel Engine
- A functional Gypsy car without body

H. Sheet Metal Shop

- Edge folding machine
- Notching machine
- Drill machine
- Truncked Sheet Bending machine

6. Students of the Department

The number of students currently during this session (August to December, 2018) in the department are as listed below.

B. E. students

Semester	Total Students
1st	90
3rd	100
5th	89
7th	97

M. E. Students

Semester	Total Students
1st	11
2nd	9

Ph. D. Students

Sl. No	Name of the students	Research Interest	
1	Mr. Dignata Kalita	Welding and optimisation	Part time
2	Mr. Bijay Kr Rai	Energy and exergy analysis of thermal power plant	Part time
3	Mr. Mafidur Rahman	Ramjet Pump	Part-time
4	Mr. Partha Pratim Bprthakur	Analysis of Traffic system of a town for improvement	Part-time
5	Mr. Dhrupad Sharma	Solar refrigeration	Full-time
6	Mr. Ranbir Kalita	Solar distillation	Full-time
7	Mr. Ajoy Krishna Dutta	Biomass Cook stove	Part-time
8	Mr. Dhanjit Das	Optimisation, waste heat recovery and hybridisation of aromatic herbs distillation plant	Part-time
9	Mrs. Rhea Mathews	Solar Electrification	Part-time
10	Mr. Politraj Sonowal	Composite Materials	Part-time
11	Mr. Tushar Ranjan Bora		Full-time
12	Anurag Sarma		Part-time

7. Faculty Members and Staff of the Department

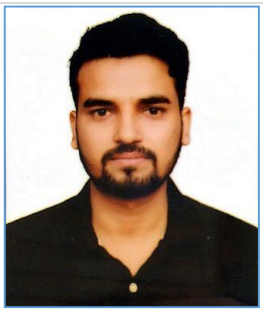
At present, the department has thirteen regular faculty members. With eight contractual faculty members under TEQIP and two part-time faculty members (Govt of Assam), the total strength is twenty two. The department also has twenty four technical/non-technical staff members engaged in the workshops and laboratories. The detailed profile of the faculty members and the supporting staff are given below.

7.1 Detailed Profile of Faculty Members

Dr. Parimal Bakul Barua Ph.D. (IIT Roorkee) Professor & HoD Phone No. 9435091412 Email id.: parimalbakul@gmail.com Specialisation: Production and Industrial Engineering Research Interest: Quality Control, Optimisation, Manufacturing and Supply Chain Management	
Dr. Pradeep Kumar Mahanta Ph.D. (REC Roorkella) Professor Phone No. 9435041405 Email id : pkmahanta@india.com Specialisation: Mechanical System Design Research Interest: Energy	
Dr. Thuleswar Nath Ph.D. (IIT Kharagpur) Associate Professor Phone No. 9954447837 Email id.: nath.thuleswar@gmail.com Specialisation: Production and Industrial Engineering Research Interest: Quality, System Dynamics and Manufacturing	
Dr. Satyajit Paul Ph.D. (University of Roorkee) Associate Professor Email id: saytyajitpaul.aec.01@gmail.com Phone No. 7638826787	

Dr. (Ms) Rupanjali Nath Ph.D. (IIT Delhi) Associate Professor Phone No. 9678071965 Email id : n.rupanjali@gmail.com Specialisation: Thermal Engineering Research Interest: Technology Initiated Change Management, Industrial Engineering and Solar Energy	
Dr. Diganta Hatibaruah Ph.D. (Tezpur University) Associate Professor Phone No.9954486973 Email id.: dhbaruah@gmail.com Specialisation: Energy Research Interest: Energy, Drying Technology and Cryogenic	
Mr. Ajoy Krishna Dutta M. Tech (IIT Guwahati) Assistant Professor Phone No. 9435050249 Email id.: dutta.krishna@gmail.com Specialisation: Machine Design Research Interest: Non-conventional Energy	
Mr. Mafidur Rahman M. Tech (IIT Guwahati) Assistant Professor Phone No. 9435533233 Email id.: mrahman1234@rediffmail.com Specialisation : Machine Design Research Interest: Design and Manufacturing	
Mr. Debarupam Gogoi M. Tech (IIT Guwahati) Assistant Professor Phone No. 8638539394 Email id : debarupam@gmail.com Specialisation : Computer Assisted Manufacturing Research Interest: FEM in Machine Design, Robotics and CAD/CAM	

Ms. Dimpi Bora M.E (Assam Engineering College) Assistant Professor Phone No. 8876581230 Email id.: dimpibora2015@gmail.com Specialisation : Fluid and Thermal Research Interest: Thermal Engineering	
Mr. Bijoy Kr. Roy M. Tech (IIT Guwahati) Assistant Professor Phone No. 9954322064 Email id : bijayroy@yahoo.com Specialisation : Design Research Interest: Energy and Heat Transfer	
Dr. Deva Kanta Rabha Ph.D. (IIT Guwahati) Assistant Professor Phone No.07896853210 Email id : devaktra@gmail.com Specialisation: Energy Research interest : Solar Thermal, Energy Conservation, Thermal energy storage, Drying	
Mr. Diganta Kalita M.E (Jorhat Engineering College) Assistant Professor Phone No. 9854158284 Email id.: digant123@yahoo.co.in Specialisation : Industrial Engineering and Production Research Interest: Optimisation and Welding	
Dr. Jitender Kundu PhD (NIT Kurukshetra) Assistant Professor (TEQIP) Phone No. 97291 43005 Email id: jitenderkundu@gmail.com Specialisation : Industrial & Production Research Interest: Advanced Manufacturing Techniques, Advanced Joining Processes, Optimization Techniques.	

Mr. Prince Kumar M. Tech (NIT Silchar) Assistant Professor (TEQIP) Phone No.70868 31287 Email id: princenits2017@gmail.com Specialisation : Thermal Engineering Research Interest: Fluid flow and Heat transfer, Fluid Flow Through Micro Channels	
Mr. Sanjeev Vishwakarma M.Tech (IIT Guwahati) Assistant Professor (TEQIP) Phone No. 90857 42465 Email id: sanjudeotalab@gmail.com Specialisation : Fluid and Thermal Research Interest: Solar thermal storage, CFD, Fluid and Thermal	
Mr. Sanjeet Kumar M.Tech. IIT Guwahati Assistant Professor (TEQIP) +91-9199906541 Email id. sanmech2014@gmail.com Specialisation: Aerodynamics and propulsion Research Interest : Aerodynamics, Heat Transfer, Computational Fluid Dynamics	
Mr. Nagendra Kushwaha M.Tech (MNNIT Allahabad) Phone No. +91-8953341316 Email id: nagendrakushwaha007@gmail.com Specialisation : Product Design and Development Research Interest: Design and Development of New Product and Services	
Mr. Divyaprakash M.Tech (IIT Gandhinagar) Assistant Professor (TEQIP) Phone No. +91-7874980691 Email id.: divyaprakash.poddar@gmail.com Specialisation : Mechanical Engineering Research Interest: Computational Fluid Dynamics, Computational Continuum Mechanics, Heat transfer	

Mr. Abhishek Kumar
M.Tech (IIIT Guwahati)
Assistant Professor (TEQIP)
Phone No. +91-8859585978
Email. Id: abhisheksharma3344@gmail.com, abhi.kumar15@iitg.ac.in
Specialisation: Computer Assisted Manufacturing
Research Interest : Numerical Simulation and experimental analysis of Friction Stir Welding, Joining Process.

Mr. Parag Kamal Talukdar
M.Tech (IIT Jodhpur)
Phone No 9707446970
E-mail ID: parag.kamal@gmail.com
Specialisation: Energy
Research Interest: Renewable Energy, Energy, Wind Tunnel Experiments

Mr. Palash Saikia
M.E (Assam Engineering College)
Assistant Professor (Contractual)
Phone No. 84863 79002
Email id: palashsaikia53@gmail.com
Specialisation : Fluid and Thermal
Research Interest: Sustainable Manufacturing and Green Machining

Mr. Tushar Ranjan Bora
M.E (Jorhat Engineering College)
Assistant Professor (Contractual)
Phone No. 70029 10342
Email id: tushbora92@gmail.com
Specialisation : Industrial and Production Engineering
Research Interest: Industrial and Production Engineering Optimisation

7.2 Staff of the Department

Sl. No	Name, Designation & Qualification
1	**Mr. Puranjit Saikia**, Junior instructor Technical School Leaving Certificate (Fitting Shop)
2	**Mr. Ghana Chutiya**, Junior instructor ITI Pass Certificate (Mechanic Motor Vehicle)
3	**Mr. Horen Chandra Lahon,** Junior instructor ITI (Carpenter), Craft Instructor, ATI, Calcutta
4	**Mr. Apurba Kr. Chiring**, Junior instructor ITI (Carpenter)
5	**Mr. Jitul Saikia,** Junior Instructor ITI (Fitter) and ITI (Molder)
6	**Mr. Robin Gogoi,** Junior instructor T. S. L. C.
7	**Mr. Dhruba Jyoti Bora**, Assistant Instructor ITI (Machinist)
8	**Mr. Rajesh Chandra Kalita**, Assistant Instructor ITI (Forger & Heat Treater)
9	**Mr. Suresh Chandra Dutta**, Assistant Instructor ITI (Moulder)
10	**Mr. Atul Chandra Saikia**, Assistant Instructor ITI (Welder)
11	**Mr. Bichitra Kamal Gogoi**, Assistant Instructor Technical School Leaving Certificate
12	**Mr. Biswajit Boruah**, Mistry HSLC
13	**Mr. Pulin Kalita**, Mistry ITI (Machinist)
14	**Mr. Biman Ch. Borah**, Fitter ITI (Plumber)
15	**Mr. Bonomali Dutta**, Mistry ITI (Forger & Heat Treater), HSLC
16	**Mr. Hira Nath Duta**, Mistry ITI (Draughtsman, Mech.)
17	**Mr. Siben Kurmi Mistry** IX pass
18	**Mr. Sada Ram Das**, Mistry HSLC
19	**Mr. Bulu Bora**, Mistry ITI (Welder, Gas & Elec.)
20	**Mr. Dhoniram Payeng,** Gr. IV Class IX pass

21	**Mr. Ananta Hazarika,** Boiler Attendant HSLC & Certificate of Boiler Attendant
22	**Mr. Arup Saikia**, Electric Mistry (Electrician) ITI (Electrician) and HSLC.
23	**Mr. Tilak Sarma**, Department Bearer/Lab Helper Class VIII pass
24	**Mr. Rajen Bora**, Department Bearer/Lab Helper Basic qualification: Class VII pass

8. List of Students Recruited in the Campus Recruitment Drive

Sl. No	Company	Name of Students
1	Hindustan Unilever	1. Meghana Sarmah 2. Prachurjya Baruah 3. Rudrajyoti Das
2	Cummins India	1. Rupak Saha 2. Tanumita Roy 3. Archita Nirmala
3	Godrej And Boyce	1. Subhabrata Roy 2. Arunav Baruah
4	Telecom Network Solutions	1. Mamin Uddin Ahmed 2. Ankur Sharma 3. Ekbal Hussain 4. Mostafizur Rohman 5. Jabed Ali Ahmed 6. Parchajit Saikia 7. Sorensangbam Nabachandra Singh
5	ITC Limited	1. Saumyasree Dutta 2. Ritom Chakraborty
6	Oil India Limited	1. Lakhyajit Saikia 2. Pratyosh Mahanta 3. Ritom Chakraborty 4. Archita Nirmala
7	Dabur	1. Bikash Gupta
8	Ethnus Consultancy Services	1. John Teron
9	Go-Speedy-Go (Dm)	1. Mridupawan Gogoi 2. Aabir Dey 3. Bhaimoon Gohain 4. Binita Gogoi 5. Ekbal Hussain 6. Monmayuri Dowarah

10	M Motors	1. Khitish Kumar Bora 2. Ankur Sharma 3. Md Forijul Hoque

9. List of GATE 2018 and MAT 2018 Qualifying Students

GATE Qualifying Students

SI. No.	Name	GATE Registration No.	GATE Score
1	Aabir Dey	ME18S14012141	414
2	Bhargov Bhattacharyya	ME18S24012049	433
3	Dibya Sarma	ME18S24012055	515
4	Dulendu Ranjan Phukan	ME18S24012103	348
5	Jibesh Chandra Das	ME18S24012169	344
6	Lakhyajit Saikia	ME18S24012063	601
7	Nerson Boro	ME18S14012196	240
8	Pratyosh Mahanta	ME18S24012101	547
9	Rahul Bhowmick	ME18S14012186	439
10	Rajarshi Boruah	ME18S14012115	414
11	Sandipan Saikia	ME18S24012061	483
12	Sayan Mazumder	ME18S24012079	366
13	Swrangsha Basumatary	ME18S14012194	268
14	Vinayak Thakur	ME18S24012040	408
15	Wrishiraj Sharma	ME18S14012069	439
16	Yubaraj Das	ME18S24012144	398

MAT Qualifying Students

Sl. No.	Name of the student	Percentile
1	Kartik Kamal Siakia	99.34
2	Abdul Hamid Laskar	95.94

10. Achievements of the Students of the Department

Sl. No	Name of the Student
1	Kartik Kamal Siakia, 8th Semester, won the third Best Debate team at the Tanu Konwar Memorial Debate (Inter-state, Gargaon college, Sivasagar district on January 2018
2	Binay Kumar Singh, 8th Semester, own the cash prize of Rs. 15000/- for his creative and meritorious project idea from Assam Engineering College, 88 FOUNDATION on January, 2018
3	Rohit Saikia and Abhinov Gogoi, 6th Semester, awarded the **FUTUREPRENEUR** trophy at the 2nd Rural Entrepreneurs, Meet 2018 at Tata Institute of Social Science, Tulijapur.

4	Ekabal Hussain, 8th Semester, won the 3rd Prize at All Assam Debo Kumar Memorial Quiz competition 2018, Titabor, Jorhat.
5	Asgutosh Das, 2nd Semester, bagged the first prize in Roboscoccer Orgainzed by JIST in March, 2018.
6	Jinmoy Jit Talukdar, Kinku Das and Subrata Acharjee, 2nd semester bagged the first prize in Robosoccer organised by Assam Engineering College, April, 2018.
7	Ekabal Hussain, 8th Semester student bagged the 2nd prize in the open general quiz held at Assam agricultural University.

11. Publications of Project Works in Journal and Conference by B.E Final Year Students

Sl. No	Journal/Conference
1	D. Sarma, P. B. Barua, N. Dey, S. Nath, M. Thakuria and S. Mallick. Investigation and Taguchi Optimization of Microbial Fuel Cell Salt Bridge Dimensional Parameters, Journal of the Institution of Engineers (India): Series C, Springer; Published online on 13th January 2018, DOI 10.1007/s40032-017-0436-0
2	Rupak Saha, Md. Forijul Hoque, K.K.Bora, Abdus Salam and Prof. Debarupam Gogoi; 'Fabrication of Spring Stiffness Measuring Apparatus Using Pneumatic System'; International Journal of Engineering Trends and Technology; June 2018, 60 (2), pp: 90-91.
3	D. K Rabha, D. Pathak, R. Baruah R., T. Kalita, A. Sharma. Experimental Investigation of the Performance of a Double-Pass Unglazed Transpired Solar Air Heater, 1st International Conference on Future Learning Objective and Aspects of Mechanical Engineering (FLAME 2018), 3rd to 5th October 2018, Amity University, Noida.
4	D. K. Rabha, B. K. Singh, A. A. Hazarika, A. H. Laskar, S. Dutta. Drying Of Black Pepper In Box Type Solar Dryers With and Without Latent Heat Storage, International Conference On Renewable & Alternate Energy (ICRAE-2018) Organized By Assam Science and Technology University (ASTU) Guwahati, Assam, India December 04-06, 2018 (Accepted for presentation).
5	D. Sarma, M. Das, B. Brahma, D. Pandwar, S. Rongphar and M. Rahman; 'Investigation and Parameter Optimization of a Hydraulic Ram Pump using Taguchi Method'; Journal of The Institution of Engineers (India): Series C, Springer; 2016, 97(4), pp: 551-559.

12. Some of the Distinguish Alumni and Alumni as Faculty Members in National Level Institutes of Higher Learning

Sl. No	Name and Designation	Photo
1	**Er. Subhir Roy Choudhori** Chairman & Managing Director (Retired) Hindustan Petroleum Corporation Ltd.	
2	**Er. Sameer Das,** CGM, Oil India, Pipeline	
3	**Er. Bimal Baruah** Regional Director (Retired) ONGC, Assam Asset	
4	**Er. Ratul Bordoloi** Managing Director Assam Petrochemicals Ltd.	
5	**Er. Jishnu Sarma** Executive Director, Oil India Ltd	
6	**Dr. Apurbba Kumar Sharma** Associate Professor Department of Mechanical and Industrial Engineering IIT Roorkee	
7	**Dr. Kurna Kalita** Associate Professor Department of Mechanical Engineering IIT Guwahati	
8	**Dr. Pankaz Kalita** Assistant Professor Centre for Energy IIT Guwahati	

9	**Dr. P Khanindra** Assistant Professor Department of Mechanical Engineering IIT Guwahati	
10	**Er.** Monti Rajkhowa, The first Assamese and the first ONGC Lady Officer to Scale the World's Third Highest Mount Kanchenjunga in May 20, 2018