GOKUL GLOBAL UNIVERSITY
Approved By Govt. of Gujarat
(Recognized by UGC under Section 22 & 2(f) of 1956)
(Gujarat Private State University Act 4 of 2018)

COURSE STRUCTURE

Bachelor of Engineering

Mechanical Engineering

Under

Choice Based Credit System (CBCS)

Faculty of Engineeering
Hansaba College of Engineering & Technology
University Campus, State Highway-41, Siddhpur - 384151, Dist. Patan, Gujarat, INDIA
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SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	I	FEB110001	Engineering Mathematics-I	5(3+2+0)	Basic Science Courses
2	I	FEB110202	Elements Of Mechanical Engineering	5(4+0+2)	Engineering Science courses
3	I	FEB110003	Communication Skill	4(3+0+2)	Humanities & Social science including management courses
4	I	FEB110304	Elements Of Electrical Engineering	5(4+0+2)	Engineering Science courses
5	I	FEB110006	Physics	4(3+0+2)	Basic Science Courses
6	I	FEB110206	Basic Workshop	2(0+0+4)	Engineering Science courses
7	I	FEB110007	Induction Program (Mandatory Course)	0(0+0+2)	Mandatory Course
			TOTAL	25	

R	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	II	FEB120001	Engineering Mathematics - II	5(4+1+0)	Basic Science Courses
2	II	FEB120102	Elements of Civil Engineering	5(4+0+2)	Engineering Science courses
3	II	FEB120403	Computer Programming With C	5(4+0+2)	Engineering Science courses
4	II	FEB120204	Engineering Graphics	5(3+0+4)	Engineering Science courses
5	II	FEB120105	Environmental Science (Mandatory Course)	0(2+2+0)	Mandatory Course
			TOTAL	20	

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	III	FEB130001	Effective Technical Communication	3 (2+0+2)	Humanities & Social science including management courses
2	III	FEB130002	Indian Constitution	0(2+0+0)	Mandatory Courses
3	III	FEB130201	Engineering Mathematics – III (PDE, Probability & Statistics)	4 (3+2+0)	Basic Science Courses
4	III	FEB130202	Manufacturing process-I	4 (3+0+2)	Professional Core Courses
5	III	FEB130203	Mechanical Measurement & Metrology	3(3+0+0)	Professional Core Courses
6	III	FEB130204	Engineering Thermodynamics	4 (3+1+0)	Professional Core Courses
7	III	FEB130205	Engineering Mechanics	4 (3+0+2)	Engineering Science courses
			TOTAL	22	

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	IV	FEB140001	Essence of Indian Knowledge Tradition	0 (3+0+0)	Mandatory Courses
2	IV	FEB140201	Applied Thermodynamics	4 (3+1+0)	Professional Core Courses
3	IV	FEB140202	Fluid Mechanics & Fluid Machines	4 (3+0+2)	Professional Core Courses
4	IV	FEB140203	Instrumentation & Control	4 (3+0+2)	Professional Core Courses
5	IV	FEB140204	Materials Engineering	4 (3+0+2)	Professional Core Courses
6	IV	FEB140205	Strength of Materials	4 (3+0+2)	Professional Core Courses
			TOTAL	20	

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	V	FEB150001	Humanities I (Engineering Economics & Management)	3 (3+0+0)	Humanities & Social science including management courses
2	V	FEB150201	Heat Transfer	3 (3+0+0)	Professional Core Courses
3	V	FEB150202	Theory of Machines	4 (3+0+2)	Professional Core Courses
4	V	FEB150203	Manufacturing Process - II	4 (3+0+2)	Professional Core Courses
5	V	FEB150204	Mechanical engineering Laboratory (Thermal) I	2 (0+0+4)	Professional Core Courses
6	V	FEB150205	Project - I	2 (0+0+4) (30 hour total)	Project (Summer Internship)
7	V	FEB150206	Design of Machine Elements	3 (3+0+0)	Professional Core Courses
				Total	21

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	VI	FEB160001	Open Elective – I (Cyber Security)	3 (3+0+0)	Open Elective Courses
2	VI	FEB160201	Dynamics of Machine	4 (3+0+2)	Professional Core Courses
3	VI	FEB160202	Advanced Manufacturing Processes	3 (3+0+0)	Professional Core Courses
4	VI	FEB160203	Mechanical engineering Laboratory (Design) II	2 (0+0+4)	Professional Core Courses
5	VI		Elective – I	3 (3+0+0)	Professional Elective Courses
6	VI		Elective – II	3 (3+0+0)	Professional Elective Courses
7	VI	FEB160208	Project - II	3 (0+0+6) (90 hour total)	Project (Winter Internship)
				Total	21

- **Elective-I**
  1. Computer Aided Design - FEB160204
  2. Composite Materials - FEB160205

- **Elective-II**
  1. Total Quality Management - FEB160206
  2. Energy Conservation & Management - FEB160207

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	VII	FEB170201	Open Elective II (Industrial Engineering)	3 (3+0+0)	Open Elective Courses
2	VII	FEB170202	Automation in Manufacturing	3 (3+0+0)	Professional Core Courses
3	VII	FEB170203	Mechanical engineering Laboratory III (Manufacturing)	2 (0+0+4)	Professional Core Courses
4	VII		Elective III	3 (3+0+0)	Professional Elective Courses
5	VII		Elective IV	3 (3+0+0)	Professional Elective Courses
6	VII	FEB170208	Project - III	3 (0+0+6)	Project
				Total	17

- **Elective-III**
  1. Internal Combustion Engine - FEB170204
  2. Process Planning and Cost Estimation - FEB170205

- **Elective-IV**
  1. Refrigeration & Air Conditioning - FEB170206
  2. Finite Element Analysis - FEB170207

SR	SEMESTER	SUBJECT CODE	SUBJECT NAME	CREDIT	CATEGORY
1	VIII	FEB180201	Humanities II (Operation Research)	3 (3+0+0)	Humanities & Social science including management courses
2	VIII	FEB180202	Open Elective III (Industrial Safety and Maintenance Engineering)	3 (3+0+0)	Open Elective Courses
3	VIII		Elective V	3 (3+0+0)	Professional Elective Courses
4	VIII		Elective VI	3 (3+0+0)	Professional Elective Courses
5	VIII	FEB180207	Project - IV	6 (0+0+12)	Project
				Total	18

- **Elective-V**
  1. Automobile Engineering - FEB180203
  2. Principles of Management - FEB180204

- **Elective-VI**
  1. Power Plant Engineering - FEB180205
  2. Gas Dynamics and Jet Propulsion - FEB180206

OUTCOME BASED EDUCATION

For the implementation of an outcome-based education the first requirement is to develop an outcome based curriculum and incorporate an outcome-based assessment in the education system. By going through outcome-based assessments, evaluators will be able to evaluate whether the students have achieved the outlined standard, specific and measurable outcomes. With the proper incorporation of outcome-based education there will be a definite commitment to achieve a minimum standard for all learners without giving up at any level. At the end of the programme running with the aid of outcome-based education, a student will be able to arrive at the following outcomes:

PO1 **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2 **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using principles of mathematics, natural sciences, and engineering sciences.

PO3 **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.

PO4 **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.

PO5 **Modern tool usage:** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6 **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.

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

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

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES

Mechanical Engineering Programme Students will be able to:

PSO-1 Apply their knowledge in the domain of engineering mechanics, thermal and fluid sciences to solve engineering problems utilizing advanced technology.

PSO-2 Successfully apply the principles of design, analysis and implementation of mechanical systems/processes which have been learned as a part of the curriculum.

PSO-3 Develop and implement new ideas on product design and development with the help of modern CAD/CAM tools, while ensuring best manufacturing practices

FEB110001: ENGINEERING MATHEMATICS-I

Program : Bachelor of Engineering **Subject / Branch :** ALL

Year : 1st **Semester :** I

Course title : Engineering mathematics-I **Course code :** FEB110001

Course type : Basic Science Courses **Course credit :** 05

Pre-requisite : Algebra, Trigonometry, Geometry

Rationale : The study of rate of changes, understanding to compute area, volume and express the function in terms of series, to apply matrix algebra.

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	2	0	5	5	70	30	30	20	150

Course Objective :

(a) To recall and remember basics of matrices,integration, sequence and series and differential calculus.
(b) To understand the concepts of basic mathematical methods for matrices, integration, sequence and series and differential calculus.
(c) To apply methods to solve engineering problems.
(d) To analyze engineering problems and evaluate.
(e) To solve and evaluate the problems using matrices, integration, sequence and series and differential calculus.

Content

Unit	Description in detail	Teaching Hours	Weightage
I	Indeterminate Forms and L'Hôspital's Rule. Improper Integrals, Convergence and divergence of the integrals, Beta and Gamma functions and their properties. Elementary row operations in Matrix, Row echelon and Reduced row echelon forms, Rank by echelon forms, Inverse by Gauss-Jordan method, Solution of system of linear equations by Gauss elimination and GaussJordan methods. Eigen values and eigen vectors, Cayley-Hamilton theorem, Diagonalization of a matrix.	12	25 %
II	Convergence and divergence of sequences, The Sandwich Theorem for Sequences, The Continuous Function Theorem for Sequences, Bounded Monotonic Sequences, Convergence and divergence of an infinite series, geometric series, telescoping series,Combining series, Harmonic Series, Integral test, The p - series, The Comparison test, The Limit Comparison test, Ratio test, Raabe's Test, Root test, Alternating series test, Absolute and Conditional convergence, Power series, Radius of convergence of a power series, Taylor and Maclaurin series. Fourier Series of $2n$ periodic functions, Dirichlet's conditions for representation by a Fourier series, Orthogonality of the trigonometric system, Fourier Series of a function of period $2n$, Fourier Series of even and odd functions, Half range expansions.	14	30 %
III	Limit and continuity of function of several variables, partial derivatives, directional derivatives, total derivatives, Chain rule, derivatives of implicit functions, Euler's theorem on homogeneous functions, Taylor's and Maclaurin's expansion for function of two variables, Extrema of function of several variables, Application of Lagrange method of undetermined multipliers, Tangent plane and normal line	10	20 %
IV	Multiple Integration: Double integrals, change of order of integration, Change of variables, Applications: areas and volumes Triple integrals, orthogonal curvilinear coordinates, Simple applications involving cubes, sphere and rectangular parallele	12	25 %

	pipeds; Jacobian, Multiple integral by substitution. Applications of definite integrals to evaluate surface areas and volumes of revolutions.		

Reference Books :.

1. Maurice D. Weir, Joel Hass, Thomas' Calculus, Early Transcendentals, 13e, Pearson, 2014.

2.Howard Anton, Irl Bivens, Stephens Davis,Calculus,10e,Wiley,2016.
3. James Stewart, Calculus: Early Transcendentals with Course Mate, 7e, Cengage, 2012.
4. Elementary Linear Algebra, Applications version, Anton and Rorres, Wiley India Edition.

5. T. M. Apostol, Calculus, Volumes 1 & 2, Wiley Eastern

Suggested Readings :

1. Swaym video lecture.
2. Mathematics magazine

Online Resources :

1. http://nptel.ac.in
2. https://ocw.mit.edu/courses
3. https://www.edx.org

Practical / Activities :

1. Problems solving.
2. Tutorial solving.
3. Seminar by students.

Course Outcome :

After learning the course the students should be able to

CO 1: To apply differential and integral calculus to improper integrals and to determine applications of definite integral. Apart from some other applications they will have a basic understanding of indeterminate forms, Beta and Gamma functions.

CO 2:To apply the various tests of convergence to sequence, series and the tool of power series and fourier series for learning advanced Engineering Mathematics.

CO 3:To compute directional derivative, maximum or minimum rate of change and optimum value of functions of several variables.

CO 4:Mathematics has the potential to understand the core Technological studies

CO 5:To compute the areas and volumes using multiple integral techniques.

CO 6:To perform matrix computation in a comprehensive manner.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	2	1	1	1	-	-	-	-	1	1	-	-	-	-
CO-2	1	1	2	-	2	-	-	-	-	-	-	-	-	-
CO-3	1	-	-	2	-	-	-	-	1	-	-	1	-	-
CO-4	-	2	-	-	1	-	-	-	-	1	-	-	-	-
CO-5	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO-6	2	-	-	1	-	-	-	-	2	1	-	1	-	-

FEB110202: ELEMENTS OF MECHANICAL ENGINEERING

Course Objective: Understanding of basic principles of Mechanical Engineering is required in various field of engineering

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
4	0	2	6	5	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	**Introduction:** Prime movers and its types, Concept of Force, Pressure, Energy, Work, Power, System, Heat, Temperature, Specific heat capacity, Change of state, Path, Process, Cycle, Internal energy, Enthalpy, Statements of Zeroth Law and First law.	4	25%
2	**Energy:** Introduction and applications of Energy sources like Fossil fuels, Nuclear fuels, Hydel, Solar, wind, and bio-fuels, Environmental issues like Global warming and Ozone depletion	3	
3	**Properties of gases:** Gas laws, Boyle's law, Charle's law, Combined gas law, Gas constant, Relation between Cp and Cv, Various non flow processes like constant volume process, constant pressure process, Isothermal process, Adiabatic process, Poly-tropic process	5	
4	**Properties of Steam:** Steam formation, Types of Steam, Enthalpy, Specific volume, Internal energy and dryness fraction of steam, use of Steam tables, steam calorimeters	6	30%
5	**Heat Engines:** Heat Engine cycle and Heat Engine, working substances, Classification of heat engines, Description and thermal efficiency of Carnot; Rankine; Otto cycle and Diesel cycles	5	

6	**Steam Boilers:** Introduction, Classification, Cochran, Lancashire and Babcock and Wilcox boiler, Functioning of different mountings and accessories	-	
7	**Internal Combustion Engines:** Introduction, Classification, Engine details, four-stroke/ two-stroke cycle Petrol/Diesel engines, Indicated power, Brake Power, Efficiencies	4	20%
8	**Pumps:** Types and operation of Reciprocating, Rotary and Centrifugal pumps, Priming	3	
9	**Air Compressors:** Types and operation of Reciprocating and Rotary air compressors, significance of Multistage	3	
10	**Refrigeration & Air Conditioning:** Refrigerant, Vapor compression refrigeration system, vapor absorption refrigeration system, Domestic Refrigerator, Window and split air conditioners	4	25%
11	**Couplings, Clutches and Brakes:** Construction and applications of Couplings (Box; Flange; Pin type flexible; Universal and Oldham), Clutches (Disc and Centrifugal), and Brakes (Block; Shoe; Band and Disc)	3	
12	**Transmission of Motion and Power:** Shaft and axle, Belt drive, Chain drive, Friction drive, Gear drive	4	

List of suggested Practical:-

1.To understand construction and working of various types of boilers.
2. To understand construction and working of different boiler mountings and accessories.
3. To determine brake thermal efficiency of an I. C. Engine.
4. To understand construction and working of different types of air compressors.
5. To demonstrate vapour compression refrigeration cycle of domestic refrigerator OR window air conditioner OR split air conditioner.

References Books:-

1. Elements of Mechanical Engineering by N M Bhatt and J R Mehta, Mahajan Publishing House
2. Basic Mechanical Engineering by Pravin Kumar, Pearson
3. Fundamental of Mechanical Engineering by G.S. Sawhney, PHI Publication New Delhi
4. Elements of Mechanical Engineering by Sadhu Singh S. Chand Publication
5. Introduction to Engineering Materials by B.K. Agrawal Tata Mcgraw Hill Publication, New Delhi

Course Outcomes:-

After learning the course the students should be able to

CO1 To understand the fundamentals of mechanical systems

CO2 To understand and appreciate significance of mechanical engineering in different fields of engineering

CO3 Enhancement of fundamental knowledge of Thermodynamics

CO4 Enhancement of fundamental knowledge of Fluid Mechanics and I.C. Engines

CO5 Acquiring knowledge of materials and their properties for engineering applications

CO6 Evaluate properties of steam. Demonstrate various types of boilers and their relative merits and demerits. Learning problem solving in particular domain.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	2	2	-	-	-	2	-	-	-	-	-	-	-	-	-
CO-3	2	-	1	1	-	-	-	-	-	-	-	-	-	-	-
CO-4	1	2	2	1	-	-	-	-	-	-	-	-	-	-	-
CO-5	1	-	-	-	1	1	1	-	-	-	-	-	-	-	-
CO-6		2	-	-	-	-	-	-	-	-	-	-	-	-	-

FEB110003: COMMUNICATION SKILL

Program : Bachelor of Engineering **Subject / Branch :**ALL

Year :1st **Semester :**I

Course title : Communication skill **Course code : :** FEB110003

Course type : Language and Communication **Course credit :** 04

Pre-requisite : Zeal to learn the subject

Rationale : The rationale of the curriculum is to help students refresh their knowledge of English language. It also targets the understanding of grammar, focusing on comprehension, and reading, speaking and writing skills. This would be developed through balanced and integrated tasks.

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
2	0	2	4	4	70	30	30	20	150

Course Objective :

(f) To enable understand
(g) To speak
(h) To Read and write

Content

Unit	Description in detail	Teaching Hours	Weightage
I	**Introduction:** Communication skills Process, types and levels of communication. Technical Communication and General Communication. Factors to be considered in technical communication Verbal and non-verbal communication (kinesics) Components of Non-verbal Communication (Kinesics) Barriers to effective communication. (Noise in oral and written communication) Communication across cultures.	11	25 %
II	**Presentation strategies for Communication:** Effective presentation strategies. Defining purpose, analysis of audience and locate, organizing contents. Preparing an outline of the presentation. Visual aids, nuances of delivery, Body language and effective presentation. Interviews Introduction, General preparations for an interview, Types of questions generally asked at the interviews. Types of interviews, Importance of nonverbal aspects.	11	25 %
III	**Public Speaking Skill:** Group Discussions Introduction, Group discussions as a part of the selection process, guidelines for group discussion. Role functions in group discussion. Letter - Writing Business Letters, Structure and types of a business letter, Letter of Inquiry, Letters of complaint, regret and adjustment. Technical reports Introduction, types of reports, structure of reports, objectives and characteristics of reports.	11	25 %
IV	**Tools of Communication Skill:** Technical Proposals Definition, Purpose, Types, Characteristics, Structure, Style and appearance. Effective Reading Skills Purpose of reading, skimming and scanning. Tips for improving comprehension skills. Job application Essential parts - Cover Letter and the 'resume'. Types of 'resumes' (Curriculum Vitae) Chronological 'resume', functional 'resume'.	11	25 %

Reference Books :

1. Practical English Usage, Michael Swan, OUP. 1995
2. Remedial English Grammar, F.T. Wood, Macmillan. 2007
3. Oxford Language Reference, (Indian Edition) OUP
4. On Writing Well, William Zinsser, Harper Resource Book. 2001
5. Communication Skills, Sanjay Kumar and Pushp Lata, Oxford University Press. 2011
6. The Study of Language, George Yule, CUP, 4th Edition. 2010
7. A Course in English Phonetics, T R Kansakar, Orient Longman. 1998
8. Spoken English, R K Bansal and J B Harrison, Orient Longman. 2013

Suggested Readings :

3. Repedex
4. Conversations books
5. Oral communication skill - calameo
6. Effective communication development

Online Resources :

1. https://youtu.be/MUGmEKrZXIY
2. https://youtu.be/srn5jgr9TZo
3. https://youtu.be/hE6I9apUvrk

Practical / Activities :

1. At the Airport
2. At the Railway station
3. Admission inquiry
4. At College
5. At Hotel
6. In Bank
7. In Grocery Shop
8. In Library
9. In Mall

Course Outcome :

CO1:Understand the basics of communication and its significance to the career as an engineer.

CO2 :Comprehend and express any idea/thought in an effective manner using the four basic communication skills: Listening, Reading, Speaking, Writing (LSRW).

CO3 : Make effective presentation, face job interview and participate in group communication fruitfully.

CO4 : Handle various professional communication situations more impressively and effectively.
CO5 : The student will acquire basic proficiency in English including reading and listening comprehension, writing and speaking skills.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	2	1	1	1	-	1	-	-	2	2	1	-	-	-
CO-2	1	1	-	-	-	1	1	1	1	1	-	1	-	-
CO-3	1	1	-	-	-	2	-	1	-	2	-	2	-	-
CO-4	-	-	-	1	-	-	1	2	1	-	1	1	-	-
CO-5	1	2	-	1	-	2	1	-	-	1	-	1	-	-

FEB110304: Elements of Electrical Engineering

Program:	Bachelor of Engineering	**Branch:**	Electrical Engineering
Year:	1st Year	**Semester:**	II

Coursetitle:	Element ofElectrical Engineering	**Course code**	FEB110304
Coursetype:	Engineering Science	**Course credit:**	05

Course Objective: Students are expected to learn the fundamentals of electrical engineering that will help them apply these concepts in everyday life. The course is divided into two parts: DC Circuit and AC Circuit. The course also discusses three-phase supplies that are used in many commercial, industrial, and agricultural applications. Considering the widespread use of batteries, a special unit of batteries has been introduced.

Teaching & Evaluation Scheme: -

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
4	0	2	6	5	70	30	30	20	150

Details Syllabus

Unit	Description in detail	Teaching Hours	Weightage
I	**Introduction Of D.C. Circuits:** Introduction, Ohm's Law, Application of Kirchhoff's Law, Nodal Analysis, Mesh Analysis, Series-Parallel of Resistance, Ideal and Practical Energy Sources, Line Regulation and Load Regulation, Source Transformation, Star-Delta Transformation, Temperature Co-efficient **Batteries and Fuel Cell:** Introduction of Batteries; The Simple cell, E.M.F and internal resistance of a cell; Primary and Secondary cells, Cell capacity; Types & Specifications of Batteries; Charging & Discharging of Battery; Safe disposal of Batteries; Fuel cell: Principle & Types of fuel cell.	10	18 %
II	**Electrostatic &Capacitor:** Electric charge and Laws of electrostatics; Definitions - Electric field, lines of force, electric field intensity, electric flux and flux density; Electrostatic induction; Gauss's law and its application; Dielectric strength; Capacitor; Capacitor in series and parallel, Energy stored in a capacitor. **Electro Magnetics:** Faradays Laws; Lenz's Law; Fleming's Rules; Effect of magnetic field on current carrying conductor; Magnetic circuits; Statically and dynamically induced EMF; Concepts of self-inductance, mutual inductance and coefficient of coupling; Inductance in series and parallel; Hysteresis and Eddy current losses; Energy stored in magnetic fields	14	25 %
III	**Single Phase A.C. Circuits:** Generation of sinusoidal voltage, Definition of average value, root mean square value, form factor and peak factor; Phasor representation of alternating quantities; Analysis with phasor diagrams of R, L, C, R-L, R-C and R-L-C circuits; Concepts of Real power, Reactive power, Apparent power and Power factor, Series, Parallel and Series - Parallel circuits; Power in AC circuit, Power factor improvement; Resonance in series and parallel circuits, Q-factor, Bandwidth and Selectivity. **Three Phase A.C. Circuits:** Necessity and Advantages of three phase systems, Generation of three phase power, Phase sequence, Balanced supply and Balanced load; Relationship between line and phase values of balanced three phase circuit; Power Measurement in balanced three phase circuits. Measure 3-Phase power bye watt-mater methods.	15	50 %
IV	**Electrical Wiring & Illumination:** Types of wires and cables; Types of Connectors & Switches; System of wiring, domestic and industrial wiring; Simple control circuit in domestic	04	07 %

	installation. Types of lamps, fixtures & reflectors; Illumination schemes for domestic, industrial & commercial premises; Lumen requirements for different categories **Safety & protection:** Safety precautions in handling electrical appliances; Electric shock, First aid for electric shock other hazards of electrical laboratories & safety rules; Grounding & Earthling - Importance of grounding and earthing, equipment for grounding, Methods of earthling; Circuit protection devices: Fuses, MCB, ELCB & Relays.		

Suggested Readings:

1. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.

2. Basic Electrical Engineering - Nagsarkar and Sukhija, Oxford University Press

Reference Books:

1. B.L. Theraja (2012), Electrical Technology, Vol – 1, S. Chand.
2. D.P. Kothari and I.J. Magrath (2013), Theory and Problems in Basic Electrical Engineering, Prentice Hall, India.
3. Parker Smith (2003), Problems in Electrical Engineering, CBS Publishers

List of Practical / Activities:

4. To perform Ohms Law
5. To perform Kirchhoff's Law.
6. To study about different types of Fuel Cell and Battery
7. To perform R-L Series circuit
8. To study Resonance in AC-RLC series Circuit
9. To study about Star-Delta connection.
10. To study about power measurement using Two Watt-Meter Method.
11. To Study about MCB, ELCB and Fuse.
12. To study about different types of cable.
13. To study about different types of Fuel Cell and Battery.

Online Resources:

1. Preparation of videos for showing real life applications, Preparation of animations for understanding the concepts,
2. Preparation of Pictures with annotations to explain the concepts.

Course Outcome:

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

CO-1: Understand electrical current, potential difference, power and energy, sources of electrical energy, resistance and its behavior with temperature.

CO-2: Use the Ohm's Law and the Kirchhoff's Law and star delta transformation for solving resistive series, parallel and series-parallel circuits.

CO-3: Define Electric field, lines of force, electric field intensity, electric flux, flux density and permittivity. Capacitor, charging and discharging phenomena of capacitors and calculations of capacitance for capacitors connected in series and parallel circuits.

CO-4: Understand Concepts of Real power, Reactive power, apparent power and Power factor and perform calculations of these quantities for series and parallel R-L-C circuits.

CO-5: Understand the importance of safety and the precaution to be taken while working with electrical equipment and accessories. Understand the working principle, usage and construction of circuit protection devices such as fuse, MCB, ELCB & Relays

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	3	-	2	3	-	-	-	1	-	-	1	-	3	1
CO-2	2	-	-	-	-	-	-	-	1	-	-	-	-	2
CO-3	1	1	-	-	1	-	-	-	-	-	-	-	2	1
CO-4	-	-	2	-	-	-	-	-	-	-	1	-	-	-
CO-5	2	-	-	-	-	1	-	-	-	-	-	-	1	1

FEB110006:PHYSICS

Program : Bachelor of Engineering **Subject / Branch :** Mechanical , Civil

Year : 1st **Semester :** I

Course title : Engineering physics-I **Course code** FEB110006

Course type : Basic Science Courses **Course credit :** 04

Pre-requisite : General lows of physics

Rationale : The study of Material and understand its property , and understand the phenomenon of physics. Understand the waves. Calculate the basic measurement.

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Th: -Theory, Tu: - Tutorial, P: - Practical, SEE: - Semester End Examinations, PA: - Progressive Assessment.

Course Objective :

(a) To recall and remember basics of physics
(b) To understand the concepts of semiconductor material and its property. Also study the superconductivity of material. And understand the waves.
(c) To apply theory on practical basis.

(d) To analyze the lows and too see how they use it.
(e) To solve the problems and make easy to our life

Content

Unit	Description in detail	Teaching Hours	Weightage
I	**Properties of Matter:** Concept of Load, Stress and Strain , Hook's Law, Stress-Strain Diagram , Ductility, Brittleness and Plasticity , Elastic behavior of solids, Working stress and factor of safety, Factors affecting elasticity, Types of Elasticity, Twisting couple on a cylinder or wire-shaft, Torsional Pendulum , Cantilever-Depression of Cantilever, Young's modulus by Cantilever, I-shape Griders, Viscosity and comparison of viscosities	8	19 %
II	**Waves, Motion and Acoustics:** Simple Harmonic motion, Free, forced, resonance, damped and undamped vibration, Damped harmonic motion, Force vibration and amplitude resonance, Velocity resonance and energy intake, Wave motion, transverse and longitudinal vibration, Sound absorption and reverberation, Sabine's formula and usage (excluding derivation), Acoustic of building	7	19%
III	**Ultrasonic and Non distractive testing (NDT):** Ultrasonic waves, Properties of ultrasound, Production of ultrasonic waves : Piezoelectric andmagnetostriction method, Detection of ultrasound, Application of ultrasound, Introduction of NDT, Advantages of NDT, NDT through ultrasound	9	25 %

IV	**Superconductivity:** Introduction of Superconductivity, Properties of superconductor, Effect of magnetic field, Meissner effect, Pressure effect, Impurity effect, Isotopic mass effect, Mechanism of Superconductivity : BCS Theory, Penetration depth : Magnetic field, Josephson's junction and its application, Application of superconductors	7	17 %
V	**Lasers :** Properties of Laser, Einstein's theory of matter radiation : A and B coefficients, Amplification of light by population inversion, Different types of lasers , gas lasers (He-Ne) solid- state lasers(ruby), Properties of laser beams: mono-chromaticity, coherence, directionality and brightness, laser speckles, Applications of lasers in science, engineering and medicine.	7	20 %

Reference Books :.

1. Engineering Physics by Dattu R Joshi, McGraw hill Publications
2. Engineering Physics by Shatendra Sharma & Jyotsan Sharma, Pearson Publication
3. Mechanics of Materials, SI Edition, 9th Edition, Barry J. Goodno, James M. Gere, Published: © 2018 Print ISBN: 9781337093354

Suggested Readings :

1. SWYAM video lecture.
2. NPTEL videos lecture.

Online Resources :

1.The Flying Circus of Physics 2ndedition by Jearl Walker, Wiley India

2.Six Ideas that shaped physics by Thomas A Moore, McGraw Hill education

3.http://www.howstuffworks.com/--Tech stuff

4.How things works by Louis A Bloom field ,Wiley Publications

5.Physics of Everyday Phenomena by W. Thomas Griffith, Juliet Brosing, McGraw Hill Education

List of Experiments:

1. Diffraction and interference experiments (from ordinary or laser pointers);

measurement of speed of light modulation; minimum deviation from a prism.

2. Measurement of the Distance using Ultrasonic Sensors. light on a table

3. Study of Object Detection using Ultrasonic Sensors.

4. Melde's Experiment Transverse and Longitudinal Modes

5. To determine the frequency of given laser source.

6. Frequency of AC Supply-Sonometer method

7. Wavelength of Light -Diffraction Grating Using LASER

8. Acoustic grating method set up for measurement of velocity of ultrasonic waves in liquid.

9. Melde's experiment

10 Resonator

11. Study of Damped Simple Harmonic Motion

12. Newton's rings, Determination of using sodium light.

13. Calibration of Spectrometer & determination of unknown wavelength

14. Dispersive curve of a prism

15. Study of Fabry-Perot Etalon

16. Study of Lloyd's Mirror

17. Study of Double Refraction in Calcite Prism

18. Virtual Heat & Thermodynamics Lab

19. Virtual Advanced Mechanics Lab

20. Virtual Laser Optics Lab

21. Virtual Harmonic Motion & Waves Lab

22.Virtual Optics Lab

23. Virtual Modern Physics Lab

24. Virtual Lab on oscillations

25. Virtual Physical Sciences Lab

Course Outcomes :-

CO-1: Able to understand, necessary parameters of different materials in different domains.
CO-2: Demonstrate the behavior of material in different fields based on their properties.
CO-3: Enhance practical capability and skills for modules using different materials and selection of material for system designs.
CO-4: The student will demonstrate understanding of basic theory, properties and applications of Superconductivity
CO-5: The student will demonstrate understanding the basic principles, properties and applications of associated with Waves, Motion and Acoustics.
CO-6: The student will demonstrate understanding of basic principles, properties, type and application Lasers.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)													
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	1	1	1	-	-	-	-	-	-	1	-	-	-
CO-2	1	1	2	1	-	1	-	-	-	-	1	-	1	1
CO-3	-	1	1	1	1	-	1	-	1	1	-	1	-	-
CO-4	2	-	1	-	-	2	-	-	-	-	1	-	-	-
CO-5	1	2	-	2	1	1	-	-	-	1	-	-	1	-
CO-6	2	-	1	1	1	1	-	-	-	1	-	1	-	-

FEB110206: BASIC WORKSHOP

Course Objective:

1. To impart training to help the students develop engineering skill sets.

2. To inculcate respect for physical work and hard labour. 3. To get exposure to interdisciplinary engineering domain

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
0	0	4	4	2	00	00	50	50	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	**Introduction:** Workshop layout, Importance of various sections/shops of workshop, Types of jobs done in each shop, General safety rules and work procedure in workshop	6	15
2	**Fitting:** Select appropriate fitting tools for the Required application, Prepare the simple jobs as per specification using fitting tools, Safety precautions	8	20
3	**Tin Smithy:** Demonstration of various tin smithy tools and sheet metal operations such as shearing, bending and joining, Preparation of tin smithy job, Safety precautions	6	15
4	**Carpentry:** Types, sketch, specification, material, applications and methods of using of carpentry tools-saws, planner, chisels, hammers, pallet, marking gauge, vice, try square, rule, etc, Types of woods and their applications, Types of carpentry hardwires and their uses, Demonstration of carpentry operations such as marking, sawing, planning, chiseling, grooving, boring, joining, etc, Preparation of wooden joints, Safety precautions.	8	20

5	**Pipefitting:** Types, specification, material and applications of pipe fittings, Types, specifications, material, applications and demonstration of pipe fitting tools, Demonstration of pipe fitting operations such as marking, cutting, bending, threading, assembling, dismantling, etc, Preparation of pipe fitting jobs	6	15
6	**Metal joining:** 1Select appropriate equipment and consumables for required application, Prepare the simple jobs as per specification using proper metal joining and cutting method, Safety precautions	6	15

List of Suggested Practical:-

1. Prepare carpentry and fitting shop layout.
2. Prepare simple fitting job as per given drawing.
3. Prepare tin smithy job as per drawing having shearing, bending, joining and riveting.
4. Prepare pipe fitting jobs as per given drawings.
5. Prepare jobs using arc welding, gas cutting, spot welding, brazing and soldering process.

References Books:-

1. Work shop technology by Hajra Chaudhary
2. Work shop technology by Chapmen

List of Suggested Book:

1. Work shop technology by Hajra Chaudhary

Course Outcomes :

CO1 To acquire skills in basic engineering practice
CO2 To acquire practical skills in the trades
CO3 Understand modern manufacturing operations, including their capabilities, limitations, and how to design economically.
CO4 Welding and soldering operations
CO5 Identify and apply suitable tools for machining processes including turning, facing, thread cutting and tapping

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	-	2	-	-	1	-	-	-	1	-	-
CO-2	2	-	-	-	-	-	-	-	1	-	-	-	1	-	-
CO-3	1	1	1	-	1	-	-	-	-	-	-	-	-	1	-
CO-4	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-5	1	-	-	-	1	-	-	-	-	-	-	-	1	-	-

FEB110007: INDUCTION PROGRAM

Initial Phase (First Day)		
Following are the activities to be carried on the first day: ● Orientation Programme ● Know your Department/Institute ● Know your university ● Know hostel and other amenities ● Information about Student Diary and Induction Program		
Regular phase (13 Days) The Regular Phase consists of 13 days, each day is of 6 hours. It covers all the 8 different activity modules. For each module, the objectives, suggested activities and guidelines are provided herewith. Institute can use additional relevant activities in additional in suggested activities for each of the phases.		
Module Name	**Objectives**	**Suggested Activities**
1. Physical Activity **(24 hours)**	1. Improve bone health 2. Improve cardio respiratory and muscular fitness 3. Understand the anatomy, basic biomechanical principles 4. Examine the effect of nutrition, rest and other lifestyle factors that contribute to the better health.	1. Running/Jogging 2. Brisk Walk 3. Cycling 4. Heavy yard work 5. Swimming 6. Yoga/Pranayam 7. Aerobics 8. Outdoor Sports/Indoor Games(In addition to cricket, Volleyball, Badminton, Chess, Carom, Table Tennis, Other games like Critical Thinking, Math skill developing Games, Memory Games can be included.) 9. Calculate Body mass index of each students and explain their fitness level from it. 10. Tree Plantation 11. Gardening

Guidelines:

- Half an hour Yoga/Pranayam followed by physical activities including various games.
- Refer this link for Yoga/Pranayam https://s3-ap-southeast-1.amazonaws.com/ministry- of-yoga/images/1528106718.pdf

Module Name	Objectives	Suggested Activities
2. Creative Arts **(12 hours)**	1. Develop creativity and imagination through a range of complex activities. 2. Improve the student's ability to control materials, tools and techniques. 3. Develop increasing confidence in the use of visual and tactile elements and materials.	1. Make a model of any physical object related to Engineering Design 2. Crafting 3. Painting 4. Sculpture 5. Pottery 6. Music 7. Dance
Guidelines: • Use any activities leading to creative thing and practice. • Show the video demonstrating the creative ideas and thinking. • Show the video demonstrating phenomenon performance using innovation in different areas of humanity and social science. • Demonstrate the story of leaders with the context of how with their creative vision, with all odds they achieved success.		
Module Name	**Objectives**	**Suggested Activities**

3. Universal Human Values **(12 hours)**	1. Impart universal human values in students. 2. Enable students to live in harmony within themselves, with family, with society and the nature 3. Initiate the process of self exploration and self investigation within themselves about their understanding of happiness.	1. Showing Motivational Movies. 2. Social Activities like visit of orphanage, old age home, blind peoples' school etc. 3. Swachchhata Mission Activities. 4. Awareness regarding environmental issues and remedies. 5. Spread awareness about blood donation, organ donation, precaution to avoid malaria in monsoon etc. 6. Discuss autobiography of legendary persons who practiced universal human values in their life and work. 7. Conduct universal human values group discussions.

Guidelines:

- Use the materials and activities covered in AICTE Guidelines. The faculties trained from institute will take leadership role to rollout it at institute level.

Module Name	Objectives	Suggested Activities
4. Literary **(12 hours)**	1. Inculcate the habit of active (or interactive) consumption of the best content available in literature. 2. Develop thinking skills. 3. Improve reading abilities and attitude.	1. Digital literacy and use of Internet 2. Basic Mathematics for Solving Real World Problems 3. Use of Scientific Calculator in Engineering 4. General Knowledge Quiz Competition 5. Vedic Mathematics 6. Reading/writing/speaking/listening 7. Debating/Elocution 8. Enacting a play 9. Book review

Guidelines:

- Use the video lectures to literate students in different skills needed for day-to-day life and need.
- Motivate students to create the nature of inquiry and reading habits.
- Arrange the various competitions like Elocution, Essay writing, Storytelling, Book reviews etc.
- Writing the review of the well known books, movies etc and sharing.

Module Name	Objectives	Suggested Activities

5. Proficiency modules **(6 hours)**	1. Determining English proficiency level of students and mentoring accordingly. 2. Learn the mining vocabulary, idioms, and expressionsand understand their meanings in context. 3. Develop ability to write a paragraph about general topics by using the English language correctly. 4. Realize the importance of English language as a global business language.	1. English general diagnostic test to determine student's English proficiency level. 2. Mentoring students to improve in English proficiency according to his/her proficiency level based on test.

Guidelines:

- An MCQ test of **45 minutes** should be conducted covering basic grammar and vocabulary.
- Group the students in three groups based on test result in three proficiency levels:
  - Unsatisfactory
  - Satisfactory
  - Good
- Following activities are to be used to uplift proficiency levels of students.
  - Motivational movies, documentary
  - Language games
  - Essay/story writing
  - Ice breaking games.
- Separate set of activities from suggested list should be used for different groups.

Module Name	Objectives	Suggested Activities
6. Lectures by Eminent people **(3 hours)**	1. Motivation through knowing experience of successful person. 2. Meet and interact with eminent personalities of different fields.	1. To conduct lecture by eminent people. 2. Interaction with leaders, experts, entrepreneurs, contributors and successful personalities

Guidelines:

- 3 expert lectures each of 1 hour per week.
- Multiple divisions can be combined in an expert lecture.
- External expert should be invited.
- Expert can be from academic, industry, research organization, social organization etc.
- An individual successful person in any of the field can be invited.
- The aspect to be addressed may be social / economical / engineering / entrepreneurship/ spiritual/ humanity science.

Module Name	Objectives	Suggested Activities

7. Visit to Local Area and Industry **(1 Full day)**	1. To familiarize students with the local area. 2. Sensitise with the different aspects of the life including social services and heritage	1. A full day visit covering at least 2 or 3 places. 2. List of possible places A. Centre of excellence B. Elite Academic Institutes C. Research institute D. Hospitals E. Industry visit D. Heritage places

Guideline and References:

- Institute can arrange visit to public, social or specifies places to give insight of the activities and overall socio-economic contribution of such places.
- The uniqueness or impact of such visits should be highlighted.

Module Name	Objectives	Suggested Activities
8. Innovation **(3 hours)**	1. Introduce the student about innovation in different fields 2. Make students aware about innovative and modern practices and products in their own branch 3. Create awareness about support available for start-up and innovation	1. Lectures by senior faculties. 2. Showing videos demonstrating innovation. 3. Introducing innovative technology/products. 4. Awareness regarding SSIP Scheme of Government of Gujarat 5. Awareness about Government initiatives in areas of innovations and supports for start- up, Incubation, Entrepreneurship etc.

Guideline:

- Video lectures from leaders and innovators.
- TeDx Talks.
- Government Policy documents for different schemes.

Closing Phase (Last Day)

The closing phase is the last day of the Induction Program and covering conclusion and summary of the Induction Program.

Conclusion and summary:

- Guiding students for preparation of student report about Induction Program.
- Instruct students regarding submission and examination of the Induction Program.
- Address by HODs/Senior faculties regarding branch/discipline and career option in respective branch.
- Introduce about the engineering and its importance in life and their responsibilities towards the society.

FEB120001-ENGINEERING MATHEMATICS – II

Program : Bachelor of Engineering **Subject / Branch :** ALL

Year : 1st **Semester :** II

Course title : Engineering mathematics-II **Course code :** FEB120001

Course type : Basic Science Courses **Course credit :** 05

Pre-requisite : Calculus, fourier series

Rationale : To compute line integrals, solution techniques of higher order ordinary differential equations, fourier integral representation.

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	2	0	5	5	70	30	30	20	150

Course Objective :

(a)To develop logical understanding of the subject.
(b) To develop mathematical skill so that students are able to apply mathematical methods & principals in solving problem from Engineering fields.
(c) To make aware students about the importance and symbiosis between Mathematics and Engineering.

Content

Unit	Description in detail	Teaching Hours	Weightage
I	Laplace Transform, Properties of Laplace Transform, Laplace transform of periodic functions. Finding inverse Laplace transform by different methods, convolution theorem. Evaluation of integrals by Laplace transform, solving ODEs and PDEs by Laplace Transform method. Fourier Integral transform, Fourier Cosine Integral and Fourier Sine Integral	14	30 %
II	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.	10	20 %
III	Ordinary differential equations of higher orders, Second order linear homogeneous differential equations with variable coefficients, Cauchy-Euler equation, Existence and Uniqueness of solution, Linear Dependence and Independence of solution, Wronskian, Non homogeneous Ordinary differential equations, method of undetermined coefficient, method of variation of parameters	12	25 %
IV	Series solution of Ordinary differential equations, Power series solutions; Legendre's equation, Legendre polynomials, Frobenius method, Bessel functions of the first kind and their properties Vector Fields, Vector derivatives, Arc length, Curvature and Torsion, Gradient of Scalar Field, Directional Derivative, Divergence of a Vector Field, Curl of a Vector Field Scalar line integrals, vector line integrals, scalar surface integrals, vector surface integrals, Theorems of Green, Gauss and Stokes.	12	25 %

Reference Books :.

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley and Sons.
2. Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage.
3. Dennis G. Zill, 4th edition, Advanced Engineering Mathematics, 4th Edition, Jones and Bartlett Publishers.
4. Maurice D. Weir, Joel Hass, Thomas' Calculus, Early Transcendentals, 13e, Pearson, 2014.

Suggested Readings :

7. Swaym video lecture.
8. Mathematics magazine

Online Resources :

4. http://nptel.ac.in
5. https://ocw.mit.edu/courses
6. https://www.edx.org

Practical / Activities :

3. Problems solving.
4. Tutorial solving.
5. Seminar by students.

Course Outcome :

After learning the course the students should be able to

CO 1 To apply mathematical tools needed in evaluating vector calculus and their usage like Work, Circulation and Flux.
CO 2 To apply the laplace transform as tools which are used to solve differential equations and fourier integral representation.
CO 3 To apply effective mathematical tools for the solutions of first order ordinary differential equations.

CO 4 To apply effective mathematical methods for the solutions of higher order ordinary differential equations.

CO 5 To implement the solution for engineering problem
CO 6 To use series solution methods and special functions like Bessels' functions.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	2	1	1	1	-	-	-	-	1	1	-	-	-	-
CO-2	1	1	2	-	2	-	-	-	-	-	-	-	-	-
CO-3	1	-	-	2	-	-	-	-	1	-	-	1	-	-
CO-4	-	2	-	-	1	-	-	-	-	1	-	-	-	-
CO-5	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO-6	2	-	-	1	-	-	-	-	2	1	-	1	-	-

FEB120102: ELEMENTS OF CIVIL ENGINEERING

Program : Bachelor of Engineering **Subject / Branch :** Civil Engineering

Year :1st **Semester :**II

Course title : Element of Civil Engineering **Course code :** FEB120102
Course type : Engineering Science courses **Course credit :** 05

Pre-requisite : Knowledge of physics and mathematics up to 12 science level.

Rationale : Basic Civil Engineering knowledge is essential for all Engineers

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
4	0	2	6	5	70	30	30	20	150

Course Objective :

(a) To enable learn about Building Planning and Construction
(b) To enable learn about Transportation Engineering
(c) To enable about basic of Surveying

Content

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction** **Basic Understanding**: What is Civil Engineering / Infrastructure? Basics of Engineering and Civil Engineering; Broad disciplines of Civil Engineering; Importance of Civil Engineering, Possible scopes for a career. **History of Civil engineering**: Early constructions and developments over time; Ancient monuments & Modern marvels; Development of various materials of construction and methods of construction; Works of Eminent civil engineers **Fundamentals of Building Materials**: Stones, bricks, mortars, timber, sand, Aggregates, Plain Reinforced & Prestressed Concrete, Construction Chemicals; Structural steel, High Tensile Steel, Carbon Composites; Plastics in Construction	**10**	**20%**
II	**Surveying, Leveling and Mapping:** **Introduction:** Definition of Surveying, Aims and applications, Fundamental principles of surveying, Classification of surveying, Plans and maps, Scales, Units of measurement. **Linear Measurement:** Methods, Instruments used in chain surveying, Selection of stations, Chaining, Ranging, Offsetting, Errors in chaining and correction, Conventional symbols. **Angular Measurement:** Instruments used, Types of compass, Types of meridians and bearings, Measurement of bearings, computation of angles. Compass traversing and correction of bearings for local attraction. **Leveling:** Aims and applications, Definition of various terms, Instruments for leveling, Methods of leveling, Recording observations in level-book, Computing reduced levels by HI and rise & fall method, Definition of contour, Characteristics of contours of different terrains and application of contour maps, Introduction to planimeter, introduction to Global	**20**	**40%**

	positioning system(GPS),		
III	**Structural Engineering**: Types of buildings; tall structures; various types of bridges; Water retaining structures; Other structural systems; **Hydraulics, Hydrology &Water Resources Engineering**: Fundamentals of fluid flow, basics of water supply systems; Underground Structures; Underground Structures Multipurpose reservoir projects	**10**	**20%**
IV	**Traffic & Transportation Engineering**: Investments in transport infrastructure development in India for different modes of transport; Developments and challenges in integrated transport development in India: road, rail, port and harbour and airport sector; PPP in transport sector; Intelligent Transport Systems; Urban Public and Freight Transportation	**05**	**15%**
V	**Industrial lectures**: Case studies of large civil engineering projects by industry professionals, covering comprehensive planning to commissioning	**03**	**05%**

Reference Books :

1. Basic Civil Engineering, Palanichamy, McGraw Hill
2. Basic Civil Engineering, Satheesh Gopi, Pearson Publishers
3. Surveying Vol. I Author: Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar Jain16th Edition Publisher: Laxmi Publication Delhi
4. Elements of Civil Engineering Author: Dr. R.K. Jain and Dr. P.P. Lodha Publisher: McGraw Hill Education, India Pvt. Ltd.
5. Building Construction and Construction Material Author: G.S.Birdie and T.D. Ahuja Publisher: Dhanpat Rai Publishing Company
6. Civil Engg. Drawing Author: S. C. Rangwala Publisher: Charotar Pub. House Anand
7. Building ConstructionAuthor: Dr. B. C. Punmia, Ashokkumar Jain, Arunkumar JainPublisher: Laxmi Pub. Delhi
8. Basic Civil Engineering M.S.Palanichamy

Web Material Links:

1. http://nptel.ac.in/courses/105107122/
2. http://nptel.ac.in/courses/105107157/
3. http://nptel.ac.in/courses/105101087/
4. http://nptel.ac.in/courses/105104100/
5. www.svnit.ac.in

Practical / Activities :

1. Unit conversation Exercise
2. Chart preparation of various materials. Collection of rate and sample. (field visit)
3. Components of building (field visit)
4. Planning of a residential building(plan, elevation& section of simple 1 room)
5. Linear and angular measurements (Chain and Compass) (in field with instrument)
6. Introduction to Theodolite & total station
7. Determine R.L of given point by Dumpy level. (in field with instrument)
8. Videos showing working of construction Equipment's
9. Presentation on BRTS / mass transportation system (city bus)
10. Seminar on green building & smart city

Course Outcome :

After learning the course, the students should be able to:

CO 1 Carry out simple land survey to prepare maps with existing details.
CO 2 Find out area of irregular shaped plane figures.
CO 3 Understand building plan elevation and section.
CO 4 Get acquainted with construction materials.
CO 5 Get acquainted with hydrological cycle and hydraulic structures.
CO 6 Get acquainted with mass transportation systems.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	3	-	-	-	3	3	2	3	2	2	1	1	-	2
CO-2	3	2	2	1	2	-	-	-	-	-	-	-	2	2
CO-3	3	2	2	1	2	-	-	-	-	-	-	-	2	3
CO-4	3	2	2	1	2	-	3	-	-	-	-	-	-	1
CO-5	3	2	2	1	2	-	-	-	-	-	-	-	-	-
CO-6	3	3	3	2	3	-	-	-	-	3	3	-	2	-

FEB120403: COMPUTER PROGRAMMING WITH C

Objective: An introduction to computer concepts, logic, and computer programming.
The major objective is to provide students with understanding of code organization and functional hierarchical decomposition with using complex data types.
The course is designed to provide complete knowledge of C language. Students will be able to develop logics which will help them to create programs, applications in C. Also by learning the basic programming constructs they can easily switch over to any other language in future.

Credit: 5 **L-T-P: 4-0-2**

Unit	Description in detail	Hours	Weightage
I	**Introduction to Computer and Programming:** Introduction, Architecture and functions of various components of computer, Concepts of Hardware and software, Types of software, Compiler and interpreter, Concepts of Machine level, Assembly level and high level programming, Algorithms, Flowchart, Programming Languages, Types of Languages **C Fundamentals:** Features of C Language, Basic Structure of C Program, Character Set, C Tokens, Keywords and Identifiers, Constants, Variables, Data Types, Declaration of Variables, Declaration of Storage Classes ,Operators and Expressions, Managing Input and Output Operations	**10**	**20%**
II	**Control Structure in C:** Simple if Statement nested if, if-else, Nesting of if Else, The Else if Ladder, switch-case, Looping constructs: for, while, do-while, Nesting Looping , break and continue, goto statement. **Arrays and String:** One-dimensional arrays, Multi-dimensional arrays, String variables, Arithmetic Operations on Characters, Comparison of Strings, Table of Strings, String Storage, Built-in-string functions	**10**	**23%**

III	**Functions:** Concepts of user defined functions, prototypes, definition of function, parameters, parameter passing, calling a function, recursive function, Macros, Pre-processing **Recursion:** Recursion, as a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort , Merge sort.	**9**	**22%**
IV	**Pointers:** Introduction, Understanding of pointers, Accessing the address of a variable, Declaring and initializing pointers, Accessing a variable through its pointers, Pointers expressions, Pointer increments and scale factor, Pointers and arrays, Pointers and Character Strings, Pointers on pointers, Pointer as function argument, Functions returning pointer, Pointers to functions, Pointers and structures. **Dynamic Memory Allocation:** Introduction to Dynamic memory allocation, malloc, calloc and realloc	**8**	**19%**
V	Structure and Unions: Introduction, Structures definition, Giving values to members, Structure initialization, Comparison of structure variables, Arrays of structures, Arrays within structure, Structure and function, Unions, Size of structures, Bit fields. File Management: Introduction, Defining and opening a file, Closing a file, Input/output operations on files, Error handling during I/O operations, Random access to files, Command line arguments.	**8**	**16%**

Reference Books:

1. Programming in ANSI C by Balagurusamy, 7th Ed., Tata McGraw Hill
2. Programming with C, Second edition, by Gottfried, Tata McGraw-Hill Publishing
3. Company Limited.
4. Let Us C by YashvantKanetkar, 12th Ed., BPB Publication
5. Programming in C by Ashok N. Kamthane, 2nd Ed., Pearson Education
6. Let us C, Yashavant P. Kanetkar, BBP Publications, Delhi
7. “Computer programming”, Pearson Education, 2007 by Ashok N. Kamthane.
8. Computer Concepts and Programming in C, R.S. Salaria, Khanna Publishing.

Course Outcome:

After learning the course the students should be able to:

CO-1: Understand the fundamentals and structure of a C programming language

CO-2: Apply the loops, arrays, functions and string concepts in C to solve the given problem

CO-3: Apply the pointers and text input output files concept to find the solution for the givenapplications.

CO-4: Use the Enumerated, Data types, Structures and Unions

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	1	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-2	-	3	1	-	-	-	-	-	-	-	-	-	2	-
CO-3	-	3	1	-	-	-	-	-	-	-	-	3	2	-
CO-4	1	3	-	-	-	-	-	-	-	-	-	-	2	-

FEB120204: ENGINEERING GRAPHICS

Course Objective:-

Engineering Graphics is the language of communication for Engineers. Engineering Graphics course provides tools and techniques of communication for various fields of Engineering

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
03	00	04	04	05	70	30	50	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	**INTRODUCTION TO ENGINEERING GRAPHICS**: Scope of Engineering Drawing in all Branches of Engineering, Uses of Drawing Instruments and Accessories, Introduction to Drawing Standards BIS-SP-46, Representative Fraction, Types of Scales (Plainand Diagonal Scale), Dimensioning Terms and Notations, Types of Arrowheads, Lines, Lettering, Numbering and Dimensioning.	03	5%
2	**ENGINEERING CURVES**: Classification of Engineering Curves, Application of EngineeringCurves, Constructions of Engineering Curves - Conics, Spirals, Involutes and Cycloids with Tangents and Normal.	05	10%
3	**PROJECTIONS OF POINTS AND STRAIGHT LINES**:- Introduction to principal planes of projections, Notation System- Points in First, Second, Third and Fourth quadrants, Projections of line Parallel to Two and Perpendicular to one of the principal planes, Line parallel to one and inclined to two principal planes, Line inclined to all the three principal planes, True length of the line and its inclination with the reference planes	06	15%
4	**PROJECTIONS OF PLANES**: Projections of various planes -Polygonal, Circular and Elliptical shape inclined to one of the Reference Plane and	06	10%

	inclined to two Reference Planes; Concept of Auxiliary Plane of Projections.		
5	**PROJECTIONS OF SOLIDS AND SECTIONS OF SOLIDS**: Classifications of Solids, Projections of right and regular solids with their axis Parallel to Two and Perpendicular to one of the principal planes, axis parallel to one and inclined to two principal planes, axis inclined to all the three principal planes. Section of solids and the true shape of the section	07	15%
6	**DEVELOPMENT OF SURFACES**: Methods of Development of Lateral Surfaces of Right Regular Solids, Parallel Line Development and Radial Line Development, Applications of Development of Surfaces.	06	15%
7	**ORTHOGRAPHIC PROJECTIONS**: Projections on Principal Planes from Front, Top and Sides of the Pictorial view of an Object, First Angle Projection and Third Angle Projection method; Full Sectional Orthographic Views -Side and Front, Offset Cutting views.	05	15%
8	**ISOMETRIC VIEW/DRAWING AND ISOMETRIC PROJECTIONS**: Isometric Scale, Conversion of orthographic views into isometric projection, isometric view or drawing	04	15%

List of Suggested Practical:-

1) Introduction to Engineering Graphics
2) Drawing Sheet on Engineering Curves.
3) Drawing Sheet on Projections of Points and Lines.
4) Drawing Sheet on Projections of Planes.
5) Drawing Sheet on Projections of Solids and Sections of Solids.
6) Drawing Sheet on Development of Surfaces.
7) Drawing Sheet on Orthographic Projections.
8) Drawing Sheet on Isometric Projection/View or Drawing.

Reference Book:

1. "Manufacturing processes for engineering materials" Kalpakjian and Schmid, (5th Edition)-Pearson India, 2014.
2. "Materials and Processes in Manufacturing" (8th Edition), E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi (ISBN 0-02-978760).

3. "Manufacturing Science" A. Ghosh, and A. K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi.

Suggested Book:

1. "Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0- 8247-7352-7
2. "Production Technology" - H.M.T. By HMT
3. "Tool Design" by Donaldson, Tata McGraw Hill Pub.
4. "Metal cutting Principles" by Trent McGraw Hill Pub.

COURSE OUTCOMES

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

CO1 To know and understand the conventions and the method of engineering drawing.

CO2 Identify the Drawing Symbols, Conventions used in Engineering Drawing

CO3 Construct the Different types of Engineering Curves.

CO4 To improve their visualization skills so that they can apply these skill in developing new products.

CO5 Apply Descriptive Geometry Principles to Solve Engineering Problems Involving Points, Lines, Planes and Solids

CO6 To improve their technical communication skill in the form of communicative drawings

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	-	2	-	1	-	-	-	1	-	-	-	-	-	-
CO-2	1	2	2	-	1	-	-	-	-	1	-	-	-	-	-
CO-3	1	2	2	1	1	-	-	-	-	1	-	-	-	-	-
CO-4	2	2	1	1	-	1	-	-	-	-	-	-	-	-	-
CO-5	1	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-6	-	1	1	-	-	1	-	-	-	-	-	-	-	-	-

FEB120105:ENVIRONMENTAL SCIENCE

Program : Bachelor of Engineering **Subject / Branch :** Civil Engineering

Year :1st **Semester :**II

Course title : Environmental Science **Course code :** FEB120105
Course type : Mandatory Course **Course credit :** 00

Pre-requisite : Interest in natural systems sustaining the life on the earth..

Rationale : To inculcate the environmental values translating into pro-conservation actions. Honorable Supreme Court of India has made it 'mandatory' to introduce a basic course on environmental at the undergraduate level

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
2	2	0	4	0	70	30	00	00	100

Course Objective :

(1) To enable learn about Building Planning and Construction
(2) To enable learn about Transportation Engineering
(3) To enable about basic of Surveying

Content

Unit	Description in detail	Total Hrs	Weightage
I	**Introduction to Environmental Science:** Definition and Components of Environment, Relationship between the different components of Environment, Man and Environment relationship, Impact of technology on Environment, Environmental Degradation, Multidisciplinary nature of the Environment studies, its scope and importance in the present day Education System	**03**	**10%**
II	**Ecology and Ecosystems:** Ecology- Objectives and Classification , Concept of an ecosystem- structure and functions of ecosystem Components of ecosystem- Producers, Consumers, Decomposers Bio-Geo- Chemical Cycles- Hydrologic Cycle, Carbon cycle, Energy Flow in Ecosystem, Food Chains, Food webs, Ecological Pyramids.	**04**	**15%**
III	**Natural Resources & Population:** Renewable and Nonrenewable resources, exploitation and conservation, Role of individual in conservation of natural resources. Population: Introduction, Reasons, Population Explosion & its Effects, Population forecast, Control Measures, Urbanization: Causes & Effects	**06**	**20%**
IV	**Environmental Pollution :** •Water Pollution Water Quality Standards, Sources of Water Pollution, Classification of Water pollutants, Effects of water pollutants •Air Pollution Composition of air, Structure of atmosphere, Ambient Air Quality Standards, Classification of air pollutants, Sources of common air pollutants like PM, SO2, NO X Auto exhaust, Effects of common air pollutants. •Noise Pollution Introduction, Sound and Noise, Noise measurements, Causes and Effects •Solid Waste: Generation and Management •Bio medical Waste: Generation and Management •E-waste: Generation and management	**08**	**30%**
V	**Global Environmental Issue:** Sustainable Development, Climate Change, Global Warming and Green House Effect, Acid Rain, Depletion of Ozone layer, Carbon Footprint, Cleaner Development Mechanism (CDM), International Steps for Mitigating Global Change **Basic Concept Of Green Building & Smart Cities:** Green Building: Introduction, Objectives, Fundamental Principles,	**07**	**25 %**

	Benefits of Green Building, Examples of Green Building Smart Cities: Concept **Concept of 4R's:** Principles & Application of 4R's		

Reference Books :

1. Basics of Environmental Studies by Prof Dr N S Varandani ,2013 Publisher: LAP – Lambert Academic Publishing , Germany.
2. Environmental Studies by Anindita Basak ,2009 Publisher: Drling Kindersley(India)Pvt. Ltd Pearson
3. Environmental Studies by Deeksha Dave & S SKateva , Cengage Publishers.
4. Environmental Sciences by Daniel B Botkin & Edward A Keller Publisher: John Wiley & Sons.
5. Environmental Studies by R. Rajagopalan, Oxford University Press
6. Environmental Studies by Benny Joseph, TMH publishers
7. Environmental Studies for Undergraduate Courses by Erach Bharucha Second edition,2013 Publisher: Universities Press (India) Private Ltd, Hyderabad.

Online Resources :

1.http://elearning.vtu.ac.in/
2.www.nptel.iitm.ac.in/courses/

Practical / Activities :

1. Introduction to Environment
2. Water Pollution
3. Air Pollution
4. Noise Pollution
5. Solid Waste
6. Bio-medical Waste
7. E-waste
8. Global Environmental Issues
9. Concept of Green Building
10. Concept of Smart Cities
11. Concept of 4R's

Course Outcome :

After learning the course the students should be able to:

CO 1 Identify the types of pollution in society along with their sources and have idea how to deal with them.

CO 2 Realize the global environmental issues

CO 3 Conceptualize the principles of Green Buildings and Smart cities.

CO 4 Implement the concept of recycle and reuse in all fields of engineering.

CO 5 Student will understand Ecology and Ecosystem of nature.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3	-	3	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	-	1	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	1	-	-	-	-	-	-	-	-	-	-	-	-	-

FEB130001: EFFECTIVE TECHNICAL COMMUNICATION

Program : Bachelor of Engineering **Subject / Branch :**ALL

Year :2nd **Semester :**III

Course title : Effective technical communication **Course code : :** FEB130001

Course type : Humanities and Social Sciences **Course credit :** 03

Pre-requisite : Zeal to learn the subject

Rationale : This curriculum is to help students learn technical communication along with necessarymoral and ethical dimensions of engineering.

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
2	0	2	4	3	70	30	30	20	150

Course Objective :

(d) To enable understand
(e) To speak
(f) To Read and write

Content

Unit	Description in detail	Teaching Hours	Weightage
I	**Dynamics of Communication:** Definition and process, Kinesics, Proxemics, Paralinguistic features, Importance of Interpersonal and Intercultural Communication in today's organizations	06	20%
II	**Technical Writing:** Report writing, technical proposal, technical description, Business letters(sales, order, complaint, adjustment, inquiry, recommendation, appreciation, apology, acknowledgement, cover letter), Agenda of meeting, Minutes of meeting , Resume writing **Technical Communication:** Public speaking, Group discussion , Presentation strategies, Interview skills, Negotiation skills, Critical and Creative thinking in communication	14	45%
III	**Ethics in Engineering:** Scope of engineering ethics, Accepting and sharing responsibility, Responsible professionals and ethical corporations, resolving ethical dilemmas, Making moral choices.	04	12%
IV	**Etiquettes:** Telephone etiquettes, Etiquettes for foreign business trips, Visits of foreign counterparts, Etiquettes for small talks, respecting privacy Learning to say NO, Time management	05	16%
V	**Self-development and Assessment:** Change, Grow, Persist, Prioritize, Read, Learn, Listen, Record, Remember, Asses, Think, Communicate, Relate, Dream.	03	07%

Reference Books :

1.Raman and Sharma, Technical Communications, OUP, New Delhi, 2017

2. Lata and Kumar, Communication Skills, OUP, New Delhi, 2018

3. Mike Martin and Roland Schinzinger, Ethics in Engineering, McGraw Hill, New York, 2014

4. Mohapatra and Sreejesh S., Case Studies in Business Ethics and Corporate Governance,

Pearson, UP, 2013

5. Ramesh and Ramesh, The Ace of Soft Skills, Pearson, UP, 2019

6. Sherfield, Montgomery and Moody, Cornerstone: Developing Soft Skills, UP, 2009

Suggested Readings :

9. Repedex
10. Conversations books
11. Oral communication skill - calameo
12. Effective communication development

Online Resources :

6. https://youtu.be/MUGmEKrZXI
7. https://youtu.be/srn5jgr9TZo
8. https://youtu.be/hE6I9apUvrk
9. https://www.scu.edu/ethics/focus-areas/more-focus-areas/engineering-ethics/engineering-ethics-cases/

Practical / Activities :

1. Role Play

2. Letter writing: Formal

3. Group Discussion.

4. Presentations

5. Book Review(Preferably related to self-development)

6. Mock Interview.

7. Report writing

8. Case studies related to unit 4, 5 and 6

9. Conducting meetings and minutes of meeting

10. Practical assessment

Course Outcome :

CO-1: Define and discuss dynamics of Verbal and Non-Verbal aspects of Communication.

CO-2: Write various formal documents of technical and professional communication.

CO-3: Communicate in diverse formal situations taking place in organizations.

CO-4: Illustrate and examine the knowledge of ethical aspects of engineering.

CO-5: Demonstrate and explain social and professional etiquettes.

CO-6: Plan self-development and practice self-assessment.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	1	2	-	2	-	-	2	-	2	-	-	-	-	-
CO-2	-	-	1	2	-	1	-	1	-	2	1	1	-	-
CO-3	2	1	-	-	1	1	-	1	1	1	1	-	-	-
CO-4	-	1	2	-	-	1	1	2	2	1	1	1	-	-
CO-5	1	-	-	1	-	-	1	1	1	-	1	2	-	-
CO-6	1	1	1	-	1	1	-	-	2	2	-	2	-	-

FEB130002:INDIAN CONSTITUTION

Program : Bachelor of Engineering **Subject / Branch :**ALL

Year :2nd **Semester :**IV

Course title : INDIAN CONSTITUTION **Course code :** FEB130002
Course type : Mandatory course **Course credit :** 0

Pre-requisite : Nil

Rationale : Nil

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
02	00	00	02	0	50	00	00	00	50

Course Objective :

1. The main objectives of the Indian constitution include sovereignty, socialism, secularism, democracy, and republic.
2. Students become aware of their basic human rights and how these human rights manifest in our Constitution
3. To provide understanding of various constitutional aspects like constitution of panchayat, municipalities, co-operative societies, elections provisions,amendment procedure etc.

Content

Unit	Description in detail	Total Hrs	Weightage
I	**Meaning of the constitution law and constitutionalism :** Meaning of the constitution law and constitutionalism **History of Indian Constitution :** Background, Timeline of Formation of IC, Constituent Assembly, Membership, Drafting, Provision of Preamble, Implementation **Salient features and characteristics of the Constitution of India** Structures – Parts, Schedules & Articles, Appendix, Influence of other constitution, Special characteristics	**5**	**18%**
II	**Fundamental Rights** History, Right to Freedom, Right to Equality, Right against Exploitation, Right to Freedom of Religion, Right to Education & Culture, Right to Constitutional Remedies **Right to Equality under Article –14** Background, Provisions given under the article, Case – studies **Right to certain Freedom under Article 19** Background, Provisions given under the article, Case – studies	**6**	**21%**
III	**Scope of the Right to Life and Personal Liberty under Article 21** Background, Provisions given under the article, Case – studies **Fundamental Duties and its legal status** Background, Article 51-A, Implementations, Case – studies **The Directive Principles of State Policy – Its importance and Implementation** Background, Part 4, , Article – 36, 41, 43, 44, 45,48, 48A, 51, Implementations	**5**	**18%**
IV	**Federal structure and distribution of legislative and financial powers between the Union and the States (PART - I)** Political, Economic and Constitutional relations between the Union and States, Union List over the State List and the Concurrent List **Parliamentary Form of Government in India –The constitution powers and status of the President of India** History of Parliament, Houses of Parliament, Powers Article 53, Powers and Duties : Legislative, Executive, Judicial, Appointment, Financial, Diplomatic, Military, Pardoning, Emergency, Selection & Election Process **Powers and Procedure for Amendments in Indian Constitution** Background, Types, Procedure, Responsible Article	**7**	**25%**
V	**History of amendments in Indian Constitutional** Key amendments in Indian constitution	**5**	**18%**

	Emergency Provisions: National Emergency, President Rule, Financial Emergency Background, Types, Procedure, Responsible Article **Local Self Government –Constitutional Scheme in India** Background, Brief History : GVK Rao Committee, L.M Singhvi Committee, Timeline of Formation, Present scenario, Functions		

Reference Books :

1. Constitutional Law of India, Dr. J.N. Pandey, Central Law Agency
2. Introduction to the Consitution of India, Durga Das Basu, LexisNexis.
3. Indian Constitutional Law, M.P. Jain, LexisNexis
4. V.N.Shukla's Constitution of India, Mahndra Pal Singh, Eastern Book Company
5. Constitutional Law – I Structure, Udai Raj Rai, Eastern Book Company

Course Outcome :

After learning the course, the students should be able to:

CO 1 Enhance human values , create awareness about law enactment and importance of Consitution

CO-2 To Understand the Fundamental Rights and Fundamental Duties of the Indian Citizen to instill morality, social values, honesty, dignity of life and their social Responsbilities.

CO-3 Create Awareness of their Surroundings, Society, Social problems and their sutaible solutions while keeping rights and duties of the citizen keeping in mind.

CO-4 Understand distribution of powers and functions of Local Self Government.

CO-5 Understand the National Emergency, Financial Emergency and their impact on Economy of the country.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	-	-	-	-	--	2	-	1	1	-	-	1	-	-
CO-2	-	-	-	-	-	1	-	1	1	-	-	2	-	-
CO-3	-	-	-	-	-	1	1	1	1	-	-	2	-	-
CO-4	-	-	-	-	-	1	-	1	1	-	-	2	-	-
CO-5	-	-	-	-	-	2	-	1	1	-	-	3	-	-

FEB130201:ENGINEERING MATHEMATICS – III

Program : Bachelor of Engineering **Subject / Branch :** Mechanical

Year : 2nd **Semester :** III

Course title : Engineering mathematics-III **Course code :** FEB130201

Course type : Basic Science Courses **Course credit :** 04

Pre-requisite : Geometry, Trigonometry, Complex number, Calculus and ODE

Rationale : This subject is a powerful tool for solving a wide array of applied problems.

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	2	0	5	4	70	30	30	20	150

Course Objective :

(a)To develop logical understanding of the subject.
(b) To develop mathematical skill so that students are able to apply mathematical methods & principals in solving problem from Engineering fields.
(c) To make aware students about the importance and symbiosis between Mathematics and Engineering.

Content

Unit	Description in detail	Teaching Hours	Weightage
I	Polar Form of Complex Numbers, Powers and Roots **Complex Variable – Differentiation :** Differentiation, Cauchy-Riemann equations, analytic functions, harmonic functions, finding harmonic conjugate; elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.	10	20 %

II	**Complex Variable – Integration:** Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula(without proof), Lowville'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.	12	20 %
III	**PDE:** Definition of Partial Differential Equations, First order partial differential equations, solutions of first order linear PDEs; Solution to homogenous and non-homogenous linear partial differential equations of second order by complimentary function and particular integral method. Second-order linear equations and their classification, Initial and boundary conditions, D'Alembert's solution of the wave equation; Duhamel's principle for one dimensional wave equation. Heat diffusion and vibration problems, Separation of variables method to simple problems in Cartesian coordinates. The Laplacian in plane, cylindrical and spherical polar coordinates, solutions with Bessel functions and Legendre functions. One dimensional diffusion equation and its solution by separation of variables.	12	25 %
IV	**Probability:** Probability spaces, conditional probability, independence; Discrete random variables,Independent random variables, the multinomial distribution, Poisson approximation to the binomial distribution, infinite sequences of Bernoulli trials, sums of independent random variables; Expectation of Discrete Random Variables, Moments, Variance of a sum, Correlation coefficient, Chebyshev's Inequality. Continuous random varibales and their properties, distribution functions and densities, normal, exponential and gamma densities.Bivariate distributions and their properties, distribution of sums and quotients, conditional densities, Bayes' rule.	12	35 %

Reference Books :

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, John Wiley and Sons.
2. J. W. Brown and R. V. Churchill, Complex Variables and Applications, McGraw Hill.
3. Peter O'Neill, Advanced Engineering Mathematics, 7th Edition, Cengage.

4. Dennis G. Zill, 4th edition, Advanced Engineering Mathematics, 4th Edition, Jones and Bartlett Publishers.
5. Dennis G. Zill, Patrick D. Shanahan, A First Course in Complex Analysis with Applications, Jones and Bartlett Publishers.
6. S. J. Farlow, Partial Differential Equations for Scientists and Engineers, Dover Publications, 1993.
7. Ian Sneddon, Elements of Partial Differential Equations, McGraw Hill.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010
9. P. G. Hoel, S. C. Port and C. J. Stone, Introduction to Probability Theory, Universal Book
Stall, 2003 (Reprint).

Suggested Readings :

1. Swaym video lecture.
2. Mathematics magazine

Online Resources :

10. http://nptel.ac.in
11. https://ocw.mit.edu/courses
12. https://www.edx.org

Practical / Activities :

6. Problems solving.
7. Tutorial solving.
8. Seminar by students.

Course Outcome :

CO-1: convert complex number in a polar form, plot the roots of a complex number in complex plane, find harmonic conjugate of analytic functions and apply conformal mapping in geometrical transformation

CO-2: evaluate complex integration by using various result, test convergence of complex sequence and series and expand some analytic function in Taylor's series

CO-3: find Laurent's series and pole of order, and apply Cauchy Residue theorem in evaluating some real integrals

CO-4: understand the terminologies of basic probability, two types of random variables and their probability functions

CO-5: observe and analyze the behavior of various discrete and continuous probability distributions

CO-6: understand the fitting of various curves by method of least square

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	2	1	1	1	-	-	-	-	1	1	-	-	-	-
CO-2	1	1	2	-	2	-	-	-	-	-	-	-	-	-
CO-3	1	-	-	2	-	-	-	-	1	-	-	1	-	-
CO-4	-	2	-	-	1	-	-	-	-	1	-	-	-	-
CO-5	1	-	1	-	-	-	-	-	-	-	-	-	-	-
CO-6	2	-	-	1	-	-	-	-	2	1	-	1	-	-

FEB130202: MANUFACTURING PROCESS-I

Course Objective: Manufacturing processes related to machining are included in this subject. All conventional machines are included in this course to understand the basic concepts in machining science.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Basic Machine Tools and Metal Cutting Principles:** Machine tools classification, working and auxiliary motions in machine tools, Primary cutting motions in machines tools, Cutting tool geometry and tool signature, cutting forces and power requirement in machining	4	8%
2.	**Metal Cutting Lathes**: Engine Lathes, construction all arrangement and principal units of engine lathes, type and size range of engine lathes, Operations carried on engine lathe , attachment extending the processing capacities of engine lathes, Types of lathe machines, Capstan and Turret lathes, Taper turning on lathe, Thread cutting on lathe using gear train and chasing dial, Alignment tests of lathes**.**	9	22%
3.	**Drilling Machines:** Purpose and field of application of drilling machines, Types of drilling machines, Drilling and allied operation: drilling, boring, reaming, tapping, counter sinking, counter boring, spot facing; deep hole drilling, alignment tests of drilling machine	6	12%
4.	**Boring Machine:** Purpose and filed of application, Horizontal boring machines, Precision boring machines,	2	6%
5.	**Milling Machines:** Purpose and types of milling machines, general purpose milling machines, different types of milling operations, milling cutters, attachments extending the processing capabilities of general purpose milling machines, Indexing, Helical milling operation and its set up, Alignment tests of milling machine	9	22%

6	**Planers, Shapers and Slotters**: Classification of planers, Shapers and Slotters, Attachments extending the processing capacities of planers, Shapers and Slotters, machine and tooling requirements	**6**	12%
7	**Sawing and Broaching Machines**: Metal sawing classification: reciprocating sawing machines, circular sawing machines, band sawing machines, Types of broaching machines, advantage and limitations of broaching**.**	**2**	6%
8	**Grinding Machines and Abrasives:** Classification of grinding machines, cylindrical grinders, internal grinders, Surface grinders, tool and cutter grinders, center less grinders, Types of grinding wheels, wheel characteristics and wheel selection	**6**	12%

List of Suggested Practical:

1. Study of Machine Tools (Lathe, Shaper, Slotter, Planner) – study the types of cutting tools available and relative motions between cutting tool and work piece on each machine tool. Also derive capacity and capability of respective machine tools from machine specifications and number of available attachments to perform variety of operations.
2. Study of Machine Tools (Grinding, Milling, Drilling) – study the types of cutting tools available and relative motions between cutting tool and work piece on each machine tool. Also derive capacity and capability of respective machine tools from machine specifications and number of available attachments to perform variety of operations.
3. Job making on lathe machine
4. Job making on shaper / slotter machine
5. Job making on milling machine
6. Job making on Drilling machine
7. Job making on Grinding machine

Reference Book

1. Workshop Technology Vol. I, II & III, WAJ Chapman.
2. Workshop Technology Vol. II, Hajra & Choudhari.
3. Manufacturing Processes, O.P. Khanna.
4. Production Technology, R. K. Jain.
5. Processes and Materials of Manufacture; Lindberg Roy A.; Prentice-Hall India.

List of Suggested Book:

1.Workshop Technology Vol. II, Hajra & Choudhari

Course Outcome:

After learning the course the students should be able to:

CO1 Understand the basic concept of machining operations
CO2 Analyze any conventional machining processes.
CO3 Generate the sequence of machining operation to produce the end product.
CO4 Judge the limitations and scope of machines to perform variety of operations
CO5 The student will be able to recommend the appropriate design of casting process systems, forming processes, welding process and machining (metal cutting) processes
CO6 The student will be able to identify/control the appropriate process parameters, and possible defects of manufacturing processes so as to remove them.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO -1	PO -2	PO -3	PO -4	PO -5	PO -6	PO -7	PO -8	PO -9	PO -10	PO -11	PO -12	PSO -1	PSO -2	PSO -2
CO-1	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-2	1	2	1	-	-	-	-	-	-	-	-	-	1	1	-
CO-3	1	-	-	-	-	-	-	-	-	-	-	-	-	1	-
CO-4	2	-	-	-	-	-	-	-	-	-	-	-	-	1	-
CO-5	1	-	2	-	-	-	-	-	-	-	-	-	-	1	-
CO-6	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-

FEB130203: MECHANICAL MEASUREMENT & METROLOGY

Course Objective:-

Measurement and Metrology deals with the application of science in Mechanical Engineering. It provides a means of assessing the suitability of measuring instruments, their calibration, and the quality control of manufactured products.

By educating in the area of Measurement and Metrology students will enable to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in engineering

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Mechanical Measurement:** Need of mechanical measurement, Basic definitions: Hysteresis, Linearity, Resolution of measuring instruments, Threshold, Drift, Zero stability, loading effect and system response. Measurement methods, Generalized Measurement system, Static performance characteristics, Errors and their classification.	03	7%
2.	**Linear and angular measurements:** Linear Measurement Instruments, Vernier calliper, Micrometer, Interval measurements: Slip gauges, Checking of slip gauges for surface quality, Optical flat, Limit gauges, Problems on measurements with gauge**.**	07	15%
3.	**Measurement of Force, Torque and Strain:** Force measurement: load cells, cantilever beams, proving rings, differential transformers. Measurement of torque: Torsion bar dynamometer, servo controlled dynamometer, absorption dynamometers. Power Measurements. Measurement of strain: Mechanical strain gauges, electrical strain gauges, strain gauge: materials, gauge factors, theory of strain gauges and method of measurement, bridge arrangement, temperature compensation.	06	14%

4.	**Displacement, Velocity/Speed, and Acceleration, Measurement:** Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer,	04	7%
5.	**Temperature measurement:** Temperature Measuring Devices: Thermocouples, Resistance Temperature Detectors, Thermistor, Liquid in glass Thermometers, Pressure Thermometers, Pyrometer, Bimetallic strip. Calibration of temperature measuring devices, Numerical Examples on Flow Measurement	04	12%
6	**Metrology:** Basics of Metrology, Need for Inspection, Accuracy and Precision, Objectives, Standards of measurements.	02	4%
7	**Metrology of Gears and screw threads:** Gear tooth terminology, Sources of errors in manufacturing of gears, Measurement of tooth thickness: Gear tooth vernier, Constant chord method, Addendum comparator method and Base tangent method, Measurement of tooth profile: Tool maker's microscope or projector, Involute tester, Measurement of pitch, Measurement of run out, Lead and Backlash checking. Measurement of concentricity, Alignment of gears. **Screw Thread Measurement:** Errors in threads, screw thread gauges, measurement of element of the external and internal threads, thread calliper gauges	06	12%
8	**Comparators:** Functional Requirements, Classification, Mechanical Comparators**,** Mechanical Optical Comparators, Electrical Comparators, Pneumatic Comparators.	06	7%
9	**Metrology of Surface finish:** Surface Metrology Concepts and terminology, Analysis of surface traces, Specification of surface Texture characteristics, and Method of measuring surface finish: Stylus system of measurement, Stylus probe instruments, Wave length, frequency and cut off, other methods for measuring surface roughness: Pneumatic method, Light Interference microscopes, Mecrin Instruments.	03	12%

10	**Miscellaneous Metrology:** Precision Instrumentation based on Laser Principals, Coordinate measuring machines: Structure, Modes of Operation, Probe, Operation and applications. Optical Measuring Techniques: Tool Maker's Microscope, Profile Projector, Optical Square. Basics of Optical Interference and Interferometry, Optoelectronic measurements**,**	04	10%

Reference Book

1. Engineering Metrology and Measurement, N V Raghavendra and Krishnamurthy, Oxford University Press,
2. Engineering Metrology and Measurements, Bentley, Pearson Education.
3. Theory and Design for Mechanical Measurements, 3 rd Edition, Richard S Figliola, Donald E Beasley, Wiley India.
4. Metrology and Measurement, Anand Bewoor& Vinay Kulkarni McGraw-Hill
5. Doebelin's Measurement Systems Ernest Doebelin, Dhanesh Manik McGraw-Hill
6. Instrumentation, Measurement and Analysis, B.C. Nakra, K.K. Chaudhry McGraw-Hill

Suggested Book

1. A Text book of Engineering Metrology, I C Gupta, Dhanpat Rai Publications
2. A course in Mechanical Measurements and Instrumentation, A K Sawhney, Dhanpat Rai Publications.
3. Mechanical Measurements and Instrumentations, Er. R K Rajput, Kataria Publication (KATSON)

Course outcomes:

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

CO1 Students will describe basic concepts of Metrology
CO2 Students will select linear measuring instrument for measurement of various components
CO3 Students select angular and taper measurement devices for measurement of various components
CO4 Students will discriminate between various screws by measuring their dimensions
CO5 Students will separate different gears through measurement of various dimensions of gears

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	1	-	-	-	1	1	-	-	-	1	-	-	1	-	-
CO-2	2	1	1	-	1	-	-	-	-	-	-	-	1	-	-
CO-3	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	2	1	1	-	1	-	-	-	-	-	-	-	1	-	1
CO-5	1	1	1	-	-	-	-	-	-	-	-	-	1	-	-

FEB130204: ENGINEERING THERMODYNAMICS

Course Objective :-Engineering Thermodynamics is the first course on Thermal Science and Engineering. It studies various energy interactions notably heat and work transfer. It is based on certain laws of nature which are never seen to be violated.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	1	0	4	4	70	30	30	20	150

Th:-Theory, Tu: - Tutorial, P:- Practical, SEE:- Semester End Examinations, PA :-Progressive Assessment

Content

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Fundamentals** - System & Control volume; Property, State & Process; Exact & Inexact differentials; Work-Thermodynamic definition of work; examples; Displacement work; Path dependence ofdisplacement work and illustrations for simple processes; electrical, magnetic, gravitational, spring and shaft work.	5	12%
2.	**Temperature, Definition of thermal equilibrium and Zeroth law**; Temperature scales; VariousThermometers- Definition of heat; examples of heat/work interaction in systems- First Law forCyclic& Non-cyclic processes; Concept of total energy E ; Demonstration that E is a property;Various modes of energy, Internal energy and Enthalpy.	5	12%
3.	**Definition of Pure substance**, Ideal Gases and ideal gas mixtures, Real gases and real gas mixtures,Compressibility charts- Properties of two phase systems - Const. temperature and Const. pressureheating of water; Definitions of saturated states; P-v-T surface; Use of steam tables and R134atables; Saturation tables; Superheated tables; Identification of states & determination of properties,Mollier’ s chart.	8	20%

4.	**First Law for Processes Flow**- Derivation of general energy equation for a control volume; Steadystate steady flow processes including throttling; Examples of steady flow devices; Unsteadyprocesses; examples of steady and unsteady I law applications for system and control volume.	5	12%
5.	**Second law**-Definitions of direct and reverse heat engines; Definitions of thermal efficiency andCOP; Kelvin-Planck and Clausius statements; Definition of reversible process; Internal and externalirreversibility; Carnot cycle; Absolute temperature scale.	5	12%
6	**Clausius inequality;** Definition of entropy S ; Demonstration that entropy S is a property; Evaluation of S for solids, liquids, ideal gases and ideal gas mixtures undergoing various processes; Determination of s from steam tables- Principle of increase of entropy; Illustration of processes in Tscoordinates; Definition of Isentropic efficiency for compressors, turbines and nozzles- Irreversibility and Availability, Availability function for systems and Control volumes undergoing different processes, Lost work. Second law analysis for a control volume. Exergy balance equation andExergy analysis.	8	22%
7	**Thermodynamic cycles** - Basic Rankine cycle; Basic Brayton cycle; Basic vapor compression cycle and comparison with Carnot cycle.	4	10%

Reference Book:

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, *Fundamentals ofThermodynamics*, John Wiley and Sons.
2. Jones, J. B. and Duggan, R. E., 1996, *Engineering Thermodynamics*, Prentice-Hall of India
3. Moran, M. J. and Shapiro, H. N., 1999, *Fundamentals of Engineering Thermodynamics*, John Wiley and Sons.

Suggested Book:

1. Nag, P.K, 1995, *Engineering Thermodynamics*, Tata McGraw-Hill Publishing Co. Ltd

Course Outcome:

After completing this course, the students will be able to

CO-1.Analyze the work and heat interactions associated with a prescribed process path.
CO-2. Criticize a different operations on steady flow energy equation
CO-3. Define the fundamentals of the first and second laws of thermodynamics and explain their significance to a wide range of systems.
CO-4. Evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process from such calculations.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-3	3	2	3	2	-	-	-	-	-	-	-	-	-	-	-
CO-4	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-

FEB130205: ENGINEERING MECHANICS

Course objective :Engineering Mechanics is a branch of applied physics that deals with the study of forces and their effects on motion. Objectives in this field typically include understanding fundamental principles and applying them to solve engineering problems.

These objectives provide a broad overview of the skills and knowledge that are typically expected in the study of Engineering Mechanics. They form the foundation for further studies in areas such as structural analysis, fluid mechanics, and machine design.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
03	00	02	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Statics:** Introduction to Engineering Mechanics, Units and Dimensions, Basic Mechanics, Laws of Mechanics, Represe,ntation of a Vector. Statics of particles: Force, system of forces, Resultant of forces, Equilibrium of Particles, Principle of Transmissibility of Forces, parallel forces, System of forces, moment, moment of force about line, Equilibrium of three forces in a plane, Varignon's theorem of moments, Couple.	6	15%
2.	**Rigid Body Equilibrium**: Free body diagram, condition of equilibrium of rigid body in two dimensions, Types of beams, loads, supports, determination of support reactions, Lame's theorem.	8	20%
3.	**Structure:** Structure of equilibrium: Trusses, Methods of joints and section.	4	10%
4.	**Centriod and Moment of Inertia**: Centroid and center of mass: Centroids of composite plane figures and curves, Pappus and Guldinus theorem, Centre of gravity, moment of inertia, parallel axis theorem, perpendicular axis theorem, mass moment of inertia.	10	20%
5.	**Friction**: Classification of friction, Laws of friction, Coefficient of friction, Limiting friction, Angle of repose, Wedge friction, Belt Friction	6	15%

6	**Kinematics of particles**: Position, velocity, Acceleration, Curvilinear motion, Relative Motion. Kinetics of particle: Equation of motion of rigid body in plane, D' Alembert's principle.	10	20%

List of Suggested Practical:

1.Equilibrium of coplanar - concurrent force system

2. Equilibrium of coplanar, non-concurrent and non-parallel force system

3. Equilibrium of Parallel Force System – Simplysupported beam

4. Determination of Co-efficient of Static Friction

5.Simple lifting machines

A. Wheel and Differentialaxle

B. Single purchasecrab

Reference Book

1. Irving H. Shames (2006), Engineering Mechanics, 4th Edition, Prentice Hall
2. F. P. Beer and E. R. Johnston (2011), Vector Mechanics for Engineers, Vol I - Statics, Vol II, – Dynamics, 9th Ed, Tata McGraw Hill
3. R. C. Hibbler (2006), Engineering Mechanics: Principles of Statics and Dynamics, Pearson Press.
4. Andy Ruina and Rudra Pratap (2011), Introduction to Statics and Dynamics, Oxford University Press
5. Shanes and Rao (2006), Engineering Mechanics, Pearson Education,
6. Hibler and Gupta (2010),Engineering Mechanics (Statics, Dynamics) by Pearson Education
7. Reddy Vijaykumar K. and K. Suresh Kumar(2010), Singer's Engineering Mechanics
8. Bansal R.K.(2010), A Text Book of Engineering Mechanics, Laxmi Publications
9. Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.

Suggested Book Khurmi R.S. (2010), Engineering Mechanics, S. Chand & Co.

COURSE OUTCOMES:

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

CO1 **Fundamental Principles:**Understand and apply the fundamental principles of statics and dynamics to solve engineering problems

CO2 **Newtons Law**: Apply Newton's laws of motion to analyse and solve problems related to particle and rigid body dynamics.

CO3 **Structure Analysis**: Analyze and calculate forces in simple structures and machines using principles of equilibrium and compatibility

CO4 **Kinematics & Kinetics:**Analyze motion in terms of kinematics and kinetics, considering forces and accelerations

CO5 **Frictional Force**: Analyze problems involving frictional forces and understand their impact on equilibrium and motion

CO6 **Centroid & Centers of Mass**:Determine centroids and centers of mass for various shapes and apply these concepts to analyze distributed forces

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	3	--	2	--	--	--	--	--	--	--	--	2	--	--
CO-2	3	3	--	--	--	--	--	--	--	--	--	--	2	--	--
CO-3	3	3	--	3	--	--	--	--	--	--	--	--	1	--	--
CO-4	3	3	2	--	--	--	--	--	--	--	--	--	2	--	--
CO-5	3	3	--	2	--	--	--	--	--	--	--	--	1	--	--
CO-6	3	3	--	--	--	--	--	--	--	--	--	--	2	--	--

FEB140001: ESSENCE OF INDIAN KNOWLEDGE TRADITION

Program : Bachelor of Engineering **Subject / Branch :**ALL

Year : 2ND **Semester:** IV

Course title : Essence of Indian knowledge tradition **Course code : :** FEB140001

Course type : Mandatory course **Course credit :** 00

Pre-requisite :NIL

Rationale :NIL

Teaching Examination Scheme :

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	0	70	30	00	00	100

Course Objective :

1: To facilitate the students with the concepts of Indian traditional knowledge and to make them understand the Importance of roots of knowledge system.
2: To make the students understand the traditional knowledge and analyses it and apply it to their day-to-day life

Content

Unit	Description in detail	Teaching Hours	Weightage
I	Basic Structure of Indian Knowledge System	24	60%
II	Modern Science and Indian Knowledge System.	06	15%
III	Yoga	03	07%
IV	Holistic Health care	03	08%
V	Case Studies	04	10%

Reference Books :

1. V. Sivaramakrishna (Ed.), Cultural Heritage of India-Course Material, Bharatiya Vidya Bhavan, Mumbai, 5th Edition, 2014

2. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

3. Fritz of Capra, Tao of Physics

4. Fritz of Capra, The wave of Life

5. V N Jha (Eng. Trans,), Tarkasangraha of Annam Bhatta, Inernational Chinmay Foundation, Velliarnad, Amaku,am

6. Yoga Sutra of Patanjali, Ramakrishna Mission, Kolkatta

7. GN Jha (Eng. Trans.) Ed. R N Jha, Yoga-darshanam with Vyasa Bhashya, VidyanidhiPrakasham, Delhi, 2016

8. RN Jha, Science of Consciousness Psychotherapy and Yoga Practices, VidyanidhiPrakasham, Delhi, 2016

9. P R Sharma (English translation), ShodashangHridayam

Suggested Readings :

1.Traditional Knowledge System in India, by Amit Jha, 2009.

2. Traditional Knowledge System and Technology in India by Basanta Kumar Mohanta and Vipin Kumar Singh, Pratibha Prakashan 2012. .

Online Resources :

1. https://www.youtube.com/watch?v=LZP1StpYEPM

2. http://nptel.ac.in/courses/121106003/

Course Outcome :

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

CO-1: Ability to understand, connect up and explain basics of Indian Traditional knowledge modern scientific perspective

CO-2: Identify the concept of Traditional knowledge and its importance.

CO 3: Explain the need and importance of protecting traditional knowledge.

CO 4: Illustrate the various enactments related to the protection of traditional knowledge.

CO 5: Interpret the concepts of Intellectual property to protect the traditional knowledge.

CO 6: Explain the importance of Traditional knowledge in Agriculture and Medicine.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)													
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2
CO-1	1	-	-	-	2	2	2	2	2	1	1	1	-	-
CO-2	2	2	2	1	1	-	-	1	-	2	-	-	-	-
CO-3	-	1	-	1	1	-	1	-	-	2	-	-	-	-
CO-4	1	1	2	-	-	2	2	-	-	-	-	1	-	-
CO-5	2	2	1	2	2	-	-	-	-	1	-	-	-	-
CO-6	-	1	-	2	-	1	-	1	-	2	1	1	-	-

FEB140201: APPLIED THERMODYNAMICS

Course Objective: Applied Thermodynamics is the first course on Thermal Science and Engineering. It studies various energy interactions notably heat and work transfer. It is based on certain laws of nature which are never seen to be violated.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	1	0	4	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Introduction to solid, liquid and gaseous fuels–Stoichiometry, exhaust gas analysis- First law analysis of combustion reactions- Heat calculations using enthalpy tables- Adiabatic flame temperature- Chemical equilibrium and equilibrium composition calculations using free energy	08	18%
2.	Vapor power cycles Rankine cycle with superheat, reheat and regeneration, exergy analysis. Supercritical and ultra super-critical Rankine cycle- Gas power cycles, Air standard Otto, Diesel and Dual cycles-Air standard Brayton cycle, effect of reheat, regeneration and intercooling- Combined gas and vapor power cycles- Vapor compression refrigeration cycles, refrigerants and their properties.	12	26%
3.	Properties of dry and wet air, use of pschyrometric chart,processes involving heating/cooling and humidification/dehumidification, dew point.	06	14%
4.	Basics of compressible flow. Stagnation properties, Isentropic flow of a perfect gas through a nozzle, choked flow, subsonic and supersonic flows- normal shocks- use of ideal gas tables for isentropic flow and normal shock flow- Flow of steam and refrigerant through nozzle, super saturation compressible flow in diffusers, efficiency of nozzle and diffuser.	08	18%
5.	Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors.	05	14%

6	Analysis of steam turbines, velocity and pressure compounding of steam turbines	03	10%

References Books:-

After learning the course the students should be able to

1. Sonntag, R. E, Borgnakke, C. and Van Wylen, G. J., 2003, 6th Edition, Fundamentals of Thermodynamics, John Wiley and Sons.

2. Jones, J. B. and Duggan, R. E., 1996, Engineering Thermodynamics, Prentice-Hall of India

3. Moran, M. J. and Shapiro, H. N., 1999, Fundamentals of Engineering Thermodynamics, John Wiley and Sons.

Suggested Book

1. Nag, P.K, 1995, Engineering Thermodynamics, Tata McGraw-Hill Publishing Co. Ltd

Course Outcomes:-

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

CO1 Good understanding of various practical power cycles and heat pump cycles.

CO2 They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors

CO3 Understand power producing cycles and refrigeration cycles with vapour and air as fluids

CO4 Understand different processes in IC Engines, calculate BP, IP, FP and prepare Heat Balance Sheet.

CO5 Understand different laws governing gases and their mixtures

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	-	2	1	2	-	-	1	-	-	-	-	-	-	-	-
CO-3	1	-	-	-	-	1	1	-	-	-	-	-	-	-	-
CO-4	-	2	2	1	-	1	-	-	-	-	-	-	-	-	-
CO-5	-	1	-	1	-	-	-	-	-	-	-	-	-	-	-

FEB140202: FLUID MECHANICS AND FLUID MACHINES

Course Objective :-The course is designed to give fundamental knowledge of fluid, its properties and behaviour under various conditions.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Th:-Theory, Tu: - Tutorial, P:- Practical, SEE:- Semester End Examinations, PA :-Progressive Assessment

Content

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	INTRODUCTION AND DYNAMICS Definition of fluid, Newton's law of viscosity, Units and dimensions-Properties of fluids, mass density, specific volume, specific gravity, viscosity, compressibility and surface tension, Control volume- application of continuity equation and momentum equation, Incompressible flow, Bernoulli's equation and its applications	09	22.5%
2.	VISCOUS AND TURBULENT FLOW : Exact flow solutions in channels and ducts, Couette and Poisuielle flow, laminar flow through circular conduits and circular annuli-concept of boundary layer – measures of boundary layer thickness – Darcy Weisbach equation, friction factor, Moody's diagram	09	22.5%
3.	DIMENSIONAL ANALYSIS Need for dimensional analysis – methods of dimension analysis – Similitude – types of similitude Dimensionless parameters – application of dimensionless parameters – Model analysis	06	15%
4.	FLUID POWER ENGINEERING Euler's equation – theory of Rotodynamic machines – various efficiencies – velocity components at entry and exit of the rotor,	08	20%

	velocity triangles – Centrifugal pumps, working principle, work done by the impeller, performance curves – Cavitation in pumps- Reciprocating pump – working principle.		
5.	HYDRAULIC TURBINE Classification of water turbines, heads and efficiencies, velocity triangles- Axial, radial and mixed flow turbines- Pelton wheel, Francis turbine and Kaplan turbines, working principles – draft tube- Specific speed, unit quantities, performance curves for turbines – governing of turbines	08	20%

List of Suggested Experiments:

1. Measurement of Coefficient of Discharge of given Orifice and Venturi meters.
2. To measure the velocity of flow using Pitot tube
3. Verification of Bernoulli's theorem
4. To determine the Friction factor for the different pipes.
5. To determine the loss coefficients for different pipe fittings.
6. Determination of the performance characteristics of a centrifugal pump
7. Determination of the performance characteristics of Pelton Wheel
8. Determination of the performance characteristics of a Francis Turbine
9. Determination of the performance characteristics of a Kaplan Turbine
   Performance test on Reciprocating compressor

References Books:-

1. Fluid Mechanics and Fluid Power Engineering by D.S. Kumar, S.K.Kataria& Sons
2. Fluid Mechanics by Frank .M. White, McGraw Hill Publishing Company Ltd.
3. Fundamentals of Fluid Mechanics by Munson, Wiley India Pvt. Ltd
4. Fluid Mechanics by A. K. Mohanty, PHI Learning Pvt. Ltd.
5. Laboratory Manual Hydraulics and Hydraulic Machines by R V Raikar

Suggested Book:

1. Fluid Mechanics and Hydraulic Machines by R.K. Bansal, Laxmi Publications
2. Fluid Mechanics and Hydraulic Machines by R.K. Rajput, S.Chand& Co.

Course Outcomes:-

After learning the course the students should be able to

CO-1: Understand the basic concept of fluid and properties of fluid.
CO-2: Analyze the basic concepts of fluid-statics, kinematics and dynamics with their applications.
CO-3: Understand and the implementation of continuity equation, discharge of flow in major and minor losses through pipes and to learn the hydraulic gradient energy.

CO-4: Implement the fluid concept in viscous and turbulent flow.
CO-5: Analyze and evaluate the performance of pumps and turbine.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	3	3	3	-	-	-	-	-	-	-	-	-	-	-
CO-3	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-4	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-5	3	3	2	2											

FEB140203: INSTRUMENTATION &CONTROL

Course Objective:-

1. Understand the methodology for modelling dynamic systems with concept of stability
2. Know the transfer function, signal flow graph representation of linear systems & their controlling actions.
3. Understand concept of time, frequency response as well as concept of state-space models and their relation to frequency domain models.
4. Control system of hydraulic and pneumatic system

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Brief overview** Measurement system, Static performance characteristics, Errors and their classification. Accuracy and precision, range, span and resolution, error sources;	1	3
2.	**Time response analysis:** Standard test signals along with examples of their usage, steady state errors Transient response specifications with numerical examples, Basic control actions and two position, proportional, PI, PID and rate feedback controllers, Limitations of time domain analysis.	4	11
3.	**Instrumentation system elements** Working principal of Resistive Potentiometer, Linear variable differential transducers, Electro Magnetic Transducers, Mechanical, Electrical and Photoelectric Tachometers, Piezoelectric Accelerometer, Seismic Accelerometer,	3	8
4	**Mathematical modelling of systems:** Translational and rotational mechanical, electrical, thermal, hydraulic and pneumatic systems, Force voltage and force current analogy, Position servo mechanism. Block diagram and signal flow graph representation of physical	8	18

	systems along with rules, properties, comparison and limitation,		
5	**Hydraulic control system:** Basic elements of hydraulic circuit, Principle used in hydraulic circuit, Sources of hydraulic power, pressure control valves, hydraulic cylinders and pistons, Integral, Derivative, PD & PID controller with its transfer function, Comparison between hydraulic and electrical control system.	**10**	**22**
6	**Pneumatic control system:** Basic elements of pneumatic circuit, Difference between pneumatic and hydraulic control systems, compressor and actuators system, pneumatic valves, forced balance type controllers, nozzle-flapper amplifier system, pneumatic controllers, and pneumatic proportional PD, PI and PID control system along with its transfer function.	**10**	**22**
7	**Stability:** Concept of stability, types of stability, Routh's stability criterion, special cases with numerical examples, stability of closed loop system, concept of root locus, open loop and closed loop transfer poles, step by step procedure for root loci, numerical examples	**3**	**8**
8	**Frequency response analysis:** Need of frequency response analysis, Sinusoidal response of linear system, methods used in frequency response, Frequency domain specifications.	**3**	**8**

Reference Book

1. Modern control theory, Katsuhiko Ogata, Pearson Education International, Fifth edition.
2. Control system engineering, Norman S Nise, John Wiley & Sons, Inc., Sixth edition
3. Modern control systems, Richard C. Dorf, Robert H Bishop, Pearson Education International, Twelfth edition.
4. Automatic control systems, Farid Golnaraghi, Benjamin C Kuo, John Wiley & Sons, Inc., Nineth edition
5. J.Nagrath and M.Gopal," Control System Engineering", New Age International Publishers, 5th Edition, 2007

List of Experiments:

1. Development of block diagram of various physical systems
2. Modelling of physical system using simulation software
3. Simulation of linear system to different inputs
4. Simulation of root locus plot using simulation software
5. Performance measurement of first and second order system using simulation system as given by instructor

6. Introduction to hydraulic trainer system/software
7. Development & performance of given hydraulic circuit
8. Introduction to pneumatic trainer system/software
9. Development & performance of given pneumatic circuit
10. Introduction of programmable logic controller and ladder diagram

List of Open source software/learning website: -

https://www.scilab.org, https://www.simscale.com,

Course outcomes:

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

CO1 Identify and choose suitable sensor for Velocity, Speed, Vibration and Acceleration measurement

CO2 Classify and Demonstrate torque/force sensors and transducers.

CO3 Make use of instrument with appropriate specifications and design of extension of range instrument.

CO4 Design of hydraulic and pneumatic circuit for speed control of single or double acting cylinders

CO5 Design of PID controller by direct synthesis and internal model control methods of model based techniques

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	2	-	-	-	1	-	-	-	-	-	1	-	1
CO-2	1	1	2	1	1	-	-	-	-	-	-	-	1	-	1
CO-3	1	1	2	1	1	1	-	-	-	-	-	-	-	1	1
CO-4	-	-	2	1	-	-	-	-	-	-	-	-	1	-	1
CO-5	1	1	2	-	1	-	-	-	-	-	-	-	1	-	-

FEB140204: MATERIALS ENGINEERING

Course Objective : Rational:-Basic principles of science are used to study the structure-properties relationships of various materials for their proper applications in this subject. Especially study of different types of ferrous and non-ferrous metals and alloys, in terms of their composition, structure, properties and applications; non destructive testing are included in this course to understand the basic concept of selection and processing of metals and materials for their applications. Corrosion covers the mechanism, types and prevention techniques

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Introduction to Material Science and Metallurgy:** Basics of Engineering Materials, their Classifications and Application, Basics of Advance Engineering Materials, Engineering requirements of materials, Properties ofengineering materials, Criteria for selection of materials for engineering Applications.	4	8%
2.	**Mechanical Property measurement:** Tensile, compression and torsion tests; Young's modulus,relations between true and engineering stress-strain curves, generalized Hooke's law, yielding andyield strength ductility, resilience, toughness and elastic recovery Hardness:Rockwell, Brinell andVickers and their relation to strength.	5	10%
3.	**Static failure theories:** Ductile and brittle failure mechanisms, Tresca, Von-mises, Maximum normalstress, Mohr-Coulomb and Modified Mohr-Coulomb; Fracture mechanics: Introduction to Stressintensityfactor approach and Griffith criterion. Fatigue failure: High cycle fatigue, Stress-lifeapproach, SN curve, endurance and fatigue limits, effects of mean stress using the ModifiedGoodman diagram; Fracture with fatigue, Introduction to non-destructive testing (NDT)	5	10%
4.	**Solidification & Theory of Alloys:** Solidification of metals and Alloy, Nucleation and Growth during freezing of pure metal and alloy, ingot's casting, Resultant macrostructures; Effects of structure on mechanical Properties.	5	10%

	Systems phases and phase rule, structural constituents, Gibb's free energy for thermodynamic stability of phases, Gibb's phase rule. Solid solutions and compounds, Hume-Rothery rules; Cooling curves, lever-arm principle.		
5.	**Phase and Phase equilibrium:** Unary and Binary equilibrium phase diagrams, Different reactions like eutectic, eutectoid, peritectic and peritectoid; Non-equilibrium cooling.	5	10%
6	**Allotropy of Iron, Iron-Iron Carbide equilibrium system** Allotropy of iron; Iron-iron carbide equilibrium diagram: Phases present and their properties, different reactions of the Iron-Iron Carbide equilibrium system; constituents, microstructures and properties of plain carbon steels. Alloy groups (Wrought Irons, Steels and Cast Irons) of Iron-Iron Carbide equilibrium system and their characteristics in general. Equilibrium cooling of eutectoid, hypoeutectoid and hypereutectoid steels, their resultant microstructures and hence correlated properties and applications. . IS and ISO Codification, Different specifications and designations of steels.	8	16%
7	**Heat Treatment of Steel:** Study of heat treatment processes such as annealing, normalizing, spherodizing, hardening, tempering, carburizing, nitriding, cyaniding, induction hardening, flame hardening and hardenability of steel. Application of above processes to machine components and mechanical equipments such as gears, shaft bearings, turbine blades, crank shafts, pistons etc.	4	10%
8	**Powder Metallurgy:** Applications of powder metallurgy, advantages of powder metallurgy, manufacturing processes, production of powder, compacting, sintering, products of powder metallurgy.	3	10%
9	**Non Destructive Testing:** Non Destructive testing of materials such as Radiography Testing, Dye Penetration Testing, Magnetic Particle Testing, Ultrasonic Testing. Eddy current testing with their Principle of non-destructive testing, the test methods, relative merits, demerits and applications.	4	10%
10	**Corrosion of Metal And Alloys:** Mechanism of corrosion, types of corrosion, corrosion prevention techniques.	2	6%

List of Suggested Practical:

1. To get acquainted with the operation, construction, use and capabilities of a metallographic microscope.
2. To study procedure of specimen preparation for microscopic examination and to carry out a specimen preparation.
3. To understand what is micro examination, importance of micro examination and to study various ferrous, non-ferrous microstructures.
4. To identify the different types of material available for design, manufacturing and processing of various components based on structure-property-performance-processing relationships.
5. To show the effect of different quenching media (Oil, Water and Brine) on the hardness of medium carbon steel.
6. To understand the concept of harden ability and its relevance to heat treatment procedure to be adopted in practice.
7. To find out the effect of varying section size on hardenability of steel and obtain hardness distribution curves of hardened steel cross-section.
8. Study of different heat treatment processes- annealing, normalizing, hardening and tempering, surface and casehardening to improve properties of steel during processes and applications.
9. To understand the procedure of testing, nature of indication, the capability and sensitivity of the liquid penetrant test and the magnetic particle test.

Reference Book

1.Callister's Material Science and Engineering, R. Balasubramaniam, Wiley India.

2. Elements of Material Science and Engineering, Lawrence H. Van Vlack, Pearson Education.

3. The Science and Engineering of Materials Donald R. Askeland and Pradeep P. Phule, Cengage Learning.

4. Principles of Materials Science and Engineering, W F Smith, McGraw Hill.

5. Materials Science and Metallurgy, K. I. Parashivamurthy, Pearson Education.

6. Physical Metallurgy, Sydney H. Avner, Tata McGraw-Hill.

7. Practical Non-Destructive Testing, Baldev Raj, T. Jayakumar and M. Thavasimuthu, Narosa Pub. House. ASM Handbook Vol

List of Suggested Book:

1.Callister's Material Science and Engineering, R. Balasubramaniam, Wiley India

Course Outcome:

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

CO1 To be able to study the various symmetry elements in the seven basic crystal systems
CO2 To be able to study the crystal structures of some materials metals, Ionic compounds and covalent compounds with the help of plastic models
CO3 To be able to study the cooling curves of a given alloy
CO4 To be able to study the micro-structure of various alloys using image analysis system
CO5 To be able to study the effect of heat treatment on cast iron and carbon steels.
CO6 To able to study various types of cubic unit cells and Bravaise lattices with the help of plastic models.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO -1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**	**PSO -3**
CO-1	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	2	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	1	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-6	3	-	-	-	-	-	-	-	-	-	-	-	-	1	-

FEB140205: STRENGTH OF MATERIALS

Course Objective: The objectives of a Strength of Materials course typically revolve around providing students with a fundamental understanding of how materials respond to applied forces and loads. Here are common objectives for a Strength of Materials course Understand Material Properties, Analyse Axial Loading, Study Torsional Loading, Analyse Bending and Shear, Understand Mohr's Circle, Analyse and Design Simple Structures

These objectives aim to provide students with a comprehensive understanding of the behaviour of materials under different loading conditions and prepare them to apply this knowledge to the design and analysis of structures in engineering practice

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Statically Determinate Structures: Analysis of support reactions, Internal forces in trusses, beams; Consideration of concentrated loads, moments/couples, Uniformly Distributed Loads (UDL), Uniformly Varying Loads (UVL); Shear Force and Bending Moment Diagrams for Beams, Point of Contraflexures, Point and magnitude of Maximum bending moment and maximum shear force,	8	20%
2.	Stresses in Beams: Flexural stresses – Theory of simple bending, Assumptions, derivation of equation of bending, neutral axis, determination of bending stresses, section modulus of rectangular & circular (solid & hollow), I,T,Angle, channel sections Shear stresses – Derivation of formula, shear stress distribution across various beam sections like rectangular, circular, triangular, I, T, angle sections.	10	20%
3.	Torsion: Derivation of equation of torsion, Assumptions, application of theory of torsion equation to solid & hollow circular shaft, torsional rigidity, Power Transmitted by shaft.	8	20%

4.	Principal Stresses: Two dimensional system, stress at a point on a plane, principal stresses and principal planes, Mohr's circle of stress	8	20%
5.	Physical & Mechanical properties of materials: Elastic, homogeneous, isotropic materials; Stress –Strain relationships for ductile and brittle materials, limits of elasticity and proportionality, yield limit, ultimate strength, strain hardening, proof stress, factor of safety, working stress, load factor, Properties related to axial, bending, and torsional & shear loading, Toughness, hardness, Ductility, Brittleness	8	20%

Reference Book

1. D.H. Young, S.P. Timoshenko " Elements of Strength of Materials" East West Press Pvt. Ltd., 5th Edition (Reprint 2014)
2. R K Bansal, "A Textbook of Strength of Materials", 4th Edition, Laxmi Publications, 2010
3. S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013)
4. Vazirani, V N, Ratwani M M. and S K Duggal "Analysis of Structures Vol. I", 17th Edition, Khanna Publishers, New Delhi.

Suggested Book

S.S. Rattan " Strength of Materials" McGraw Hill Education (India) Pvt. Ltd., 2nd Edition (Sixth reprint 2013

List of Suggested Practical:.

1. Verification of principle of moment: Bell crank lever
2. Determination of member force in a triangular truss
3. Determination of hardness of metals: Brinell /Vicker/Rockwell hardness test
4. Determination of impact of metals: Izod/Charpy impact test
5. Determination of Transverse strength and Modulus of Elasticity for Metals/Timber
6. Determination of Torsional strength and Modulus of Rigidity for Metals

Course Outcome:

After learning the course, the students should be able to:

CO1 Understand the fundamental concepts related to stress, strain, and material propertiessuch as stress, strain, modulus of elasticity, and Poisson's ratio
CO2 Analyse and calculate normal stress and strain in structural elements subjected to axial loading
CO3 Calculate shear stress and angle of twist in circular shafts subjected to torsional loading
CO4 Analyse and calculate bending stress, shear stress, and deflection in beams subjected to various loading conditions
CO5 Use Mohr's circle to analyse and represent two-dimensional stress and strain states
CO6 Understand fatigue and fracture mechanics, including the S-N curve and factors influencing material failure under cyclic loading.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	2	-	-	-	-	-	-	-	-	-	-	1	-	-	-
CO-2	2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO-3	2	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	2	2	2	-	-	-	-	-	-	-	-	1	-	3	-
CO-5	2	2	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-6	2	-	-	2	-	2	-	-	-	-	-	-	-	2	-

FEB150001 : ENGINEERING ECONOMICS AND MANAGEMENT

Course Objectives: -To impart knowledge, with respect to concepts, principles and practical applications of Economics, which govern the functioning of a firm/organization under different market conditions.

To help the students to understand the fundamental concepts and principles of management; the basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	0	0	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Introduction to Economics;** Definitions, Nature, Scope, Difference between Microeconomics & Macroeconomics Theory of Demand & Supply; meaning, determinants, law of demand, law of supply, equilibrium between demand & supply Elasticity; elasticity of demand, price elasticity, income elasticity, cross elasticity	4	10%
2.	**Theory of production;** production function, meaning, factors of production (meaning &characteristics of Land, Labour, capital & entrepreneur), Law of variable proportions & law of returns to scale Cost; meaning, short run & long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost. Break even analysis; meaning, explanation, numerical	4	10%
3.	**Markets;** Meaning, types of markets & their characteristics (Perfect Competition, Monopoly, Monopolistic Completion, Oligopoly) National Income; meaning, stock and flow concept, NI at current price, NI at constant price, GNP, GDP, NNP,NDP, Personal income, disposal income	5	10%
4.	**Basic economic problems;** Poverty-meaning, absolute & relative poverty, causes, measures to	4	10%

	reduce Unemployment: meaning, types, causes, remedies Inflation; meaning, types, causes, measures to control		
5.	**Money;** Meaning, functions, types, Monetary policy- meaning, objectives, tools, fiscal policy-meaning, objectives, tools Banking; meaning, types, functions, Central Bank- RBI; its functions, concepts; CRR, bank rate, repo rate, reverse repo rate, SLR.	4	10%
6	**Introduction to Management;** Definitions, Nature, scope Management & administration, skill, types and roles of managers Management Principles; Scientific principles, Administrative principles, Maslow's Hierarchy of needs theory	4	11%
7	**Functions of Management;** Planning, Organizing, Staffing, Directing, Controlling (meaning, nature and importance) Organizational Structures; meaning, principles of organization, types-formal and informal, line, line & staff, matrix, hybrid (explanation with merits and demerits), span of control, departmentalization.	5	11%
8	Introduction to Marketing management; Marketing Mix, concepts of marketing, demand forecasting and methods, market segmentation Introduction to Finance Management; meaning, scope, sources, functions	5	11%
9	**Introduction to Production Management;** Definitions, objectives, functions, plant layout-types & factors affecting it, plant location- factors affecting it. Introduction to Human Resource Management; definitions, objectives of manpower planning, process, sources of recruitment, process of selection	5	11%
10	**Corporate Social Responsibility;** meaning, importance Business Ethics; meaning, importance	2	6%

Reference Book:

- Engineering Economics, R.Paneerselvam, PHI publication
- Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.
- Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
- Principles and Practices of Management by L.M.Prasad
- Principles of Management by Tripathy and Reddy
- Modern Economic Theory, By Dr. K. K. Dewett& M. H. Navalur, S. Chand Publications

Course Outcome

CO-1: The course is intended to provide basic understanding of Economics and Management to engineering students with following aspects: To impart knowledge, with respect to concepts, principles and practical applications of Economics,

CO-2: Which govern the functioning of a firm/organization under different market conditions. To help the students to understand the fundamental concepts and principles of management

CO-3: basic roles, skills, functions of management, various organizational structures and basic knowledge of marketing

CO-4: Understand major principles of economic analysis for decision making among alternative courses of action in engineering.

CO-5: Apply cost estimation and alternative analysis techniques for engineering applications.

CO-6: Understand techniques and methods of sensitivity analysis and expected-value decisions.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	1	3	2	2	2	2	1	-	-	-	-
CO-2	3	2	-	1	-	1	-	1	2	-	-	3	-	-	-
CO-3	3	-	1	-	2	-	-	-	-	3	-	-	-	-	-
CO-4	3	-	2	-	1	-	3	1	1	-	-	2	-	-	-
CO-5	2	2	2	1	-	2	2	1	2	2	-	-	-	-	-
CO-6	2	2	2	1	-	-	1	1	-	1	-	-	-	-	-

SUBJECT NAME: HEAT TRANSFER

SUBJECT CODE: FEB150201

Course Objective:- To make the students to understand heat transfer characteristics materials and equipment. To understand the mechanisms of heat transfer under steady and transient conditions. To understand the concepts of heat transfer through extended surfaces.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Introduction to three modes of heat transfer, Derivation of heat balance equation- Steady one dimensional solution for conduction heat transfer in Cartesian, cylindrical and spherical geometry, concept of conduction and film resistances, critical insulation thickness, lumped system approximation and Biot number, heat transfer through pin fins- Two dimensional conduction solutions for both steady and unsteady heat transfer- approximate solution to Un steady conduction heat transfer by the use of Heissler charts.	12	30%
2.	Heat convection, basic equations, boundary layers- Forced convection, external and internal flows- Natural convective heat transfer- Dimensionless parameters for forced and free convection heat transfer-Correlations for forced and free convection- Approximate solutions to laminar boundary layer equations (momentum and energy) for both internal and external flow- Estimating heat transfer rates in laminar and turbulent flow situations using appropriate correlations for free and forced convection.	8	20%
3.	Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative	8	20%

	properties, view factors and the radiosity method.		
4.	Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and ε-NTU methods.	6	18%
5	Boiling and Condensation heat transfer, Pool boiling curve	3	6%
6	Introduction mass transfer, Similarity between heat and mass transfer	3	6%

References Books:-

1. A. Bejan, Heat Transfer John Wiley, 1993
2. J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
3. F.P.Incropera, and D.P. Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, Sixth Edition, 2007.
4. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002
5. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002

COURSE OUTCOMES

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

CO-1:	Explain the basic modes and laws of heat transfer.
CO-2:	Develop and analyze general conduction equation in Cartesian, cylindrical and spherical coordinates.
CO-3:	Illustrate the concept of free and forced convection and discuss the dimensional analysis.
CO-4:	Classify the concept of boundary layer and develop the related equations.
CO-5:	Summarize the laws of thermal radiation and the concept of black body.
CO-6:	Explain the types of heat exchangers and discuss LMTD and NTU approaches for the design of heat exchangers.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	2	-	-	-	-	-	-	-	-	-	-	3	-	-
CO-2	3	3	2	3	-	-	-	-	-	-	-	-	-	-	2
CO-3	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-4	3	3	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-6	3	3	3	2	-	-	-	-	-	-	-	-	-	-	-

FEB150202: THEORY OF MACHINE

Course Objective: -Theory of Machines is a fundamental course for Mechanical engineers to understand the working principals of any machine. This course is essential to understand the motion, transmission of the motion and the forces responsible for the motion

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Classification of mechanisms- Basic kinematic concepts and definitions- Degree of freedom, mobility- Grashof's law, Kinematic inversions of four bar chain and slider crank chains- Limit positions- Mechanical advantage- Transmission angle- Description of some common mechanisms- Quick return mechanism, straight line generators- Universal Joint- Rocker mechanisms	8	15
2.	Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equations- kinematic analysis of simple mechanisms- slider crank mechanism dynamics Coincident points- Coriolis component of acceleration- introduction to linkage synthesis three position graphical synthesis for motion and path generation	8	20
3.	Classification of cams and followers- Terminology and definitions- Displacement diagrams- Uniform velocity, parabolic, simple harmonic and cycloidal motions- derivatives of follower motions- specified contour cams- circular and tangent cams- pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers	8	20

4.	Involute and cycloidal gear profiles, gear parameters, fundamental law of gearing and conjugate action, spur gear contact ratio and interference/undercutting- helical, bevel, worm, rack & pinion gears, epicyclic and regular gear train kinematics	8	15
5	Surface contacts- sliding and rolling friction- friction drives- bearings and lubrication friction clutches- belt and rope drives- friction in brakes	8	10
6	Gyroscope: Principle of gyroscope, Definition of axes, active and reactive couples; Roll, Yaw and Pitch motions; Gyroscopic effect in a rotor, two wheelers, Four wheelers, ship and aeroplane.	**	10
7	Governors: Necessity of governor, Classification of Governors, working principle of centrifugal governors, Concept of control force, Control force diagram, Stability of governor, Condition for stability, Concept of isochronism, Sensitivity of governor, Characteristics of governors, Hunting of governors.	**	10

List of Suggested Experiments:
1. Performance on gravity-controlled governors. 2. Analysis of gyroscopic effect. 3. Performance on spring-controlled governors. 4. Analysis of clutch. 5. Analysis of brakes.

References Books: -

1. Thomas Bevan, Theory of Machines, 3rd edition, CBS Publishers & Distributors, 2005.
2. CleghornW.L. , Mechanisms of Machines, Oxford University Press, 2005.
3. Robert L. Norton, Kinematics and Dynamics of Machinery, Tata McGrawHill, 2009.
4. Ghosh A. and Mallick A.K., Theory of Mechanisms and Machines, Affiliated East-West Pvt. Ltd, New Delhi, 1988.

COURSE OUTCOMES

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

CO-1: Illustrate the student conversant with commonly used mechanism for industrial application.

CO-2: Analyze the velocity and acceleration of a mechanisms analytically and synthesis of problems.

CO-3: Construct the cam profile and analyze effect of friction in different mechanisms.

CO-4: Determine the static and dynamic forces for mechanical systems and flywheels

CO-5: Design of belt and chain drive system

CO-6: Design CAM/ Follower mechanisms for a given motion or a given input/output motion or force relationship

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	3	2	2	-	-	-	-	-	-	-	-	2	2	-
CO-3	3	3	2	2	-	-	-	-	-	-	-	-	2	2	-
CO-4	3	2	2	-	-	-	-	-	-	-	-	-	2	2	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	2	-	-
CO-6	3	2	3	3	-	-	-	-	-	-	-	-	1	-	-

FEB150203: MANUFACTURING PROCESS-II

Course Objective:-

1. The course focuses on understanding the basics of science and technology of casting processes. Metal casting industries have evolved during the past hundred years because of advancements in technologies.
2. The educational objectives of the Welding Technology program are: Graduates will be well versed in both traditional welding technologies, including all major arc welding processes.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.*	**Metal casting** Patterns practices:Types of patterns, allowances and material used for patterns, moulding materials, mouldingsands, Moulding sands; properties and sand testing; grain fineness; moisture content, claycontent and permeability test, core materials and core making, core print; core boxes, chaplets,gating system design. Moulding practices: Green, dry and loam sand moulding, pit and floormoulding; shell moulding; permanent moulding; carbon dioxide moulding. Casting practices:Fundamental of metal casting, Sand casting, Shell-Mould casting, Mold casting (plaster andceramic), Investment casting, Vacuum casting, Permanent mould casting, Slush casting,Pressure casting, Die casting, Centrifugal casting, Continuous casting, Squeeze casting, Castingalloys, Casting defects, Design of casting, Gating system design, and riser design. Meltingfurnaces-rotary, Pit electric, Tilting and cupola. Metallurgical considerations in casting elementsof gating system, and risers and their design.	11	30%

4	**Metal Joining Processes:** Principle of welding, soldering, Brazing and adhesive bonding. Classification of welding and allied processes. Capabilities and applications; welding parameters, general concepts of weldability, welding metallurgy and weldament design, Gas welding and gas cutting, Arc welding, Power sources and consumables, Resistance welding: Spot, Projection and seam welding process, Atomic hydrogen, ultrasonic, Plasma and laser beam welding, Electron beam welding, and special welding processes e.g. TIG, MIG, friction and explosive welding, welding of C.I. and Al. Defects of welding and remedial actions. Numerical Calculation of Different process parameters of welding.	12	20%
5*	**Plastic, Ceramic and Glass Processing:** Classification of Plastics, Ingredients of Moulding compounds, General Properties of Plastics, Plastic part manufacturing processes such as compression moulding, Transfer moulding, Injection moulding, Extrusion moulding, Blow moulding, Calendaring, Thermoforming, slush moulding, laminating. Ceramic Structure, Properties, and Applications, Shaping Ceramics, Glasses Structure, Properties, and Applications, Forming and shaping of glass, Composite materials, Processing of metal matrix and ceramic matrix composites, Processing semiconductors.	10	25%
6*	**Forming and Shaping Processes:** Metal working, Elastic and plastic deformation, Concept of strain hardening, Hot and cold Working, Rolling: Principle and operations, Roll pass sequence, Extrusion, Wire and tube drawing processes.Forging: Method of forging, Forging hammers andpresses, Principle of forging tool design, Cold working processes: Shearing, Drawing,Squeezing, Blanking, Piercing, deep drawing, Coining and embossing, Metal working defects,cold heading, Riveting, Thread rolling bending and forming operation.	9	25%

List of Suggested Practical:

1. Basic understanding of Different Manufacturing Processes: concepts, application, advantage and future aspects.
2. Hands on Exercise on Pattern Making.
3. Performance on Metal Casting of Simple component
4. Performance on Welding of simple work piece (Example Arc and Resistance Welding)
5. Exercise Problems on Welding
6. Exercise problems on Casting
7. Exercise problems on Sheet Metal Works

8. Demonstration on Plastic, Glass and Ceramic Processing (Industrial Visit)

Reference Book

1. "Manufacturing Technology" Vol-II, By P.N. Rao, Tata McGraw Hill.
2. "Manufacturing Engg. And Technology" By S. Kalpakajain, PHI/Pearson.
3. "Welding technology", by O.P.Khanna, DhanpatRai publishers.
4. "Manufacturing Engineering And Technology" By S. Kalpakjian, Pearson.
5. "Manufacturing Processes", Kalpakjian, Pearson

COURSE OUTCOMES

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

CO1 Analyze and access the use of casting processes in manufacturing and understand the working of various casting processes
CO2 Understand the basics of metal cutting and working of different types of machine tools.
CO3 Analyze and access the importance of welding processes in manufacturing and apply knowledge to select appropriate welding process based on the type of industrial application
CO4 Analyze the Welding processes for varied engineering applications
CO5 To select and apply knowledge, techniques, skills, and modern tools of the Welding Processes.
CO6 Explain the conventional and advanced metal forming processes and composite fabrication.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	-	1	-	-	-	-	-	-	-	-	1	-
CO-2	1	1	-	-	2	-	-	-	-	-	-	-	-	1	1
CO-3	1	-	1	-	1	2	1	-	-	-	1	1	-	1	-
CO-4	1	1	-	-	2	-	-	-	-	-	-	-	-	1	1
CO-5	1	-	1	-	1	-	1	-	1	-	-	-	-	1	1
CO-6	1	2	1	-	2	-	-	-	1	-	1	-	1	-	-

FEB150204: MECHANICAL ENGINEERING LABORATORY (THERMAL) I

Teaching & Evaluation Scheme: -

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
0	0	4	4	2	00	00	30	20	50

List of Suggested Practicals

1. To determine Metacentric height of floating body.
2. To determine the Coefficient of discharge through open channel flow over a Notch. (Rectangular or V notch)
3. To determine the different types of flow Patterns by Reynolds's experiment.
4. Performance test on Reciprocating pump.
5. Performance test on Centrifugal compressor.
6. To determine the thermal conductivity of given metal rod
7. To determine heat transfer co-efficient by forced convection.
8. To determine heat transfer co-efficient by natural convection
9. To study drop & film wise condensation & determine the film co-efficient
10. To measure convective heat transfer co-efficient and effectiveness of the fin under natural convection.
11. To determine heat transfer co-efficient for tube and tube heat exchanger.
12. To measure convective heat transfer co-efficient and effectiveness of the fin under forced convection.
13. To conduct performance test on Refrigeration Test Rig.
14. To conduct performance test on Electrolux Refrigeration system.
15. To find C.O.P of Water to Water Heat Pump.
16. To Conduct performance test on Ice Plant Trainer.
17. Performance test of 2 stroke Diesel Engine.
18. Performance test of 4 stroke Diesel Engine.

COURSE OUTCOMES:

CO-1: Upon completion of this course, students will be able to mathematically analyse the simple flow situation
CO-2: They will be able to evaluate the performance of pumps and turbines.
CO-3: Understand statics, dynamics and various approaches to fluid mechanics.
CO-4: Understand fundamentals of flow through pipes
CO-5: Understand basics of compressible flow
CO-6: Correlate fundamentals of fluid mechanics with various mechanical systems.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	-	-	2	-	-	-	-	3	2	-	-	-	-	-
CO-2	2	3	-	2	-	-	-	-	3	2	-	-	-	-	-
CO-3	2	2	-	3	-	-	-	-	3	2	-	-	-	-	-
CO-4	2	-	-	-	-	-	-	-	2	3	-	-	-	-	-
CO-5	2	2	-	-	-	-	-	-	3	2	-	-	-	-	-
CO-6	2	2	-	-	-	-	-	-	2	3	-	-	-	-	-

FEB150205: PROJECT-I

Course Objective:-

- The purpose of Project in Mechanical Engineering is to develop the necessary knowledge, understanding Practical knowledge
- Demonstrated the ability to analyze, design and improve practical thermal and/or mechanical systems.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
0	0	4	4	1	00	00	80	20	100

Sr. No.	Particular	Weightage
1.	**Understanding of Design Thinking methodology/ need** ✓ Importance and understanding of Design Thinking for innovation, entrepreneurship, societal solutions with various learning tools	15
2.	**Observation towards Empathy** ✓ Field Activity/observation and outcome ✓ Mind Mapping - Summarization and data analysis ✓ Observation Technique (AEIOU Framework)	20
3.	**Log book** **(Individual completed log book, duly signed by guide regularly)** Continuous Assessment Card for Internal Evaluation (Complete and duly signedby guide regularly)	10
4.	**Understanding of Canvases/Framework** ✓ AEIOU, Mind Mapping ✓ Empathy mapping ✓ Ideation Canvas ✓ Product development Canvas	15

5.	**Design Problem Definition** ✓ Prior art search/Secondary research ✓ Diachronic and Synchronic analysis	10
6.	**Report:** ✓ Compilation of work report (process report), ✓ Online Certificate generated through DE Portal, Future action plan, ✓ Question and Answer, ✓ Communication Skill, Attitude	10

COURSE OUTCOMES

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

CO1 Demonstrate a sound technical knowledge of their selected project topic.
CO2 Undertake problem identification, formulation and solution.
CO3 Design engineering solutions to complex problems utilising a systems approach
CO4 Conduct an engineering project.
CO5 Communicate with engineers and the community at large in written an oral forms.
CO6 Demonstrate the knowledge, skills and attitudes of a professional engineer.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	1	-	1	1	1	1	1	-	2	2	2	-	-	-	-
CO-2	1	2	1	1	1	-	1	-	2	2	2	-	-	1	2
CO-3	1	1	1	2	-	-	-	-	1	1	-	-	-	1	2
CO-4	1	2	1	-	-	1	1	-	1	1	1	-	1	-	1
CO-5	-	1	-	-	-	2	1	1	1	2	-	-	-	-	-
CO-6	1	-	-	1	-	1	-	-	1	2	1	1	-	1	-

FEB150206: DESIGN OF MACHINE ELEMENTS

Course Objective: -The objectives of a "Design of Machine Elements" course are to provide students with a solid foundation in the principles, methods, and practices involved in designing various machine components. These objectives aim to equip students with the necessary knowledge and skills to analyse and design machine elements that meet specific functional requirements, considering factors such as material selection, loading conditions, safety, and reliability

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Content:-

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Design Against Fluctuating Loads: Stress Concentration, Endurance limit and Fatigue failure, Factors affecting endurance limit, S-N Diagram, Tolerances, Limits and Fits: Introduction, Basic Definitions, Maximum Metal Condition, Least Metal Condition, Grade of tolerance, Linear and Angular Tolerances, Fundamental deviations, Types of Fits and its basis	5	10%
2.	Design of Springs: Classification of springs, Helical Spring: Style of ends, Stresses, Correction Factors, and Deflection, Design against static and fluctuating loads, Helical Torsion Multi-Leaf Spring: Terminology, Nipping, and Design of multi-leaf spring.	5	15%
3.	Design of sliding and Journal bearing: Method of lubrication, Hydrodynamic, Hydrostatic, boundary, etc., Minimum film thickness and thermal equilibrium, Selection of anti-friction bearings for different loads and load cycles, Design of thrust bearing, Rolling contact bearing, Ball bearing, Rolling contact bearing under variable loading.	8	20%

4.	Design of clutches and brakes: Function , Classification, Material selection, Design of positive clutches, Friction clutches -cone, single, Multiple and centrifugal clutches, Design of band brake, External and internal shoe brakes, Internal expanding shoe brakes, Design of disc brakes. Power Transmissions Elements : Transmission of power by Belt and Rope drives, Transmission Efficiencies, Design of Belts Flat and V types, Design of Chain drives and wire rope.	10	10%
5.	Design of solid and hollow circular shaft subjected to torque and combined loading; Design of shaft for rigidity and stiffness; Design of Couplings: Concept of rigid and flexible couplings, Design of: Clamp, Rigid flange and Flexible coupling.	6	10%
6	Power Screws and Threaded Joints: Forms of thread, Single and Multiple threaded screw, Terminology of power screw, Torque requirement of lifting/lowering, Self-locking, Efficiency of threads, coefficient of friction, design of screw and nut. Basic types of screw fastening, Cap and Set screw, Bolt of Uniform strength, locking devices, Terminology of Screw thread, Bolted Joint: Simple and Eccentric loading, Torque requirement for bolt tightening Welded and Riveted Joints: Welded joints: stress relieving of welded joints, Strength of butt and fillet joint, Eccentric load in the plane of weld, Welded joint subjected to bending and torsion.	10	20%
7	Gear Design: Spur and Helical Gears: Stress in gear tooth: Lewis formula, AGMA bending stress equation and AGMA pitting resistance formula, Gear quality and selection aspects. Bevel and Worm gears: Specifications and design of bevel and worm gears	8	15%

References Books:-

[1] Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, Fifth Edition, McGraw-Hill International; 1989.
[2] Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan, 1992.
[3] Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley, 1994.
[4] Spottes, M.F., Design of Machine elements, Prentice-Hall India, 1994.
[5] R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall, 1998

COURSE OUTCOMES

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

CO-1: Explain the design procedures and methods, properties of engineering materials and their selection, design against static and fluctuating load

CO-2: Solve the design problems of different types of joints i.e. bolted, riveted joint and welded joint under different loading conditions.

CO-3: Analyse the design problems related to the design of springs under different loading conditions.

CO-4: Analyse the transmission shafts and keys under different loading conditions

CO-5: Design problems related to clutches, brakes and selection of bearings from manufacturer's catalogue.

CO-6: Design gears and gearboxes, considering factors such as tooth profile, pitch, and power transmission requirements
Design joints and fasteners, considering factors like bolted and welded connections, to ensure structural integrity

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	2	2	3	-	-	-	-	-	-	-	-	-	2	-
CO-3	3	3	2	2	-	-	-	-	-	-	-	-	-	3	-
CO-4	3	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO-5	3	3	3	3	-	-	-	-	-	-	-	-	-	2	-
CO-6	3	2	2	2	-	-	-	-	-	-	-	-	-	3	-

FEB160001: CYBER SECURITY

Objective: Stay up to date with the latest cyber security news and trends and make sure you are implementing adequate cyber security measures in your organization using suitable hardware and software.

Avoid the risks of phishing attacks by adhering to ethical security behavior.

Understanding cloud computing and how it can help your business is vital for the success of your venture.

The goal of cyber security is to ensure secure storage, control access and prevent unauthorized processing, transfer, or deletion of data. It safeguards the confidentiality, integrity, and availability of information.

Credit: 3 **L-T-P: 0-0-6s**

Sr.	Content	Total Hrs	% Weightage
1	Systems Vulnerability Scanning Overview of vulnerability scanning, Open Port / Service Identification, Banner / Version Check, Traffic Probe, Vulnerability Probe, Vulnerability Examples, OpenVAS, Metasploit. Networks Vulnerability Scanning - Netcat, Socat, understanding Port and Services tools - Datapipe, Fpipe, WinRelay, Network Reconnaissance – Nmap, THC-Amap and System tools. Network Sniffers and Injection tools – Tcpdump and Windump, Wireshark, Ettercap, Hping Kismet	08	25%
2	Network Defense tools Firewalls and Packet Filters: Firewall Basics, Packet Filter Vs Firewall, How a Firewall Protects a Network, Packet Characteristic to Filter, Stateless Vs Stateful Firewalls, Network Address Translation (NAT) and Port Forwarding, the basic of Virtual Private Networks, Linux Firewall, Windows Firewall, Snort: Introduction Detection System	08	25%
3	Web Application Tools Scanning for web vulnerabilities tools: Nikto, W3af, HTTP utilities - Curl, OpenSSL and Stunnel, Application Inspection tools – Zed Attack Proxy, Sqlmap. DVWA, Webgoat, Password Cracking and Brute-Force Tools – John the Ripper, L0htcrack, Pwdump, HTC-Hydra	08	25%

4	Introduction to Cyber Crime and law Cyber Crimes, Types of Cybercrime, Hacking, Attack vectors, Cyberspace and Criminal Behavior, Clarification of Terms, Traditional Problems Associated with Computer Crime, Introduction to Incident Response, Digital Forensics, Computer Language, Network Language, Realms of the Cyber world, A Brief History of the Internet, Recognizing and Defining Computer Crime, Contemporary Crimes, Computers as Targets, Contaminants and Destruction of Data, Indian IT ACT 2000.	**03**	**10%**
5	Introduction to Cyber Crime Investigation Firewalls and Packet Filters, password Cracking, Keyloggers and Spyware, Virus and Warms, Trojan and backdoors, Steganography, DOS and DDOS attack, SQL injection, Buffer Overflow, Attack on wireless Networks	**05**	**15%**

Reference Books:

1. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
2. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives byNinaGodbole and SunitBelpure, Publication Wiley.
3. Cyber Security Understanding Cyber Crimes, Computer Forensics and Legal Perspectives byNina Godbole and Sunit Belpure, Publication Wiley
4. Cyber Security and Cyber Laws Paperback – 2018 by Alfred Basta, Nadine Basta , MaryBrown , Ravinder Kumar, publication Cengage
5. Anti-Hacker Tool Kit (Indian Edition) by Mike Shema, Publication Mc Graw Hill.
6. Cyber security and laws – An Introduction, Madhumita Chaterjee, Sangita Chaudhary, GauravSharma, Staredu Solutions

List of Suggested Practical:

1. TCP scanning using NMAP
2. Port scanning using NMAP
3. TCP / UDP connectivity using Netcat
4. Network vulnerability using OpenVAS
5. Web application testing using DVWA
6. Manual SQL injection using DVWA
7. XSS using DVWA
8. Automated SQL injection with SqlMap

Course Outcomes:

CO-1: Analyze and evaluate the cyber security needs of an organization.

CO-2: Determine and analyze software vulnerabilities and security solutions to reduce the risk ofexploitation.

CO-3: Measure the performance and troubleshoot cyber security systems.

CO-4: Design and develop a security architecture for an organization

CO-5: Design operational and strategic cyber security strategies and policies.

CO-6: Comprehend and execute risk management processes, risk treatment methods, and key risk andperformance indicators

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*													
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**
CO-1	3	2	1	-	3	1	-	-	-	-	2	3	-	1
CO-2	-	-	-	-	-	-	-	2	-	-	-	-	1	-
CO-3	2	-	1	-	1	-	-	-	-	-	2	-	-	1
CO-4	-	-	-	-	-	2	1	-	-	-	-	1	2	-
CO-5	2	-	-	1	-	-	-	-	1	-	1	-	-	1
CO-6	-	1	-	-	1	2	-	1	-	-	-	-	1	-

FEB160201: DYNAMICS OF MACHINE

Course Objective: - The "Dynamics of Machine" course focuses on imparting knowledge and skills related to the analysis of motion, forces, and dynamic behaviour of machines and mechanical systems

Teaching & Evaluation Scheme: -

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	2	5	4	70	30	30	20	150

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Balancing of Rotating Masses:** Concept of static and dynamic balancing, Analysis of effect of unbalanced masses in single and multiple planes in rotating elements, Bearing reactions Approaches and equipment for measurement of unbalanced masses	3	10
2.	**Dynamics of Reciprocating Engines:** Single Cylinder Engine: Slider – Crank kinematics (Analytical), Gas force and torque; static and dynamic equivalence of models (for masses); Inertia, shaking force and shaking torque, Analysis of pin forces,balancing.Multi Cylinder Engines: Configurations; Inline Engines: Effect of phase angles, firing order and number of strokes; Shaking forces and moments, inertia torques and determination best configuration / unbalanced mass. Analysis of V and radial engine configurations. Graphical methods may be demonstrated but emphasis should be on analytical approach	7	20
3.	**Introduction to Mechanical Vibrations:** Elements of simple harmonic motion, concept of natural frequency, types of vibrations, Basic elements and lumping parameters of a vibratory system, lumping of physical systems, Concept of Degrees of Freedom	2	5
	Single Degrees of Freedom System (Linear and Torsional): Undamped free vibrations, equivalent stiffness, equivalent systems, determination of natural frequency; Coulomb and Viscous damping, Types of dampers, Damping coefficient, damping effects: under, over and critically damped system,	10	20

	Damping factor, damped natural frequency and logarithmic decay; Analytical solution of Forced vibrations with harmonic excitation system and vector representation, Dependence of Magnification Factor, Phase difference and Transmissibility on frequencyof		
	Two Degrees of Freedom System: Equation of motion and principal mode of vibration, torsional vibrations of two and three rotor system, torsionally equivalent shaft, geared system	5	10
	Multi degree freedom systems and analysis (Free vibrations): Concepts of normal mode vibrations, natural frequencies, mode shapes, nodes, Correct definition of natural frequency	4	5
	Vibrations of Continuous Systems (Free Vibrations): Longitudinal vibrations of bar or rod: Equation of motion and solution, Lateral vibrations of beam: Equation of motion, initial and boundary conditions, solution	4	10
	Rotating unbalance: Whirling of shafts, Critical speed and its practical importance in the design of shafts, Application of Dunkerley's method and Rayleigh's method for estimating the critical speed of shafts	4	10
	Vibration Measurement: Introduction to vibration measurement and analysis devices: pickup Vibrometer, velocity, accelerometer, FFT analyser	**	
4	**Cam Dynamics:** Dynamic analysis of force-closed cam follower: Undamped and Damped response, Jump phenomenon: concept, effect of spring force and dead weights.	4	10

List of Suggested Experiments:

1.Understand and verify the fundamental laws of static & dynamic balancing.

2.Study balancing of reciprocating masses.

3.Study and confirm relation between the period of oscillation and length of pendulum for simple and compound pendulums.

4.longitudinal vibrations of spring mass system.

5.To study the undamped free vibration of equivalent spring mass system.

6.To determine the time period and frequency of torsional vibrations of a single rotor system.

7.To determine the time period and frequency of torsional vibrations of two rotors system.

8.Study forced damped vibrations of single degree of freedom system.

9.To determine whirling speed of the shaft and study effect of shaft diameter and end conditions on the same.

10.Study forced lateral vibrations of a beam.

11.Study jump phenomenon in the cam.

12.Vibration measurement and analysis

References Books: -

1. S S Rao, Mechanical Vibrations,Pearson.
2. R L Norton, Kinematics and Dynamics of Machinery,McGraw-Hill.
3. J.Uicker , Gordon R Penstock & J.E. Shigley, Theory of Machines and Mechanisms,Oxford.
4. Kenneth J Waldron , Gary L Kinzel, Kinematics, Dynamics and Design of Machinery,Wiley.
5. R L Norton, Design of Machinery,McGraw-Hill.

Suggested Books

1. S S Rao, Mechanical Vibrations,Pearson.

COURSE OUTCOME

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

CO-1: Learn methods for balancing rotating masses to minimize vibrations and improve the performance and durability of machines.

CO-2: Study the dynamics of reciprocating engines, including the analysis of inertia forces, balancing, and vibration.

CO-3: Develop skills in the dynamic analysis of machines, considering forces,,moments, and their effects on machine components

CO-4: Understand the fundamentals of mechanical vibrations.

CO-5: Ability to apply different methods for formulating the equation of motion for free and damped vibratory system and their solution cases.

CO-6: Understand the different modes of vibrations and applications of numerical methods.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	-	2	-
CO-2	2	3	2	2	-	-	-	-	-	-	-	-	-	-	-
CO-3	2	2	2	-	-	-	-	-	-	-	-	-	-	2	-
CO-4	2	-	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	2	2	1	-	-	-	-	-	-	-	-	-	-	2	-
CO-6	2	2	-	-	-	-	-	-	-	-	-	-	-	2	-

FEB160202: ADVANCED MANUFACTURING PROCESSES

Course Objective :-To provide knowledge on machines and related tools for manufacturing various Components .To understands the relationship between process and system in manufacturing domain. To identify the techniques for the quality assurance of the products and the optimality of the process in terms of resources and time management.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Metal Cutting:** Principles of metal cutting, classification of Metal cutting/machining processes: Orthogonal and oblique cutting, Effect of tool geometry and other cutting parameters, Mechanisms of formation of chips, types of chips formed, chip Breakers, concept of specific cutting pressure, The forces acting on the cutting tool and their measurement, Merchant's circle diagram, force dynamometer, force and velocity relationship, Tool wear, Factors causing wear, tool life, variables affecting tool life, economical cutting speed, machinability of metals	10	20
2.	**Gear and Thread Manufacturing:** Different types of Threads manufacturing methods, and tools involved, Different gear forming and generating methods with their special features, Gears finishing processes.	03	10
3.	**Thermal Aspects in Machining:** Sources of heat generation in machining and its effects, Temperature Measurement techniques in machining, types of cutting fluids, Functions of cutting fluid, Characteristics of cutting fluid, Application of cutting fluids, Economics of Metal Cutting Operations.	03	10
4.*	**Jigs and Fixtures:** Definition, Differences between Jigs and Fixtures, Its usefulness in mass production, design principles, 3-2-1 location principle and its application to short and long cylinders, types of locators, concept of work piece control, geo metric control, dimensional control and mechanical control, Clamps, jig bushes, Jigs and fixtures for various machining operations	05	15

5.*	**Press Tool:** Classification of presses, Classification of dies, cutting actions in dies, clearance, cutting forces, Methods of reducing cutting forces, Minimum Diameter of Piercing Center of Pressure, Blanking, Piercing, Drawing, Bending and Progressive Die design, scrap reduction, strip layout	06	15
6.	**Rapid prototyping introduction:** Prototyping fundamentals: Need for time compression in product development, Need for Additive Manufacturing, Historical development, Fundamentals of Additive Manufacturing, AM Process Chain, Advantages and Limitations of AM, Commonly used Terms, Classification of AM process, Fundamental Automated Processes: Distinction between AM and CNC, other related technologies	07	12
7.	**Non-conventional Machining Processes:** Introduction of EDM, IBM, ECM, ECG, CM, AJM, Wire cut EDM, USM, LBM process principle, process parameters and their applications. Process capabilities and their applications.	04	08
8.	**Advance Super finishing Technology:** Introduction, Lapping, Horning, Buffing, Barrel Tumbling, Burnishing, Powder coating, Polishing.	04	10

List of Reference Book :

1. "Manufacturing processes for engineering materials" Kalpakjian and Schmid, (5th Edition)-Pearson India, 2014.
2. "Materials and Processes in Manufacturing" (8th Edition), E. P. DeGarmo, J. T Black, R. A. Kohser, Prentice Hall of India, New Delhi (ISBN 0-02-978760).
3. "Manufacturing Science" A. Ghosh, and A. K. Mallik, Affiliated East-West Press Pvt. Ltd. New Delhi.
4. "Nontraditional Manufacturing Processes", G.F. Benedict, Marcel Dekker, Inc. New York (ISBN 0- 8247-7352-7
5. "Production Technology" - H.M.T. By HMT
6. "Tool Design" by Donaldson, Tata McGraw Hill Pub.
7. "Metal cutting Principles" by Trent McGraw Hill Pub.

8. List of Suggested Book :

1."Manufacturing processes for engineering materials" Kalpakjian and Schmid, (5th Edition)-Pearson India, 2014.

COURSE OUTCOMES

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

CO-1: Have a strong background in manufacturing processes and materials for discreet piece part manufacture, considering nomenclature recognition, limits, costs, benefits, etc. of comparative processes and materials through a hand on approach.

CO-2: Have an ability to utilize modern tools and techniques to effectively communicate technical requirements and functionality in oral, written, and graphical forms.

CO-3: Students able to understand different forces acting while metal cutting and can draw merchant circle diagram and also able to apply knowledge to economic metal cutting

CO-4: Students can able to grasp distinctive knowledge of gear forming and its generating methods.

CO-5: To understand high speed machining and its characteristics.

CO-6: To impart knowledge on process parameters for nonconventional and micromachining

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	-	-	1	-	-	-	1	-	-	-	1	-	-
CO-2	-	-	2	-	2	-	-	-	1	-	-	-	-	-	-
CO-3	3	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-6	3	-	-	-	2	-	-	1	-	-	-	-	-	-	-

FEB160203: MECHANICAL ENGINEERING LABORATORY (DESIGN) II

Course Objective:-

- To develop an ability to Create Solid Models of machine components.
- The student should be able to apply these skills to the solution of a variety of practical problems and be able to employ their knowledge to solve more complicated problems.

Teaching & Evaluation Scheme: -

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
0	0	4	4	2	00	00	30	20	50

- **Content**

1. Uniaxial tension test on mild steel rod
2. Torsion test on mild steel rod
3. Impact test on a metallic specimen
4. Brinnell and Rockwell hardness tests on metallic specimen
5. Bending deflection test on beams
6. Strain measurement using Rosette strain gauge
7. Microscopic examination of heat-treated and untreated metallic samples
8. Velocity ratios of simple, compound, epicyclic and differential gear trains
9. Kinematics of four bar, slider crank, crank rocker, double crank, double rocker and oscillating cylinder mechanisms
10. Cam & follower and motion studies
11. Single degree of freedom Spring-mass-damper system, determination of natural frequency and damping coefficient

COURSE OUTCOMES

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

CO1 To be able to understand fundamentals of design including material selection and axial retainment of rotating parts
CO2 To be able to design various joints, screwed connections, shafts, keys and couplings
CO3 To develop understanding of stress concentration and fatigue and apply the same
CO4 To be able to design levers, belt drives, pulleys, flywheels and hoisting machine elements
CO5 To develop an ability to design brakes and clutches

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	1	1	1	1	-	-	-	-	-	-	-	-
CO-2	1	1	-	-	1	-	1	-	-	-	-	-	-	1	-
CO-3	1	1	1	-	-	-	-	-	-	1	-	-	-	1	-
CO-4	1	-	1	-	-	-	-	-	-	1	1	-	-	-	1
CO-5	-	1	-	1	-	-	1	1	1	-	-	-	-	-	-

FEB160204: COMPUTER AIDED DESIGN

Course Objective:-. Apply practical skills and knowledge to solve challenging engineering design problems, including developing design concepts, creating detailed engineering drawings, and performing engineering analyses using CAD tools.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Introduction**: A typical product cycle, CAD tools for the design process of product cycle, CAD / CAM system evaluation criteria, Input / Output devices; Graphics Displays: Refresh display, DVST, Raster display, pixel value and lookup table, estimation of graphical memory, LCD, LED fundamentals. Concept of Coordinate Systems: Working Coordinate System, Model Coordinate System, Screen Coordinate System. Line and Curve generation algorithm: DDA, Bresenham's algorithms. Graphics exchange standards and Database management systems.	7	19
2.	**Curves and Surfaces**: Parametric representation of lines: Locating a point on a line, parallel lines, perpendicular lines, distance of a point, Intersection of lines. Parametric representation of circle, Ellipse, parabola and hyperbola. Synthetic Curves: Concept of continuity, Cubic Spline: equation, properties and blending. Bezier Curve: equations, properties; Properties and advantages of B-Splines and NURBS. Various types of surfaces along with their typical applications.	11	24
3.	**Mathematical representation of solids**: Geometry and Topology, Comparison of wireframe, surface and solid models, Properties of solid model, properties of representation schemes, Concept of Half-spaces, Boolean operations. Schemes: B-rep, CSG, Sweep representation, ASM, Primitive instancing, Cell Decomposition and Octree encoding	10	23
4.	**Geometric Transformations**: Homogeneous representation; Translation, Scaling, Reflection, Rotation, Shearing in 2D and 3D; Orthographic and	15	34

	perspective projections. Window to View-port transformation.		

Reference Book

1. Ibrahim Zeid, Mastering CAD CAM, Tata McGraw Hill Publishing Co. 2007.
2. C. McMohan and J. Browne, CAD/CAM Principles, II edition, Pearson Education, 1999.
3. W. M. Neumann and R.F. Sproul, Principles of Computer Gra[hics, McGraw Hill, 1989.
4. D. Hearn and M.PBaker, Computer Graphics, Prentice Hall Inc., 1992

List of Suggested Book :

1. Ibrahim Zeid, Mastering CAD CAM, Tata McGraw Hill Publishing Co. 2007

COURSE OUTCOMES

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

CO-1: Understand the basics of CAD/CAM, CIM and Computer Aided Quality Control.
CO-2: Construct model of different types of curves, surfaces and solids.
CO-3: Understand the concept of group technology, transformation of points and lines in computer aided software
CO-4: Understand and implement the coding.
CO-5: Apply computer aided process planning.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	3	2	-
CO-2	3	2	2	-	-	-	-	-	-	-	-	-	2	3	-
CO-3	3	-	2	-	-	-	-	-	-	-	-	-	2	1	-
CO-4	3	2	2	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	3	-	-	-	-	-	-	-	-	-	-	-	1	1	-

FEB160205: COMPOSITE MATERIALS

Course Objective:- Equip students with knowledge on composite strengthening addition of components and their production routes. Familiarize students about the properties and response of composite structures subjected to mechanical loading.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	0	0	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Introduction**: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix. Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance	5	14%
2.	**Reinforcements:** Preparation-layup, curing, properties and applications of glass fibers, carbon fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions	4	12%
3.	**Manufacturing of Metal Matrix Composites:** Casting – Solid State diffusion technique, Cladding – Hot isostatic pressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications	15	32%
4.	**Manufacturing of Polymer Matrix Composites**: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications	14	30%
5.	**Strength:** Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply	4	12%

	discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations		

References Books:-

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,
3. Hand Book of Composite Materials-ed-Lubin
4. Composite Materials – K.K.Chawla
5. Composite Materials Science and Applications – Deborah D.L. Chung
6. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi

COURSE OUTCOMES

CO-1: Explain the advantages and applications of composite materials

CO-2: Describe the properties of various reinforcements of composite materials

CO-3: Summarize the manufacture of metal matrix, ceramic matrix and C-C composite

CO-4: Describe the manufacture of polymer matrix composites.

CO-5: Formulate the failure theories of composite materials.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	-	1	1	-	-	-	-	-	1	-	-
CO-2	3	-	-	-	-	1	-	-	-	-	-	-	-	-	-
CO-3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	3	1	1	-	-	-	-	-	-	-	-	-	1	-	-

FEB160206: TOTAL QUALITY MANAGEMENT

Course Objective:-

- The principles of Quality, Quality Assurance, and Total Quality Management will provide an insight into the concepts of Excellence and Best Value and the contribution of quality to strategic management
- There are many tools and doctrines that can be used for assessing product/service quality and selection of these tools can help in the pursuit of excellence. This course is designed to provide a valuable perspective for future business managers.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
0	0	4	4	1	00	00	80	20	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Introduction Quality Management Indian Companies Monopolize the Deming Awards in 2003, Quality Management- A conceptual frame work, Strategic Quality Management, Benchmarking.	4	8
2.	Quality Standards and business excellence models Quality system Standards, Bureau of Indian Standards, Agmark Grading and standardization, Quality council of India, International Organization for Standardization, Conformance to Specifications, Quality Assurance, Quality Circles, Quality audits, ISO 14000, Customer Operations Performance Centre (COPC) 2000	4	8
3.	Total Quality Management (TQM) W. Edwards Deming's Contribution to TQM, Juran's Contribution to TQM, Crosby's contribution to TQM, Ishikawa's contribution to TQM, Comparing the Quality Gurus, Total Productive Maintenance (TPM).	6	14
4.	Service quality management and Cost of Quality Products and services, Classification of services, Service Quality, Measuring Service Quality, Prevention costs, Appraisal Costs, Internal and External failure costs, Cost of quality models, India's Quality Journey so far, Quality management in India, Quality related priorities of Indian companies, Case studies	8	21

5.	Six sigma and Experimental design Meaning of Six sigma, The seven magnificent Quality tools, Introduction of experimental design, Taguchi Method in Experimental Design, Concept, Application of QFD, Case Study.	8	16
6	Statistical Quality Control Quality control-its introduction and benefits, Variation in processes: factors, process capability & Its analysis, control charts for variables and attributes, Establishing & interpreting control charts, Concept of Acceptance Sampling, sampling by attributes, single and double sampling plans, inspections by samples, AQL, LTPD, consumers and producer's risk, construction and use of operating characteristic curves, use of standard sampling tables and related IS, sampling by variables, Continuous sampling plan, vendor ratings.	10	25
7	Intellectual Properties System Definition of intellectual property, importance of IPR; TRIPS and its implications, patent, copyright, industrial design and trademark	4	8

Reference Book:

1. Quality Management by KanishkaBedi
2. Intellectual Property Rights, PrbuddhaGanguli, TMH
3. Probability and Reliability with Statistics, Trivedi, PHI
4. Statistical Quality Control By M. Mahajan

Suggested Book:

1. TQM in Service Sector, R.P.Mohanty and R.R.Lakhe
2. Total Quality Management, Arora ,Kataria
3. Total Quality Management, Subburaj, TMH

COURSE OUTCOMES:

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

CO1 Understand the historical development of quality management principles.
CO2 Knowledge of industry-specific quality standards and regulations.
CO3 Ability to apply these tools to analyze and improve processes.
CO4 Understand how quality aligns with organizational strategy and goals.
CO5 Recognize the ethical considerations in quality management.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	1	1	1	1	-	-	-	-	-	-	1	-	1	-	-
CO-2	1	2	1	-	-	1	-	-	1	1	2	1	-	-	-
CO-3	1	2	1	1	1	-	-	-	-	1	1	-	-	-	-
CO-4	1	1	-	1	2	-	-	-	1	1	2	-	-	-	-
CO-5	1	-	1	-	1	-	-	3	-	-	-	1	-	1	-

FEB160207: ENERGY CONSERVATION & MANAGEMENT

Course Objective:-

To identify the need of energy conservation.

To observe standard practices based on energy conservation act.

To familiarize the process of energy auditing and apply good engineering practices toreduce energy loss.

Teaching & Evaluation Scheme: -

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Energy conservation:** Principles of energy conservation, Energy Conservation Act 2001 and its features, Electricity Act-2003 & its features, Energy consumption pattern, Resource availability, Energy pricing, Energy Security, Estimation of energy use in a building. Heat gain and thermal performance of building envelope - Steady and non-steady heat transfer through the glazed window and the wall - Standards for thermal performance of building envelope, Evaluation of the overall thermal transfer, ECBC code for Building Construction	10	24
2.	**Energy efficiency in thermal utilities:** Energy efficiency in boilers, furnaces, steam systems, cogeneration utilities, waste heat recovery, compressed air systems, HVAC&R systems, fans and blowers, pumps, cooling tower **Energy efficiency in electrical utilities:** Energy efficiency for electric motors, lighting systems, Characteristics of Light, Types of Lighting, Incandescent Lighting, Fluorescent Lighting, Vapor Lighting, Street Lighting, LED Lighting, Lighting Design, Light Dimming, Tips for Energy Conservation, Products for Energy Conservation in lighting system	10	24
3.	**Energy Audit:** Definition, objective and principles of Energy Management, Need of Energy Audit and Management, types of energy audit, audit process, Guidelines for writing energy audit report, data presentation in report, findings recommendations, impact of renewable	9	22

	energy on energy audit recommendations and energy audit report, energy audit of building system, lighting system, HVAC system, Water heating system, heat recovery opportunities during energy audit, Industrial audit opportunities, Instruments for Audit and Monitoring Energy and Energy Savings		
4.	**Energy Economics:** Simple Payback Period, Time Value of Money, Internal Rate of Return, Net Present Value, Life Cycle Costing, Equivalent uniform annual cost (EUAC), Life cycle cost, Discounting factor, Capital recovery, Depreciation, taxes and tax credit, Impact of fuel inflation on life cycle cost, Cost of saved energy, cost of energy generated, Energy performance contracts and role of Energy Service Companies (ESCOs).	9	22
5.	**Climate Policy:** Kyoto protocol, Clean development mechanism (CDM), Geopolitics of GHG control; Carbon Market	4	8

Reference Book:

1. General aspects of energy management and energy audit, Guide book EA-EM, BEE, India.
2. Energy efficiency in Electrical utilities, Guide book EA-EM, BEE, India.
3. Energy efficiency in Thermal utilities, Guide book EA-EM, BEE, India.
4. Energy performance assessment for equipment and utility systems, Guide book EA-EM,BEE, India.

COURSE OUTCOMES:

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

CO1 Understand energy scenario and policy
CO2 Understand the significance and procedure for energy conservation and audit.
CO3 Understand causes and remedies for global energy issues
CO4 Analyze, calculate and improve the energy efficiency and performance of electrical utilities
CO5 Analyze, calculate and improve the energy efficiency and performance of mechanical utilities

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	-	1	-	1	1	1	1	-	1	-	-	-	-
CO-2	1	1	-	-	-	1	-	-	1	1	1	-	-	-	-
CO-3	1	-	1	-	1	-	-	-	1	1	1	-	1	-	-
CO-4	-	1	-	1	1	-	-	-	1	-	1	-	1	-	-
CO-5	-	1	-	1	-	-	-	-	-	-	1	-	-	1	-

FEB160208: PROJECT-II

Course Objective:-

- Project rationale is an argument in favour of implementing the proposed project by your organization. It gives a detailed explanation of why the project is required in the area.
- The project work could be done in the form of a project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
0	0	6	6	2	00	00	80	20	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Design for Performance, Safety and Reliability:** ✓ *Design for performance*: The final product/process must perform for designed (projected in Product Development Canvas - PDC) features and functions as per the requirement of the user in actual working environment (revealed through rough prototype validation). ✓ *Design for Safety*: Safety is the most important aspect of human centric product/process. Reasonable factor of safety should be taken into account considering all adverse and factual factors (Ideation canvas – location/context/situation may be referred back here) as there is human interaction with product/process in manifold circumstances ✓ *Design for Reliability:* Reliability is the ability of a system or component to perform its required functions under stated conditions for a specified period of time. Your final product/process should be reliable as required by the user and should perform its desired functions as required for desired time period.	4	8
2.	**Design for Ergonomics and Aesthetics** ✓ *Ergonomics* is all about designing for human factors/comforts wherever they interact with product/process and surrounding environments. According to the International Ergonomics Association within the discipline of ergonomics there exist domains	4	8

	of specialization: (a) Physical Ergonomics – is concerned with the human anatomy, bio mechanical and physiological ability and its relevance to the product and surrounding systems; (b) Cognitive Ergonomics – is concerned with the mental ability such as perception, memory, reasoning and response power as they affect the interactions between humans and products/systems ; (c) Organizational Ergonomics – is concerned with the optimization of socio-technical systems including organizational structures, policies and processes ✓ *Aesthetics* is all about designing for physical appearance (looks) of the product. In current time, customers are willing to buy the products which have stunning looks with respect to their competitive products. Design for Aesthetics includes appearance, style, colour, form/shape, visuals and so on.		
3.	**Design for Manufacturability & Assembly (DFMA)** ✓ Check for alternative and compatible raw materials (Refer/ revise to LNM) Minimize the number of parts (Refer/ revise to PDC) ✓ Develop a modular design ✓ Design parts to be multi-functional ✓ Design parts for multiple-use ✓ Design for ease of fabrication/ production/ assemble♣ Minimize assembly paths ✓ Avoid separate fasteners (i.e. monolithic units)♣ Eliminate adjustments as possible (i.e. movement in parts addressing multiple. ✓ Avoid use of additional tools when possible ✓ Minimize subassemblies (i.e. joining and removing some of the parts) ✓ Use standard parts when possible (refer/ revise to LNM)♣ Simplify operations ✓ Design for efficient and adequate testing (refer/ revise to LNM) ✓ Use repeatable & understood processes Analyze failures	6	14
4.	**Design for Cost, Environment** ✓ *Design for cost* means designing for lowest possible life cycle cost. It involves assumed product design cost (manufacturing), delivery cost (to the end-user) as well as cost of operation and maintenance. Design for environment strategy describes best practices of designing a product/process to minimize health and environmental ill-impacts. Four main concepts of Design for Environment includes: (a) Design for Environmental aspects during Processing and Manufacturing; (b) Design for Environmental	8	21

	aspects in Packaging; (c) Design for Disposal or Reuse (i.e. after end of product/ process lifecycle as involved in one's case); (d) Design for Energy Efficiency (i.e. energy consumption during the product/ process usable life) Using the theories, methods, tools, software, mathematical tools, and standards etc. as listed in LNM prepared by the students during their studies of semester 4, students should complete the detail design (physical dimensioning/specifications) and production drawing/construction plan of the product/process during this semester so that fabrication of prototype/ sample live-working model can be undertaken during next semester. As the process is iterative students can also update the LNM based on the course work undertaken and experience gained so far.		

COURSE OUTCOMES:

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

CO1 Understand the design thinking process
CO2 Design a solution to an engineering problem
CO3 Identify needs and constraints of product development system
CO4 Create a prototype model
CO5 Evaluate the designed solution
CO6 Make economic decision for solution.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	2	1	-	-	-	1	-	-	-	2	-	-	-	-
CO-2	1	1	2	1	1	-	-	-	1	1	2	-	-	1	-
CO-3	1	1	1	-	1	-	-	-	1	-	2	-	1	-	1
CO-4	1	1	1	1	-	-	-	-	1	-	-	-	1	-	1
CO-5	1	1	-	2	-	1	-	-	1	-	-	-	1	-	1
CO-6	1	-	1	1	-	1	1	-	-	-	1	-	1	-	1

FEB170201: INDUSTRIAL ENGINEERING

Course Objective:- Demonstrate a solid technical competence for the planning and control of operations, design and improvement of processes, formulation and evaluation of projects, management of logistics operations, as well as development of industrial automation processes.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	Location Selection and Plant Layout: Nature of Location Decision, Importance of Plant Location, Dynamic Nature of Plant Location, Choice of site for selection, Comparison of location, Principles of Plant layout and Types, factors affecting layout, methods, factors governing flow pattern, travel chart, analytical tools of plant layout, layout of manufacturing shop floor, repair shop, services sectors and process plant. Quantitative methods of Plant layout: CRAFT and CORELAP, Relationship diagrams	8	15%
2	Production Planning and Control: Types of Production systems and their Characteristics, functions and objectives of Production Planning and Control, Sales forecasting: Techniques and Applications, Steps of Production Planning and Control: Process planning, Leading, Scheduling, Dispatching and Expediting with illustrative examples, Introduction to line of balance, assembly line balancing, and progress control	8	18%
3	Productivity and Work Study: Definition of productivity, application and advantages of productivity improvement tools, reasons for increase and decreases in productivity. Areas of application of work study in industry. Reaction of management and labour to work study. Method Study: Objectives and procedure for methods analysis, Recording techniques, Operations Process Chart, Flow Process	8	20%

	Chart, Man-Machine , Multiple Activity Chart, Travel Chart, and Two Handed process chart, String Diagram, Therbligs, Micro motion and macro-motion study: Principles of motion economy, Normal work areas and work place design. Work Measurement: Objectives, Work measurement techniques – time study, work sampling, pre-determined motion time standards (PMTS) Determination of time standards. Observed time, basic time, normal time, rating factors, allowances, and standard time. Introduction to ergonomics.		
4	job Evaluation and Wage Plan: Objective, Methods of job evaluation, job evaluation procedure, merit rating (Performance appraisal), method of merit rating, wage and wage incentive plans.	5	10%
5	Industrial Legislation: Need for Industrial legislation, Factories act 1948, Industrial dispute act 1947, The Indian trade unions act 1926, Industrial employment act 1946, Payment of wage act 1936, Workmen compensation act 1923, Payment of bonus act 1965, Employees provident fund scheme 1952.	5	10%
6	Inspection and Statistical Quality Control: Inspection – functions, types, objectives and benefits, quality control principles, Concepts of quality circles, Total quality management, Quality assurance, Quality audit, Basic Concept ISO 9000, ISO 14000 and QS 9000, Six sigma: Concept, Principle, Methodology, Scope, Advantage and limitations. SQC Concept, variable and attributes, normal distribution curves and its property charts for variable and attributes and their applications and interpretation (analysis) process capability. Acceptance sampling, sampling plans, OC curves and AOQ curves.	8	20%
7	Entrepreneurship: Concept, product identification, infrastructure facilities, preparation of project report, sources of industrial finance, Resources allocation, Government incentives to entrepreneurs.	3	7%

References Books:-

(1) Manufacturing Organisation and Management Author : Harold Amrine, John Ritchey, Moodie, Kmec Publisher : Pearson

(2) Production System, Planning, Analysis and Control Author : J.L. Riggs Publisher : Wiley

(3) Production and Operations Management Author : R. Panneerselvam Publisher : PHI Private Ltd

(4) Industrial Engineering and Production Management Publisher :MartandTelsang S Chand & company

List of Suggested Books:

Industrial Engineering and Production Management Publisher :MartandTelsang S Chand & company

Course Outcome:

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

CO-1: Understand the concept of production system, productivity, facility and process planning in various industries
CO-2: Apply the various forecasting and project management techniques
CO-3: Apply the concept of breakeven analysis, inventory control and resource
CO-4: Apply principles of work study and ergonomics for design of work systems
CO-5: Formulate mathematical models for optimal solution of industrial problems using linear programming approach
CO-6: Analyze the effect of various performing parameters on industry.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	-	-	-	-	-	1	1	-	-	-	-	-	-	-
CO-2	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	1	-	2	-	-	-	-	-	-	-	-	-	-	1	-
CO-5	1	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-6	1	2	-	-	-	-	-	-	-	-	-	-	-	-	-

FEB170202: AUTOMATION IN MANUFACTURING

Course Objective:-

- Describe the basic concepts of automation in manufacturing systems.
- Acquire the fundamental concepts of automated flow lines and their analysis.
- Classify automated material handling, automated storage and retrieval systems
- Illustrate adaptive control systems and automated inspection methods.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Computer Aided Manufacturing**: CAM Concepts, Objectives & scope, Nature & Type of manufacturing system, Evolution, Benefits of CAM, Role of management in CAM, Concepts of Computer Integrated Manufacturing, Impact of CIM on personnel, Role of manufacturing engineers, CIM Wheel to understand basic functions.	6	16%
2.	**NC/CNC Machine Tools:** NC and CNC Technology: Types, Classification, Specification and components, Construction Details, Controllers, Sensors and Actuators, CNC hardware: Re circulating ball screw, anti friction slides, step/servo motors. Axis designation, NC/CNC tooling. Fundamentals of Part 09 programming, Types of format, Part Programming for drilling, lathe and milling machine operations, subroutines, do loops, canned Cycles, parametric sub routines	8	16%
3.	**Programmable Logic Controllers**: Relay Device components, Programmable controller architecture, programming a programmable controller, tools for PLC logic design.	4	9%
4.	**Group Technology and CAPP:** Introduction, part families, part classification and coding systems: OPITZ, PFA, FFA, Cell design, rank order clustering, composite part concepts, Benefits of group technology. Approaches to Process Planning, Different CAPP system, application and benefits	8	15%

5.	**Flexible Manufacturing System:** Introduction & Component of FMS, Needs of FMS, general FMS consideration, Objectives, Types of flexibility and FMS, FMS lay out and advantages. Automated material handling system: Types and Application, Automated Storage and Retrieval System, Automated Guided Vehicles, Cellular manufacturing, Tool Management, Tool supply system, Tool Monitoring System, Flexible Fixturing, Flexible Assembly Systems..	7	17%
6.	**Robot Technology: I**ntroduction: Robot Anatomy, Laws of Robot, Human System and Robotics, Coordinate system, Specifications of Robot. Power sources, actuators and Transducers, Robotic Sensors, Grippers, Robot Safety, Robot Programming and Robot Applications, Economic Considerations of Robotics system, Robot Kinematics and Dynamics, Robot Arm Dynamics. Concepts of Computer Vision and Machine Intelligence.	5	16%
7.	**Integrated Production Management System**: Introduction, PPC fundamentals, Problems with PPC, MRP-I, MRP-II. Just in Time philosophy: JIT & GT applied to FMS, concepts of Expert System in Manufacturing and Management Information System	3	11%

Reference Book:

1. CAD/CAM/CIM, (2 nd Edition),by Radhakrishnan and Subramanian, NewAge Publications.
2. CAD / CAM/ CIM by Radhakrishnan.
3. Automation by W. Buekinsham

Suggested Book:

1. Automation, Production Systems and Computer Integrated Manufacturing: M.P. Groover./PE/PHI
2. Computer Control of Manufacturing Systems: Yoram Coren.

E-Resources & other digital Material:

- **https://nptel.ac.in/courses/112104288**

COURSE OUTCOMES:

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

CO1 Explain the role of automation in manufacturing and robotics industry.
CO2 Describe the group technology and flexible manufacturing techniques in the automated production line and manufacturing system.
CO3 Understand the computer aided process planning and shop floor manufacturing activities.
CO4 Develop CNC programs and apply in industry for manufacturing.
CO5 Understand the concept automated guided vehicle and automated storage system in material handling.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	-	1	1	-	1	-	-	-	-	1	1	-	1
CO-2	1	1	1	-	1	-	-	-	1	-	1	-	1	-	1
CO-3	1	1	2	1	2	1	1	-	-	1	-	-	1	1	1
CO-4	1	1	1	-	1	-	-	-	1	-	-	-	1	-	1
CO-5	1	1	2	1	1	-	-	-	-	1	-	-	1	1	1

FEB170203: MECHANICAL ENGINEERING LABORATORY (MANUFACTURING) III

Course Objective :-Manufacturing processes related to machining are included in this subject. All conventional machines are included in this course to understand the basic concepts in machining science.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
0	0	4	4	2	00	00	30	20	50

- **Content**
  1. Taper turning and external thread cutting using lathe
  2. Contour milling using vertical milling machine
  3. Spur gear cutting in milling machine
  4. Measurement of cutting forces in Milling/Turning process
  5. CNC part programming
  6. Drilling of a small hole using wire EDM
  7. Microprocessor controlled pick & place robot
  8. Use of Tool Maker's Microscope
  9. Comparator and sine bar
  10. Surface finish measurement equipment
  11. Bore diameter measurement using micrometer and telescopic gauge
  12. Use of Autocollimator

COURSE OUTCOMES:

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

CO-1: Upon completion of this course, the students can able to apply the different metal removing ,finishing and super finishing and for component production
CO-2: Learn various cutting tool operations using CNC machines...
CO-3: Upon completion of this course, the students can able to understand and compare the functions and applications of different metal cutting tools
CO-4: Upon completion of this course, the students can able to understand and compare the process.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO -1	**PO -2**	**PO -3**	**PO -4**	**PO -5**	**PO -6**	**PO -7**	**PO -8**	**PO -9**	**PO -10**	**PO -11**	**PO -12**	**PSO -1**	**PSO -2**	**PSO -3**
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	-	-	2	-	2	1	-	-	-	-	-	-	-	-	2
CO-3	2	-	-	-	1	-	-	-	1	-	-	-	-	-	1
CO-4	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

SUBJECT NAME: INTERNAL COMBUSTION ENGINE

SUBJECT CODE: FEB170204

Course Objective:-The principle Diesel's idea of a rational heat motor was designing a cycle that would allow maximum heat utilisation, based on the Carnot cycle. To overcome the low efficiency of steam and combustion engines of the time, Diesel wanted to build an entirely new type of internal combustion engine.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Introduction:** Basic components and terminology of IC engines, working of four stroke/two stroke - petrol/diesel engine, classification and application of IC engines, engine performance and emission parameters	2	5%
2.	**Fuel Air Cycles and Actual Cycles:** Assumptions for fuel–air cycles, Reasons for variation of specific heats of gases, change of internal energy and enthalpy during a process with variable specific heats, isentropic expansion with variable specific heats, effect of variable specific heats on Otto, Diesel and Dual cycle, dissociation, comparison of air standard and fuel air cycles, effect of operating variables, comparison of air standard and actual cycles, effect of time loss, heat loss and exhaust loss in Petrol and Diesel engines, valve and port timing diagrams	7	15%
3.	**Combustion**: Combustion equations, stoichiometric air fuel ratio, enthalpy of formation, adiabatic flame temperature, determination of calorific values of fuels – calorimeter*- Bomb and Junkers gas calorimeter	4	10%

4.	**Fuels and its supply system for SI and CI engine:** Important qualities of IC engine fuels, rating of fuels**,** Carburation, mixture requirement for different loads and speeds, simple carburetor and its working, types of carburetors, MPFI, types of injection systems in CI engine, fuel pumps and injectors, types of nozzles, spray formation	**4**	**10%**
5.	**Ignition and Governing System**: Battery and magneto ignition system, spark plug, firing order, quality, quantity & hit and miss governing	**4**	**10%**
6	**Supercharging**: Need for supercharging, Effect of supercharging, types of supercharger, methods of supercharging, thermodynamic analysis of supercharged engine cycle, limitations of supercharging, turbocharging	**4**	**10%**
7	**Combustion in SI and CI Engines**: Stages of combustion in SI engines, abnormal combustion and knocking in SI engines, factors affecting knocking, effects of knocking, control of knocking, combustion chambers for SI engines, Stages of combustion in CI engines, detonation in C.I. engines, factors affecting detonation, controlling detonation, combustion chamber for SI and CI engine	**7**	**15%**
8	**Engine Lubrication and Cooling:** Lubrication of engine components, Lubrication system – wet sump and dry sump, crankcase ventilation, Types of cooling systems – liquid and air cooled, comparison of liquid and air cooled systems	**3**	**8%**
9	**Measurement and Testing of IC engines**: Measurement of indicated power, brake power, fuel consumption and emission, Measurement of friction power by Willan's Line Method* and Morse Test*, calculation of brake thermal efficiency, brake power and brake specific fuel consumption of IC Engines, variable compression ratio engines, heat balance sheet of IC Engines	**4**	**10%**
10	**Engine Emission and their control**: Air pollution due to IC engines, Euro I to VI norms, HC, CO and NOx emission, catalytic convertor	**2**	**5%**
11	Application of diesel engines in power field, merit and demerits of diesel engine power plants, layout of diesel engine power plants	**1**	**2%**

References Books:-

1. Internal Combustion Engine Fundamentals by John B. Heywood, McGraw Hill Education Pvt Ltd.
2. Internal Combustion Engine by V Ganeshan, McGraw Hill Education Pvt Ltd.
3. Internal Combustion Engine by M.L.Mathur and R.P.Sharma, DhanpatRai Publications (P) Ltd.
4. Fundamentals of Internal Combustion engine by H.N.Gupta, PHI Learning.

5. Internal Combustion Engines 2nd Edition by Colin Ferguson and Allan Kirkpatrick, Wiley India Pvt. Ltd.

Course Outcomes:

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

CO-1: Introduction to heat engines and understand various cycles of operations of Internal combustion engines
CO-2: Discuss the mixture requirement and fuel injection system in IC engines
CO-3: Understand the concept of knocking and fuel ignition system in various engines
CO-4: Describe the lubrication system of engine and evaluate its performance parameters.
CO-5: Analyze the current scenario on the pollution and illustrate methods of emission control

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	3	-	3	-	-	-	-	-	-	-	-	2	-	-
CO-2	3	3	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-3	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-5	3	3	-	3	-	-	-	-	-	-	-	-	-	2	-

SUBJECT NAME: PROCESS PLANNING AND COST ESTIMATION

SUBJECT CODE: FEB170205

Course Objective :- The present course intends to give the exposure of various methods estimating and costing of various product as well as processes of manufacturing. The subject will give the better knowledge of costing as well as estimating for a product whose scale ranges from miniature to extra-large. Since "Process Planning and Cost Estimation" is an important manufacturing route to fabricate bulk storage and processing equipment's. The subject focuses on knowledge and understanding of various costing techniques.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	0	0	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Introduction of Process Planning-** methods of process planning, drawing interpretation, material evaluation, steps in process selection, production equipment and tooling selection	8	16%
2.	**Process planning activities-** process parameter calculation for various production processes, selection of jigs and fixtures, selection of quality assurance methods, documents for process planning, economics of process planning, case studies	10	25%
3.	**Introduction to cost estimation-** importance of costing and estimation, methods of costing, elements of cost estimation, types of estimates, estimating procedure, estimation of labor cost, material cost, allocation of overhead charges, calculation of depreciation cost	8	19%
4.	**Machining time estimation-** importance of machine time calculation, machining time for different lathe operations, drilling and boring time calculations, Machining time calculation for Milling, Shaping, Planning and Grinding	12	30%
5.	**Production costs-** different production processes for different jobs, estimation of forging cost, estimation of welding cost, estimation of foundry cost, estimation of machining cost	4	10%

Reference Books:

- Estimation and Costing by Banga& Sharma, Khanna
- Mechanical Estimating and Costing by B.P.Sinha, TMH
- Mechanical Costing & Estimation by Sinha, Standard
- Mechanical Estimating & Costing by Singla, Aggrawal, Kaston Pub.
- Estimating & Costing by Mukharjee and Goswami
- Elements of Estimating & Costing(Mechnical) by Saha
- Process Planning, Design/ Manufacture Interface, Elsevier Sci.&Tech. 2002, Peter Scalon,
- Manufacturing Processes and Systems, 9th ed., John Wiley 1998, Ostwaal P.F. and Munez J.,
- Product Design and Manufacturing, 2nd ed., Prentice Hall 2002, Chitale A.V. and Gupta R.C.,

Course Outcomes:

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

CO-1: Associate the knowledge of engineering fundamentals for process planning
CO-2: Distinguish various process planning activities
CO-3: Discuss the various elements involved in costing.
CO-4: Estimate the product cost of job done by various manufacturing methods
CO-5: Estimate the Machining time for various operations carried out in different machines
CO-6: Apply the concept of Process planning and cost estimation for various production process

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO-2	2	-	-	-	-	-	-	-	-	-	-	-	2	-	-
CO-3	2	1	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	2	1	-	-	-	-	-	-	-	-	-	-	-	2	2
CO-5	2	1	-	-	-	-	-	-	-	-	-	-	-	2	1
CO-6	3	-	-	-	-	-	-	-	-	-	-	-	-	1	1

FEB170206: REFRIGERATION & AIR CONDITIONING

Course Objective:-To familiarize with the terminology associated with refrigeration systems and air conditioning & understand basic refrigeration processes.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Th:-Theory, Tu: - Tutorial, P:- Practical, SEE:- Semester End Examinations, PA :-Progressive Assessment

Content

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Classification of refrigeration systems, Electrolux refrigeration system	5	12.5%
2.	Advanced vapour compression cycles, Refrigerants and their mixtures: properties andcharacteristics - Ozone depletion and global warming issues - System components:Compressors, Condensers, Expansion devices and Evaporators -Performance matching ofcomponents of refrigeration systems	15	37.5%
3.	Advanced absorption refrigeration systems and their components.	6	15%
4.	Review of Psychrometry and Air-conditioning processes - Comfort air conditioning and Cooling load calculations - Applications of AC systems - Concept of enthalpy potential – Air washers, Cooling towers, Evaporative condensers, Cooling and dehumidifying coils.	14	35%

References Books:-

1. Gosney, W.B, Principles of Refrigeration, Cambridge University Press, 1982.

2. Stoecker, W.F. and Jones, J.W., Refrigeration and Air conditioning, Tata McGraw Hill,1986.

3. Kuehn, T.H., Ramsey, J.W. and Threlkeld, J.L., Thermal Environmental Engineering, 3rdEdition, Prentice Hall, 1998.

Suggested Book:

1. Arora, C.P., Refrigeration and Air conditioning, Tata McGraw Hill, 2nd Edition, 2000.

Course Outcomes:

CO-1: Understand the concept of different refrigeration processes.
CO-2: Learn about refrigerants, their properties and evaluate the COP of VCR and VAR systems.
CO-3: Understand the basics of Psychometry and its implementation in air conditioning systems.
CO-4: Understand of standards for human comforts.
CO-5: Implement the knowledge of air conditioning systems in different heating load calculations.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	3	-	3	-	-	-	-	-	-	-	-	2	-	-
CO-3	3	3	-	2	-	-	-	-	-	-	-	-	-	-	-
CO-4	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-5	3	2	3	3	-	-	-	-	-	-	-	-	-	-	-

FEB170207: FINITE ELEMENT ANALYSIS

Course Objectives:-To Introduce the concepts of Mathematical Modeling of Engineering Problems. To appreciate the use of FEM to a range of Engineering Problems.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Th:-Theory, Tu: - Tutorial, P:- Practical, SEE:- Semester End Examinations, PA :-Progressive Assessment

Unit	Subject Content	Teaching Hours	Weightage (%)
1.	**INTRODUCTION** Historical Background – Mathematical Modeling of field problems in Engineering – Governing Equations – Discrete and continuous models – Boundary, Initial and Eigen Value problems– Weighted Residual Methods – Variational Formulation of Boundary Value Problems – Ritz Technique – Basic concepts of the Finite Element Method.	9	20%
2.	**ONE-DIMENSIONAL PROBLEMS** One Dimensional Second Order Equations – Discretization – Element types- Linear and Higher order Elements – Derivation of Shape functions and Stiffness matrices and force vectors- Assembly of Matrices - Solution of problems from solid mechanics and heat transfer. Longitudinal vibration frequencies and mode shapes. Fourth Order Beam Equation – Transverse deflections and Natural frequencies of beams.	9	20%
3.	**TWODIMENSIONAL SCALAR VARIABLE PROBLEMS** Second Order 2D Equations involving Scalar Variable Functions – Variational formulation –Finite Element formulation – Triangular elements – Shape functions	9	20%

	and element matrices and vectors. Application to Field Problems - Thermal problems – Torsion of Non circular shafts –Quadrilateral elements – Higher Order Elements.		
4.	**TWODIMENSIONAL VECTOR VARIABLE PROBLEMS:** Equations of elasticity – Plane stress, plane strain and axisymmetric problems – Body forces and temperature effects – Stress calculations - Plate and shell elements.	9	20%
5.	**ISOPARAMETRIC FORMULATION** Natural co-ordinate systems – Isoparametric elements – Shape functions for iso parametric elements – One and two dimensions – Serendipity elements – Numerical integration and application to plane stress problems - Matrix solution techniques – Solutions Techniques to Dynamic problems – Introduction to Analysis Software.	9	20%

Reference Books :

1. Seshu, P, “Text Book of Finite Element Analysis”, Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.
2. Chandrupatla&Belagundu, “Introduction to Finite Elements in Engineering”, 3rd Edition, Prentice Hall College Div, 1990
3. Logan, D.L., “A first course in Finite Element Method”, Thomson Asia Pvt. Ltd., 2002
4. Rao, S.S., “The Finite Element Method in Engineering”, 3rd Edition, Butterworth Heinemann, 2004
5. Robert D. Cook, David S. Malkus, Michael E. Plesha, Robert J. Witt, “Concepts and Applications of Finite Element Analysis”, 4th Edition, Wiley Student Edition, 2002.

Suggested Books:

1. Reddy. J.N., “An Introduction to the Finite Element Method”, 3rd Edition, Tata McGraw-Hill, 2005
2. Bhatti Asghar M, "Fundamental Finite Element Analysis and Applications", John Wiley & Sons, 2005.

Course Outcomes:

CO-1: Summarize the basics of finite element formulation.
CO-2: Apply finite element formulations to solve one dimensional Problems.
CO-3: Apply finite element formulations to solve two dimensional scalar Problems.
CO-4: Apply finite element method to solve two dimensional Vector problems.
CO-5: Apply finite element method to solve problems on iso parametric element and dynamic Problems.

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	2	-	2	-	-	-	-	-	-	-	-	-	2	-
CO-3	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-4	1	2	-	3	-	-	-	-	-	-	-	-	-	2	-
CO-5	2	2	-	-	-	-	-	-	-	-	-	-	-	-	-

FEB170208: PROJECT-III

Course Objective:-

- The project work could be done in the form of a project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.
- The objective of the minor project is to provide an opportunity for students to undertake short research training outside the classroom to solve real-world issues.

Teaching scheme

Teaching Scheme				Credits	Examination Marks		Total Marks
					Practical		
Th	Tu	P	Total		PA (V)	PA (I)	
0	0	6	6	3	80	20	100

Project Guideline:

This subject will be offered to the all final year mechanical engineering students during the 7th semester.

Minor Project is a course requirement wherein under the guidance of a faculty member, a 7th semester student is required to do an innovative work with application of knowledge earned while undergoing various courses and laboratories in the course of study.

Minor Project I envisages that a student during the 7th semester will acquire the ability to use a wide range of the skills learned during their course of study. A student is required to carry out the project work related to Mechanical Engineering, under the guidance of a faculty member and/or the supervisor of the concerned industry/institute/organization.

The student can undertake the project in a group of not more than four students.

The project must cover at least any one area suggested below:

- ✓ Design, analysis and/or fabrication,
- ✓ Experimentation,
- ✓ Product design and development.
- ✓ Design and development of laboratory equipments/test rigs,
- ✓ Industry needs based basic survey or Testing or Analysis etc.

Course Outcomes:

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

CO1 Identify an open ended problem in area of mechanical engineering which requires further investigation
CO2 Identify the methods and materials required for the project work.
CO3 Manage the work with team members.
CO4 Formulate and implement innovative ideas for social and environmental benefits.
CO5 Analyze the results to come out with concrete solutions.
CO6 Write technical report of the project apart from developing a presentation

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	2	1	2	1	-	-	-	-	-	1	-	1	1	-
CO-2	1	1	1	-	1	-	1	-	2	1	2	-	1	-	1
CO-3	1	1	-	1	1	-	-	-	3	1	2	-	1	1	1
CO-4	1	1	1	1	-	-	2	1	-	-	2	-	-	1	-
CO-5	1	1	-	1	-	1	-	-	1	1	1	-	1	-	1
CO-6	1	1	1	1	-	1	-	-	1	1	1	-	1	-	1

FEB180201: OPERATION RESEARCH

Course Objective:-

1.To understand the methodology of OR problem solving and formulate linear programming problem.

2. To develop formulation skills in transportation models and finding solutions.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Introduction:** Origin of Operation Research, Historical Standpoint, Methodology, Different Phases, Characteristics, Scope and Application of Operations Research.	2	6%
2.	**Linear Programming (LP) :** Concepts, Formulation of model, Graphical solution, Maximizations / Minimizations – Simplex Algorithm, Use of slack / surplus / artificial variables, Big M and Two phase method – Nature & type of solutions, Interpretation of optimal solution. Dual problem – relation between primal and dual, Dual simplex method – Interpretation of dual variables, Introduction to Integer programming, Economic Interpretation.	12	24%
3.	**Transportation & Assignment problems:** Concepts, formulations of models, Solution procedures, Optimality checks, Balanced/Unbalanced, Maximum/Minimum problems, Prohibited case – degeneracy	8	18%

4.	**Replacement Models:** Introduction, Replacement of capital equipment which depreciated with time, replacement by alternative equipment, Group and individual replacement policy	3	8%
5.	**Game Theory:** Introduction, Characteristics of Game Theory, Two Person, Zero sum games, Pure strategy. Dominance theory, Mixed strategies (2x2,mx2), Algebraic and graphical methods.	4	10%
6.	**Decision Theory:** Introduction, Decision under certainty, Decision under risk, Decision under uncertainty: Laplace criterion, MaxiMin criterion, MiniMax criterion, savage MiniMax regret criterion, Hurwitz criterion, Decision tree.	3	8%
7.	**Queuing Models:** Basis of Queuing theory, elements of queuing theory, Kendall's Notation, Operating characteristics of a queuing system, Classification of Queuing models, Preliminary examples of M/M/1:∞/FCFA.	3	8 %
8.	**Project Management:** Introduction to PERT and CPM, critical Path calculation, float calculation and its importance. Cost reduction by Crashing of activity.	8	18%

Reference Book

1 Quantitative Techniques in management, N.D. Vora – Tata McGraw Hill

2 Operations Research – An Introduction – Fifth edition by HamdyATaha- Prentice Hall of India. , Delhi.

3 Principles of Operations Research : With Applications to Management Decisions, Wagner, H.M., Prentice-Hall of India, New Delhi, 1982.

4 Hillier, F.S. and Lieberman, G.J., Operations Research, Holden Day Inc., San Francisco, 1974.

5 Littlechild, S.C. (ed), Operational Research for Managers, Philip Allan, Oxford, 1977.

6 Mitchell, G.H. (ed), Operational Research Techniques and examples, The English Universities Press Ltd., London, 1972. Moder, J.J. and Elmaghraby, S.E. (ed.), Handbook of

7. Payne, T. A., Quantitative Techniques for Management: A Practical Approach, Reston

Course Outcome:

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

CO-1: Formulate, solve and optimize real-world problems using linear programming model (LPP).
CO-2: Solve specialized linear programming problems using transportation and assignment model.
CO-3: Analyze and evaluate game and sequencing theory with the help of practical problems.
CO-4: Formulate stochastic inventory models and compute with the help of various simulation models for important performance measures
CO-5: Analyze and compare PPC techniques such as PERT and CPM. Discuss different waiting line models for solving queuing problems.
CO-6: Perform hands-on experiments and computations relevant to industrial management

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	3	2	2	-	-	-	-	-	-	-	-	2	-	1
CO-2	1	2	2	2	-	-	-	-	-	-	-	-	-	2	-
CO-3	3	2	2	2	2	-	-	-	-	-	-	-	2	-	2
CO-4	-	2	2	1	-	-	-	-	-	-	-	-	-	2	-
CO-5	1	1	1	2	2	-	-	-	-	-	-	-	3	-	2
CO-6	-	-	-	-	-	-	-	-	2	-	-	-	-	-	-

FEB180202: INDUSTRIAL SAFETY AND MAINTENANCE ENGINEERING

Course Objective: Industrial safety is the first course on industrial safety and Engineering. It studies various engineering safety principle and maintenance engineering notably how to deal with the safety measures of the plant. It is based on certain laws of plant maintenance with safety devices which are never seen to be violated.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	Introduction to the development of industrial safety and management: History and development of Industrial safety: Implementation of factories act, Formation of various councils, Safety and productivity, Safety organizations. Safety committees, safety committee structure, Roll of management and roll of Govt. in industrial safety, Safety analysis	7	17%
2	Accident preventions, protective equipments and the Acts: Personal protective equipment, Survey the plant for locations and hazards, Part of body to be protected, Education and training in safety, Prevention causes and cost of accident, Housekeeping, First aid, Fire fighting equipment, Accident reporting, Investigations, Industrial psychology in accident prevention, Safety trials.	6	14%
3	SafetyActs: Features of Factory Act, Introduction of Explosive Act, Boiler Act, ESI Act, Workman's compensation Act, Industrial hygiene, Occupational safety, Diseases prevention, Ergonomics, Occupational diseases, stress, fatigue, health, safety and the physical environment, Engineering methods of controlling chemical hazards, safety and the physical environment, Control of industrial noise and protection against it, Code and regulations for worker safety and health.	8	19%
4	Principles and practices of Maintenance planning: Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity – Importance and	8	18%

	benefits of sound Maintenance systems – Reliability and machine availability, Equipment Life cycle, Measures for Maintenance Performance: Equipments breakdowns, Mean Time Between Failures, Mean Time To Repair, Factors of availability, Maintenance organization, Maintenance economics.		
5	Maintenance policies and preventive maintenance: Maintenance categories – Comparative merits of each category – Preventive maintenance, Maintenance schedules: Repair cycle, Principles and methods of lubrication, Fault Tree Analysis, Total Productive Maintenance: Methodology and Implementation,	7	17%
6	ConditionMonitoring: Condition Monitoring: Cost comparison with and without Condition Monitoring, Onload testing and off load. Methods and instruments for Condition Monitoring, Temperature sensitive tapes, Pistol thermometers, wear-debris analysis, noise vibration and harshness analysis of machines	6	14%

References Books:-

(1) Industrial Maintenance Management Author : Srivastava, S.K. Publisher : S. Chand and Co.

(2) Installation, Servicing and Maintenance Author : Bhattacharya, S.N. Publisher : S. Chand and Co.

(3) Occupational Safety Management and Engineering Author : Willie Hammer Publisher : Prentice Hall

(4) Maintenance Planning Author : White, E.N. Publisher : Documentation

Course Outcome:

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

CO-1: To ensure the desired plant availability at an optimum cost within the safety prescription
CO-2: Student able to know about the objectives of maintenance..
CO-3: To minimize the total cost of unavailability and resources
CO-4: Explain the repair methods of beds and slide ways.
CO-5: :Discuss various condition monitoring techniques.
CO-6: Basic probability axioms and rules and the moments of discrete and continuous random variables

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	2	-	1	-	-	1	-	1	-	-	-	-	-	-	-
CO-2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3	-	-	-	1	-	1	-	-	-	-	-	-	-	-	-
CO-4	-	-	-	-	-	-	-	-	-	-	-	-	1	-	-
CO-5	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-6	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-

FEB180203: AUTOMOBILE ENGINEERING

Course Objective :-The aim is to introduce students to the vehicle structure and associated systems. Fundamentals related to vehicle and its systems' layouts, basic design of vehicle body structure and selection of systems components are introduced.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Th:-Theory, Tu: - Tutorial, P:- Practical, SEE:- Semester End Examinations, PA :-Progressive Assessment

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	Introduction to Automotive Systems Vehicle body classification and specification: Body construction type, Location of engine and Drive system types and arrangement, specification of vehicles; Functional requirements of vehicle body, Body trim and fittings, Overview of various systems including safety features, steering system types, Tire construction and types.	7	15%
2.	Body Load Analysis: Vehicle Loads: Static load, Load due to Acceleration and Braking, Moments and Torque due to driving conditions, resistance to motion and aerodynamic load, Types of materials used in body construction, Analysis and Selection of body member sections, Body sub frame and underfloor structure, car front and rear end structure, Vehicle Structure Analysis by Simple Structural Surface (SSS) Method: Saloon and simple van	9	20%
3.	Transmission and Driveline systems Constructional features and working of clutches*, Gear Train: sliding mesh, constant mesh and synchromesh gear boxes with related components, Propeller and drive shaft, universal joints, Rear wheel drive arrangements, Rear axle final drive, the differential,	7	20%

	rear axle, Simple problems in all mentioned topics, Automatic Transmission and CVT.		
4.	Suspension, Steering and Braking systems Types of suspension systems, Functional requirements of suspension systems, Front suspension system and Steering: Types, Definitions for wheel orientation and its effect, Types and Constructional features of Front Suspension, , Steering layout, types of steering gears, steering linkages, steering mechanism, definitions and significance of camber, caster and king pin inclination, toe in and toe out on turn, measurement and adjustment of various steering system layouts, steering ratio, under steering and over steering, steering geometry; Rear suspension system: Types, Factors affecting design and selection; Performance Analysis of Suspension system: Mobility, kinematic / graphical analysis, Roll centre analysis, and force analysis Brake system components and configurations, Fundamentals of braking: braking distance, braking efficiency, weight transfer, wheel skidding, Brake proportioning and adhesion utilization, ABS and Electronic Braking system: Working principles, Features and advantages.	14	25%
5	Electrical and Electronics: Electrical and electronic components of vehicle, fundamentals of engine electricals, Lighting and Indicators: Features, Requirements and typical settings, Body electrical and electronic systems, Monitoring and Instrumentation.	5	15%
6	Modern Vehicles: Introduction to electric vehicles & hybrid vehicles	2	5%

Reference Books:

1. An Introduction to Modern Vehicle Design, Julian Happian-Smith, Butterworth-Heinemann, 2002.
2. Theory of Ground Vehicles, J.Y. Wong, John Wiley and Sons, 2001.
3. Automobile Mechanical and Electrical Systems Automotive Technology: Vehicle Maintenance and Repair, Tom Denton, Butterworth Heinemann, 2011.
4. Clutches and Brakes, W C Orthwein, Marcel Dekker.
5. Automotive Mechanics by William H Crouse.
6. Advanced Vehicle Technology by Heinz and Heisler

Suggested Books:

1. Motor Vehicle Structures: Concepts and Fundamentals, Jason C. Brown, A. John Robertson, Stan T. Serpento, Butterworth Heinemann, 2002.
2. Handbook of Vehicle Design Analysis, John Fenton (Editor), Mechanical Engineering Publications Limited, London and Bury St Edmunds, UK, 1996.
3. Automobile Technology, N.K. Giri, Khanna Publishers, 2011.

Course Outcomes:

After learning the course the students should be able to:

CO-1: Understand the working of common automobile component, single and multi-cylinder engines, valve operating and fuel injection systems.
CO-2: Understand the working principles of clutches and their types.
CO-3: Understand the working principles of gearbox and their types.
CO-4: Understand the working principles of propeller shaft, differential and their types.
CO-5: Understand the working principles of brakes and their types.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	3	-	-	-	2	-	-	-	2	-	-	-	-	-	-
CO-2	3	-	-	-	-	-	-	-	-	3	-	-	-	-	-
CO-3	3	-	-	-	2	-	-	-	2	-	-	-	-	-	-
CO-4	3	-	-	-	-	-	-	-	-	2	-	-	-	-	-
CO-5	3	-	-	-	-	-	-	-	2	-	-	-	-	-	-

FEM180204: PRINCIPLE OF MANAGEMENT

Course Objective :-To understand the principles of management and their application to the functioning of an organization.

Teaching & Evaluation Scheme:-

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	0	0	100

Th:-Theory, Tu: - Tutorial, P:- Practical, SEE:- Semester End Examinations, PA :- Progressive Assessment

Content

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1.	**Definition of management, science or art, manager vs entrepreneur -** Types of managers- managerial roles and skills; Evolution of management- scientific, human relations, system and contingency approaches; Types of Business Organizations, sole proprietorship, partnership, company, public and private enterprises; Organization culture and environment; Current trends and issues in management.	8	23%
2.	**Nature and purpose of Planning -** types of Planning, objectives, setting objectives, policies, Strategic Management, Planning Tools and Techniques, Decision making steps & processes.	5	12%
3.	**Nature and purpose of Organizing -** formal and informal organization, organization structure, types, line and staff authority, departmentalization, delegation of authority, centralization and decentralization, job design, human resource management, HR planning, Recruitment selection, Training & Development, Performance Management, Career planning and Management. Directing, individual and group behavior, motivation, motivation theories, motivational techniques, job satisfaction, job enrichment, leadership, types & theories of leadership, effective communication.	21	45%

4.	**Controlling** - system and process of controlling, budgetary and non-budgetary control techniques, use of computers and IT in management control, productivity problems and management, control and performance, direct and preventive control, reporting.	8	20%

Reference Books :

1. Economics: Principles of Economics, N Gregory Mankiw, Cengage Learning
2. Principles and Practices of Management by L.M.Prasad
3. Principles of Management by Tripathy and Reddy
4. Modern Economic Theory, By Dr. K. K. Dewett& M. H. Navalur, S. Chand Publications

Suggested Books:

1. Principles of Management, Tata McGraw Hill, 1999, Tripathy PC & Reddy PN,
2. Fundamentals of Management: Essential Concepts and Applications, Pearson Education, Robbins S.P. and Decenzo David A.

Course Outcomes:

CO-1: Understanding of management functions in an organization
CO-2: Understand the fundamental concepts and principles of management; thebasic roles, skills, functions of management various organizational structures.
CO-3: Understand basic knowledge of marketing.

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	-	-	-	-	-	2	-	2	-	-	2	-	-	-	-
CO-2	2	2	-	-	-	-	-	-	-	-	2	-	-	-	-
CO-3	-	-	-	-	-	2	-	-	-	-	3	2	-	-	-

FEB180205: POWER PLANT ENGINEERING

Course Objective: More specifically this course is focused on application of energy principles and power generation cycles. The main purpose of implementing this course in curriculum is to learn about how the power is generated in a power plant and its applications.

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	Coal based thermal power plants, basic Rankine cycle and its modifications, layout of modern coal power plant. Super critical boilers, FBC boilers.	3	7%
2	Turbines, steam and heating rates, subsystems of thermal power plants, fuel and ash handling,	12	26%
3	Condensers, draught system, feed water treatment, binary cycles and cogeneration systems.	7	15%
4	Gas turbine and combined cycle power plants, Brayton cycle analysis and optimization, components of gas turbine power plants, combined cycle power plants, Integrated Gasifier based Combined Cycle (IGCC) systems.	7	15%
5	Basics of nuclear energy conversion, Layout and subsystems of nuclear power plants, Boiling Water Reactor (BWR), Pressurized Water Reactor (PWR), CANDU Reactor, Pressurized Heavy Water Reactor (PHWR), Fast Breeder Reactors (FBR), gas cooled and liquid metal cooled reactors, safety measures for nuclear power plants.	6	13%
6	Hydroelectric power plants, classification, typical layout and components, principles of wind, tidal, solar PV and solar thermal, geothermal, biogas and fuel cell power systems	5	12%

7	Energy, economic and environmental issues, power tariffs, load distribution parameters, load curve, capital and operating cost of different power plants, pollution control technologies including waste disposal options for coal and nuclear plants.	5	12%

Reference Books:

1. Nag P.K., Power Plant Engineering, 3rd ed., Tata McGraw Hill, 2008.
2. El Wakil M.M., Power Plant Technology, Tata McGraw Hill, 2010.
3. Elliot T.C.,Chen K and Swanekamp R.C.,Power Plant Engineering, 2nd McGraw Hill 1998

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

CO-1: Know about the different energy sources and power generation.
CO-2: Understand the concept of hydrology and details about the hydroelectric power plant.
CO-3: Ability to analyze steam cycle and learn about different handling systems used in steam power generators.
CO-4: Understand the environmental norms and standards in thermal power generation.
CO-5: Learn about combined cycles for power generation and diesel engine power plants.
CO-6: Understand the conceptual knowledge of nuclear energy, its resources and the economics of power generation.

Course Outcomes	**Expected Mapping with Programme Outcomes** *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-2	3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
CO-3	3	3	-	2	-	-	3	-	-	-	-	-	-	-	-
CO-4	3	-	-	-	-	-	3	-	-	-	-	-	-	-	-
CO-5	3	2	-	3	-	-	-	-	-	-	-	-	-	-	-
CO-6	3	-	-	-	-	-	2	-	-	-	-	-	-	-	-

FEB180206: GAS DYNAMICS AND JET PROPULSION

Course Outcome: Gas dynamics mainly concerned with the motion of gases and its effects .It differ from fluid dynamics .Gas dynamics considers thermal or chemical effects while fluid dynamics usually does not

Teaching Scheme				Credits	Examination Marks				Total Marks
					Theory		Practical		
Th	Tu	P	Total		SEE (E)	PA (M)	Viva (V)	PA (I)	
3	0	0	3	3	70	30	00	00	100

Sr No.	Subject Content	Teaching Hours	Weightage (%)
1	Compressible flow, definition, Mach waves and Mach cone, stagnation states, Mass, momentum and energy equations of one-dimensional flow.	8	19%
2	Isentropic flow through variable area ducts, nozzle s and diffusers, subsonic and supersonic flow I variable area ducts, choked flow, Area-Mach number relations for isentropic flow.	10	23%
3	Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables.	9	22%
4	Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines.	8	19%
5	Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights	7	17%

Reference Books:

1. Ahmed F. El - Sayed, Aircraft Prpoulsion and Gas Turbine Engines, CRC Press, 2008.
2. H.S. Mukunda, “Understanding Aerospace Chemical Propulsion”, Interline Publishing, 2004.
3. Hill P. and Peterson C., Mechanics & Thermodynamics of Propulsion, Addison Wesley, 1992.
4. Zucrow N. J., Aircraft and Missile Propulsion, Vol.I& II, John Wiley, 1975.
5. Sutton G.P., Rocket Propulsion Elements, John Wiley, New York, 1986.

Course Outcomes:

CO1: Apply the thermodynamics concepts in relation to compressible flows and derive relationships between various compressible flow parameters

CO2: Understanding of isentropic compressible flows in variable area ducts and apply in design of static components like nozzles and diffusers

CO3: Solve for compressible flow characteristics with friction and heat transfer

CO4: Develop relationship for shocks and determine their characteristics under various conditions

CO5: Analyse the performance of aircraft and rocket propulsion engines

Course Outcomes	Expected Mapping with Programme Outcomes *(1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)*														
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**PO-9**	**PO-10**	**PO-11**	**PO-12**	**PSO-1**	**PSO-2**	**PSO-3**
CO-1	3	3	1	1	-	-	-	-	-	-	-	1	2	-	-
CO-2	3	3	1	1	-	-	-	-	-	-	-	1	1	2	-
CO-3	3	3	1	1	-	-	-	-	-	-	-	1	1	-	-
CO-4	3	3	1	1	-	-	-	-	-	-	-	1	-	-	-
CO-5	3	3	1	1	-	-	-	-	-	-	-	1	-	1	-

FEB180207: PROJECT-IV

Course Objective:-

- The project work could be done in the form of a project or internship in the industry or even a minor practical project in the college. Participation in any technical event/ competition to fabricate and demonstrate an innovative machine or product could be encouraged under this course.
- The objective of the minor project is to provide an opportunity for students to undertake short research training outside the classroom to solve real-world issues.

Teaching scheme

Teaching Scheme				Credits	Examination Marks		Total Marks
					Practical		
Th	Tu	P	Total		PA (V)	PA (I)	
0	0	12	12	6	80	20	100

Project Guideline:

- It is an opportunity for the students to apply knowledge and skill sets, which they have obtained during classroom teaching, practical course work and field visits, spread over three semesters.
- The major project is conceptualized to independently think and engage in research to provide sustainable solutions based on learning during the master's degree course work. It requires a deeper understanding of the development process, the driving factors, and the inter-linkages within the earth system science, climate change issues, sustainable development challenges, renewable energy, community engagement, legal frameworks, among others.
- The students are required to hypothesize a research problem and carry out detailed and substantial amount work with their original thoughts and frameworks. At the end of the major project, students are expected to submit a dissertation/thesis, which is reflection of knowledge acquired in previous studies and demonstrates the prospect to probe profoundly into a research question and integrate the learning while findings the answer.

- Along with the dissertation/thesis the students are required to present the entire work before an evaluation committee based on the major project guidelines (see additional information).

The student can undertake the project in a group of not more than four students.

The project must cover at least any one area suggested below:

- ✓ Design, analysis and/or fabrication,
- ✓ Experimentation,
- ✓ Product design and development.
- ✓ Design and development of laboratory equipments/test rigs,
- ✓ Industry needs based basic survey or Testing or Analysis etc.

Course Outcomes:

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

CO1 To be able to conduct review of literature to arrive at selected advances topic for seminar.
CO2 To be able to summerise the concept of the chosen topic systematically after considerable study of the content from primary as well as secondary sources
CO3 To be able to write and present a technical report with suitable conclusion as per international standards
CO4 For a selected research topic, student manager will be able to compile relevant data, interpret & analyze it and test the hypotheses wherever applicable
CO5 Based on the analysis and interpretation of the data collected, student manager will be able to arrive at logical conclusions and propose suitable recommendations on the research problem
CO6 To be able to discuss and depend the outcome of the report in a seminar

Course Outcomes	Expected Mapping with Programme Outcomes (1- Weak Correlation; 2- Medium correlation; 3- Strong Correlation)														
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PO-9	PO-10	PO-11	PO-12	PSO-1	PSO-2	PSO-3
CO-1	1	1	1	1	-	-	-	-	1	1	2	-	1	1	1
CO-2	1	1	-	1	-	1	-	-	1	1	1	-	1	1	1
CO-3	1	1	1	2	1	-	-	-	1	1	1	-	1	-	1
CO-4	1	2	1	1	-	1	1	-	-	1	1	-	1	-	1
CO-5	1	2	2	1	-	-	-	-	2	1	1	-	-	1	1
CO-6	1	1	1	-	-	-	-	-	2	1	-	-	-	-	-