Gayatri Vidya Parishad College for Degree and PG Courses (A)

Department of Mechanical Engineering

Accredited by NBA and NAAC

B.Tech MECHANICAL ENGINEERING PROGRAM (R - 20)

SEMESTER V

(III year I Semester)

Sl. No.	Code	Category	Course Title	Hours per week			Allotment of Marks		Total Marks	Credits
				L	T	P	Internal	External		
1	2095501	PCC	Theory of Machines – II	3	0	0	30	70	100	3
2	2095502	PCC	Applied Thermodynamics- II	3	0	0	30	70	100	3
3	2095503	ESC	Metrology	3	0	0	30	70	100	3
4	2095504	PEC	Elective-I	3	0	0	30	70	100	3
5	2095505	PEC	Elective-II	3	0	0	30	70	100	3
6	2095506O	OEC	Open Elective-I	3	0	0	30	70	100	3
7	2095503P	PCC	Metrology Lab	0	0	3	50	50	100	1.5
8	2095505P	PCC	Manufacturing Technology Lab-II	0	0	3	50	50	100	1.5
9	2095407S	SOC	SOC-3	1	0	2	50	50	100	2
10	2095408	MC	Community Service	0	0	0	100	0	100	1.5
			Total	**19**	**0**	**8**	**430**	**570**	**1000**	**24.5**
11	2095409	PCC	**Minor Course-II**	**3**	**1**	**0**	**30**	**70**	**4**	**4**
12	2095410	PCC	**Honors Course-II**	**3**	**1**	**0**	**30**	**70**	**4**	**4**

Elective-I:
2095504A Mechatronics
2095504B Rapid Prototyping
2095504C Work Study
2095504D Power Plant Engineering

Elective-II:
2095505A Un Conventional Machining Process
2095505B Industrial Tribology
2095505C Total Quality Management
2095505D Automobile Engineering

Open Elective-I :
2095506O Basic Mechanical Engineering

Skill Oriented Course-III
2095407S Python Programming

PCC : Professional Core Course
ESC : Engineering Science Course
PEC : Professional Elective Course
OEC : Open Elective Course
MC : Mandatory Course
SOC : Skill Oriented Course

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B.Tech MECHANICAL ENGINEERING PROGRAM (R - 20)

SEMESTER VI

(III year II Semester)

Sl. No.	Code	Category	Course Title	Hours per week			Allotment of Marks		Total Marks	Credits
				L	T	P	Internal	External		
1	2095601	PCC	CAD-CAM	3	0	0	30	70	100	3
2	2095602	PCC	Heat and Mass Transfer	3	0	0	30	70	100	3
3	2095603	PCC	Production Planning and Control	3	0	0	30	70	100	3
4	2095604	PCC	Design of Machine Elements	3	0	0	30	70	100	3
5	2095605	PEC	Elective - III	3	0	0	30	70	100	3
6	2095606O	OEC	OEC-II	3	0	0	30	70	100	3
7	2095607S	SOC	SOC-IV	0	0	3	50	50	100	2
8	2095601P	PCC	Engines and Mechanisms Lab- II	0	0	3	50	50	100	1.5
9	2095602P	PCC	Heat and Mass Transfer Lab	0	0	3	50	50	100	1.5
			Total	**18**	**0**	**9**	**330**	**570**	**900**	**23**
10	2095608	PCC	**Minor Course-III**	**3**	**1**	**0**	**30**	**70**	**4**	**4**
11	2095609	PCC	**Honors Course-III**	**3**	**1**	**0**	**30**	**70**	**4**	**4**

Elective-III:

2095605A Project Management

2095605B Supply Cain Management

2095605C Tool Design

2095605D Finite Element Analysis

Open Elective-II :

2095606O Industrial Engineering

Skill Oriented Course-IV

2095607S Internet Of Things

PCC : Professional Core Course

PEC : Professional Elective Course

OEC : Open Elective Course

SOC : Skill Oriented Course

THEORY OF MACHINES – II

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095501	3	1	0	4	30	70	100	3

Course Objectives:

- **CO 1** To help students to understand and learn the gyroscopic effect on vehicles and concept of gears
- **CO 2** To teach students the balancing procedures for rotating and reciprocating masses
- **CO 3** To teach students and make them analyze the fundamental concepts of vibrations and cam-follower motion

COURSE OUTCOMES

- **CO 1** To understand the principle of gyroscope effect and apply the effect of gyroscope on ships, aero planes and automobiles
- **CO 2** To compare tooth profiles of gears, explain interference and compute velocity ratio of different gear trains
- **CO 3** To develop the balancing test on rotating & reciprocating masses
- **CO 4** To recall classification of different types of vibrations and determine the natural frequencies of different systems under vibrations.
- **CO 5** To draw the cam profiles for given follower motions and calculate velocity and acceleration for cams profiles.

SYLLABUS:

UNIT I:

Gyroscopic Couple and Precessional Motion: Precessional and angular motion- gyroscopic couple- effect of gyroscopic couple on an aero plane and on a naval ship, stability of a four wheel vehicle moving in a curved path

UNIT II:

Toothed gearing & Gear Trains: Classification of toothed wheels, technical terms, conditions for constant velocity ratio of toothed wheels - Law of gearing - Velocity of sliding of teeth, forms of teeth- Length of contact, arc of contact - interference in involute gears - Types of gear trains - Simple, compound, reverted and epicyclic gear trains- Velocity ratio of epicyclic gear train- Tabular method.

UNIT III:

Balancing of Rotating and Reciprocating Masses: Balancing of a single rotating mass - balancing of several masses revolving in the same plane and different planes - Primary and secondary unbalanced forces of reciprocating masses - Partial balancing of unbalanced primary forces in a reciprocating engine

UNIT IV:

Vibrations: Longitudinal, Transverse and Torsional Vibrations: Definitions- Types of vibrations- Natural frequencies of free longitudinal vibrations of systems having single degree of freedom

Natural frequency of free transverse vibrations due to point load and uniformly distributed load acting over a simply supported shaft – Natural Frequency for a shaft subjected to number of point loads.

Natural frequency of free torsional vibrations- Free torsional vibrations of single rotor system, two rotor system, three rotor system and gear system.

UNIT V:

Cams: Classification of followers and cams- Definitions- Motions of the follower- Uniform velocity- Simple harmonic motion- Uniform acceleration and retardation- Displacement- Velocity and acceleration diagrams. Construction of cam profiles- Cam with knife edged follower and roller follower.

Text Book:

1. Theory of Machines by R.S.Khurmi &J.K.Gupta.

Reference books:

1. Theory of Machines by Thomas Bevan.
2. Theory of Machines by S.S. Rattan.

APPLIED THERMODYNAMICS- II

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095502	3	1	0	4	30	70	100	3

COURSE OBJECTIVES:

1. Students would appreciate the fundamentals of IC engines being extended to Working of real time applications.
2. Students might come out with pioneering ideas which may be extended in the form of Projects
3. Course could bridge the gap between conventional and non-conventional methods of power generation.

COURSE OUTCOMES:

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

CO 1 Distinguish between the CI and SI engine and thermal analysis of air cycles.

CO 2 Gain knowledge on stages of combustion in SI and CI engines and understand the significance of combustion chamber design and fuel rating.

CO 3 Understand the working of various compressors and evaluate their efficiency.

CO 4 Understand the working of Gas Turbine plants and Nuclear power plants.

CO 5 Understand the different renewable energy sources.

SYLLABUS:

UNIT-I

Heat Engine, IC Engine Classification, Basic Engine components and Nomenclature, Working principles of two stroke and four stroke engines, Comparison of S.I and C.I. engines, Valve timing diagram of 4 stroke engine, port timing diagram of 2 stroke engine. Engine Performance parameters- indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, volumetric efficiency and relative efficiency, Air standard cycle and their analysis(Thermal efficiency, Work output, MEP) -Otto, Diesel, Dual, Problems(Moderate level only), Stirling, Ericson and Atkinson cycles representation on P-V and T-S diagrams.

UNIT-II

S.I. engines stages of combustion, Flame front propagation, factors influencing the flame speed, Normal combustion and abnormal combustion, Phenomenon of knock in SI engines, Effect of Engine variables on knock, Combustion chambers for SI engines.C.I. engines- Stages of combustion, Factors affecting delay period, Phenomenon of knock in CI engines, Combustion chambers for CI engine. Fuel requirements and fuel rating- SI engines, CI engines.

UNIT-III

Reciprocating Compressors: Reciprocating compressors classifications- working of single stage compressor -effect of work with and without clearance, volumetric efficiency, isothermal efficiency, Problems on single stage compressor (Moderate level), multi-stage compressors- effect of inter cooling in multi stage compressors, Methods to increase isothermal efficiency.Rotary Compressors: Working-Roots blower, Vane type blower, Centrifugal compressor-Components, Adiabatic efficiency, Velocity diagrams only (No Problems), degree of reaction, performance characteristics of Centrifugal pump.

UNIT-IV

Gas Turbines: Classification of Gas Turbines, Open cycle gas turbine-Efficiency, Methods to improve Thermal efficiency of open cycle gas turbine, Closed cycle gas turbine (cycle working only), work ratio and optimum pressure ratio for simple gas turbine cycle, comparison of closed and semi-closed cycle,Gas turbine fuels. Jet propulsion- Working of Turbo jet, Turbo Prop, Ramjet ,Pulse jet , basic working of Rockets. Nuclear Power Plants: Nuclear Fission and Fusion - Nuclear Fuels, Breeding Components of Reactor,Fuel moderator and coolant, Control and safety rods, Classification of reactors - Pressurized water reactor(PWR)-Boiling water reactor(BWR)-CANDU reactor-Gas cooled reactor-Liquid metal cooled reactor, Radiation hazards and shielding, Radio active waste disposal.

UNIT-V

Solar Energy Introduction, Solar collectors-Flat plate, concentrating- line focussing, Point focusing, Energy storage- Solar Ponds. Wind Energy- Basic component of WECS, Wind Energy conversion system(WECS) classification, Working of Horizontal AxisWind mills, Working of Vertical Axis wind mills , Thermo Electric- MHD.

Text books:

1. Internal combustion engines by V. Ganesan, Tata McGraw Hill Publications
2. Thermal Engineering, by Er.R.K.Rajput,Lakshmi Publications

Reference books:

1. Applied Thermodynamics-II by R. Yadav.
2. I.C. Engines / Heywood /McGrawHill.
3. Non Conventional Energy Sources, G.D.Rai, Khanna PublisheRS

METROLOGY

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095503	3	1	0	4	30	70	100	3

COURSE OBJECTIVES:

1. Equip with knowledge of limits, fits, tolerances and gauging
2. Acquire knowledge on linear and angular measurements, Screw thread and gear measurement & comparators.
3. To make the students acquainted with realistic equipment for alignment test

COURSE OUTCOMES:

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

CO 1 Apply the knowledge of limits, fits, tolerances to a machine component and able to select a suitable gauge for inspection during mass production.

CO 2 Make use of relevant instruments to measure the various parameters of screw threads and spur gear.

CO 3 Understand the various methods for measuring geometrical features, angular measurements and able to select comparators for measurement.

CO 4 Analyze the surface texture of a component and can choose a relevant surface testing method.

CO 5 Understand the alignment tests for machine tools and use of CMM for measurement.

Syllabus :

UNIT-I
Limits Fits and Tolerances

Introduction to Metrology, Need of Inspection, Accuracy and Precision

Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, concept of limits and terminology. hole basis and shaft basis system, types of fits- Clearance, Transition, Interference. Tolerances – Unilateral, bilateral tolerances, geometric and position-tolerances. Classification of gauges, brief concept of design of gauges (Taylor's principle), Wear allowance on gauges, Types of gauges.

UNIT-II
Measurements of screw threads and Gears

Measurement of screw threads- Internal and External threads, Thread terminology

Measurement of - Major diameters, minor diameters and effective diameter, Pitch of the screw threads, Limit gauges for internal and external threads, Tool maker's microscope.
Measurement of Gears – Need of Inspecting the gear tooth, Gear terminology, forms (involute and cycloid) and types of gears. Measurement of pitch, profile and tooth thickness of spur gear.

UNIT-III

Geometrical Feature Measurements, Angular Measurements and Comparators

Geometry Feature Measurement: Slip gauges, Straightness measurement – Straight edge, Wedge Method, Spirit level, Auto-collimator; Squareness testing – Engineers square, indicator method, Optical test using auto-collimator; Flatness measurement - Comparison with the liquid surface, Beam Comparator, Auto-collimator; Roundness measurement - Using V block and

Dial Indicator, Roundness measuring machine, Bench centre method.

Angular Measurements - Optical bevel protractor, Sine bar, Angle gauges, Angle dekkor. **Comparators** - Twisted strip mechanical comparator, Optical lever comparator, Optical projector, Electric comparator, Pneumatic comparator.

UNIT-IV
Surface Texture

Surface texture: Introduction to surface finish, Factors affecting surface roughness, Order of geometrical irregularities, elements of surface texture, Evaluation of Surface Finish,

Stylus probe instruments - Profilometer, Tomlinson Surface meter and Taylor-Hobson Talysurf for surface roughness measurement.

UNIT-V
Acceptance tests on machine tools and CMM

Alignment tests - for Lathe machine, Milling machine, Radial drill, Alignment test by Laser equipment.

Coordinate Measuring Machine (CMM) – Construction, working and types of Coordinate Measuring Machine.

Text books:

1. A Textbook of Metrology by M. Mahajan, Dhanpat Rai Publications, Delhi.
2. A Textbook of Engineering Metrology, I.C. Gupta, Dhanpat Rai Publications, Delhi.

Reference books:

1. Engineering metrology and measurements by N.V. Raghavendra, Oxford University Press New Delhi.
2. A Textbook of Engineering Metrology, R.K. Jain, Khanna Publishers.

RAPID PROTOTYPING

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095504B	**3**	**1**	**0**	**4**	**30**	**70**	**100**	**3**

Mapping of Course Out Comes with PO/PSO

CO#	Course Out Come	PO/PSO
CO 1	Understand the principle methods, areas of usage, possibilities and limitations as well as environmental effects of the Rapid Prototyping and tooling Technologies.	1,2,3,5,6/1
CO 2	Understand the process capabilities of liquid and solid based rapid prototyping methods	1,5,6,8,12/2
CO 3	Understand the process capabilities and advantages of powder based rapid prototyping techniques	1,5,6,8,12/2
CO 4	Select the appropriate material for processing through various rapid prototyping techniques	1,2,3,4,5,12/1
CO 5	Develop innovative components and products through RP applications and case studies	1,3,5,6,12/1

Syllabus :

UNIT-I

INTRODUCTION: History Development of RP systems Applications in Product Development, Reverse Engineering, Rapid Tooling, Rapid Manufacturing- Principle Fundamental File format Other translators medical applications of RP - On demand manufacturing Direct material deposition - Shape Deposition Manufacturing.

UNIT-II

LIQUID AND SOLID BASED RAPID PROTOTYPING SYSTEMS: Classification – Liquid based system - Stereo lithography Apparatus (SLA), details of SL process, products, Advantages, Limitations, Applications and Uses. Solid based system - Fused Deposition Modeling, principle, process, products, advantages, applications and uses - Laminated Object Manufacturing

UNIT-III

POWDER BASED RAPID PROTOTYPING SYSTEMS: Selective Laser Sintering – principles of SLS process, principle of sinter bonding process, Laser sintering materials, products, advantages, limitations, applications and uses. Three Dimensional Printing – process, major applications, research and development. Direct shell production casting – key strengths, process, applications and uses, case studies, research and development. Laser Sintering System, e-manufacturing using Laser sintering, customized plastic parts, customized metal parts, emanufacturing - Laser Engineered Net Shaping (LENS).

UNIT-IV

MATERIALS FOR RAPID PROTOTYPING SYSTEMS: Nature of material – type of material – polymers, metals, ceramics and composites- liquid based materials, photo polymer development – solid based materials, powder based materials - case study.

UNIT-V

RAPID TOOLING: Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications. Case studies - automotive, aerospace and electronics industries.

Text books :

1. Rafiq I. Noorani, Rapid Prototyping, "Principles and Applications", Wiley & Sons, 2006. 89
2. Chua C.K, Leong K.F and Lim C.S, "Rapid Prototyping: Principles and Applications", Second Edition, World Scientific, 2003.

Reference books :

1. N.Hopkinson, R.J.M, Hauge, P M, Dickens, "Rapid Manufacturing – An Industrial revolution for the digital age", Wiley, 2006
2. Ian Gibson, "Advanced Manufacturing Technology for Medical applications: Reverse Engineering, Software conversion and Rapid Prototying", Wiley, 2006
3. Paul F.Jacobs, "Rapid Prototyping and Manufacturing : Fundamentals of Stereolithography",
McGraw Hill 1993. 4. Pham. D.T., and Dimov. S.S., "Rapid Manufacturing", Springer Verlog 2001.

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
		L	T	P	Int	Ext	
2095504C	WORK STUDY	3	0	0	30	70	3

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

Course Objectives:

1. To understand the meaning of productivity and the means of increasing the productivity.
2. To know about work study and method study. To get acquainted with different methods of recording the work and ways to improve the method of doing work.
3. To know the different methods of measuring the work done and compute standard time.
4. To know the principles of motion economy.
5. To learn about job evaluation and merit rating.
6. To understand the meaning of Ergonomics and Anthropometry.

CO1	Understand the factors for low productivity, eliminate them and improve productivity.
CO2	Analyze the existing method of doing work, improve the method by eliminating unwanted steps in the process.
CO3	Will be able to measure the work and find the standard time required for doing the work.
CO4	Will be able to apply principles of motion economy and make work easier and improve the performance of the workers.

Note: L – Lecture periods; T- Tutorial periods; P- Practical periods

UNIT-I

Introduction to work study: Scientific management – Productivity - Advantages of work study to management, Supervisors and workers.

UNIT-II

Method Study

Introduction - Process charts, Critical Examination, Identification of key activities on process charts, Diagrams and Templates, Therbligs, Micro motion analysis, Memo motion study. Developing new method - Job survey report writing.

UNIT-III

Work Measurement

Work measurement techniques – Rating - Measuring the job – Allowances - Standard time - Synthetic data - Analytical estimating – PMTS ,Work factor, MTM, Activity sampling, Its applications.

UNIT-IV

Principles of Motion Economy

Related to Human body, Work place and Equipment.

UNIT-V

Job Evaluation Techniques of job Evaluation, Merit rating, Incentive plans.

Ergonomics

Basics of Ergonomics Anthropometry.

Text Books:
1. Introduction to Work Study - International Labour Organisation.
2. Elements of Work Study and Ergonomics by Dalela et al, Standard Publications.
References:
1. Motion and Time Study, by Barnes, John Wiely.

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
		L	T	P	Int	Ext	
2095505A	UNCONVENTIONAL MACHINING PROCESSES	3	0	0	30	70	3

COURSE OBJECTIVES

1. Understand the need and importance of non-traditional machining methods and process selection.
2. Gain the knowledge to remove material by thermal evaporation, mechanical energy process.
3. Apply the knowledge to remove material by chemical and electro chemical methods.

COURSE OUTCOMES:

At the end of the practice, the students will be able to,

1. Understand the need and importance of non-traditional machining methods and process selection and importance of USM
2. summarize the principle and processes of abrasive, water jet machining and electro chemical techniques.
3. Understand the principle, processes and applications of thermal metal removal processes.
4. Identify the principles, processes and applications of EBM and LBM.
5. Understand the principle, processes and applications of Plasma Machining.

SYLLABUS:

UNIT – I

Introduction – Need for non-traditional machining methods-Classification of modern machining processes – considerations in process selection. Materials. Applications.

Ultrasonic machining – Elements of the process, mechanics of metal removal process, parameters, economic considerations, applications and limitations, recent development.

UNIT - II

Abrasive Jet Machining, Water Jet Machining and Abrasive Water Jet Machining: Basic principles, equipment, process variable, and mechanics of metal removal, MRR, application and limitations.

Electro – Chemical Processes: Fundamentals of electro chemical machining, electrochemical grinding, electro chemical honing, metal removal rate in ECM, Surface finish and accuracy.

UNIT – III

UNIT-III

Thermal Metal Removal Processes: General Principle and applications of Electric Discharge Machining, Mechanics of metal removal in EDM, Process parameters, selection of tool electrode and dielectric fluids, methods surface finish and machining accuracy,

Electric Discharge Grinding and electric discharge wire cutting processes, characteristics of spark eroded surface and machine tool selection. Wire EDM, principle, applications.

UNIT – IV

Generation and control of electron beam for machining, theory of electron beam machining, comparison of thermal and non-thermal processes. Machining accuracy and applications.

General Principle and application of laser beam machining – thermal features, cutting speed, accuracy of cut and applications.

UNIT - V

Application of plasma for machining, metal removing mechanism, process parameters, accuracy and surface finish and other applications of plasma in manufacturing industries.

Chemical machining – principle - maskants - applications. Magnetic abrasive finishing, Abrasive flow finishing, Electro stream drilling, shaped tube electrolyte machining.

Text Books

1. Advanced Machining Processes by VK Jain Allied publishers
2. Modern Machining Processes by P. C. Pandey, H. S. Shan / Mc Graw Hill

Reference Books

1. Advanced Machining Processes, Hassan Abdel-Gawad El-Hofy /Mc Graw Hill
2. Unconventional Manufacturing Processes/ Singh M.K/ New Age Publishers, first edition

PROGRAM: ENGINEERING AND TECHNOLOGY

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
		L	T	P	Int	Ext	
2095505D	AUTOMOBILE ENGINEERING	3	1	0	30	70	3

COURSE OBJECTIVES:

1. Understand the fundamentals, operation and function of an automotive engine
2. Understand the working of fuel, ignition, cooling, lubrication and electrical systems
3. Understand the performance and emission characteristics of an engine

COURSE OUTCOMES:

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

1. Understand the basic lay-out of an automobile.
2. Understand the operation of engine cooling, lubrication, ignition, electrical and air conditioning systems.
3. Explain the working of various parts like engine, transmission, clutch, brakes
4. Describe how the steering and the suspension systems operate and understand the principles of braking systems.
5. Understand the environmental implications of automobile emissions

UNIT- I

VEHICLE STRUCTURE AND ENGINES

Classification of automobiles, Layout of an automobile, vehicle construction, chassis frame -semi integral and integral, Automobile major Parts , Automobile stream lining.

Engine classification: 'In-line' and 'V' type, Multi-Valve Engines, VCR Engines, automobile types: front, rear and four wheel drive, functions and automotive materials.

UNIT- II

ENGINE AUXILIARY SYSTEMS

Super Charging/Turbo charging, Air filters, Electronically controlled diesel injection system -Unit injector system, Rotary distributor type and common rail direct injection system, Ignition system -Battery, Conventional.

Air pollution and their control: EGR and Catalytic Converters-2 way,3 way,Nobel, Engine emissions -EURO/Bharat Stage Norms: I, II, III, IV and V., Engine Cooling-Air Cooled, Water Cooled-Thermosyphon, Forced Circulation, Evaporative, Pressure, Engine Lubrication -Wet sump, Dry sump, Mist

UNIT -III

TRANSMISSION SYSTEMS

Clutch-Principle, classification(singleplate, multiplate and cone) elementary discussion about clutches and applications

Gear boxes- Principle, classification –constant mesh, sliding mesh, synchromesh, gear shift mechanisms, fluid flywheel –torque converter,

Propeller shaft: types-Hotchkiss Drive and Torque Tube Drive, slip joints, universal joint-Hookes, Differential, and rear axle.

UNIT- IV

STEERING, BRAKES AND SUSPENSION SYSTEMS

Steering geometry constant velocity joints and linkages, types of steering gear box- Rack and pinion, Power Steering.

Types of Suspension Systems-coil, leaf and shock absorber(piston and cylinder arrangement), wheel alignment-king pin angle, caster, camber, toe-in and toe- out.

Necessity of breaking system, types-Pneumatic and Hydraulic Braking Systems, Antilock Braking System

UNIT -V

ALTERNATIVE ENERGY SOURCES

Combustion and Emission Characteristics of SI and CI engines with these alternate fuels – Natural Gas, Liquefied Petroleum Gas, Bio-diesel, Bio-ethanol, Gasohol and Hydrogen

Hybrid and Electric Vehicles-classification, construction, applications and challenges.

Text Books:

1. Automobile Engineering – KK Jain/ RB Asthana, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-044529-X
2. Automotive Mechanics (10/e) - William H. Crouse and Donald L. Anglin, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-059054-0
3. Internal Combustion Engines and Air Pollution- E.F. Obert, Harper & Row International Publishers Inc., ISBN: 0-06-350561-4

Reference Books:

1. Automotive Mechanics – S. Srinivasan, Tata McGraw-Hill Publishing company Limited, ISBN: 0-07-044941-6
2. Internal Combustion Engines – Heywood, John, B. McGraw-Hill Publications Limited.
3. Automotive Engines- S Srinivasan, Tata McGraw-Hill Publishing Company Limited, ISBN: 0-07-040265-5

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
		L	T	P	Int	Ext	
2095506O	BASIC MECHANICAL ENGINEERING	3	0	0	30	70	3

COURS OBJECTIVES:

Basic Mechanical Engineering Practices is a basic subject for all branches of Engineering and Technology. This subject is aimed at providing basic understanding of the fundamentals of practical sections; mainly planning, marking, cutting, filing, wiring connections, standards & conventions of wiring, the tools, the use of measuring instruments in engineering applications and plumbing tools and practices.

The subject is planned to include sufficient practices which would help the student to understand the principles of manufacturing.

COURSE OUTCOMES: At the end of the practice, the students will be able to,

1. Acquire skills in basic engineering practice.
2. Identify the hand tools and instruments.
3. Study and use measuring instruments.
4. Practical skills in the fitting, Carpentry and wiring trades.

Carpentry

Introduction to various types of wood such as Deodar, Teak, Mango, Sheesham, etc. Demonstration, function and use of commonly used hand tools. Introduction to various types of wooden joints, their relative advantages and uses. Care, maintenance of tools and safety measures.

1. Job –I: Preparation of half lap joint
2. Job –II: Preparation of TEE-Joint

Welding

Introduction to welding and its importance in engineering practice, types of welding, common materials that can be welded, introduction to welding equipment e.g. A.C. welding set, D.C. rectifier, Electrode holder, electrodes and their specifications, welding screens and other welding related equipment and accessories. Electric arc welding, preparation ,procedure and precautions while using electric arc welding,

1. Job –I: Preparation of Lap weld joint
2. Job –II: Preparation of Butt weld Joint

House Wiring.

Introduction, of common electrical materials such as wires, cables, switches, fuses, ceiling roses, PVC Conduits, PVC Channels and allied items, tools and accessories. Electrical safety measures and about use of protective devices. Such as fuses, MCBs and relays Job I Identification of phase, neutral and earth of domestic appliances and their connection to two pin/three pin, plugs. Job II Preparation of a house wiring circuit on wooden board using fuse, Switches, socket, holder,

ceiling rose etc. by PVC Conduit and PVC casing and capping. Study of common electrical appliances such as electric iron, electric kettle, ceiling fan, table fan, electric mixer, electric Geyser, gas geyser, desert cooler, refrigerator, water purifier

1. Job - 1: One lamp controlled by one-way switch – measure and check the voltage and current using multimeter.
2. Job – 2: Two lamps connected in series - measure and check the voltage and current using multimeter.
3. Two lamps connected in parallel - measure and check the voltage and current using multimeter.

TEXT BOOKS

1. Workshop Technology I,II,III, by S K Hajra, Choudhary and A K Chaoudhary. Media Promoters and Publishers Pvt. Ltd., Bombay

2. Workshop Technology by Manchanda Vol. I,II,III India Publishing House, Jalandhar.

3. Manual on Workshop Practice by K Venkata Reddy, KL Narayana et al; MacMillan India Ltd. New Delhi

4. Basic Workshop Practice Manual by T Jeyapoovan; Vikas Publishing House (P) Ltd., New Delhi

5. Workshop Technoogy by B.S. Raghuwanshi, Dhanpat Rai and Co., New Delhi

6. Workshop Technology by HS Bawa, Tata McGraw Hill Publishers, New Delhi

Course code	Title of the Lab	Contact Hours/week			Allotment of Marks		Credits
		L	T	P	Int	Ext	
2095503P	Metrology Lab	0	0	3	50	50	1.5

COURSE OUTCOMES:

1. Demonstrate the necessary skills for calibration and testing of different instruments.
2. Demonstrate the necessary skills to collect data, perform analysis and interpret results to draw valid conclusions through standard test procedures using various metrology instruments.
3. Develop the ability to apply the principles in instruments and measuring techniques.

METROLOGY LAB. EXPERIMENTS - (Any Five)

1. Calibration of the following instruments: (using slip gauges)
   i. Calibration of Micrometer. ii. Calibration of Vernier Height Gauge.
   iii. Calibration of Vernier Caliper. iv. Calibration of Dial Gauge.
2. Measurement of taper angle using
   i. Bevel Protractor ii. Dial Gauge iii. Sine-Bar iv. Auto-Collimator.
3. Alignment tests:
   i. Parallelism of the spindle ii. Circularity & Concentricity of the spindle
   iii. Trueness of running of the spindle.
4. Gear parameters Measurement
   i. Diameter, pitch/module ii. Pitch circle diameter iii. Pressure angle
   iv. Tooth thickness.
5. Measurement of Central Height of Spigot
6. Check the Straightness of a surface plate.
   i. Using spirit level ii. Using Auto-collimator
7. Tool Maker's Microscope:
   i. Establish the thread details ii. To find the cutting tool angles.
8. Profile of Gear Tooth and Screw Thread and compare the parameters by
   i. Profile Projector ii. Gear tooth Vernier Calipers
9. Miscellaneous:
   i. To find the diameter of a cylindrical piece ii. Taper angle of a V-block

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
		L	T	P	Int	Ext	
2095505P	MANUFACTURING TECHNOLOGY LAB-II	0	0	3	50	50	1.5

COURSE OUTCOMES:

1. The student would able to understand the relation between cutting forces, feed and depthof cut of various machine tools (lathe, drilling machine and milling)
2. The students would able to understand the single point cutting tool as per given toolsignature.
3. The student would able to understand the various properties of sand and their testingprocedure.

List of Experiments

1. Experiments on Lathe to establish the following Curves.
    a. Depth of Cut Vs Cutting Forces
    b. Feed Vs Cutting Forces
    c. Cutting Speed Vs Cutting Force
2. Grinding of Single point cutting tool as per given specifications(to check the tool angles).
3. Study of Chip formation on shaping machine (with lead samples).
4. Torque measurement on drilling/milling machine.
5. Effect of speed and feed on surface roughness.
6. Measurement of cutting tool temperature in turning.
7. Sieve analysis to evaluate G. F. No.
8. Moisture and Clay content test.
9. Green Compression and Shear test.
10. Shatter Index and hardness test.

PYTHON PROGRAMMING

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095407S	3	1	0	4	30	70	100	3

COURSE OBJECTIVES:

1. Learn basic programming of Python
2. To develop programs using Python packages

COURSE OUTCOMES:

At the end of the course student will be able to

1. Develop the Python programs using operators, conditional and looping statements and strings
2. Implement programs using functions and different types of Data structures
3. Develop the programs using Python Packages, OOP and GUI concepts

MODULE-I

Week 1: Introduction:

History of Python, Need of Python Programming, Python Installation, Python basics.

Week 2: Operators in python, conditional statements

1. Accept two numbers from the user and calculate Addition, Subtraction, multiplication and Division.
2. Write a Program for checking whether the given number is an even number or not.
3. Given a two integer numbers return their product and if the product is greater than 1000, then return their sum.
4. A student will not be allowed to sit in exam if his/her attendance is less than 75%. Take following input from user Number of classes held; Number of classes attended; and print percentage of class attended, and print whether the student is allowed to sit in exam or not

Week 3: Iterations, continue and break statements.

1. Print the following pattern

   1
   12
   123
   1234
   12345
2. Accept number from user and calculate the sum of all number between 1 and given number
3. Given a number count the total number of digits in a number

Week 4: Strings, string functions, string slicing

1. Given 2 strings, s1 and s2, create a new string by appending s2 in the middle of s1
2. Given a string input Count all lower case, upper case, digits, and special symbols
3. Given an input string, count occurrences of all characters within a string

MODULE-II

Week 5: Lists and Tuples

1. Write a Python program to get the largest number and smallest number from a list**.**
2. Write a Python program to remove duplicates from a list
3. Write a Python program to find the length of a tuple
4. Write a Python program to convert a list to a tuple

Week 6: Sets and Dictionaries

1. Dictionaries and dictionary methods, Sets and set methods.
2. Write a Python script to merge two Python dictionaries
3. Write a Python program to sort a dictionary by key

4. Return a set of identical items from a given two Python set

Week 7: Functions: Defining Functions, Calling Functions, Passing Arguments, Anonymous Functions, Fruitful Functions (Function Returning Values)

1. Write a Python program to reverse a string using functions
2. Write a Python function to check whether a number is perfect or not
3. Write a function unique to find all the unique elements of a list.

Week 8: Recursion

1. Write a Python program to get the factorial of a non-negative integer using Recursion
2. Write a Python program to solve the Fibonacci sequence using recursion

Week 9: Regular expressions: Metacharacters, Special Sequences, Sets, RegEx Function, Filehandling: modes, reading files, writing and closing files, Iterators, Generators, Filters and Lambda.

1. Write a Python program to find the substrings within a string
2. Write a Python program to Email id validation
3. Write a Python program to write a list to a file
4. Write a Python program to copy the contents of a file to another file

MODULE-III

Week 10: Modules: Creating modules, import statement, from. Import statement, name spacing. Python packages: Introduction to PIP, Installing Packages via PIP, Using Python Packages.

1. Install packages requests, flask and explore them. using (pip)
2. Write a script that imports requests and fetch content from the page. Eg. (Wiki)
3. Write a simple script that serves a simple HTTPResponse and a simple HTMLPage

Week 11: Basics of NumPy and Pandas packages, Basics of Matplotlib library.

1. Add the following two NumPy arrays and Modify a result array by calculating the square of each element.
2. Write a Python program to convert a dictionary to a Pandas series

Week 12: OOP

a) Class variables and instance variable

I. Robot
II. ATM Machine

Week13: GUI, Graphics

1. Write a GUI for an Expression Calculator using tk
2. Write a program to implement the following figures using turtle

CAD/CAM

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095601	3	1	0	4	30	70	100	3

COURSE OBJECTIVES:

1. Know the development of the various design steps to manufacture the products with high quality in less time.
2. Understand the importance of the computer aided designing and manufacturing techniques.
3. Understand the usage of Computer Aided Process Planning and Quality Inspection techniques in an industry.

COURSE OUTCOMES:

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

CO 1 Understand the importance of computer in design and manufacturing of different products.

CO 2 Interpret the various transformation systems and make use of various geometric modelling techniques that are used in CAD.

CO 3 Understand the importance of finite element analysis before manufacturing a component.

CO 4 Apply the GT codes and Computer Aided Process Planning techniques in an industry. Also, can explain the use of automated material handling equipment in an industry.

CO 5 Examine the various Computer Aided Quality Inspection techniques and gaining knowledge of FMS & CIMS.

SYLLABUS:

Syllabus :

UNIT-I

Fundamentals of CAD

Introduction, Design process, Application of computers for design; Operating systems and Hardware in CAD; The design work station - I/O Devices, CAD system configurations (Network and Ring), Creating database for manufacturing, Benefits of CAD.

UNIT-II

Interactive Computer Graphics

Graphic display devices- Graphics system- Graphics standards, Graphical user interface; Coordinate systems; Transformation systems- 2D and 3D transformations (Translation, Scaling, Rotation and Reflection), Linear transformations- windowing and clipping; Geometric Modeling - Wire frame Modeling, Surface Modeling, 3D Solid Modeling - Boundary representation (B-rep) and Constructive Solid Geometry (CSG).

UNIT-III

Introduction to Finite Element Analysis (FEA)

Definition of Node and Element, Types of elements – 1D, 2D and 3D elements; Steps of FEA for solving a physical problem, CAD techniques to finite element data preparation, Mesh

generation techniques – Semi automatic and fully automatic techniques, Presentation of results, Advantages, Limitations and Applications of FEM.

UNIT-IV

Group Technology

Classification and Coding systems, Merits & demerits, Applications of GT; Cellular manufacturing.

Computer Aided Process Planning

Introduction to process planning, Methods of process planning – Manual and Computer aided process planning (Variant and Retrieval approaches), CAPP systems.

Computer Aided Material Handling

Robots: Structure and operation and configuration of Robots, robot sensors and applications, Automated guided vehicles and its types.

UNIT-V

Computer Aided Inspection and Quality Control

Quality assurance and quality control. Contact and Non-contact inspection techniques.

FMS & CIMS

Building blocks of Flexible Manufacturing Systems (FMS), Tool management systems, Advantages of FMS, Introduction to the concept of Computer Integrated manufacturing systems (CIMS), Components of CIM and its benefits.

Text books:

1. CAD/CAM- Computer Aided Design & Manufacturing, by M.D. Groover & E.W. Zimmer. Special Indian Edition 2014, Pearson publications
2. Computer Aided Manufacturing, by P.N. Rao, N.K. Tewari & T.K. Kundra, Third Edition Tata McGraw-Hill publishing company Ltd, New Delhi.
3. Introduction to Finite Elements in Engineering, by Tirupati R. Chandrupatla, Ashok D. Belegundu, Fourth Edition, Pearson publications

Reference books:

1. Computer Aided Design and Manufacturing by Dr. Sadhu Singh, Fifth edition, Khanna Publishers.
2. CAD/CAM/CIM by P. Radhakrishnan, S. Subramanyan and V. Raju, Third Edition, New age international Publishers.

HEAT AND MASS TRANSFER

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095602	3	1	0	4	30	70	100	3

COURSE OBJECTIVES:

1. To know three modes of heat transfer, distinguish between steady and unsteady state also understands the free and forced convection process.
2. To acquire knowledge on radiation mode heat transfer and significance of shape factor in exchanging heat through radiation.
3. Analyse the types of heat exchangers and its performance and understand the basic principles of boiling, condensation and mass transfer

COURSE OUTCOMES:

Students are able to

1. Understand the basic modes of heat transfer. Also distinguish the steady and unsteady state heat transfer for various geometry and solve problems
2. Understand the concept of free and forced convection. Analyze the convection problem regard to distinct flow conditions.
3. Study the different laws of radiation. Also evaluate the heat transfer problems through radiation and identify the significance of shape factor in it.
4. Differentiate the heat exchangers based on application. Also analyze the heat transfer through heat exchanger using LMTD and NTU methods.
5. Distinguish between mechanism of Boiling and Condensation.Also differentiate the modes of mass transfer.

SYLLABUS:

UNIT I

Introduction: Basic modes of heat transfer- Fourier's law of heat conduction, Thermal conductivity-Thermal resistance-Generalized heat conduction equation in Cartesian, Cylindrical Coordinate System and Generalized heat conduction equation in Spherical(No Derivation) coordinate systems.

Conduction: Heat conduction through a plane wall and composite wall (uniform thermal conductivity only)-Overall heat transfer coefficient- Problems – (Simple)-Heat conduction through hollow and composite cylinders (uniform thermal conductivity only)-Logarithmic mean area for the hollow cylinder-Problems (Simple)-Heat conduction through hollow and composite spheres of uniform thermal conductivity (No derivation)-Logarithmic mean area for the hollow spheres (No derivation).

Critical thickness of insulation, for cylinder- Problems and for sphere (No derivation)

Heat transfer from extended surfaces, Heat flow through a rectangular fin, Heat dissipation from an infinitely long fin, fin insulated at the tip, fin of finite length- Efficiency and Effectiveness of fin – Problems (Simple)

Unsteady steady state heat conduction (Transient heat conduction), solids having infinite thermal conductivity (Lumped system analysis), solids with finite conduction and convective resistance (Heisler charts) - Problems (Simple)-Time constant and response of temperature measuring instruments (no problems)

UNIT II

Convection: Dimensions, Methods of dimensional analysis, Rayleigh's Method, Buckingham's Pi Method/theorem- Dimensional analysis applied to Forced convection heat transfer, Natural or free convection heat transfer- Dimensional numbers and their physical significance, Characteristic length or equivalent diameter.

Concept of Boundary Layer Free and Forced convection-Concept of continuity, Momentum, Energy Equations (No derivations , Elementary Treatment only)-
Forced Convection- Concepts of hydrodynamic (Vonkorman Integral momentum equation) and thermal boundary layer -Laminar and Turbulent flow over a flat plate, flow through pipes/ tubes (No derivations)- Empirical correlations for forced convections, laminar and turbulent flow over flat plates and walls, flow inside tubes- Problems (Simple).
Free Convection- Concept of free convection heat transfer on a vertical flat plate-Momentum and energy integral equation on flat plate-Empirical correlations for free convection, vertical and horizontal, plates and cylinders-Problems (Simple)

UNIT III

Radiation: Surface emission properties-Absorptivity, reflectivity, and transmitivity-Black body concept-Laws of Stefan Boltzmann, Kirchhoff's, Planck's, Wien's displacement – Intensity of radiation - Lamberts cosine law- Problems (Simple)
Radiation exchange between two black bodies(Shape factor theorem) -Heat exchange between non-black(grey bodies) (No derivations)- Concepts of Electrical analogy for thermal radiation systems (No derivations) - Radiation shields- Problems (Simple).

UNIT IV

Heat Exchangers: Types of heat exchangers-Heat exchanger analysis-LMTD for Parallel flow, Counter flow- Problems(Simple).
Overall heat transfer coefficients- Fouling factor- Heat exchanger effectiveness- NTU method- Problems (Simple).

UNIT V

Boiling: Definition, Forms of Boiling,Boiling regimes,Calculations on Nucleate boiling, Critical Heat flux and Film boiling –Problems (Simple)
Condensation: Definition**,** Film wise and drop wise condensation, Nusselt's Theory of Condensation on a vertical plate(only theory and no derivations), Film Condensation-on horizontal tubes- inside tubes,Problems (Simple).
Mass Transfer: Modes of Mass transfer, Concentrations (definitions only)- Mass, Molar, Mass fraction, Mole fraction, Fick's law of diffusion.

Note: Heat Transfer data book is allowed.

Text Books:

1. Heat and Mass Transfer by R.K. Rajput, S. Chand & Co Publisher, 5th Revised Edition.
2. Fundamentals of Engineering Heat and mass transfer by Sachdeva, New age International publishers, 5th Edition.
3. Fundamental of Heat and mass transfer by C P Kothandaraman, New Age International Publishers, 4th Edition.

References:

1. Analysis of Heat transfer, by Eckert and Drake, Int.Student edition, McGraw Hill Kogakusha Ltd.
4. Heat Transfer, by J.P.Holman, Int. Student edition, McGraw Hill book company.

PRODUCTION PLANNING AND CONTROL

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095603	3	1	0	4	30	70	100	3

COURSE OBJECTIVES:

1) To make the student understand the concept of Production planning and production control.
2) To make the student understand the different types of production and their selection criteria and make the student knowledgeable to deal with production planning and control in different types of production.
3) To make the student to understand the concept of forecasting and its necessity in real world requirements and its linkage to other functions of production manager

COURSE OUTCOMES: At the end of the course, the student able to

1. Participate and can interact in real world scenario regarding production planning and production control and suggest the type of production required for specific real world requirement.
2. Undertake the responsibility of doing forecasting in real world situation is able to suggest correct forecasting method/technique for a specific real world situation.
3. Understand the need of inventory control and can able to undertake activities relating to inventory management.
4. Knowledgeable about MRP-1&2, JIT Aggregate planning can able to implement them in real world situation.
5. Understand and participate in the design of both forward and backward scheduling and Master scheduling and can able to evaluate different job shop schedules with reference to priority scheduling rules.

SYLLABUS:

UNIT-I:

Introduction: Definition – Objectives of production Planning and Control – Functions of production planning and control – Types of production – Organization of production planning and control department.

UNIT -II

Forecasting: Importance – Types of forecasting– Forecasting techniques –qualitative methods and quantitative methods.

UNIT –III

Inventory management: Functions of inventories – relevant inventory costs – EOQ model – Inventory control systems – ABC analysis – VED analysis Material Requirement Planning, Bill of material, MRP II, Master Production Scheduling.

UNIT –IV

Routing: Definition – Routing procedure –Route sheets — Factors affecting routing, procedure – Difference with loading

UNIT - V

Scheduling: Policies – Types of scheduling- Forward and Backward Scheduling – Gantt Charts – Flow shop Scheduling – n jobs and 2 machines, n jobs and 3 machines – Job shop Scheduling – 2 jobs and n machines – Line of Balance.

Dispatching: Activities of dispatcher – Dispatching procedure – follow up – priority rules for dispatching jobs. Applications of computer in production planning and control.

Text Books:

1. Elements of Production Planning and Control / Samuel Eilon.
2. Modern Production/ operation managements / Baffa&RakeshSarin

References:

1. Operations Management – S.N. Chary.
2. Inventory Control Theory and Practice / Martin K. Starr and David W. Miller.
3. Production Control A Quantitative Approach / John E. Biegel.
4. Operations Management / Joseph Monks.

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
		L	T	P	Int	Ext	
2095604	**Design of Machine Elements**	3	1	0	30	70	**3**

COURSE OBJECTIVES:

CO 1	To Acquainted with standards like ASTM, ASME etc. and to analyze static and fluctuating stresses
CO 2	To learn to formulate Stress and strains for Temporary fasteners and design of power transmission elements
CO 3	To learn and design of springs under static and dynamic conditions

COURSE OUTCOMES:

CO 1	To understand standards used for machine elements, different materials used in manufacturing and their mechanical properties
CO 2	To able to define different stresses in machine members and apply theories of failures in machine components.
CO 3	To recall different forms of screw threads, welded joints and analyze permanent joints under concentric and eccentric conditions
CO 4	To design and analyze shafts, couplings and keys under various loading conditions
CO 5	To classify different types of spring and their terminology, and design spring system.

SYLLABUS:

Unit I:

Introduction to Mechanical engineering design: Traditional design methods - different design models - Problem formulation - Design considerations, engineering materials and processes and their selection - BIS designation of steels - Mechanical properties, Load determination, manufacturing considerations in design

Unit II:

Design against static loads, fluctuations and fatigue stresses: Modes of failure, Factory of safety - Axial, bending and torsional stresses - Stress concentration factors. Static failure theories.

Soderberg - Goodman and modified Goodman diagrams - fatigue failure - design consideration in fatigue

Unit III:

Threaded and welded joints: Forms of threads, basic types of screw fastenings - ISO metric screw threads - eccentrically loaded bolted joints, Fluctuations loads on bolted joints.

Types and strength of weld joints subjected to bending and fluctuating loads - welding inspection.

Unit IV:

Shafts, keys and couplings: Shafts design on strength basis, torsional rigidity basis, Design of hollow shafts, flexible shafts, ASME codes for shafts, Keys - introduction, Flat, square keys, Couplings - Rigid and flange couplings, Flexible couplings

Unit V:

Spring Design: Classification and spring materials - Design of helical compression springs, helical extension springs, torsion springs, leaf springs - Surge in springs, nipping and shot peening.

Text Books:

1. Design of Machine Elements by V.B.Bhandari, TMH Publishing Co. Ltd., New Delhi

References:

1. Machine Design by Jain, Khanna Publications.
2. Machine Design by Pandya and Shaw, Charotar publications

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
2095605A	PROJECT MANAGEMENT	L	T	P	Int	Ext	3
		3	0	0	30	70	

COURSE OBJECTIVES:

The main objective of the course 'Project Management' is to impart basic knowledge on various aspects related to Project Management for the students who are pursuing B.Tech degree in Mechanical Engineering and enable them to understand the basic aspects while executing projects in an industry.

COURSE OUTCOMES: At the end of the course, the students will be able to

CO-1: Know the concept of project management and classification of projects
CO-2: Understand the various steps involved in project identification and formulation
CO-3: Know various project management techniques
CO-4: Identify tasks that are necessary for project completion using critical path method
CO-5: Understand probabilistic projects and able to calculate the time estimates

SYLLABUS:

UNIT - I: Introduction to Project Management

Introduction to Project Management (PM) – Definition of project- project management - objectives of PM - Importance of PM – Project characteristics – Project performance dimensions - Project life cycle – S-curve, J-curve ; Traits of a project manager ; Benefits of PM approach ; Classification of projects.

UNIT –II: Project Identification and Formulation

Project identification and Formulation – Steps involved in project formulation - Pre-feasibility Studies / Opportunity Studies - Feasibility Study - Economic and Market Analysis – Technical Analysis – Market Analysis - Financial Analysis: Pay-back period; Return on Investment; Net Present Value; Profitability Index/Benefit Cost Ratio; Internal Rate of Return (These topics are limited to definitions and no problems); Economic Benefits - Project Risk and Uncertainty; Detailed project report and its components.

UNIT –III: Project Management Techniques

Introduction to project management techniques – Classification of project management techniques, bar charts, Gantt charts, mile stone charts – procedures – advantages, limitations, simple problems on bar charts, Gantt charts, mile stone charts.

UNIT - IV: Project Network Analysis – I

Introduction to the Critical Path method, Application of CPM techniques, Network Diagram Representation-activities, events, sequencing, Rules for drawing Network Diagram, Time estimates and critical path in network analysis Forward pass computations for earliest event time, Backward pass computations for latest allowable time. Types of floats, Determination of floats and slack times, simple problems on Critical path method.

UNIT - V: Project Network Analysis – II

Introduction to program Evaluation and Review Technique (PERT) analysis, The optimistic time, the most likely time, The pessimistic time Expected time, formulas for calculations estimated time, Standard deviation for the project, Standard normal variate (Z) Standard deviation for each on critical path activity, Uses of PERT/CPE for Management, Application Areas of Pert/ CPM Techniques, Disadvantages of Network techniques, Simple problems on PERT.

TEXT BOOK:

1. Project Management by PRADEEP PAI, Pearson Education India, 1st Edition.

REFERENCE BOOKS:

1. Project Management: A Systems Approach to Planning, Scheduling, and Controlling, Harold Kerzner, Wiley Publication, 12th edition
2. PERT and CPM Principles and Applications, L.S.Srinath, East-West Press Pvt. Ltd,3rd edition
3. Operations Research by S.D.Sharma, Kedar Nath Ram Nath , 15th edition

FINITE ELEMENT ANALYSIS

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095605D	**3**	**1**	**0**	**4**	**30**	**70**	**100**	**3**

COURSE OBJECTIVES:

1. This subject deals with fundamentals of the finite element method for the analysis of engineering problems arising in solids and structures.
2. Emphasis an ability to apply knowledge of mathematics, science and engineering to do the analysis of simple and complex elastic structures using the finite element analysis.
3. Demonstrate an ability to design and conduct numerical analysis as well as analyze and interpret the results.
4. It deals with ability to identify, formulate, and solve engineering problems using the finite element analysis.

COURSE OUTCOMES:

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

1. Ability To gain the knowledge and understand the basics concepts of Finite element analysis.
2. Ability to understand the mathematical problems and get experience for problems solving of machine members.
3. To gain the knowledge of dynamics of fluids is introduced through the control volume approach which gives an integrated understanding of the transport of mass, momentum and energy.
4. Ability to understand advanced computing techniques and tools in the area develop the applications of FEA in engineering. To gain experience in the application of FE analysis to real engineering designs/Problems.
5. Get experience to implement different FEA/FEM tools for solving Structural engineering problems and write code for some of them in MATLAB.

SYLLABUS:

UNIT-I

Fundamental Concepts: Introduction, Historical background, Outline of presentation, General procedure for FEA, Stresses and Equilibrium, Boundary conditions, Strain- Displacement relations, Stress-Strain relations, Plane stress, Plane strain problems, Temperature effects, Potential energy and equilibrium. The Rayleigh-Ritz method, Hamilton’s principle.Galerkin's method, Saint Venant's principle.

UNIT-II

One-dimensional Problems: Introduction, Finite element modeling, coordinates and Shape functions. The potential energy approach. The Galerkin approach, Assembly of the global stiffness matrix-mass matrix and load vector, Treatment of boundary conditions, Quadratic shape functions, Temperature effects. Trusses: Introduction, Plane trusses, Three-dimensional trusses, Assembly of global stiffness matrix for the Banded and Skyline solutions.

Two-dimensional Problems: Using Constant Strain Triangles: Introduction, Finite element modeling, Constant strain triangle, In plane and Bending, problem modeling and boundary conditions.

UNIT-III

Axisymmetric Solids Subjected to Axisymmetric Loading: Introduction, Axisymmetric formulation, Finite element modeling, Triangular element, Problem modeling and boundary conditions.

UNIT-IV

Two-dimensional Isoparametric Elements and Numerical Integration: Introduction, The four-node quadrilateral, Numerical integration, requirements, h-refinement and p-refinement, Higher-order elements, Convergence

UNIT-V

Beams and Frames: Introduction, Finite element formulation, Load vector, Boundary Considerations, Shear force and bending moment, Beams on elastic supports, Plane frames.

Text Book:

1. Introduction to Finite Elements in Engineering, by Tirupati R. Chandrupatla, Ashok D.Belegundu.

References:

1. Introduction to Finite Element Method, by S.S.Rao
2. Finite Element Method, by O.C. Zienkiewicz.
3. Concepts and Applications of Finite Element Analysis, by Robert D. Cook.
4. Introduction to Finite Element Method, by J.N.Reddy.

Course code	Title of the Course	Contact Hours/week			Allotment of Marks		Credits
2095606O	**INDUSTRIAL ENGINEERING**	L	T	P	Int	Ext	**3**
		3	**0**	**0**	**30**	**70**	

COURSE OBJECTIVES:

The main objective of the course 'Industrial Engineering' is to impart basic knowledge on various aspects related to industry environment for the students who are pursuing B.Tech degree in any branch of Engineering.

COURSE OUTCOMES: At the end of the course, the students will be able to

CO-1: Know the concept of Industrial engineering and different production systems
CO-2: Understand the importance of plant location and plant layout to meet the requirements
CO-3: Understand the various phases and activities of production planning and control
CO-4: Know the importance of plant maintenance and the use of material handling systems
CO-5: Know the importance of quality and understanding of the use of quality control charts

SYLLABUS:

UNIT - I: Introduction to Industrial Engineering and Production systems

Introduction to Industrial Engineering- Definition - objectives and importance of Industrial Engineering - Functions of Industrial Engineer ; List of tools and techniques of Industrial Engineering; Production - Production system - Types of production systems - Job-shop production - Batch production - Mass production - Continuous production ; Productivity - Factors influencing the productivity of an organization .

(Explanation for all the topics at introductory level only)

UNIT –II: Plant location and Plant layout

Introduction to plant location - Factors affecting plant location; advantages, limitations and suitability of urban, rural and semi-urban industrial sites ; Plant layout – definition and objectives of plant layout ; Factors affecting plant layout; Principles of pant layout ; Types of plant layout – product layout, process layout , combination layout ; fixed position layout and group layout.

(Explanation for all the topics at introductory level only)

UNIT –III: Production planning and control

Introduction to production planning and control (PPC) – Need for PPC; Objectives of PPC; Functions of PPC - Planning, Routing, Scheduling, Dispatching, follow-up and Inspection

(Explanation for all the topics at introductory level only and No numerical problems)

UNIT - IV: Plant maintenance and material handling systems

Plant maintenance – Importance of plant maintenance ; objectives of plant maintenance; Types of plant maintenance – Breakdown maintenance; scheduled maintenance ; preventive maintenance and predictive maintenance ; Materials Handling- objectives of material handling systems; Principles of material handling systems ; Concept of unit load, Containerization and Pelletization; Selection of material handling equipment, Types of material handling equipment used in manufacturing industries.

(Explanation for all the topics at introductory level only)

UNIT - V: Quality control

Introduction to Quality -Quality control- Dimensions of Quality- Phases of Quality-Quality costs Sources of Variation. Control charts- Variable Attribute – P- chart,nP- chart C- chart – simple problems on these charts.

(Explanation for all the topics at introductory level and No numerical problems)

TEXT BOOKS:

1. Industrial Engineering and Management by Pravinkumar, Pearson Education India.
2. Industrial Engineering and Management by O.P.Khanna and A.Sarup, DhanpatRai Publications Pvt. Ltd.

REFERENCE BOOKS:

1. Industrial Engineering and Production Management by Martand T Telsang,S.Chand& Company Ltd.
2. Industrial Engineering and Management by Dr.Ravi Shankar, Galgotia Publications Pvt. Ltd

INTERNET OF THINGS

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095607S	**0**	**0**	**3**	**3**	**50**	**50**	**100**	**1.5**

COURSE OBJECTIVES:

1. To learn basics IOT, boards, sensors etc.
2. To develop workable setups to measure and analyse them.

COURSE OUTCOMES:

At the end of the course student will be able to

1. Create different setups to measure temperature, distance etc.
2. Analyse different created setups for implementation in real time
3. Promote the usage and implementation of simple setups and implement them

EXPERIMENTS

1. Install IDE of Arduino and write a program using Arduino IDE to blink a given LED.
2. Develop Traffic Light controlling system using Arduino.
3. Develop IoT based Temperature Monitoring System.
4. Measure Humidity/Moisture using Arduino based system.
5. Develop Temperature controlled fan.
6. Develop heart beat Monitoring system using Arduino.
7. Interface a Gas sensor with Arduino.
8. Obstacle Detection Using IR Sensor and Arduino.
9. Measure distance using Ultra sonic sound Sensor.
10. Interface LDR with Arduino.
11. Develop a weighing machine using a load cell.
12. Develop a program to sense rpm of a given machine using an IR sensor.

ENGINES AND MECHANISMS LAB- II

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095601P	**0**	**0**	**3**	**3**	**50**	**50**	**100**	**1.5**

COURSE OUTCOMES

CO 1: The Student will be able to understand the practical training on the basics of internal combustion engines, Compressor.
CO 2: The Student will be able to understand various mechanisms and apply the kinematic principles to them
CO 3: The Student will be able to understand the theoretical concepts of Gyroscope, Balancing of masses through practical performance assessment.

LIST OF EXPERIMENTS

1. To Conduct Load Test on IC Engine and draw performance curves
2. To calculate the Air-Fuel ratio for a given load on IC Engine.
3. To draw Heat Balance Sheet on IC Engine
4. Study of Multi-cylinder Engine and determination of its firing order
5. To calculate the efficiencies at different pressure conditions of an Air Compressor
6. To Verify Laws of Balancing using motorized balancing apparatus
7. To determine the ratio of times and ram velocities of Withworth quick return mechanism
8. To find the magnitude of gyroscopic couple and compare it with theoretical value using motorized gyroscopic apparatus

HEAT TRANSFER LAB

Course code	Periods			Total contact hours/ per week	Sessional Marks	Exam Marks	Total Marks	Credits
	L	T	P					
2095602P	**0**	**0**	**3**	**3**	**30**	**70**	**100**	**1.5**

COURSE OBJECTIVES:

- Students have to be exposed to practical applications of various modes of heat transfer
- Students have to learn how to use measuring instruments related to heat transfer studies
- Students have to be exposed to latest equipment's related to heat transfer studies
- Students have to learn various experimental/analytical methods of evaluating Parameters related to heat transfer studies

COURSE OUTCOMES:

- Students will learn applications of heat transfer in real time applications
- Students will have hands on experience of handling various equipment's used in heat Transfer studies
- This exposure will help students to undertake projects related to heat transfer studies

LIST OF EXPERIMENTS

1	Thermal Conductivity Of Composite Wall
2	Measurement Of Surface Emissivity
3	Heat Transfer Through Forced Convection Over Horizontal Cylinder
4	Heat Transfer Through Natural Convection Over Horizontal Cylinder
5	Heat Transfer Through Natural Convection Over Vertical Cylinder
6	Experimental Investigation On Performance Of Pin-Fin Natural Convection
7	Experimental Investigation On Performance Of Pin-Fin Forced Convection
8	Drop And Film Wise Condensation