

Jharkhand University of Technology
Jharkhand, Ranchi

Syllabus for B.Tech 4th Semester

Mechanical Engineering

Mechanical Engineering4th semester course structure

Sl. No.	Course code.	Subject	L	T	P	Credits
01	ME401	Theory Of Machines	3	1	0	3
02	ME402	Fluid Machines	3	1	0	3
03	ME403	Applied Thermodynamics	3	1	0	3
04	PE401	Manufacturing Process-I	3	1	0	3
05	EC404	Electronics & Instrumentation Engg.	3	1	0	3
06	EN401/ IT402	Engineering Economics / Cyber Security	2	0	0	0
01	ME401P	Theory Of Machines Lab	0	0	3	1
02	ME403P	Applied Thermodynamics Lab	0	0	3	1
03	PE401P	Manufacturing Process-I Lab	0	0	3	1
04	EX401	Extra Activities (NSO/NSS/NCC/Yoga/ Creative Arts/Mini Project)	0	0	2	1
05	IN401	Internship/ Tour & Training/Industrial Training	0	0	0	2
Total credits						21

THEORY OF MACHINE

(ME , PROD)

Course code -ME 402

Objective:

- To understand the kinematics and rigid-body dynamics of kinematically driven machine components
- To understand the motion of linked mechanism in terms of the displacement, velocity and acceleration at any point in a rigid link
- To understand the kinematics of gear trains

Contents:

Module -1

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

Module-II

Displacement, velocity and acceleration analysis of simple mechanisms, graphical velocity analysis using instantaneous centers, velocity and acceleration analysis using loop closure equation-kinematics 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(**8hrs**)

Module-III

Classification of cams and followers –Terminology and definitions –Displacement diagrams –Uniform velocity, parabolic, simple harmonic and cycloidal motions-derivatives of follower motion-specified counter cams-circular and tangents cams – pressure angle and undercutting, sizing of cams, graphical and analytical disc cam profile synthesis for roller and flat face followers(**8hrs**)

Module – IV

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(**8hrs**)

Module – V

Surface contacts-sliding and rolling friction- friction drives- bearings and lubrication-friction clutches-belt and rope drives-friction in brakes(8hrs)

Course outcomes:

- After completing this course, the students can design various types of linkage mechanism for obtaining specific motion and analyze them for optimal functioning.

Text Book:

- 1.Thomas Bevan,Theory of machines,3rd edition, CBS Publishers &Distributors,2005.
- 2.Cleghorn W.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 Mechanism and Machines, Affiliated East-West Pvt.Ltd,New Delhi,1988.

APPLIED THERMODYNAMICS

Course Code-ME 402

Objectives:

- 1) To learn about of 1st law for reacting systems and heating value of fuels.
- 2) To learn about gas and vapor cycles and their first law and second law efficiencies.
- 3) To understand about the properties of dry and wet air and the principles of psychometry.
- 4) To learn about gas dynamics of air flow and steam through nozzles.
- 5) To learn the about reciprocating compressors with and without intercooling
- 6) To analyze the performance of steam turbines.

Module-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.

Module -II

Vapor power cycles Rankine cycle with superheat, reheat and regeneration, energy analysis Super- critical 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(12hrs)

Module-III

properties of dry and wet air, use of pschymetric chart, processes involving heating/cooling and humidification/ dehumidification, dew point(4hrs)

Module-IV

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. (8hrs)

Module-V

Reciprocating compressors, staging of reciprocating compressors, optimal stage pressure ratio, effect of intercooling, minimum work for multistage reciprocating compressors. (5hrs)

Module-VI

Analysis of steam turbines, velocity and pressure compounding of steam turbine. (3hrs)

Outcomes:

1. After completing this course the students will get a good understanding of various practical power cycles and heat pump cycles.
2. They will be able to analyze energy conversion in various thermal devices such as combustors, air coolers, nozzles, diffusers, steam turbines and reciprocating compressors.
3. They will be able to understand phenomena occurring in high speed compressible flows.

MANUFACTURING PROCESSES I

Course Code-PE 401

Objectives:

To motivate and challenge students to understand and develop an appreciation of the processes in correlation with material properties which change the shape, size and form of the raw materials into the desirable product by conventional or unconventional manufacturing methods.

Module-I

Conventional Manufacturing Processes:

Casting and moulding: Metal casting processes and equipment, Heat transfer and solidification, shrinkage, riser design, casting defects and residual stresses. (5hrs)

Module-II

Introduction to bulk and sheet metal forming, plastic deformation and yield criteria;

fundamentals of hot and cold working processes; load estimation for bulk forming (forging, rolling, extrusion, drawing) and sheet forming (shearing, deep drawing, bending) principles of powder metallurgy.

Metal Cutting: Single and multi-point cutting; Orthogonal cutting, various force components: Chip formation, Tool wear and tool life. Surface finish and integrity, Machinability, Cutting tool materials, cutting fluids coating; Turning, Drilling, Milling and finishing processes, Introduction to CNC machining (8hrs)

Module-III

Additive manufacturing: Rapid prototyping and rapid tooling (3hrs)

Module-IV

Joining/ fastening processes: Physics of welding, brazing and soldering; design considerations in welding. Solid and liquid state joining processes; Adhesive bonding (3hrs)

Module-V

Unconventional Machining Processes:

Abrasive Jet Machining, Water Jet Machining Abrasive Water Jet Machining, Ultrasonic Machining principles and process parameters (5hrs)

Module-VI

Electrical Discharge Machining principle and processes parameters, MRR, surface finish tool wear, dielectric, power and control circuits, wire EDM; Electro-chemical machining (ECM), etchant & maskant, process parameters, MRR and surface finish.(8hrs)

Module-VII

Laser Beam Machining (LBM), Plasma Arc Machining (PAM) and Electron Beam Machining (3hrs)

Books and References:

1. Kalpakjian and Schmid, Manufacturing processes for engineering materials (5th Edition)- Pearson India, 2014.
2. Mikell P. Groover, Fundamentals of Modern Manufacturing: Materials, Processes, and Systems.
3. Manufacturing Technology by P.N. Rao., MCGRAW HILL INDIA.
4. Materials and Manufacturing by Paul Degarmo.
5. Manufacturing Processes by Kaushish, PHI.
6. Principles of Foundry Technology, Jain, MCGRAW HILL INDIA
7. Production Technology by RK Jain.
8. Degarmo, Black &Kohser, Materials and Processes in Manufacturing.

Course Outcomes:

Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products Objectives:

ELECTRONICS AND INSTRUMENTATION ENGINEERING

Course code – EC404

(For Civil, Mech. and Production Engineering).**Module 1: Basic Electronic Components**

Active and Passive Components, Types of resistors and Colour coding, Capacitors, Inductors applications of Resistor, Capacitor and Inductor, Relay, LDR, Basic Integrated Circuits (IC 7805, 7809, 7812, 555 etc.). Measuring Instruments like CRO, Power supply, Multi-meters etc.

Module II: Semiconductors, Diode and Transistors:

Difference between Insulators, Semiconductors and Conductors, Mobility and Conductivity, Intrinsic and Extrinsic Semiconductors, Fermi Level, Energy band, P-N Junction Diode, construction, working, characteristics and diode equation Application of Diode, Rectifier: Half Wave, Full Wave and Bridge Rectifier, Zener Diode and its Applications, Varactor Diode, Schottky Diode, Regulated Power Supply using Zener Diode and Regulated ICs, LED, Photodetector, Construction, Working, Modes and Configuration of BJT, Input and Output Characteristics of all Configurations, Comparison of all Configuration & Modes, BJT as a Switch and as an Amplifier. JFET Construction, working and characteristics. MOSFET Construction, working and Characteristics, Types of MOSFET,.

Module III: Digital Electronics Fundamentals:

Difference between analog and digital signals, Boolean algebra, Basic and Universal Gates, Symbols, Truth tables, logic expressions, Logic simplification using K- map, Logic ICs, half and full adder/subtractor, multiplexers, demultiplexers, flip-flops, shift registers, counters, Block diagram of microprocessor/microcontroller and their applications.

Module IV: Electronic Instruments:

Measurement of Temperature, RTD, Thermistors, LVDT, Strain Gauge, Piezoelectric Transducers, Digital Shaft Encoders, Tachometer, Hall effect sensors. Sensors and Transducers for physical parameters: temperature, pressure, torque, flow. Speed and Position Sensors. Electronic Display Device, Digital Voltmeters, Digital Energy meter, CRO, measurement of voltage and frequency, Lissajous Patterns, Plotting B-H curve of a magnetic material, Wave Analyzers, Harmonic Distortion Analyzer. Digital Energy Meter. Measurements of R, L and C. Digital Multi-meter, True RMS meters, Clamp-on meters, Meggers. Digital Storage Oscilloscope.

Module V: Electronic Communication Systems:

The elements of communication system, IEEE frequency spectrum and Transmission media: wired and wireless, need of modulation, AM and FM modulation schemes, Mobile communication systems: cellular concept and block diagram of GSM system, Ultrasonic wave & its application in distance measurement.

Text Books

1. Basic Electronics and Linear Circuits by N. N. Bhargava, D. C. Kulshreshtha and S. C. Gupta,

2. Op-Amps and Linear Integrated Circuits by Ramakant A. Gayakwad, PHI Publications.
3. Electronic Devices and Circuits by Godse and Bakshi Technical, Vol-1 Technical Publication Pune.
4. Floyd ,” Electronic Devices” Pearson Education 9th edition, 2012.
5. R.P. Jain , “Modern Digital Electronics”, Tata Mc Graw Hill, 3rd Edition, 2007.
6. Frenzel, “Communication Electronics: Principles and Applications”, Tata Mc Graw Hill, 3rd Edition, 2001

Reference Books

1. Integrated Devices & Circuits by Millman & Halkias, TMH Publications.
2. Electronics Devices and Circuit Theory by R. Boylestad & L. Nashelsky, Pearson Publication
3. Electronic Communication System by G. Kennedy, TMH Publications.
4. Basic Electronics by Sanjeev Kumar & Vandana Sachdeva, Paragaon International Publication

CYBER SECURITY

Course code –IT 402

Module I: Introduction to Cybercrime : Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, and Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

Module II: Cyber Offenses: How Criminals Plan Them: Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing.

Module III: Cybercrime : Mobile and Wireless Devices: Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

Module – IV: Tools and Methods Used in Cybercrime : Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

Module V: Cyber Security : Organizational Implications Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

TEXT BOOK:

- Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

REFERENCE BOOK:

- Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.

- Introduction to Cyber Security , Chwan-Hwa(john) Wu,J.David Irwin.CRC Press T&F Group

ENGINEERING ECONOMICS

Course code –EN 401

COURSE OUTLINE:

The basic purpose of this course is to provide a sound understanding of concepts and principles of engineering economy and to develop proficiency with methods for making rational decisions regarding problems likely to be encountered in professional practice.

Module -1

Introduction of Engineering Economics and Demand Analysis: Meaning and nature of Economics, Relation between science, engineering, technology and economics; Nature of Economic problem, Production possibility curve, Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility – its practical application and importance.

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, practical importance & applications of the concept of elasticity of demand.

Module -II

Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economies and diseconomies of scale.

Various concepts of cost – Fixed cost, variable cost, average cost, marginal cost, money cost, real cost, opportunity cost. Shape of average cost, marginal cost, total cost, Cost curves.

Module III

Meaning of Market, Types of Market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets)

Pricing Policies- Entry Detering policies, Predatory Pricing, Peak load Pricing. Product Life cycle

Firm as an organisation- Objective of the Firm, Type of the Firm, Vertical and Horizontal Integration, Diversification, Mergers and Takeovers.

Module -IV

Nature and characteristics of Indian economy (brief and elementary introduction), Privatization – meaning, merits and demerits. Globalisation of Indian economy – merits and demerits. Elementary Concepts of VAT, WTO, GATT & TRIPS agreement, Business cycle, Inflation

RECOMMENDED BOOKS:-

1. R.Paneer Seelvan: Engineering Economics, PHI
2. Managerial Economics, D.N.Dwivedi, Vikash Publication
3. Managerial Economics, H.L. Ahuja, S. Chand and Co. Ltd.
4. Managerial Economics, Suma Damodaran, Oxford.
5. R.molrishnd Ro T.V S 'Theory of firms : Economics and Managerial Aspects'. Affiliated East West Press Pvt Ltd New Delhi
6. Managerial Economics, H. Craig Petersen & W. Cris Lewis, Pearson Education.

APPLIED THERMODYNAMICS LAB

Course Code-ME 402P

List of Experiments: (At least 8 of the following)

1. Study of Fire Tube boiler.
2. Study of Water Tube boiler.
3. Study and working of Two stroke petrol Engine.
4. Study and working of Four stroke petrol Engine.
5. Determination of Indicated H.P. of I.C. Engine by Morse Test.
6. Prepare the heat balance sheet for Diesel Engine test rig.
7. Prepare the heat balance sheet for Petrol Engine test rig.
8. Study and working of two stroke Diesel Engine.
9. Study and working of four stroke Diesel Engine.
10. Study of Velocity compounded steam turbine.
11. Study of Pressure compounded steam turbine.
12. Study of Impulse & Reaction turbine.
13. Study of steam Engine model.
14. Study of Gas Turbine Model.

S. No.	Name of the Experiment
1	To study the construction and operation of a Cochran boiler

2	To study the construction and operation of a Babcock boiler
3	To study the construction and operation of a Lancashire boiler
4	To study the construction and operation of a vertical water tube boiler
5	To study about 2-Stroke petrol Engine
6	To study about 4-Stroke petrol Engine
7	To study about CI Engine(Diesel Engine)
8	Study of simple and compound Steam Engine
9	To determine the volumetric and isothermal efficiency
10	To determine the static efficiency and total efficiency

THEORY OF MACHINE LAB

ME402P

Name of the Experiment

1. To draw velocity diagram of four bar mechanism
2. To draw velocity diagram of slider crank mechanism.
3. To draw acceleration diagram of four bar mechanism
4. To draw acceleration diagram of slider crank mechanism
5. To study Different types of Cam profile
6. To draw displacement diagram, velocity diagram & acceleration diagram of cam follower
7. To draw a cam profile
8. To study Different types of Gears
9. To draw Involute gear profile.
10. To draw Cycloidal gear profile

MANUFACTURING PROCESS LAB

Course Code-PE401P

List of Experiments: (At least 8 of the following along-with study of the machines/processes)

1. Shear-angle determination (using formula) with tube cutting (for orthogonal) on lathe machine.
2. Bolt (thread) making on Lathe machine.
3. Tool grinding (to provide tool angles) on tool-grinder machine.
4. Gear cutting on Milling machine.

5. Machining a block on shaper machine.
6. Finishing of a surface on surface-grinding machine.
7. Drilling holes on drilling machine and study of twist-drill
8. Study of different types of tools and its angles & materials.
9. Experiment on tool wear and tool life.
10. Experiment on jigs/Fixtures and its uses.
11. Gas welding experiment.
12. Arc welding experiment.
13. Resistance welding experiment.
14. Soldering & Brazing experiment.
15. Study and understanding of limits, fits & tolerances.
16. Study of temperature measuring equipment's.
17. Measurement using Strain gauge.
18. Experiment on dynamometers.
19. To study the displacement using LVDT.

Course Outcomes: Upon completion of this course, students will be able to understand the different conventional and unconventional manufacturing methods employed for making different products.