SEMESTER-V

Subject Code	Course Title	Hrs per week			Max. Marks		Total Marks	Credits
		Lecture	T	P	Int.	Ext.		
BMECS1-501	Heat Transfer	3	1	0	40	60	100	4
BMECS1-502	Mechanical Measurement & Metrology	3	0	0	40	60	100	3
BMECS1-503	Automobile Engineering	3	0	0	40	60	100	3
BMECS1-504	Kinematics & Theory of Machines	3	1	0	40	60	100	4
XXXXX	Open Elective	3	0	0	40	60	100	3
BMECS1-505	Mechanical Engineering Lab-III (MMM &HT)**	0	0	2	60	40	100	1
BMECS1-506	Mechanical Engineering Lab-IV (AE &TOM)***	0	0	2	60	40	100	1
BMECS1-507	*Industrial Training	0	0	0	60	40	100	3
Total Credits		**15**	**2**	**4**	**380**	**420**	**800**	**22**

- ***Industrial training to be imparted at the end of 4th semester for six weeks.**
- ** MMM-Mechanical Measurement & Metrology Lab, HT- Heat Transfer Lab**
- ***AE-Automobile Engineering Lab, TOM-Theory of Machine Lab**

HEAT TRANSFER

Subject Code:BMECS1-501 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. To introduce students different modes of heat transfer like conduction, convection & Radiation. The aim of the course is to build a solid foundation in heat transfer.
2. Able the students to develop solution procedures of governing equations for the different modes of heat transfer. Estimation of heat transfer through composite walls & transient temperature state HT to sudden change.
3. Understand the principles of boiling and condensation including radiation heat transfer related engineering problems.
4. Understand the basic principles of heat exchanger analysis and thermal design.

Course Outcomes:

Upon successful completion of this course, the student will be able to:

1. Formulate and analyze a heattransfer problem involving any of the three modes of heat transfer.
2. Obtain exact/approximate solutions for the temperature variation using analytical methods where possible or employ approximate methods or empirical correlations to evaluate the rate of heat transfer.
3. Design devices such as heat exchangers and also estimate the insulation needed to reduce heat losses where necessary.
4. Apply the boiling and condensation heat transfer principles to engineering problems.

UNIT-I

Concept of heat transfer, Difference between the subject of "Heat Transfer" and its parent subject "Thermodynamics" Fouier's law of heat conduction, Introduction to three modes Basic modes of Heat Transfer & their mechanisms. 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- Straight fins of uniform cross-section, Straight fins with

varying cross-sectional area Circumferential fins of rectangular cross section, Fin performance: fin effectiveness and fin efficiency, total fin effectiveness, total fin efficiency Optimizing design of fin. Solutions of two dimensional conduction (approximate). **15 Hrs.**

UNIT-II

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. **15 Hrs.**

UNIT-III

Interaction of radiation with materials, definitions of radiative properties, Stefan Boltzmann's law, Plank's law, Kirchoff's law, Lambert's Cosine law, black and gray body radiation, Calculation of radiation heat transfer between surfaces using radiative properties, view factors and the radiosity method. Coefficient of radiant heat transfer, Radiation from gases, vapors and flames.Error in Temperature measurement by a thermocouple probe due to radiation losses. **10 Hrs.**

Heat Exchanger: Classification of heat exchangers, LMTD Approach for parallel & Counter flow heat exchangers, NTU approach for parallel/ Counter flow heat exchangers, Types of heat exchangers, Analysis and design of heat exchangers using both LMTD and NTU methods.

8Hrs.

UNIT-IV

Boiling and Condensation heat transfer, Pool boiling curve. Forced convection boiling, heat transfer during pool boiling of a liquid. Nucleationand different theories of nucleation, Condensation, types of condensation, film wise condensation on a vertical and inclined surface, Introduction mass transfer, Similarity between heat and mass transfer. Recent advancement in heat transfer and geothermal systems. **12 Hrs.**

Recommended Books:

1. A.J. Chapman, 'Heat Transfer', McGraw Hill Book Company, New York.

2. Frank P. Incropera and David P. De Witt, Fundamentals of Heat and Mass transfer, JohnWiley.
3. Yunus A Cengel, Heat Transfer : A Practical Approach, McGraw Hill, 2002
4. Fundamentals of Heat and Mass Transfer by F.P.Incropera and D.P.Dewitt, 4th ed., John Wiley & Sons.
5. J.P.Holman, Heat Transfer, Eighth Edition, McGraw Hill, 1997.
6. MassoudKaviany, Principles of Heat Transfer, John Wiley, 2002.

MECHANCIAL MEASUREMENTS AND METROLOGY

Subject code: BMECS1-502 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives:

1. The main objective of this course is to make students familiar with the mechanical measuring systems, and the standard measurement methods.
2. It further aims to make them to understand the basic measuring systems in the real time engineering applications.
3. To educate students on different measurement systems for metrology purpose.
4. To introduce concepts of linear, angular, roughness thread, gear measurements, limits, fits and tolerances.

Course Outcome

Upon successful completion of this course, the student will be able to:

1. Understand the classification of measurements and measurement standards used in industrial applications. To introduce concepts of linear, angular, roughness thread, gear measurements, limits, fits and tolerances.
2. Understand about various errors in measuring systems and evaluate the errors by statistical methods.
3. Know about functions and types of sensors and transducers and their utility in instrumentation.
4. Use various instruments for measurements like pressure, flow, temperature etc. In process industry manufacturing.

UNIT-I

Mechanical Measurement and Measurement systems: Definition, significance of measurement, generalized measurement system, Methods of Measurement, Classification of measuring instruments, Selection of measuring instruments, Input output configuration of measuring instruments, Methods of correction for interfering & modifying inputs, definitions and concept of Range and span, accuracy and precision, calibration, hysteresis and dead zone, sensitivity and

linearity, threshold and resolution; speed of response, lag, fidelity and dynamic error, dead time and dead zone. **6 Hrs.**

Errors in Measurement: Errors in Measurement: Sources of errors; Gross, Systematic and Random errors; Statistical analysis of test data- single sample test and multi sample test; Probable error – average and standard deviation for normal curves; Rejection of test data.

3 Hrs.

UNIT-II

Metrology: Line, end and wavelength standards; linear measurements - vernier scale and micrometer, vernier height gauge and depth guage; Angular measurements - sine bar, clinometer, angle gauge. Precision instrumentation based on laser principles; 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, optoelectronics measurements. **6 Hrs.**

Comparators: Introduction; need of comparators, basic principles of operation, uses, essential characteristics, classification of comparators; mechanical, optical, mechanical optical, pneumatic, fluid displacement. **4 Hrs.**

UNIT-III

Surface finish measurement: Introduction; Different surface texture, elements of surface texture, factors affecting surface finish, reasons for controlling surface texture, methods of measuring surface finish, indication of surface roughness symbols used. **6 Hrs.**

Pressure and Flow Measurement: Bourdon tube; diaphragm and bellows; Vacuum measurement – McLeod gauge; thermal conductivity gauge and ionization gauge; dead weight gauge tester. Electromagnetic flux meters; ultra-sonic flow meters and hot wire anemometer. Flow visualization techniques. **6 Hrs.**

UNIT-IV

Transducers: Variable resistance transducers, variable capacitance transducers, piezo-electric transducers, photoelectric transducers, strain gauges, use of various transducers. Measurement of strain and temperature: Theory of strain gauges, types, electrical resistance strain gauge, preparation

and mounting of strain gauges, gauge factor, methods of strain measurement. Temperature compensation, Wheatstone bridge circuit, orientation of strain gauges for force and torque, Resistance thermometers, thermocouple, law of thermocouple, materials used for construction, pyrometer, optical pyrometer. **6 Hrs.**

Speed and Force Measurementwith the help of latest measurement systems: Mechanical tachometers; vibration reed tachometer and stroboscope; proving ring;. Hydraulic and pneumatic load cells. Recent trends in Signal Processing: Sensing elements, Types of Signals, Signal Processing and Conditioning elements, Data Acquisition Digital Techniques in Mechanical Measurements, Readouts and Data Processing, analysis and Data Presentation elements.

Current Trends in Instrumentation, Fiber Optic Instrumentation, Fiber Optic Sensors such as Pressure Sensors, Voltage Sensor, Liquid Level Monitoring, Temperature Sensors, Stress Sensor. Fiber Optic Gyroscope Polarization Maintainingfiber. **8 Hrs.**

Recommended Books:

1. A. Bewoor and V. Kulkarni, 'Metrology and Measurement', McGraw-Hill, 2009.
2. E.O Doebelin, Measurement System: Application and Design, McGraw Hill, 2008.
3. J.P Holman, Experimental Methods for Engineers, McGraw Hill.
4. Instrumentation, Measurment and Analysis by B.C.Nakra and K.K.Chaudhary, TMH.
5. T.G. Beckwith, R.D. Marangoni and J.H. Lienhard, *Mechanical Measurements*, 5th Ed., Addison Wesley, 1993.
6. Measurement & Instrumentation Principles", Alan S MorrisPrentice Hall of India, 1996.

AUTOMOBILE ENGINEERING

Subject code: BMECS1-503 **L T P C** **Duration: 45 Hrs.**

3 0 0 3

Course Objectives.

1. Understand the layout, constructional and working of power unit and fuel supply system of an automobile.
2. To understand functioning of lubrication, cooling andsuspension system of an automobile.
3. To understand construction and working of transmission, steering and braking system of an automobile.
4. To understand working of starting and electrical systems of an automobile. Also to get knowledge of the recent developments in the automobile field.

Course Outcomes:

Students successfully completing this course will be able to -

1. Know the layout, constructional and working of power unit and fuel supply system of an automobile.
2. Know the functioning of lubrication, cooling and suspension system of an automobile.
3. Know construction and working of transmission, steering and braking system of an automobile.
4. Know working of starting and electrical systems of an automobile. Also get knowledge of recent developments in the automobile field.

UNIT-I

Introduction: Basic structure, general layout and type of automotive vehicles, Frameless and unitary construction; position of power unit; Components of the Automobile; Functions of Major Components of an Automobile.

Power Unit: Power requirements - motion resistance and power loss, tractive effort and vehicle performance curves; selection of power unit and engine performance characteristics; pollution due to vehicle emission and exhaust emission control system, silencers, types of pistons and rings.

Fuel Supply System: Air cleaner and fuel pumps; Air fuel requirements and carburation; constructional details of carburetor and fuel injection systems; MPFI (Petrol), Diesel Engine fuel

supply system - cleaning, injection pump, injector and nozzles, Individual Pump and Common Rail fuel supply systems. **12 Hrs.**

UNIT-II

Lubrication and Cooling Systems: Necessity of lubrication; Desirable properties of lubricants; various types of lubricants and oil additives; different systems of lubrication - oil filters, oil pumps and oil pressure indicator; crank case ventilation and dilution. Purpose of cooling, air and water cooling systems; radiator, thermostat, pump and fan.

Chassis and Suspension: Loads on the frame, considerations of strength and stiffness, engine mounting, independent suspension systems (Mac Pherson, Trailing Links, Wishbone), shock absorbers and stabilizers; wheels and tyres, tyre wear types, constructional details of plies **11 Hrs**

UNIT-III

Transmission System: Basic requirements and standard transmission systems; constructional features of automobile clutch, gear box, differential, front and rear axles; overdrives, propeller shaft, universal joint and torque tube drive; Rear wheel vs front wheel drive, principle of automatic transmission

Steering System: Requirement and steering geometry; castor action, camber and king pin angle, toe-in of front wheels, steering linkages and steering gears; wheel alignment; power steering, Ball re-circulating mechanism

Braking System: General braking requirements; Mechanical, hydraulic, vacuum power and servo brakes; Weight transfer during braking and stopping distances, Anti-Braking systems.

10 Hrs.

UNIT-IV

Starting System: Principle, starting torque, engine resistance torque, and power required for starting of engine. Starter motor and its circuit. Types of drive mechanisms: Bendix drive, pinion type, axial sliding armature starter. Slipping and overrunning of clutches, automatic switches for starting, cold starting devices: Glow plug & choke.

Electrical and electronic Systems: Classification, Introduction to Conventional and transistorized ignition systems; Charging, capacity ratings and battery testing; voltage and current regulation, wiring, fuse system, circuit breakers, Relays, Switches. Layout and Wiring diagram of vehicles, automotive accessories and safety features in automobile.

Latest Trends in automobile sector: Introduction of Gas, Electrical and Hybrid, solar powered vehicles.

Maintenance: Preventive maintenance, trouble shooting and rectification in different systems; engine tuning and servicing, major tools used for maintenance of automobiles. **12 Hrs.**

Recommended Books

1. Kamaraju Ramakrishna, 'Automobile Engineering', PHI Course, New Delhi, 2012.
2. Jain &Asthana, 'Automobile Engineering', Tata McGraw-Hill, New Delhi, 2002.
3. W.H. Crouse, 'Automotive Mechanics', McGraw Hill.
4. J. Heitner, 'Automotive Mechanics', East West Press.
5. Kirpal Singh, 'Automobile Engineering', Vol. I and II, Standard Publishers.
6. P.S Gill, 'Automobile Engineering', S.K. Kataria.

KINEMATICS AND THEORY OF MACHINES

Subject code:BMECS1-504 **L T P C** **Duration: 60 Hrs.**

3 1 0 4

Course Objectives:

1. The primary object of the course is to make the student understand the concept of: displacement, velocity and acceleration of simple mechanisms, cams and cam profiles of various cams, using different followers and motions.
2. The students will able to understand constructional and working features of important machine elements.
3. The students should be able to understand various parts involved in kinematics of machines including balancing of single and multiple rotating masses Gyroscopic motion and couples.
4. The students should be able to understand gear trains, belt rope and chains, and governors.

Course outcomes:

Upon the completion of this module students shall be able to understand, analyze and solve design problems related to:

1. Four bar chain, displacement, and velocity and acceleration analysis of simple mechanisms.
2. Cams and its displacement, velocity and acceleration diagrams, cams profiles, gears and gear trains.
3. Belts, ropes, chains and different types of governors.
4. Balancingof reciprocating masses, engines rotors and gyroscopic motion couples and robotic motions.

UNIT-I

Introduction: Kinematic Pairs, mechanisms, degree of freedom, Grashof's law, Inversions of four bar chain and slider crank chain, quick return mechanism. **6 Hrs.**

Velocity and acceleration analysis: Displacement, Velocity and acceleration analysis of simple mechanism, graphical velocity analysis using instantaneous centres, Coriolis component of acceleration.Universal joint- single and double, calculation of maximum torque. Oldham’s Coupling, steering mechanism including Ackermann’s and Davis steering mechanism. Mechanism with lower

pairs, pantograph, exact and approximate straight line motion,

6 Hrs.

UNIT-II

Cams: Classification of cam and follower -terminology and definitions- displacement diagrams - uniform velocity, parabolic, simple harmonic and cycloidal motions, follower motions, circular and tangent cams- roller and flat face follower **8 Hrs.**

Gear and Gear trains: Involute and cycloidal gear profiles, gear parameters, fundamental laws of gearing, and spur gear contact ratio and interference /undercutting. Helical, bevel, worm, rack and pinion gears Gear trains, types of gear trains simple, compound, Epicyclic and Compound Epicyclic gear trains, problems involving their applications. **8 Hrs**.

UNIT-III

Belts ropes & chains: Belt , ropes and chain drives , flat and V-belts, rope and chain drives, idle pulley ,crowning of pulley , loose and fast pulley , ratio of tension on tight and slack side of belt , length of belt , creep and slip , power transmitted by belt. **7 Hrs.**

Governors: Function, Porter and Proell governors, Hartnell and Willson-Hartnell spring loaded governors, Sensitivity, stability, Isochronism and hunting of governor, Governor effort and power, controlling force curve, effect of sleeve friction **10 Hrs.**

UNIT-IV

Balancing: Necessity of balancing, static and dynamic balancing, balancing of single and multiple rotating masses, partial unbalanced primary force in an engine, balancing of reciprocating masses, and condition of balance in multi cylinder in line V-engines, concept of direct and reverse crank, balancing of machines, rotors, reversible rotors **10 Hrs.**

Gyroscopic Motion and Couples: Effect on supporting and holding structures of machines. Stabilization of ships and planes, gyroscopic effect on two and four wheeled vehicles.An introduction to ModernRobot mechanisms for robotic motions. **5 Hrs.**

Recommended Reference &Text Books

1. John, Gordon, and Joseph, ‘Theory of Machines and Mechanisms’, Oxford University Press.
2. S.S. Rattan, ‘Theory of Machines’, Tata McGraw Hill, New Delhi.
3. JagdishLal, ‘Theory of Machines and Mechanisms’, Metropolitan Book Co.

4. Sandor G.N., Erdman A.G "Theory of Machines", Prentice Hall Publications,
5. J.S Rao and R.V Dukkipati Mechanism and Machine theory NEWAGE international Publishers.
6. Shigley J.E., Uiker J.J "Theory of Mechanisms & Machines", McGraw Hill Int., 1985.
7. Ghosh A, Mallik A "Theory of Mechanisms & Machines, Ed", Aff. East-West Press, 3rd 1998.

MECHANICAL ENGINEERING LABORATORY-III (MMM & HT)

Subject code: BMECS1-505 **L T P C**

0 0 2 1

Course Objectives:

1. To illustrate the theoretical concepts taught in Mechanical Measurements & Metrology through experiments.
2. To illustrate the use of various measuring tools.
3. To understand calibration techniques of various measuring devices.
4. To enable the student to apply conduction, convection and radiation heat transfer concept to practical applications.
5. To enable the student to perform analysis and interpret results to draw valid conclusions through standard test procedures
6. To enable the student to determine thermal properties and performance of heat exchange and other heat transfer devices.

Contents:

1. Measurement of an angle with the help of sine bar.
2. Measurement of surface roughness of a machined Plate, Rod and Pipe.
3. Measurement of gear elements using profile projector.
4. Measurement of thread element by Tool maker microscope.
5. Use of stroboscope for measurement of speed of shaft.
6. Calibration of Micrometer using slip gauges.
7. To study and compare temperature distribution, heat transfer rate, overall heat transfer in parallel flow and counter flow heat exchanger.
8. To find out total thermal resistance and total thermal conductivity of composite wall.
9. To study the temperature distribution along the length of fin in Forced convection and Natural Convection
10. To determine heat transfer coefficient in drop wise and film wise condensation.
11. To study the phenomenon of the boiling heat transfer and to plot the graph of heat flux versus temperature difference.
12. To determine the emissivity of given test plate surface.

Course Outcome

The student will be able to:

1. Define metrology and apply concept of metrology to engineering applications
2. Understand the basic measurement units and able to calibrate various measuring devices.
3. Use measuring tools such as Sine bar, surface roughness tester, profile projector, Tool Maker Microscope, stroboscope, Micrometer, etc.
4. Perform steady state conduction experiments to estimate temperature distribution and thermal conductivity of different materials.
5. Perform transient heat conduction experiments
6. Estimate heat transfer coefficient in natural, forced convection and condensation and boiling process also.
7. Determine surface emissivity of different surfaces and Stefan Boltzmann's constant.

MECHANICAL ENGINEERING LABORATORY-IV (AE & TOM)

Subject code: BMECS1-506 **L T P C**

0 0 2 1

Course Objectives

1. To deliver basic knowledge of different components of automobiles
2. To understand functioning of different systems of automobile.
3. To enhance knowledge of fault diagnosis and troubleshooting capabilities of different systems of an automobile.
4. The main objective of the course is to make the student understand regarding link pair and chains, motorized gyroscope, gear and gear trains and Cams.
5. The students will understand gear train speed of different gears.
6. They will also gain knowledge of gyroscopic effect, gyroscope active and reactive couple for ships.

Contents:

1. Study and demonstration of layout of an Automobile
2. Trouble shooting in cooling system of an automotive vehicle.
3. Trouble shooting in the fuel supply system of Petrol and Diesel engine vehicles.
4. Demonstration of steering system and measurement of steering geometry angles and their impact on vehicle performance.
5. Trouble shooting in braking system with specific reference to master cylinder, brake shoes, overhauling of system and the adjusting of the system and its testing.
6. Fault diagnosis in transmission system including clutches, gear box assembly and differential.
7. Disassembling of engine: inspection of engine components, servicing of components, measurement of dimensions of different components of engine, compare with standard specifications, piston ring setting, assembling using special tools.
8. To determine the position of sleeve against controlling force and speed of Hartnell Governor and to plot the characteristic curve of radius of rotation.

9. To analyze the motion of a motorized gyroscope when the couple is applied along its spin axis.
10. Velocity ratios of simple, compound, Epicyclic and differential gear trains.
11. Kinematics of four bar, slider crank, crank rocker, double crank, double rocker andOscillating cylinder mechanisms.
12. Cam & follower and motion studies.

Course Outcomes:

The student will be able to:

1. Identifythe different components of the automobile.
2. Understand the functioning of different systems of automobile.
3. Do fault diagnosis and troubleshooting capabilities of different systems of an automobile.
4. Construct different types of cam profile for a given data &for opening and closing of valves.
5. Do kinematic synthesis and different applications of gyroscopic effect, gyroscope active and reactive couple for ships and aeroplanes.

SEMESTER-VI

Subject Code	Course Title	Hrs per week			Max. Marks		Total Marks	Credits
		Lecture	Tutorial	Practical	Int.	Ext.		
BMECS1-601	Manufacturing Technology & Processes	4	0	0	40	60	100	4
BMECS1-602	Design of Machine Elements	3	1	0	40	60	100	4
YYYYY	Department Elective-II	3	0	0	40	60	100	3
YYYYY	Department Elective-III	3	0	0	40	60	100	3
XXXXX	Open Elective	3	0	0	40	60	100	3
BMECS1-603	Mechanical Lab- V(MP)*	0	0	2	60	40	100	1
BMECS1-604	Mechanical Lab- VI (MSM)**	0	0	2	60	40	100	1
BMECS1-605	Minor Project	0	0	2	60	40	100	1
Total		**16**	**1**	**6**	**380**	**420**	**800**	**20**

DepartmentElective –II (Chose any one from the following)

1. Internal Combustion Engines - BMECD1-611
2. Gas Dynamics and Jet Propulsion - BMECD1-612
3. Power Plant Engineering - BMECD1-613

DepartmentElective – III (Chose any one from the following)

1. Mechatronic Systems - BMECD1-621
2. Microprocessors in Automation- BMECD1-622
3. Automation in Manufacturing- BMECD1-623

* MP- Manufacturing Processes Lab

** Materials Science & Metallurgy Lab

MANUFACTURING TECHNOLOGY & PROCESSES

Subject Code: **BMECS1-601** **L T P C** **Duration: 60 Hrs**

4 0 0 4

Course Objectives

1. To expose the students to the principles of different manufacturing techniques and learn advanced operations of machining.
2. To understand Procedure or methodologies for conducting the casting and welding processes.
3. To understand working of various machine tools.
4. To understand innovative conceptual idea about latest manufacturing processes and their industrial applications.

UNIT I

Casting Processes, Pattern making, pattern materials, Types of pattern, Removable and disposable pattern, pattern allowances, properties of moulding sand. Moulding: Types of Moulds, Procedure for making moulds, Cores: Properties of cores, types of cores, core making and chaplets.

Elements of gating system, Types of gating, risering, Melting and pouring of metals, Electric arc furnace, Induction furnace. Solidification principles, Advantages and limitations of casting processes, selection of casting process. Defects in sand casting. Special casting Processes; Investment casting. shell mould casting, investment casting, permanent mould casting, full mould casting, vacuum casting, die casting, centrifugal casting, and continuous casting.

15 Hrs

UNIT- II

Welding Processes: manual metal arc welding, MIG welding, TIG welding, plasma arc welding, submerged arc welding. Resistance welding: principle and their types, friction welding, friction stir welding, ultrasonic welding, thermit welding, and electro slag welding.

Mechanical Working of Metals: Hot rolling, hot spinning, wire drawing. Metal Forming Process: Rolling Processes, rolling operation, terminology used in rolling, rolling mills, thread rolling, Extrusion Process: Types of extrusion, extrusion pressure in direct and indirect extrusion.

15 Hrs

UNIT-III

Machine Tools: Lathe: classification, description and operations, Shaping and planing machine: classification, description and operations. Milling machine: classification, description and operations, indexing devices, up milling and down milling. Drilling and Boring machine: classification,

description and operations. Grinding machines: classification, description and operations.

15 Hrs

UNIT- IV

Manufacturing of plastics & ceramics: Basic manufacturing processes for processing of plastics & ceramics. Powder Metallurgy; Introduction to Micro manufacturing process, Additive Manufacturing.

Fundamentals of CAD: Design process with and without computer; CAD/CAM system and its evaluation criteria, brief treatment of input and output devices, Graphics standard GKS, IGES and STEP; Modeling and viewing; Application areas of CAD/CAM **15 Hrs**

Course Outcomes: On completion of this course, students will be

1. Able to apply knowledge of manufacturing processes and the skills to develop and manipulate the operating parameters for a given process.
2. Able to understand processing of plastic and ceramic materials.
3. Ability to understand the latest technologies in casting and welding processes will get increased.
4. Students will be able to come up with innovative conceptual idea about latest manufacturing processes and their industrial applications.

Recommended Books:

1. Manufacturing Engineering and Technology; SeropeKalpakjian and Steven R.Schmid-4th edition, Pearson Edition.
2. Principles of Manufacturing Materials and Processes; Campbell-Tata Mc.Graw Hill.
3. Degarmo,E.P, Kohser, Ronald A. and Black J.T.; Material and Processes in Manufacturing, Prentice Hall of India

DESIGN OF MACHINE ELEMENTS

Subject code: BMECS1-602 **L T P C** **Duration : 60 hours**

3 1 0 4

Course Objectives:This course seeks to provide an introduction to the design of machine elements commonly encountered in mechanical engineering practice, through

1. An understanding of the origins, nature and applicability of empirical design and rational design principles based on safety considerations.
2. An overview of codes, standards and design guidelines for different elements
3. An appreciation of parameter optimization and design iteration
4. An appreciation of the relationships between component level design and overall machine system design and performance

UNIT-I

Basics of machine Design-Definition, Types of design,Asimov's cycle,Design considerations - limits, fits and standardization, Selection of material.

Design of shafts- Design of shafts under static loadings – Pure torsion, Pure bending, Combined bending and torsion,Shaft under combination of torsion, bending and axial loading.

12 Hrs

UNIT-II

Bearings -Analysis and design of sliding contact bearing- theory of sliding contact bearings, design of Journal bearing, Theory of Rolling contact bearings,design of Ball bearings and Roller bearings

Transmission elements - Design of transmission elements: spur, helical, bevel and worm gears; Design of flat belt, V belt and chain drives**.** **18 Hrs**

UNIT-III

Springs- Design of springs: basic terms, design of helical compression and tension springs, Design of leaf springs.

Joints- Design of joints: Riveted joints, threaded joints and welded joints under static loading.

14 Hrs

UNIT-IV

Keys and couplings- Different type of keys- Design of square and rectangular keys. Design of couplings- Muff coupling, split muff coupling, pin type rigid flange coupling and pin type flexible coupling

Clutches and Brakes - Analysis of clutches-plate clutch and cone clutch.Design of brakes – block brake and band brakes.

Design Software– Utility of the software for the purpose of design, Different type of design software, carrying out the design of some machine components by the use of software.

16 Hrs

Course Outcomes:

Upon completion of this course, students will get the knowledge of

1. Concept of machine design and procedure for selection of materials
2. An overview of the design methodologies employed for the design of various machine components.
3. Understand the relationship between component level design and overall machine design
4. Understand the concept of design software and their utility/ application for designing of different machine components

Note: Use of design data hand book by Mahadevan,Balaveera Reddy of CBS publisher is allowed.

Reference Books:

1. Shigley, J.E. and Mischke, C.R., Mechanical Engineering Design, McGraw-Hill International.
2. Deutschman, D., Michels, W.J. and Wilson, C.E., Machine Design Theory and Practice, Macmillan.
3. Juvinal, R.C., Fundamentals of Machine Component Design, John Wiley.
4. Spottes, M.F., Design of Machine elements, Prentice-Hall India.
5. R. L. Norton, Mechanical Design – An Integrated Approach, Prentice Hall
6. P C Sharma , D K Aggarwal , Machine Design , S K Kataria and Sons
7. R S Khurmi, J K GuptaA text book of Machine Design, Eurasia Publishing Company.

INTERNAL COMBUSTION ENGINES

Subject Code: BMECD1-611 **L T P C** **Duration 45 Hrs**

3 0 0 3

Course Objectives:

1. To understand basics of IC engine and Air standard cycles.
2. To understand the fuel supply system and in IC engines.
3. To learn about engine cooling and lubrication system in IC engines.
4. To understand engine testing and control of engine emissions.

UNIT-I

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.

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.

13 Hrs

UNIT-II

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.

Fuels 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.

Combustion in S.I. and CI Engine: 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.

12 Hrs

UNIT-III

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.

Supercharging: Introduction, purpose of supercharging, type of superchargers, analysis of superchargers, performance of superchargers, Arrangement of Supercharger and its installation, Turbo charged engines, supercharging of S.I. & C.I. Engines. Limitations of supercharging.

10 Hrs

UNIT-IV

Measurement and Testing: Measurement of friction horse power, brake horse power, indicated horse power, measurement of speed, air consumption, fuel consumption, heat carried by cooling water, heat carried by the exhaust gases, heat balance sheet, governing of I.C. Engines, performance characteristics of I.C. Engines: Performance parameters, performance of S.I. Engines, performance of C.I. Engine, Engine performance maps.

Engine Emission and Control: Air pollution due to IC engines, Euro I to VI norms, HC, CO and NOx emission, catalytic convertor, HybridElectric Vehicles. **10 Hrs**

Course Outcomes:

Students who have done this course will have a good idea of:

1. The basics of IC engines
2. Fuel supply and combustion in IC Engine
3. Engine cooling and lubrication
4. Testing and control of engine emissions.

Reference Books:

1. V. Ganesan, Internal Combustion Engines, Tata Mcgraw-Hill.
2. Mathur. R.B. and R.P. Sharma, "Internal Combustion Engines"., DhanpatRai
3. H.N. Gupta, “Fundamentals of Internal Combustion Engine” PHI Publications
4. John B. Heywood, “Internal Combustion Engine Fundamentals” McGraw-Hill
5. V. M. Damundwar, A Course in Internal Combustion Engines, DhanpatRai.
6. Richard Stone, Introduction to Internal Combustion Engines Society of Automotive Engineers.

GAS DYNAMICS AND JET PROPULSION

Subject code: BMECD1-612 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

1. To understand the basics of compressible flow.
2. To understand basics of Shock Waves
3. To provide basics of jet propulsion.
4. To provide basics of rocket engine and propellants.

UNIT-I

Compressible flow, definition, Mach waves and Mach cone, stagnation states, Mass, momentum and energy equations of one-dimensional flow, Isentropic flow through variable area ducts, nozzle s and diffusers, subsonic and supersonic flow, variable area ducts, choked flow, Area-Mach number relations for isentropic flow. **15 Hrs**

UNIT-II

Non-isentropic flow in constant area ducts, Rayleigh and Fanno flows, Normal shock relations, oblique shock relations, isentropic and shock tables **10 Hrs**

UNIT-III

Theory of jet propulsion, thrust equation, thrust power and propulsive efficiency, Operating principle and cycle analysis of ramjet, turbojet, turbofan and turboprop engines. **10 Hrs**

UNIT-IV

Types of rocket engines, propellants & feeding systems, ignition and combustion, theory of rocket propulsion, performance study, staging, terminal and characteristic velocity, space flights.

10 Hrs

Course Outcomes:

Upon completion of this course, the students will be able:

1. To apply the concepts of compressible flow.
2. To understand the phenomenon of Shock Waves.
3. To apply gas dynamics principles to jet propulsion.
4. To understand the working of rocket engine and propellants.

Reference Books:

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

POWER PLANT ENGINEERING

Subject code: BMECD1-613 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

1. Basic knowledge of Different types of Power Plants, site selection criteria of each one of them.
2. Understanding of Thermal Power Plant Operation, turbine governing, different types of high-pressure boilers including supercritical and supercharged boilers, Fluidized bed combustion systems.
3. Design of chimney in thermal power plants, knowledge of cooling tower operation, numerical on surface condenser design.
4. Basic knowledge of Different types of Nuclear power plants including Pressurized water reactor, Boiling water reactor, gas cooled reactor, liquid metal fast breeder reactor.

UNIT-I

Generators, Boilers, Turbines and Condensers: Classification of steam generators, Types of Boilers: Babcock Wilcox, Cochran boilers, Types of condensers, effect of air in condensers, Dalton's law of partial pressure, cooling water calculations, steam nozzles, types of steam turbines, efficiencies, compounding, governing and control. Draught system and its types Combined Power Cycles– Comparison and Selection, Load Duration Curves. Fluidized Bed combustion system. Energy conservation and management. **05 Hrs**

UNIT-II

Thermal Power Plant: Layout and working of Modern Thermal Power Plant, Fuel characteristics and storage, Coal benefication, blending and desulphurization, Liquid and Gaseous fuels, Slurry or Emulation type fuels,Coal handling, Storage, Preparation and Feeding, Ash handling and Dust collection, Scrubber technology, selection of site, Description of Rankin cycle, Regenerative cycle, Reheat-Regenerative Cycle, Binary Vapour Cycle, High Pressure and Super Critical Boilers. Different systems of thermal power plant: fuel, air and flue gas systems, pulverizes, Condensate and feed water treatment system, Construction and functioning of condenser, de-aerator and closed feed water heaters, HP - LP By-pass systems, Auxiliary Steam System, Turbine gland steam system. Cooling water system, Cooling Ponds and Cooling Towers—principle of operation and types, Advantages and Disadvantages of Thermal Power Plants. **12 Hrs**

UNIT- III

Hydro-Electric Power Plants: Layout of Hydro Power Plant, selection of site, classification of Hydro power plants, Design, Construction and Operation of Different components of Hydro-Electric Power stations, Hydrology, Hydraulic Turbines, Governing of Turbines-Micro Hydel developments, Calculation of available Hydro Power, Combined operation of Hydro and Thermal Power Plants, Advantages and Disadvantages of Hydro Power Plants.

Nuclear Power Plants: Energy– Fission, Fusion Reaction, Radioactivity, Nuclear reactions, Components of Nuclear Power Plant, selection of site, Layout of Nuclear Power Plant, Types and classification of Reactors, General problems of Reactor operation, Pressurized Water Reactor (PWR), Boiling Water Reactor (BWR),CANDU type reactor, Gas cooled reactors, Liquid Metal-cooled reactors, Organic moderated and cooled reactors, Breeder reactors Waste Disposal and safety, Advantages and Disadvantages of Nuclear Power Plants. Comparison of Nuclear and Thermal power plants. **14 Hrs**

UNIT-IV

Diesel and Gas Turbine Power Plant: Diesel power plant- Layout, Selection of site, Types of Diesel Plants, Components, Diesel Cycle, Engine Types and different systems of diesel power plant. Performance and advantages and disadvantages over thermal plants

Gas Power Plant- Layout, Gas Turbine cycle, Fundamental concept of gas turbine control and monitoring system, Applications of Gas Turbine Power Plant–Fuels- Gas Turbine Material–Open, Closed Cycles and Combined Cycle, Efficiency, Components of gas turbine plants, Gas and steam turbine combined cycles, Waste heat recovery system, Advantages and Disadvantages of diesel and gas turbine power plant.

Non-Conventional Power Generation: Power from Renewables(Solar, wind,Biomass and small Hydro), Geothermal power plant,Tidal power plants, Wind power plants, Solar power plants, Direct Energy conversion system, Magneto Hydrodynamic System(MHD). Combined Operation of Different Power Plants. **14 Hrs**

Course Outcomes:

Students successfully completing this module will be able to:

1. Describe sources of energy and types of power plants.
2. Analyze different types of steam cycles and it's efficiencies in a steam power plant,
3. Describe basic working principles of gas turbine and diesel engine power plants.
4. Define the performance characteristics and components of such power plants.

ReferenceBooks:

1. EI-Wakil M.M., 'Power Plant Technology', McGraw Hill.
2. S.C. Arora, 'A course in Power Plant Engineering',Dhanpat Rai & Sons.
3. P.K. Nag, 'Power Plant Engineering', Tata McGraw Hill**.**
4. G.R. Nagpal,'Power Plant Engineering', Hanna Publishers**.**
5. K.K.Ramalingam, 'Power Plant Engineering', Scitech Publications**.**
6. G.D.Rai,'Introduction to Power Plant Technology', Khanna Publishers
7. R.K. Rajput, 'Power Plant Engineering', Laxmi Publications

MECHATRONIC SYSTEMS

Subject Code: BMECD1-621 **L T P C** **Duration 45 Hrs**

3 0 0 3

Course Objective:

1. Mechatronics system design and simulation, ergonomics and safety
2. Theoretical and practical aspects of computer interfacing, real time data acquisition and control
3. Design of motion control, motion converter and temperature control.
4. To understand the construction, operation and installation of PLCs.

UNIT-I

Introduction: Overview: Mechanical Actuation System – Kinematic Chains, Cam, Gear, Train Ratchet Mechanism, Belt, Bearing.

Hydraulic and Pneumatic Actuation Systems: Overview: Pressure Control Valves, Cylinders, Direction Control Valves, Rotary Actuators, Accumulators, Amplifiers, and Pneumatic Sequencing Problems. **11Hrs**

UNIT-II

Electrical Actuation Systems: Switching Devices, Mechanical Switches – SPST, SPDT, DPDT, Debouncing keypads; Relays, Solid State Switches, Diodes, Thyristors, Transistors, Solenoid, Types Devices: Solenoid Operated Hydraulic and Pneumatic Valves, Electro-Pneumatic Sequencing Problems. Control of DC Motors, Permanent Magnet DC Motors, Control of DC Motors, Bush less Permanent Magnet DC Motors, AC Motors, Stepper Motors, Stepper Motor Controls, Servo Motors.

Interfacing controllers: Interfacing, Buffers, Darlington Pair, I/O Ports, Interface Requirements, Handshaking, Serial and Parallel Port Interfacing, Peripheral Interface, Adapters.

Digital logic: Number Systems, Binary Mathematics, Boolean Algebra, Gates and Integrated Circuits Like 7408, 7402, Karnaugh Maps, Application of Logic Gates as: Parity Generators, Digital Comparators, BCD to Decimal Decoders, Flip Flops. Introduction to Microcontroller – Intel 8051, Selecting a Microcontroller.

Sensors and transducers and application: Performance Terminology, Static and Dynamic Characteristics, Displacement, Position and Proximity Sensors, Potentiometer Sensors, Strain Gauge Element, LVDT, Optical Encoders, Pneumatic Sensors, Hall Effect Sensors, Tach generators, Strain Gauge Load Cell, Thermostats, Photo Darlington. Interfacing Sensors in Mechatronic System as – Temperature Switch Circuit, Float Systems. **12Hrs**

UNIT-III

Introduction to signal conditioning: Signal Conditioning Processes, Inverting Amplifiers, Non Inverting Amplifiers, Summing, Integrating, Differential, Logarithmic Amplifiers, Comparators, Amplifiers Error, Filtering, Wheatstone Bridge, Temperature Compensation, Thermocouple Compensation, Analog to Digital Conversion, Digital To Analog Conversion, Sample and Hold Amplifiers, Multiplexers, Time Division Multiplexing, Data Acquisition, Digital Signal Processing, Pulse Modulation.

System models: Mechanical System Models Applications like – Machine on a floor, Car Wheel Moving along a road etc. Model Development of an Electrical Systems, Fluid System, and Thermal Systems: Rotational – Translation Systems, DC Motors, Speed Control and Hydraulic – Mechanical Systems. **11Hrs**

UNIT-IV

Programmable logic controllers (plc):PLC Structure, Input / Output Processing, Programming, Language (Ladder Diagram), Logic Functions, Latching, Sequencing, Timers, Internal Relays andCounters, Shift Registers, Master and Jump Controls, Jumps, Data Movement, Code Conversion, Ladder Circuits.

Case studies: Auto-Focus Camera, Printer, Domestic Washing Machine, Optical Mark Reader, Bar Code Reader and Pick and Place robot Arm. **11Hrs**

Course Outcome:

Students will be able to understand the mechatronics design

1. Understand the basics and key elements of Mechatronics design process
2. Familiar with basic system modelling
3. Understand the concepts of engineering system and dynamic response of the system
4. Realize the concepts of real time interfacing and data acquisition

Reference Books:

1. W. Bolton, “Mechatronics”, Pearson Education Ltd.
2. Mohammad Ali Mazidi Janice GillispierMazidi, “The 8051 Microcontroller”, Pearson Education Inc.
3. Gary Dunning, “Introduction to Programmable Logic Controllers”, Thomson Asia P. Ltd., Singapore.
4. Gopal K. Dubey, “Fundamentals of Electrical Drives”, Narosa Publishing House.
5. Charles H. Roth, “Jr. Fundamentals of Logic Design”, Jaico Publishing House.
6. "HMT Mechatronics”, Tata McGraw Hill Publishing Co. Ltd..

7. DevdasShetty, Richard A. Kolk "Mechatronics System Design", Thomson Asia Pvt. Ltd., Singapore.
8. A.K. Tayal, "Instrumentation & Mechanical Measurements", Galgotia Publication Pvt.Ltd.
9. NitaigourPremchandMahalik, "Mechatronics Principles, Concepts & Application", Tata McGraw Hill Publishing Co.Ltd..
10. Mikell P. Groover, "Automation, Production Systems and Computer-Integrated Manufacturing", Prentice Hall.

MICROPROCESSORS IN AUTOMATION

Subject code: BMECD1-622 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

1. To introduce the basic concepts of Digital circuits.
2. To understand the concept of interrupt, interrupt controller and interfacing peripherals.
3. To understand the working of ADC/DAC and data communication.
4. To understand concept of Microprocessor system and digital controller.

UNIT-I

Number Systems, codes, digital electronics: Logic Gates, combinational circuits design, Flip-flops, Sequential logic circuits design: Counters, Shift registers.

Introduction to 8085 Functional Block Diagram, Registers, ALU, Bus systems, Timing and control signals.

Machine cycles, instruction cycle and timing states, instruction timing diagrams, Memory interfacing.

13 Hrs

UNIT-II

Assembly Language Programming: Addressing modes, Instruction set, simple programs in 8085; Concept of Interrupt, Need for Interrupts, Interrupt structure, Multiple Interrupt requests and their handling, Programmable interrupt controller; Interfacing peripherals: Programmable peripheral interface (8255). **12 Hrs**

UNIT-III

Interfacing Analog to Digital Converter & Digital to Analog converter, Multiplexed seven segments LED display systems, Stepper Motor Control, Data Communication: Serial Data communication (8251), Programmable Timers (8253); 8086/8088 Microprocessor and its advanced features.

11 Hrs

UNIT-IV

Introduction to Digital Control: Sampling theorem, Signal conversion and Processing, Z-Transform, Digital Filters, Implementation of Digital Algorithm. **09 Hrs**

Course Outcomes:

The students will be able to

1. Define Microprocessor and Microcontroller family and working of 8085 Microcontroller Architecture and Programming model.

2. Understand the programming of 8085 and 8255 microprocessors.
3. Understand the concept of Timer, Interrupt, I/O Port interfacing with 8251/8253 microcontroller and advanced features of 8086/8088.
4. Understand the concept of digital control interfacing with Real time system.

Reference Books:

1. Digital Electronics: An Introduction to Theory and Practice, William H. Gothmann, PHI LearningPrivate Limited
2. Digital Computer Electronics: An Introduction to Microcomputers, Albert Paul Malvino, TataMcGraw-Hill Publishing Company Ltd.
3. Microprocessor Architecture, Programming, and Applications with the 8085, Ramesh Gaonkar,PENRAM International Publishers.
4. Digital Control Systems, Benjamin C. Kuo, Oxford University Press (2/e, Indian Edition.
5. Microcomputer Experimentation with the Intel SDK-85, Lance A. Leventhal, Prentice Hall.

AUTOMATION IN MANUFACTURING

Subject code: BMECD1-623 **L T P C** **Duration: 45 Hrs**

3 0 0 3

Course Objectives:

1. To understand the design and operation of hydraulic and pneumatic components and systems and their application in manufacturing and mechanical systems.
2. To understand the construction, operation and installation of PLCs.
3. To understand the concepts of DCS and SCADA systems.
4. To provide the knowledge on interfacing the PLCs and field devices with communication protocols and advanced process controls.

UNIT-I

Hydraulic and Pneumatic System: Hydraulic and Pneumatic Actuators: Cylinders- Types and construction, Application, Hydraulic and Pneumatic cushioning – Hydraulic and pneumatic motors, Control Components: Direction control, Flow control and Pressure control valves-Types, Construction and Operation- Servo and Proportional valves – Applications – Types of actuation. Accessories: Reservoirs, Pressure Switches- Applications- Fluid Power ANSI Symbols

11 Hrs

UNIT-II

PLC: Introduction; Timer instructions – On delay, Off delay, Cyclic and Retentive timers, Up /Down Counters, control instructions – Data manipulating instructions, math instructions; Applications of PLC – Motor start and stop, Simple materials handling applications, Automatic water level controller, Automatic lubrication of supplier Conveyor belt, Automatic car washing machine, Bottle label detection and process control application. **11 Hrs**

UNIT-III

Scada System and Architecture: Data acquisition systems, Evolution of SCADA, Communication technologies, Monitoring and supervisory functions, SCADA applications in Utility Automation, Industries – SCADA System Components: Schemes- Remote Terminal Unit (RTU), Intelligent Electronic Devices (IED), Communication Network, SCADA Server, SCADA/HMI Systems Various SCADA architectures, advantages and disadvantages of each system.

12 Hrs

UNIT-IV

Industrial Process Control: Study of Advanced Process control blocks: Statistical Process Control, Model Predictive Control, Fuzzy Logic Based Control, Neural-Network Based Control, PID Control.

11 Hrs

Course Outcome:

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

1. Understanding operating principles and constructional features of hydraulic and pneumatic systems.
2. Choose appropriate PLC and explain the architecture, installation procedures and trouble shooting. And can develop PLC programs using various functions of PLCs for a given application.
3. Explain the application development procedures in SCADA and manage data, alarm, storage and can explain the architecture of DCS
4. Describe the advanced controller elements and program methods.

Reference Books:

1. Gary Dunning, Introduction to Programmable Logic Controllers,3rd India edition, Cengage Learning
2. John Webb, Programmable Logic Controllers: Principles and Applications, 5th edition Prentice Hall of India.
3. Krishna Kant Computer Based Process Control, Prentice Hall of India.
4. Michael P. Lukas, Distributed Control Systems: Their Evaluation and Design, Van Nostrand Reinhold Co.
5. Anthony Esposito, Fluid Power with Applications, Prentice Hall.

MECHANICAL ENGINEERING LABORATORY-V
(Manufacturing Processes Lab)

Subject code: BMECS1-603 **L T P C**

0 0 2 1

Course Objectives:

1. To understand lathe and its working
2. To understand different advanced manufacturing technique
3. To acquire knowledge of various casting processes
4. To understand different welding techniques.

Contents:

To prepare different types of jobs which include

1. Advanced exercises on Lathe where the students will work within specified tolerances, cutting of V- threads and square threads (internal as well as external).
2. Production of machined surfaces on shaper and planner.
3. Generation of plane surfaces, production of spur gears/helical involute gears, use of end mill cutters on milling machine.
4. Drilling, boring, tapping operations on drilling machine.
5. Exercises of different types of advanced casting processes like investment casting, centrifugal casting etc.
6. Exercises on MIG/TIG welding by making weld joints with these processes.
7. Exercises of various Resistance Welding Techniques(Spot , seam and butt)
8. Exercises of different plastic processing techniques like extrusion, blow moulding.

Course Outcomes:

Students who have undergone the course will be able to

1. Understand the different manufacturing and fabrication processes which are commonly employed in the industry, to fabricate components using different materials.
2. Fabricate components with their own hands.
3. Acquire the practical knowledge of the dimensional accuracies and dimensional tolerances possible with different manufacturing processes.

MECHANICAL ENGINEERING LABORATORY-VI
(Materials Science & Metallurgy Lab)

Subject code: BMECS1-604 **L T P C**

0 0 2 1

Course Objectives:

- To analyse the microstructure of different ferrous and non-ferrous samples.
- To explore the effect of heat treatment on various engineering materials by analysing its microstructure and hardness.

EXPERIMENTS

1. Preparation and study of crystal models for simple cubic, body centered cubic, face centered cubic and hexagonal close packed structured.
2. Annealing the steel specimen and study the effect of annealing time and temperature on hardness of steel.
3. Hardening the steel specimen and study the effect of quenching medium on hardness of steel.
4. Determination of chemical composition of commercial alloys by optical emission spectroscopy**.**
5. Study of metallurgical microscope.
6. Practice of specimen preparation (cutting, mounting, polishing and etching) of mild steel, aluminum and hardened steel specimens.
7. Microscopic examination of pure metals like Iron, Cu and Al.
8. Identification of ferrite and pearlite constituents in given specimen of mild steel.
9. Harden ability of Steels by Jominy end quench test.
10. To find out the hardness of various heat treated and untreated plain carbon steels.

Course Outcomes:

Students who have undergone the course will be able to

- Analysethe microstructure of different ferrous and non-ferrous samples.
- Explorethe effect of heat treatment on various engineering materials by analysing its microstructure and hardness.

MINOR PROJECT

Subject code: BMECS1-605 **L T P C**

0 0 2 1

Course Objectives:

No study is to be undertaken in the project . The project should be such that the theoretical knowledge acquired by the students so far during the course of degree is implemented in the practical form. The steps to be covered in the minor project

1. The survey for the project which includes the novelty of the project and the study of its practical applications.
2. Make a written statement and assess the viability of the project
3. Schematic diagram and working mechanism of the project
4. Design of all the components of the project
5. Report writing

Note : The minor project may be carried out by a group of 3 to 5 students