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