IPS Academy, Institute of Engineering & Science

(A UGC Autonomous Institute, Affiliated to RGPV, Bhopal)

Mechanical Engineering Department

B. Tech, VII Sem

Scheme

S. No.	Subject Code	Category	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours per week			Total Credits
				Theory			Practical						
				End Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem	Term work / Lab Work & Sessional		L	T	P	
1.	HSMC - ME701	HSMC	Operation Research	70	20	10	-	-	100	3	0	0	3
2.	PCC - ME701	PCC	Machine Design-II	70	20	10	60	40	200	2	1	2	4
3.	PCC - ME702	PCC	Refrigeration & Air Conditioning	70	20	10	60	40	100	2	1	2	4
4.	PEC - ME701	PEC	Professional Elective-II	70	20	10	-	-	100	4	0	0	4
5.	OEC - ME701	OEC	Open Elective-III	70	20	10	-	-	100	3	0	0	3
6.	PROJ - ME701	PROJ	Internship –II	-	-	-	60	40	100	0	0	2	1
7.	PROJ - ME702	PROJ	Project-I	-	-	-	60	40	100	0	0	12	6
Total Academic Engagements and Credits										**14**	**2**	**18**	**25**
Total				**350**	**100**	**50**	**240**	**160**	**800**	**34**			**25**

S. No.	Professional Elective-II	Open Elective-III
1	PEC-ME701 (A) Fluid Machinery	OEC - ME701 (A) IOT
2	PEC-ME701 (B) Finite Element Method	OEC - ME701 (B) Energy Audit & Conversation
3	PEC-ME701 (C) Mechatronics	OEC - ME701 (C) Design and Analysis of Experiments
4	PEC-ME701 (D) Industrial Engineering & Ergonomics	OEC - ME701 (D) Disaster Mgt, Laws, Policies and Regulations

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Syllabus

HSMC-ME701	Operation Research	3L: 0 T: 0P (03 hrs.)	Credits: 03

Pre requisite(s): M-II, M-III

Course Objectives:

Course Objective:

- To be familiar with all the OR Techniques and optimization methods.
- To be familiar with various inventory control techniques.
- To be familiar with waiting line models and Competitive strategy.
- To clear idea of the decision making and meta-heuristic algorithm.
- To understand project network analysis.

Course Content:

Module 1 **(12 Hrs)**

Linear System and Distribution Models: Mathematical formulation of linear systems by LP, solution of LP for two variables, Simplex method, special cases of LP- transportation and assignment model and their graphical solution, Vogels Approximation Method (VAM) or penalty method, cell evaluation degeneracy.

Module 2 **(10 Hrs)**

Inventory Models: Necessity of inventory in process and safety stock, problem of excess inventory and cycle time, JIT/ Lean Mfg; basics of inventory models with deterministic demand, Classical EOQ Model, ABC, VED and other analysis based on shelf life, movement, size, MRP technique and calculations, lot sizing in MRP, linking MRP with JIT; evolution of MRP to ERP to SCM and e-business.

Module 3 **(10 Hrs)**

Waiting Line Models: Introduction, Input process, service mechanism, Queue discipline, single server (M/M/1), average length and average time calculations, optimum service rate; basic multiple server models (M/M/s).

Competitive Strategy: concept and terminology, assumptions, pure and mixed strategies, two person zero sum games, saddle point, dominance, graphical, algebraic and LP methods for solving game theory problems.

Module 4 **(10 Hrs)**

Decision Analysis: Decision under certainty, risk Probability and uncertainty, Hurwicz criterion AHP assigning weight and consistency test of AHP.

Metaheuristics: definition of heuristic and metaheuristic algorithms.

Module 5 **(10 Hrs)**

Network Analysis: Project Planning, Scheduling and Controlling; Project management; Network Techniques and its role in project management, Network logics, Fulkerson's Law,

Merits and Demerits of AON Diagrams; Programme Evaluation and Review Technique (PERT), Critical Path Method (CPM), Determination of critical path, Float/Slack.

Course Outcome:

After completion of the course student will be able:

1. Formulate and solve problems related to optimization.
2. Solve various inventory control problems used in industries.
3. Apply the concept of Queuing and Game Theory.
4. Solve the management problems by using concepts of decision making and meta-heuristic algorithm.
5. Develop Network Analysis model to solve real industrial project management problems.

Text Books :

1. Hillier FS and Liberman GJ; 2008, Introduction to Operations Research concept and cases, 8th Ed; TMH ,.
2. Heera and Gupta,Operation Research, S Chand Pub.reprint with corrections ,2017.
3. Sharma JK; Operations Research; Macmillan 3rd Ed. 2006.
4. Heera and Gupta ,Problems in Operations Research Principles and Solutions, S Chand Pub, 4th Ed. 2015.

Reference Books:

1. Taha H; Operations research; PHI, 10th Ed.2019.
2. Jain, pandey & shrivastava; Quantitative techniques for management, New Age publishers.2019
3. Srinivasan G; Quantitative Models In Operations and SCM; PHI Learning, 2017
4. Sen RP; Operations Research-Algorithms and Applications; PHI Learning, 2009
5. Bronson R ;Theory and problems of OR; Schaum Series; TMH, 2016.

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PCC – ME701	Machine Design-II	2L: 1T: 2P (05 hrs.)	Credits: 04

Pre-requisite(s):
Basic concepts of Engineering Mechanics & Machine Design-I

Course Objective:

- To teach students how to design the Belt, Rope and Chain Drives and select commonly used machine components.
- To illustrate to students the variety of mechanical gears available and emphasize the need to continue learning.
- To understand procedure of I.C. Engine design and develop an ability to apply it for simple component design by using design data hand book.
- To understand procedure of Coupling & Pressure Vessel design and develop an ability to apply it for simple component design by using design data hand book.
- To understand the current optimization technique and apply for the machine component for strength and material saving.

Course Content:

Module 1 **(10Hrs)**

Design of Belts, Rope and chain Drive: Types of belts and their selection criteria, types of ropes and chains and design criteria for their selections for various applications, matched sets of belts, calculations of different tensions, lengths, sections, materials, etc.

Module 2 **(12 Hrs)**

Gears: Material selection for different types of gears, reviews of kinematic considerations, design of spur, bevel, worm, helical gears, different case studies of failure

Module 3 **(12 Hrs)**

Design of I.C. Engine Components: General design considerations in I C engines; design of cylinder; design of piston and piston-rings; design of connecting rod; design of crankshaft.

Module 4 **(10 Hrs)**

Design of Miscellaneous Components: design of Flanged coupling; Rigid coupling, Design of Pressure vessels subjects to internal pressure, external pressure, design of penetration, design of flanges, cone cylinder junctions ,Materials, Fabrication.

Module 5 **(08 Hrs)**

Design Features of Piping System: Pipe fittings, elbows and flange design, wall thickness determination, branched connections. Piping network analysis. Selection of Pipe Materials and Economical Considerations in Piping Design.

Course Outcome:

After completion of the course student will be able:

1. Analyse behavior subjected to loads and identify the failure criteria.
2. Applying the basic concept of gears.

3. Designs of I.C. Engine parts subjected to loads and identify the failure criteria.
4. Design of Coupling and Pressure Vessels.
5. Design of piping system subjected to the pressure, material selection and wall thickness.

Text Book:

1. Bhandari V.B., Introduction to Machine Design, Tata McGraw Publication, 2001
2. Sharma and Agrawal, Machine Design, S.K. Kataria and Sons, 2012

Reference Books:

1. Shigley and Mischke, Mechanical Engineering Design, Tata McGraw Publication, 2001
2. Robert C. Juvinall and Kurt M. Marshek, Fundamentals of Machine Component Design, John Wiley, 2006
3. Black V, Machine Design, Tata McGraw Publication, 1988

List of Experiment:

1. Design of Belt Drives (Flat Belt and V Belt)
2. Design of Chain Drive.
3. Design of Spur Gear.
4. Design of Helical Gear.
5. Design of Bevel Gear.
6. Design of Cylinder.
7. Design of Piston and Piston Rings.
8. Design of connecting Rod.
9. Design of Crankshaft.
10. Design of Couplings.
11. Design of Pressure Vessels.

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PCC - ME702	Refrigeration & Air Conditioning	2L: 1T: 2P (05 Hrs.)	Credits: 04

Pre-requisite(s):
Basic concepts of Engineering Thermodynamics

Course Objective:
- Learn the basic concepts and principles of refrigeration and air conditioning.
- Learn the fundamental analysis methodology of VCR refrigeration system.
- Learn the fundamental analysis methodology of VAR refrigeration system & Refrigerant.
- Learn the basic process and systems of air conditioning.

Course Content:

Module 1 **(08 Hrs)**

Introduction: Principles and methods of refrigeration, freezing; mixture cooling by gas reversible expansion, throttling, evaporation, Joule Thomson effect and reverse Carnot cycle; unit of refrigeration, coefficient of performance, vortex tube & thermoelectric refrigeration, adiabatic demagnetization; air refrigeration cycles- Joule's cycle Boot-strap cycle, reduced ambient cycle and regenerative cooling cycles.

Module 2 **(10 Hrs)**

Vapour Compression System: Vapor compression cycle, p-h and t-s diagrams, deviations from theoretical cycle, sub-cooling and super heating, effects of condenser and evaporator pressure on cop; Basic principles of VRF systems; low temperature refrigeration: production of low temperatures, cascade system, dry ice, production of dry ice, air liquefaction system.

Module 3 **(06 Hrs)**

Vapour Absorption System: Theoretical and practical systems such as aqua ammonia, Electrolux & other system.

Steam Jet Refrigeration: Principles and working, simple cycle of operation, description and working of simple system.

Refrigerants: nomenclature & classification, desirable properties, common refrigeration, comparative study, leak detection methods, environment friendly refrigerants and refrigerant mixtures, brine and its properties

Module 4 **(10 Hrs)**

Psychometric: Calculation of Psychrometric properties of air by table and charts; Psychrometric processes: sensible heating and cooling, evaporative cooling, cooling and dehumidification, heating and humidification, mixing of air stream, sensible heat factor; principle of air conditioning, requirements of comfort air conditioning, ventilation standards, infiltrated air load, fresh air load human comfort, effective temperature & chart, heat production & regulation of human body.

Module 5 **(12 Hrs)**

Air conditioning : Calculation of summer & winter air conditioning load, bypass factor of coil, calculation of supply air rate & its condition, room sensible heat factor, grand sensible heat

factor, effective sensible heat factor, dehumidified air quantity. Problems on cooling load calculation. Air distribution and ventilation systems

Course Outcome:

After completion of the course student will be able:

1. Apply the basic knowledge of Common refrigeration processes.
2. Evaluate the Vapour Compression refrigeration cycle performance.
3. Describe the Refrigerant and Understand the basic Vapour absorption cycles.
4. Identify the Psychrometric Process used in current scenario.
5. Applying the psychrometric process to design, load calculation to Air conditioner and HVAC system.

List of Text Books:

1. Arora CP; Refrigeration and Air Conditioning; TMH
2. Sapali SN; Refrigeration and Air Conditioning; PHI

List of Reference Books:

1. Ananthanarayan; Basic Refrigeration and Air conditioning; TMH
2. Manohar Prasad; Refrigeration and Air Conditioning; New Age Pub
3. Ameen; Refrigeration and Air Conditioning; PHI
4. Pita ; Air conditioning Principles and systems: an energy approach; PHI
5. Stoecker W.F, Jones J; Refrigeration and Air conditioning; McGH, Singapore
6. Jordan RC and Priester GB Refrigeration and Air Conditioning, PHI USA

List of Experiments:

1. General Study of vapor compression refrigeration system.
2. Determine the COP of Air conditioning cycle.
3. General Study and working of cold storage
4. Determine the COP of heat pipe with comparison of two other pipe
5. Determine the COP of Vapour compression refrigeration cycle.
6. Determine the COP of Vapour absorption refrigeration cycle.
7. Determine the COP of window air conditioning cycle.
8. Determine the COP of Mechanical Heat Pump Test Rig
9. Determine the COP of Ice Plant Test Rig
10. Determine the COP of Cascade refrigeration cycle

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PEC-ME701 (A)	Fluid Machinery	4L: 0 T: 0P (04 hrs.)	Credits: 04

Pre-requisite(s): Fluid Mechanics

Course Objective(s):
The course should enable the students to:
- Strengthen the knowledge of theoretical and technological aspects of hydrodynamic forces on jets.
- Correlate the principles with applications in hydraulic turbines.
- Apply the practical applications on Francis and Kaplan turbine.
- Analysis the similarities between prototype and model types of hydraulic similitude.

Course Content:

Module 1 **(10 hrs)**

Introduction: Impulse of Jet and Impulse Turbines: Classification of Fluid Machines & Devices, Application of momentum and moment of momentum equation to flow through hydraulic machinery, Euler's fundamental equation.

Module 2 **(08 hrs)**

Hydrodynamic Force of Jets: on stationary and moving flat inclined and curved vanes, jet striking centrally and at tip. Velocity triangles at inlet and outlet, work done, efficiency, angular momentum principle, layout of hydropower plant, heads and efficiencies.

Module 3 **(08 hrs)**

Turbines: Classification of turbines, Impulse turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Governing of Pelton wheel. Francis and Kaplan turbines, Constructional details, Velocity triangles, Power and efficiency calculations, Degree of reaction, Draft tube, Cavitation in turbines, Principles of similarity, Unit and specific speed, Performance characteristics, Selection of water turbines.

Module 4 **(08 hrs)**

Pumps: Classifications of centrifugal pumps, Vector diagram, Work done by impellor, Efficiencies of centrifugal pumps, Specific speed, Cavitation & separation, Performance characteristics.

Reciprocating Pumps: Working, Discharge, slip, indicator diagrams.

Module 5 **(08 hrs)**

Hydraulic Power Transmission Machines: Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, hydraulic crane, hydraulic lift, hydraulic Ram, hydraulic coupling, hydraulic torque converter, air lift pump, jet pump.

Course Outcome(s):
After completion of the course student will be able:
1. Apply different fluid mechanics equations on hydraulic machines.

2. Calculate the impact of force on the jet.
3. Evaluate the performance characteristics of turbines.
4. Evaluate the performance characteristics of pumps.
5. Conceptualize the working principle of hydraulic power transmission machines

List of Text Books

1. Hydraulic Machines by Jagdish Lal, Metropolitan book co. pvt ltd.
2. Hydraulic Machines by K Subramanya, Tata McGraw Hill
3. Fluid Mechanics and Machinery by C.S.P.Ojha, R. Berndtsson, P.N. Chandramouli, Oxford University Press
4. Fluid Mechanics and Fluid Power Engineering by D S Kumar, S K Kataria& Sons
5. Fluid Mechanics and Turbo machines by Das, PHI
6. Fluid Power with Applications, by Esposito, Pearson
7. Fluid Mechanics and hydraulic machines by Modi & Seth, Standard Book House

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PEC-ME701 (B)	Finite Element Method	4L: 0 T: 0P (04 hrs.)	Credits: 04

Prerequisite: Strength of Materials (PCC ME 303), Mechanical Vibrations (PCC ME 602)

Course Objective's:

- To learn basic principles of finite element analysis procedure.
- To learn the theory and characteristics of finite elements that represent engineering structures.
- To learn and apply finite element solutions to structural, thermal, dynamic problem to develop the knowledge and skills needed to effectively evaluate finite element analyses.

Course Content:

Module 1 **(08 Hrs)**

Introduction Finite Element Analysis: Continuous and discrete systems (discussion on differential equations, matrix algebra) – Energy methods: Variational principles and weighted residual techniques (least square method, collocation, sub-domain collocation, Galerkin method) for one-dimensional equation, Rayleigh-Ritz Formulation, development of bar and beam element, application to truss and frames. Basic steps in finite element problem formulation, General applicability of the method.

Module 2 **(08 Hrs)**

Finite elements for two-dimensions: Equivalence between energy formulation and Galerkin approach, discretization concepts, choice of elements, derivation of element shape functions, Generalized co-ordinates and nodal shape functions, 2D rectangular and triangular elements, Axisymmetirc elements.

Module 3 **(08 Hrs)**

Assembly of Elements and Matrices Concept of element assembly: Global and local co-ordinate systems, Boundary conditions, Solution of simultaneous equations, Gaussian elimination and Choleksy decomposition methods, Numerical integration, One and 2D applications.

Module 4 **(06 Hrs)**

Higher Order and Isoparametric Elements: One dimensional quadratic and cubic elements, Use of natural co-ordinate system, Area co-ordinate system continuity and convergence requirements, h-refinement, and p-refinement.

Module 5 **(08 Hrs)**

Static & Dynamic Analysis: Analysis of machine subassemblies, Advantages and limitations Hamilton's principle, Derivation of equilibrium, Consistent and lumped mass matrices, Derivation of mass matrices for ID elements, Determination of natural frequencies and mode shapes, Use of commercial software packages.

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Course Outcome:

After completion of the course student will be able:

1. Broadly understand applicability of Finite Element Method to engineering problems (Linear 1-D).
2. Analyze 2D structural problems using CST element and analyse the axi-symmetric problems with triangular elements.
3. Analyze an engineering problem for discretization and convergence.
4. Evaluate the Eigen values and Eigenvectors for stepped bar and beam, explain nonlinear geometric and material nonlinearity.
5. Examine the different types of analysis.

Textbooks:

1. Introduction to Finite Elements in Engineering, Chandrupatala & Belegundu, Pearson Education India, 4th Edition (2011)
2. Introduction to Finite Element Analysis, JN Reddy, Mc Graw Hill, 4th Edition (2012)

References:

1. Finite element procedures, K J Bathe, Prentice Hall, Indian edition, 2006.

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PEC-ME701 (C)	Mechatronics	4L: 0 T: 0P (04 hrs.)	Credits: 04

Pre-requisite's: Fundamentals of Mechanical Engineering and Electronics Engineering.

Course Objective's:

The course trains students to practice Mechatronics Engineering in various areas of industrial and non-industrial automation.

Course Content:

Module 1 **(08 Hrs)**

Introduction: Definition of Mechatronics, Multi-disciplinary scenario, origins. Evaluation of Mechatronics, An over view of Mechatronics, Design of Mechatronics system. Measurements system and function of main elements of measurement systems. Need for Mechatronics in industries. Objectives, advantages and disadvantages of Mechatronics.

Module 2 **(08 Hrs)**

Review of Transducers and Sensors: Definition and classification of transducers and sensors, Principle of working and applications of light sensors, proximity sensors and Hall Effect sensors, Review of fundamentals of electronics. Data conversion devices.

Module 3 **(09 Hrs)**

Microprocessor: General definitions of microprocessors, Microprocessor based digital control. Digital number system, binary and hexadecimal number system, basic elements of control systems. Microcontrollers, applications, classification of micro controllers. difference between microprocessor and micro controllers. Programmable Logic Controllers.

Module 4 **(10 Hrs)**

Mechanical Actuation System: Cams, Gear trains, Belt and chain drives, Bearings. Hydraulic and Pneumatic Actuation System: Introduction to Hydraulic and Pneumatic Systems, Valves, Classifications, Pressure Control Valves – Pressure relief valves, Pressure regulating/reducing valves Directional Control valves, Flow control valves. Electrical Actuation System: Electrical systems, Solid State Switches, Solenoids, D.C. motors, A.C. motors, Stepper motors, servomotors.

Module 5 **(07 Hrs)**

Signal Conditioning: Concept, necessity, op-amps, protection, filtering, wheat stone bridge – Digital Signals – Multiplexer. Data acquisition – Introduction to digital signal processing – Concepts and different methods.

Course Outcome:

After completion of the course student will be able:

1. Simplify the design of Mechatronics system and its applications.
2. Identify appropriate sensors and transducers for an engineering application.
3. Acquire knowledge about microprocessor architecture and classify the micro-controller.

4. Analyze different types of actuator and actuator system.
5. Explain the concept of digital signals and elements of data acquisition.

Text Books:

1. R. K Rajput, Mechatronics, Laxmi Publications
2. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi, 1988.

Reference Books:

1. Mechatronics – Principles, Concepts and applications – Nitaigour and Premchand, Mahilik – Tata McGraw Hill -2003
2. Mechatronics – W. Bolton, Pearson Education Asia -3rd Edition
3. Introduction to mechatronics and measurement systems –David G. Alciatore & Michel BiHistand – Tata McGraw Hill –2000
4. Mechatronics – H.D. Ramachandra – Sudha Publication -2003 Mechatronics by HMT Ltd. – Tata McGrawHill -2000.
5. Mechatronics System design by Devadas Shetty and Richard A. Kark – Thomas Learining - 1997.
6. Mechatronics an Introduction by Robert H Bishop – CRC
7 Mechatronics systems Fundamentals by Rolf Isermann - Springer

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PEC-ME701 (D)	Industrial Engineering & Ergonomics	4L: 0 T: 0P (04 hrs.)	Credits: 04

Pre requisite(s): Manufacturing Process & Manufacturing Technology

Course Objectives:

- To introduces the role of Work Study in the industry.
- The course also introduces the concept of conducting time studies and production studies to assess time standards and production standards.
- To introduces the various types of jobs evaluation system used in industry.
- To know about various types of wage incentive schemes.

Course Content

Module 1 **(10 Hrs)**

Method Study: Purpose of work study, its objectives, procedure and applications; method study definition and basic procedure, selection of job, various recording techniques like outline process charts, flow process charts, man machine charts, two handed process charts, string diagram, flow diagram, multiple activity chart, simo, cyclographs and chrono-cyclographs; critical examination, development, installation and maintenance of improved method; principles of motion economy and their application in work design; micro motion study, memo motion study and their use in methods study.

Module 2 **(10 Hrs)**

Work Measurement Technique: Introduction & definition, objectives and basic procedure of work measurement; application of work measurement in industries; time study: basic procedure, equipments needed, methods of measuring time, selection of jobs, breaking a job into elements; numbers of cycles to be timed; rating and methods of rating, allowances, calculation of standard time. Work sampling**:** Basic procedure, design of work sampling study conducting work sampling study and establishment of standard-time. Methods Time Measurement (MTM).

Module 3 **(08 Hrs)**

Job Evaluation and Merit Rating: Purpose, Various types of jobs evaluation system and their application of classification. Wage Cure, Designing salary structure and Grade, Merit Rating, Performance Appraisal.

Standard Data System; elemental and non-elemental predetermined motion systems, work factors system;

Module 4 **(08 Hrs)**

Wage Incentives: Various types of wage Incentive schemes and their impact on productivity, Comparison of different incentive plans, design of incentive plans, Group system of Wage payment, Supervisory incentive plans. Starlight line, Tailor, Merrick and Gantt incentive plans.

Module 5 **(10 Hrs)**

Human Factor Engineering: Definition and history of development of human factors engineering, types & characteristics of man-machine-system, relative capabilities of human being and machines; development and use of human factor data; information input and processing: Introduction to information theory; factors effecting information reception and processing; coding and selecting of sensory inputs. Case Study

Course Outcome's:

After completion of the course student will be able to:

1. Apply the various work study techniques for productivity improvement
2. Examine the work measurement technique
3. Apply the various Job Evaluation techniques in industries.
4. Realization of the significance of wage Incentive schemes and their impact on productivity
5. Explain human factor engineering and its application.

Text Books:

1. ILO; work-study; International Labour Organization ,1992
2. Khan MI; Industrial Ergonomics; PHI Learning 1St 2010.
3. John R. Wilson, Evaluation of Human Work, 3rd Edition, NIGEL CORLETT – 2005.
4. M.I. Khan, Industrial Engineering, New Age International (P) Limited, 2007.
5. Kumar Pravin, Industrial Engineering and Management, Pearson India, 2015.

Reference Books:

1. Sandera M and Mc Cormick E; Human Factors in Engg and design; MGHill,1993
2. Currie RM; Work study; BIM publications, 1964.
3. Mynard; Hand book of Industrial Engg, McGraw-Hill Education, 05-Jun-2001.

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PROJ-ME702	Major Project-I	0L:0T: 12P (12 hrs)	Credits: 06

Course Objectives:

- To provide students with a comprehensive experience for applying the knowledge gained so far by studying various courses.
- To develop an inquiring aptitude and build confidence among students by working on solutions of small industrial problems.
- To give students an opportunity to do something creative and to assimilate real life work situation in institution.
- To adapt students for latest development and to handle independently new situations.
- To develop good expressions power and presentation abilities in students**.** The focus of the Major Project I is on preparing a working system or some design or understanding of a complex system using system analysis tools and submit it the same in the form of a write up i.e. detail project report.

The student should select some real life problems for their project and maintain proper documentation of different stages of project such as need analysis market analysis, concept evaluation, requirement specification, objectives, work plan, analysis, design, implementation and test plan. Each student is required to prepare a project report and present the same at the final examination with a demonstration of the working system (if any).

Working Schedule:

The faculty and students should work according to following schedule:

Each student undertakes substantial and individual project in an approved area of the subject and supervised by a faculty of the department. In special case, if project is huge, then maximum 03 students may be permitted to work together as a team to do the same. The student must submit outline and action plan for the project execution (time schedule) and the same be approved by the concerned faculty and Head of department.

Project guide should motivate students to develop some Innovative working models in the area of Advanced Automotives, Aero-modelling, Renewable Energy based systems, Mechatronics, Robotic systems, Advanced Manufacturing Technology based systems etc. which can contribute to the society.

Course Outcome's:

1. Identify a topic in areas of Mechanical Engineering.
2. Review literature to identify gaps and define objectives & scope of the work.
3. Generate and implement innovative ideas for social benefit.
4. Develop a prototypes/models, experimental set-up and software systems necessary to meet the objectives.
5. Prepare a report as per recommended format and defend the work.