Govt. College of Engineering Amravati

(An Autonomous Institute of Govt. of Maharashtra)

Curriculum
for

VII and VIII Semesters.

of

B. Tech. (Mechanical Engineering)

Department of Mechanical Engineering

WEF 2014-2015 (NEW)

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

MECHANICAL ENGINEERING DEPARTMENT

SCHEME FOR B. Tech. (Mechanical Engineering) from academic year 2011-2012

Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme							
						Theory				Practical			
		L	T	P	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	Credits
Semester – III													
SHU301	Engineering Mathematics-III	3	-	-	3	10	15	15	60	-	-	100	3
CEU303	Strength of Materials	3	1	-	4	10	15	15	60	-	-	100	4
EEU311	Electrical Drives and Control	4	-	-	4	10	15	15	60	-	-	100	4
MEU301	Material Science and Engineering	3	-	-	3	10	15	15	60	-	-	100	3
MEU302	Engineering Thermodynamics	4	-	-	4	10	15	15	60	-	-	100	4
CEU307	Strength of Materials Lab.	-	-	2	2	-	-	-	-	25	25	50	1
EEU312	Electrical Drives & Control Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU303	Material Science and Engineering Lab	-	-	2	2	-	-	-	-	25	25	50	1
SHU305	General Proficiency-II	1	-	2	3	-	-	-	-	25	25	50	2
		18	1	8	27	50	75	75	300	100	100	700	23
Semester – IV													
MEU401	Fluid Mechanics	4	-	-	4	10	15	15	60	-	-	100	4
MEU402	Kinematics of Machines	3	1	-	4	10	15	15	60	-	-	100	4
MEU403	Thermal Engineering & Energy	4	-	-	4	10	15	15	60	-	-	100	4
MEU404	Manufacturing Processes	4	-	-	4	10	15	15	60	-	-	100	4
MEU405	Machine Drawing	2	-	-	2	4	8	8	30	-	-	50	2
MEU406	Fluid Mechanics Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU407	Kinematics of Machines Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU408	Manufacturing Processes Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU409	Computer Aided Drafting Lab.	-	-	4	4	-	-	-	-	50	50	100	2
		17	1	10	28	44	68	68	270	125	125	700	23

GOVERNMENT COLLEGE OF ENGINEERING, AMRAVATI

MECHANICAL ENGINEERING DEPARTMENT

SCHEME FOR V and VI Sem. B. Tech. (Mechanical Engineering) from academic year 2012-2013

Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme							Credits
						Theory				Practical			
		L	T	P	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
Semester – V													
MEU501	Machine Design – I	3	-	-	3	10	15	15	60	-	-	100	3
MEU502	Dynamics of Machines	3	-	-	3	10	15	15	60	-	-	100	3
MEU503	Machining Processes	3	-	-	3	10	15	15	60	-	-	100	3
MEU504	Metrology and Measurement system	4	-	-	4	10	15	15	60	-	-	100	4
MEU505	Hydraulic Machines	3	-	-	3	10	15	15	60	-	-	100	3
MEU506	Machine Design-I Lab.	-	-	2	2	-	-	-	-	25	-	25	1
MEU507	Dynamics of Machines Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU508	Machining Processes Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU509	Metrology Measurement Systems	-	-	2	2	-	-	-	-	25	25	50	1
MEU510	Hydraulic Machine Lab	-	-	2	2	-	-	-	-	25	25	50	1
MEU511	Self study -I	-	-	-	-	25	-	-	-	-	-	25	2
		16	**0**	**10**	**26**	**75**	**75**	**75**	**300**	**125**	**100**	**750**	**23**
Semester – VI													
MEU601	Operation Research Management	3	-	-	3	10	15	15	60	-	-	100	3
MEU602	Machine Design-II	3	-	-	3	10	15	15	60	-	-	100	3
MEU603	Heat Transfer	3	-	-	3	10	15	15	60	-	-	100	3
MEU604	Control Systems Engineering	3	-	-	3	10	15	15	60	-	-	100	3
MEU605	Industrial Management and Quality	3	-	-	3	10	15	15	60	-	-	100	3
MEU606	Computational Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU607	Machine Design – II Lab.	-	-	2	2	-	-	-	-	25	-	25	1
MEU608	Heat Transfer Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU609	Control Systems Engineering Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU610	Minor Project	-	-	2	2	-	-	-	-	25	25	50	2
MEU611	Self Study-II	-	-	-	-	25	-	-	-	-	-	25	2
MEU612	Industrial Lecture - I	1	-	-	1	-	-	-	-	-	-	-	-
		16	**0**	**10**	**26**	**75**	**75**	**75**	**300**	**125**	**100**	**750**	**23**

The ESE (Theory) duration for all courses shall be 2hrs 30 min except courses MEU101, MEU501 and MEU602 for which the ESE duration will be 3hrs.

ICA - Internal Continuous Assessment; ESE - End Semester Examination

Assessment of course MEU612 Industrial Lecture -I is scheduled in VII semester with course MEU711 Industrial Lecture - II

The course MEU511 Self Study-I is based on the basis of 20% curriculum of the courses MEU502, MEU503, MEU504 and MEU505 declared by the respective course coordinator at the beginning of the semester

The course MEU611 Self Study-II is based on the basis of 20% curriculum of the courses MEU601, MEU603, MEU604 and MEU605 declared by the respective course coordinator at the beginning of semester

One Faculty member shall be appointed as Course Coordinator for the course Self Study and his/ her teaching workload shall be considered as 01 hr per week

Government College of Engineering, Amravati

Mechanical Engineering Department

SCHEME FOR VII and VIII Sem. B. Tech. (Mechanical Engineering) from academic year 2014-2015

Course Code	Name of the Course	Teaching Scheme (Hrs./week)				Evaluation scheme							Credits
						Theory				Practical			
		L	T	P	Total	TA	CT1	CT2	ESE	ICA	ESE	Total	
Semester – VII													
MEU701	Refrigeration and Air Conditioning	3	-	-	3	10	15	15	60	-	-	100	3
MEU702	Computer Aided Design	3	-	-	3	10	15	15	60	-	-	100	3
MEU703	Elective-I	3	-	-	3	10	15	15	60	-	-	100	3
MEU704	Institute Level Elective	3	-	-	3	10	15	15	60	-	-	100	3
MEU705	Refrigeration and Air Conditioning Lab	-	-	2	2	-	-	-	-	25	25	50	1
MEU706	Computer Aided Design Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU707	Elective-I Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU708	Project Stage-I	-	-	4	4	-	-	-	-	50	-	50	2
MEU709	Seminar	-	-	2	2	-	-	-	-	50	-	50	1
MEU710	Industrial Training / Visit	-	-	-	-	-	-	-	-	50	-	50	2
MEU711	Industrial Lecture - II	1	-	-	1	-	-	-	-	25	-	25	1
MEU712	Self Study-III	-	-	-	-	25	-	-	-	-	-	25	2
		13	**0**	**12**	**25**	**65**	**60**	**60**	**240**	**250**	**75**	**750**	**23**
Semester – VIII													
MEU801	Internal Combustion Engines	3	-	-	3	10	15	15	60	-	-	100	3
MEU802	Mechatronics	3	-	-	3	10	15	15	60	-	-	100	3
MEU803	Elective-II	3	-	-	3	10	15	15	60	-	-	100	3
MEU804	Elective-III	3	-	-	3	10	15	15	60	-	-	100	3
MEU805	Internal Combustion Engines Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU806	Mechatronics Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU807	Elective-III Lab.	-	-	2	2	-	-	-	-	25	25	50	1
MEU808	Project	-	-	6	6	-	-	-	-	75	100	175	6
MEU809	Self Study-IV	-	-	-	-	25	-	-	-	-	-	25	2
		12	**0**	**12**	**24**	**65**	**60**	**60**	**240**	**150**	**175**	**750**	**23**

The ESE (Theory) duration for all courses shall be 2hrs 30 min except courses MEU101, MEU501 and MEU602 for which the ESE duration will be 3hrs.

ICA – Internal Continuous Assessment; ESE – End Semester Examination

Assessment of course MEU612 Industrial Lecture -I is scheduled in VII semester with course MEU711 Industrial Lecture - II

The course MEU712 Self Study-III is based on the basis of 20% curriculum of the courses MEU701, MEU702 and MEU703 declared by the respective course coordinator at the beginning of the semester

The course MEU809 Self Study-IV is based on the basis of 20% curriculum of the courses MEU801, MEU802, MEU803 and MEU804 declared by the respective course coordinator at the beginning of semester

One Faculty member shall be appointed as Course Coordinator for the course Self Study and his/ her teaching workload shall be considered as 01 hr per week

Students of this department will select any one Interdisciplinary Elective offered by other other departments. Interdisciplinary Elective shown below will be offered to the students of other departments.

MEU704(E) Interdisciplinary Elective Foundation skills in Integrated Product Development (FSPID) shall also available to Mechanical Engineering students along with students of other departments.

Sr. No.	MEU703 ELECTIVE-I	MEU704 INTERDISCIPLINARY ELECTIVE	MEU803 ELECTIVE-II	MEU804 ELECTIVE-III
A	New and Renewable Energy Sources	Quality System Engineering	Power Plant Engineering	Automobile Engineering
B	Tool Engineering	Human Resource Management	Production Management	Mechanical Vibrations
C	Experimental Stress Analysis	Entrepreneurship Development	Machine Tool Design	Finite Element Method
D		Thermal Engineering	Lean Manufacturing	Computer Integrated Manufacturing Systems
E		Foundation skills in Integrated Product Development (FSIPD)		

MEU701 REFRIGERATION AND AIR CONDITIONING

Teaching Scheme: 03 L + 00 T **Total : 03** **Credit : 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total marks : 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. Identify basic refrigeration methods and their applications
II. Explain the standard cycles referred for refrigeration
III. Describe the working principle of multiple components refrigeration systems
IV. Explain different refrigerant properties &designation of refrigerants
V. Describe construction, working and applications of air-conditioning systems
VI. Explain the concept of psychometry and psychometric terms
VII. Understand the basic steps for Air-conditioning system design

Introduction: History, methods and applications of refrigeration; Types and applications of air conditioning systems; current status and future trends; air cycle refrigeration systems

Vapour compression refrigeration (VCR) systems: Analysis of simple VCR system; Use of *p-h* and *T-s* charts; Effect of operating conditions such as condenser and evaporator pressure, superheating and sub-cooling; Actual VCR system

Refrigerants: Classification, desirable properties and designation of refrigerants; merits and demerits of commonly used refrigerants

Multi pressure vapour compression systems: classification; compound compression systems, multi-evaporator systems, individual and multiple expansion valves

Vapour absorption systems: Simple vapour absorption cycle; practical absorption systems, comparison of vapour compression and absorption cycles

Refrigeration system components and controls: Brief description of compressors, condensers, evaporators, defrosting methods, expansion devices, accessories and refrigeration controls

Psychrometry of air conditioning processes: Properties of moist air; Psychrometric chart, Psychrometric processes, Psychrometric processes related to air conditioning

Air conditioning systems: Unitary system, window type and split type air conditioning; Central system: direct expansion system, all water and all air systems; winter, summer and year round air conditioning

Heating and cooling load calculations: Basic considerations, heat gain/losses, sensible and latent, heating load estimates, sensible heat factor, bypass factor, apparatus dew point

Text Books

1. Heat Refrigeration and air conditioning, Ahmadul Ameen, Prentice Hall of India, New Delhi, 2006
2. Text Refrigeration and air conditioning, C P Arora, Tata McGraw-Hill, 2nd edition, 2003

Reference Books:

1. Refrigeration and air conditioning, W F Stoecker, JW Jones, McGraw-Hill, 1982
2. The ASHRAE Handbooks with CDs, 2005-2008
3. Refrigeration and Air Conditioning Technology, Tomczyk, J. A., Whitman, W. C., Johnson, W. M., Pub: Delmar S. Africa, 4th edition, 2000.

Course Outcomes: After completion of course, student will be able to:

MEU701.1. Analyze the basic refrigeration system components problems and suggest suitable remedies

MEU701.2. Design the proper type of multiple component refrigeration system as per given requirement

MEU701.3. Select the proper type of refrigerant for suitable application

MEU701.4. Implement general safety norms in refrigeration and Air-conditioning industry

MEU701.5. Evaluate the required parameters for Air-conditioning system from given design data

MEU702 COMPUTER AIDED DESIGN

Teaching Scheme	**: 03 L Total = 03**	**Credit**	**: 03**
Evaluation Scheme	**: 15 CT1 + 15 CT2 + 10 TA + 60 ESE**	**Total Marks**	**:100**
Duration of ESE	**: 2 hrs. 30 min.**		

Course Objectives:

I. To learn about engineering design through the use of computer aided design (CAD) software and hardware.

II. To learn about graphical user interface, graphics systems and standards, different geometric modeling techniques like wire frame modeling, solid modeling etc.

III. To learn the fundamental concepts of the theory of the finite element method and to develop the skills needed to apply Finite Element Methods to Problems in Mechanical Engineering.

IV. To enable the students to formulate the design 1D and 2D Problems into FEA.

Fundamentals of CAD/CAM: Definition of CAD, implementation CAD, Design Process, Manufacturing Process, Application of computers for design, Benefits of CAD/CAM.

Computer Graphics Software: Display Devices, Ground rules for Graphics Software, The Software Configuration of a Graphics System, and Functions of a Graphics System, Constructing the Geometry, Transformation, Database Structure and Contents.

Automated Drafting: Configuration of typical drafting packages, layers, entities, editing, display commands, hatching, dimensioning, Text plotting, Script files, DXF and IGES files, blocks, Parametric programming, Customization of drafting packages and graphic standards.

Wire Frame, Surface and Solid Modeling: Modeling of curves and surfaces, Techniques of splining, cubic splines, Bezier splines Schemes for representing solid objects, Construction, Solid geometry and boundary representation, Feature of solid modeling packages.

Finite Element Methods: Introduction**,** Importance, and Applications of FEA, Fundamental concepts, Discrimination, Numbering, Stress strain equilibrium, Stress –Strain relationship, Boundary and support conditions, and general steps of finite element method.

1D/2D Problems: Coordinate and Linear Shape Functions, The potential energy approach, The Galerkin approach, The global stiffness matrix, Boundary conditions , Penalty and Elimination Methods, Quadratic Shape Functions, Constant Strain Triangle CST, Isoperimetric representations, Development of Truss equations, Introduction to FEA packages.

Text Books:

1. Computer Aided Design and Manufacturing , Groover,M.P., Prentice-Hall of India , 5th Edition ,2005
2. CAD/CAM Theory and Practice, Zeid Ibrahim, Tata McGraw Hill,4th edition,2001.
3. An Introduction to the Finite element Methods, Reddy, J.N., Tata McGraw Hill, 3rd Edition, 2005

Reference Books:

1. Automation Production Systems and Computer Integrated Manufacturing, Groover, M. P., Prentice-Hall of India, 2nd Edition.
2. CNC Machines , Pabla, B.S., New Age International Publications,1st Edition , Reprint 2005.
3. CAD/CAM Principals and Applications, Rao, P.N. Tata McGraw Hill, 2002.

Course Outcomes: After completion of course, student will be able to:
MEU702.1. Acquire the Knowledge of data bases, software s and hardware's for computer design and the concepts of surface modeling, wire frame modeling, solid modeling.
MEU702. 2.Able to obtain an understanding of the fundamental theory of the FEA method.
MEU702.3. Able to formulate simple design problems into finite elements.

MEU703 ELECTIVE - I

(A) NEW AND RENEWABLE ENERGY SOURCES

Teaching Scheme: 03 L + 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30 min.

Course Objectives:

I. To provide students an overview of global energy resources.
II. To introduce students to Wind Energy, Tidal and Ocean Energy, Geothermal Energy and Magneto Hydrodynamics, Nuclear Energy and solar energy.
III. To expose students to future energy systems and energy use scenarios with a focus on promoting the use of renewable energy resources and technologies.

Principles of solar radiation: Role and potential of new and renewable source, the solar energy option, Environmental impact of solar power, physics of the sun, the solar constant,

extraterrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data.

Solar energy collection: Flat plate and concentrating collectors, classification of concentrating collectors, orientation and thermal analysis, advanced collectors.

Solar energy storage and applications: Different methods, Sensible, latent heat and stratified storage, solar ponds. Solar Applications- solar heating, cooling techniques, solar distillation and drying, photovoltaic energy conversion.

Wind Energy: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, Betz criteria.

Bio-Mass: Principles of Bio-Conversion, Anaerobic/aerobic digestion, types of Bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, ICEngines operation on Bio-mass and their economic aspects.

Geothermal Energy: Resources, types of wells, methods of harnessing the energy, potential in India.

Ocean Energy: Ocean Thermal Energy Conversion, Principles utilization, setting of Ocean Thermal Energy Conversion plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques, mini-hydel power plants, and their economics.

Direct Energy Conversion: Need for direct energy conversion, Carnot cycle and its limitations, principles of direct energy conversion. Thermo-electric generators, see-beck, Peltier and Joule-Thomson effects, Figure of merit, materials, applications, MHD generators, principles, dissociation and ionization, hall effect, magnetic flux, MHD accelerator, MHD Engine, power generation systems, electron gas dynamic conversion, economic aspects. Fuel cell principle, Faraday's law, thermodynamic aspects, selection of fuels and operating conditions.

Text Books:

1. Fundamentals of Renewable Energy Resources, G. N.Tiwari and M. K. Ghosal, Narosa Publishing House, 2007
2. Solar Energy, Sukhatme, 3rd Edition, Tata McGraw-Hill Education, 2008

Reference Book:

1. Renewable Energy Resources, John Twidell & Anthony D. Weir, 2nd Edition, Taylor & Francis, 2006
2. Thermal Energy, Mahesh Rathore, Tata McGraw-Hill Education, 2010
3. Principles of Solar Energy, D. Yogi Goswami, Frank Krieth & John F Kreider, 2nd Edition, Taylor & Francis, 2000
4. Non-Conventional Energy, Ashok V Desai, Wiley Eastern Ltd. New Delhi, 2003
5. Non-Conventional Energy Systems, K. Mittal, Wheeler Publishing, 1997
6. Renewable Energy Technologies, R. Ramesh, K. Uday Kumar, M. Anandakrishnan, Narosa Publishing House, 1997
7. Non-Conventional Energy Sources, G.D. Rai, 4th Edition, Khanna publishers, 2009

Course Outcomes: After completion of course, student will be able to:

MEU703A.1 Identify renewable energy sources and their utilization.

MEU703A.2 Understand the basic concepts of solar radiation and analyze the working of solar PV and thermal systems.

MEU703A.3 Understand principles of energy conversion from alternate sources including wind, geothermal, ocean, biomass, biogas and hydrogen.

MEU703A.4 Understand the concepts and applications of fuel cells, thermoelectric convertor and MHD generator.

MEU703A.5 Identify methods of energy storage for specific applications.

MEU703 ELECTIVE - I
(B) TOOL ENGINEERING

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs.30 min.

Course Objectives:

I. The course provides students with fundamental knowledge and principles in material removal processes.
II. In this course, the students apply the fundamentals and principles of metal cutting to practical applications through multiple labs using lathes, milling machines, grinding machines, and drill presses, Computer Numerical Control etc.
III. To demonstrate the fundamentals of machining processes and machine tools.
IV. To develop knowledge and importance of metal cutting parameters.
V. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
VI. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

Tool materials and Heat treatment: Properties of tool materials, ferrous tooling materials, Nonferrous tooling materials, nonmetallic tooling materials, heat treatment, factors affecting heat treating

Cutting Tools:

Single point cutting tool: Geometry, classification, nomenclature, Design

Twist drill and Reamers: Geometry, types, cutting force, power, and torque

Broach: Introduction and geometry of broach, designing of broach, cutting force and Power

Milling Cutter: Geometry of plain milling cutter, types of milling cutters, forces acting on plain milling cutter

Threaded cutting tools: geometry of tap and dies

Press Tools: Classification of presses, Press characteristics, safety devices, principles of feeding and unloading, Design principals of presses

Design of Dies: Types of dies, shear in die cutting operation, clearance, cutting forces, shear on punch and die, Design of: blanking dies, piercing dies, bending dies, and drawing dies.

Jigs and Fixtures: classification, fundamental principles and applications, Location and clamping: principle of location, different types of locators and clamps, Simple design for drilling jigs and milling fixtures etc, Indexing of jigs and fixture.

Text Books:

1. Fundamentals of Metal Cutting & M/c Tools, Juneja B. L., Sekhon G. S. and Seth Nitin, 2nd Edition New Age Int. Publishers, 2008
2. Tool Design, Donaldson, C., LeCain G. H. and Goold V. C., 3rd Edition, Tata McGraw Hill, 2006

Reference Book:

1. Fundamental of Tool Engineering, Basu, Mishra and Mukharjee, 2nd Edition, Oxford and IBH Publishing Co., 2007
2. Metal Cutting Theory and Practice, Bhattacharya, A, 2nd Edition, Central Book Publisher, 2008

Course Outcomes: After completion of course, student will be able to:

MEU703 1. Apply cutting mechanics to metal machining based on cutting force and power consumption.

MEU703 2. Operate lathe, milling machines, drill press, grinding machines, etc.

MEU703 3. Select cutting tool materials and tool geometries for different metals.

MEU703 4. Select appropriate machining processes and conditions for different metals.

MEU703 ELECTIVE - I
(C) EXPERIMENTAL STRESS ANALYSIS

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs.30 min.

Course Objectives:

I. To study Stress analysis utilizing experimental techniques including transmission photo elasticity, strain gauges, digital image correlation for 2D (planar) surfaces, digital image correlation for 3D objects

II. To study the basic concepts in optics including imaging principles and their use in computer vision. Basic concepts in coherent optics in stress analysis with emphasis on engineering applications

Basic equations in elasticity: state of strain, brittle coating method, and crack patterns produced by direct loading, refrigeration method, releasing method, effect of coating thickness and environment

Photoelasticity methods: behavior of light, plane polarized and circular polariscope, isochromatic and isoclinic fringe patterns for two dimensional photoelasticity, three dimensional photoelasticity, model slicing and shear difference method, birefringent coating method.

Strain measurement methods: types of gauges, electric strain gauge, strain rosette analysis, three element, delta, four element rosette, strain gauge circuits and recording instrument.

Moire fringe technique: surface strain measurements and flexural studies. Grid analysis. X-ray techniques and holography, Motion measurements.

Text Books:

1. Experimental Stress Analysis, Dove and Adam, Tata McGraw Hill Publications, Third edition Reprint 2004.
2. Experimental Stress Analysis, Dally and Riley, Tata McGraw Hill Publications Fourth edition 2006.

Reference Books:

1. Modern Experimental Stress Analysis, Doyle James, Johan Wiley Publications First edition 2007

Course Outcomes: After completion of course, student will be able to:
MEU703C.1 Understand the overall concepts of stress/strain analysis by experimental means.
MEU703C.2 Demonstrate a basic understanding of experimental methods (e.g. strain gages, photoelasticity, image correlation) commonly used in experimental solid mechanics.
MEU703C.3 Acquire the knowledge on Brittle and bi-refrigent coatings and working of strain gauges.
MEU703C.4 Demonstrate the ability to analyze experimental data and develop appropriate, logical conclusions based on comparisons to theoretical results and other experimental evidence.

MEU704 INTERDISCIPLINARY ELECTIVE
(A) QUALITY SYSTEM ENGINEERING

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30 min.

Course Objectives:

I. To learn various types of Inspection methods in industries
II. To understand Selection of quality inspection methodology
III. To understand Reliability factor for each component

Introduction

Meaning of quality, evolution of quality, importance of quality, quality of design, quality of conformance, quality of Assurance, reliability, and maintainability.

Inspection
Types of inspection : 100% inspection and Sampling inspection , Advantages and limitations of sampling inspection, Introduction to Operating Characteristic (OC) curve, AQL, LTPD, Producers' risk, Consumers' risk, Types of sampling plan: single, double, multiple sampling plan.

Statistical Quality Control
Meaning, importance, chance causes, and assignable causes, control chart for variables: X bar and R-chart, control charts for attributes: p-chart and c-chart, introduction to process capability.

Quality Assurance
Meaning, advantages, stages of assurance, quality audit, quality circle.

Quality-Systems Economics
Cost of quality: costs of prevention, costs of appraisal, costs of failures, value of cost.

Quality systems
ISO9000 series standard: ISO 9000, ISO 9001, ISO 9002, ISO 9003, ISO 9004, Total Quality Management: meaning, principles, and characteristics

Text Books:

1. Statistical Quality Control, E. L. Grant, R.S. Leavenworth 6th Edition, Tata Mc Graw Hill, 2005
2. Quality Control and TQM, P.L. Jain, 6th Edition, Tata Mc Graw Hill, 2001

Reference Book:

1. Quality Handbook, J.M. Juran, 4th Edition, Tata Mc Graw Hill, 2005
2. Quality Control, TTTI Madras, 11th Edition, Tata Mc Graw Hill, 2005

Course Outcomes: After completion of course, student will be able to:

MEU704.1 Explain meaning of quality and its influence

MEU704.2 Describe, distinguish and use statistical tools of quality management

MEU704.3 Describe ISO standards and principles of TQM

MEU704.4 Describe the working of quality audit and apply the concept of quality circle

MEU704 INTERDISCIPLINARY ELECTIVE
(B) HUMAN RESOURCE MANAGEMENT

Teaching Scheme: 03 L +00T **Total: 03** **Credit: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

Introduction: Evolution of Human Resources Management (HRM), human capital management, comparison of HCM, PM, HRM, factors affecting HRP, scope of HRM in industries, HR issues for integrating new technologies, internal forces, organizational culture and conflict, personal productivity through motivation.

Human Resources Management: Integrating HR strategy with business strategy, strategic HRM and conventional HRM, barriers to strategic HRM, model of strategic HRM, strategy formulation and integration, relation of Job satisfaction with work behavior.

Human Resources Planning: Potential uses of HRP, career planning, career management framework, group behavior and the dynamics of interpersonal influence, personality and stress management.

Recruitment, Selection and Performance Appraisal: Introduction, objectives, different models and methods of selection and assessment, techniques of human resources demand forecasting, HRD audit process¬ human resource accounting and information system¬ HRM strategic development, personal records, promotion policies, transfers..

Wage Administration & Wage Policy : Goal setting and self¬ efficacy; job design practices; performance evaluation, reinforcement theory, rewards , employment fringe benefits, industrial relations, personnel motivation, industrial relations and industrial disputes – some case studies on current issues.

Text Books:

1. Personnel Management and Industrial Relations, R.S. Davar, Vikas Pub. House Pvt..Ltd. New Delhi, 2001 edition
2. Personnel Management, E.B. Filippo, Hill Education India Ltd. New Delhi, 2005 edition.

Reference Books:

1. Essentials of Management,, Koontz, Harold, McGraw Hill Education India Ltd. New Delhi, 2009 edition.
2. Purchasing and Materials Management, Gopalkrishnan, McGraw Hill Education India Ltd. New Delhi, 2010 edition.
3. Human Resource Management, Gary Dessler, Prentice Hall New Delhi, 2009 edition
4. Wayne Cascio, Ranjeet Nambudiri, Managing Human Resources: Productivity, Quality of Work Life, Profits, McGraw-Hill Education, New Delhi 2010.

Course Outcomes: After completion of course, student will be able to:

MEU704 INTERDISCIPLINARY ELECTIVE
(C) ENTREPRENEURSHIP DEVELOPMENT

Teaching Scheme: 03 L+00T Total :03 Credit: 03
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE Total Marks: 100
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To develop solid understanding of business and management
II. To develop critical thinking in students for data collection, interpretation and analysis
III. To develop effective communication and interaction skills
IV. To develop global perspective so as to understand the impact of globalization on business operations, opportunities and challenges
V. To understand the basics of finance, banking regulations, taxation and various financial support mechanisms for SME sector

Introduction: Concept, characteristics, types of entrepreneurs, Entrepreneurial traits, true motivation and leadership, understanding of Entrepreneurial process, women entrepreneurs and problems, rural entrepreneurship, factors affecting entrepreneurship, entrepreneurship development agencies and their role in encouraging entrepreneurship, entrepreneurship in Indian scenario, future prospects in India and emerging economies..

Start up of Small Business: Relationship between SSIs and large scale industries, objectives of entrepreneurship in industries, project identification and selection, criteria of selection, project appraisal, different types of ownership structures and some case studies.

Institutional Finance to Entrepreneurs : Various financing institutions and their mechanisms of financing to various enterprises **,** taxation benefits to SSIs, government policies for SSIs, industrial sickness and methods of avoiding industrial sickness.

Inventory and Working Capital Management: Types of inventories, objectives, make or buy decision, simple models of inventory management, working capital objectives, simple numerical examples on inventory management and working capital management in SSIs.

International Marketing: Scope of international marketing for SSIs, documents, procedures of export business, E- commerce, problems of international marketing, government schemes and policies for export marketing for SSIs, some case studies.

Text Books:

1. Patterns of Entrepreneurship, J.M. Kaplan, John Wiley & Sons (Asia), Pvt. Ltd. Singapore, 2010 edition
2. Entrepreneurship Development, S.S. Khanka,, S. Chand & Sons, New Delhi ,2010 edition

Reference Books:

1. Koontz, Harold, Essentials of Management,, McGraw Hill Education India Ltd. New Delhi, 2009 edition.
2. Gopalkrishnan, Purchasing and Materials Management, McGraw Hill Education India Ltd. New Delhi, 2010 edition.
3. Services Marketing and Management, B. Balaji, S. Chand & Sons, New Delhi, 2009 edition

Course Outcomes: After completion of course, student will be able to:

MEU704C.1 Demonstrate strong understanding of business environment, regulations and management

MEU704C.2 Analyze critically the relevant data to strategize business policies in accordance with the market trends

MEU704C.3 Interact effectively with all stakeholders through strong communication skills
MEU704C.4 Understand and analyze the current market trends to be able to develop global perspective for business growth
MEU704C.5 Develop financial acumen required of a successful entrepreneur

MEU704 INTERDISCIPLINARY ELECTIVE
(D) THERMAL ENGINEERING

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30 min.

Course Objectives:

I. Understand thermal related basic components and their uses
II. Explain the different thermodynamic processes
III. Explain the working principles of IC engines, Boiler, condensers, & jet-propulsion
IV. Understand construction, working and applications of centrifugal and reciprocating compressors
V. Explain working and applications of Gas turbine turbines and air compressor
VI. Understand the need & types of non-conventional energy sources

Basic concepts and properties: introduction, thermodynamic system, control volume, macroscopic and microscopic approaches, properties of a system, continuum, state and equilibrium, processes and cycles, quasi-static process, point and path functions, steady flow process, energy concept, Properties of Pure Substances and ideal gas. First law of thermodynamics, second law of thermodynamics.

Steam power plant: Steam power cycle, reheat, regenerative cycles, analysis, layout of steam power plant, , Steam generators, flow through nozzles, critical pressure ratio and choked flow, nozzle efficiency, determination of throat and exit areas, concept of super saturated flow and Wilson line (no numerical), type of steam turbines, Types of steam turbines, Compounding, Velocity diagrams. Graphical and analytical methods for work and power developed, Turbine governing and control, need of a condenser and its types, quantity of cooling water required, condenser and vacuum efficiency. Sources of air in condensers and its effect on performance, concept of co-generation

Air Compressors: Industrial uses of compressed air, types of compressor, Methods of compression and efficiencies of compression, clearance volume and its effect on work done and volumetric efficiency, condition for minimum work, Intercooling and its effects..

I.C. Engines: Classification of I.C. engines, General description of Petrol and Diesel engine, working, performance parameter and characteristic, Gas Turbines, Closed cycle and open cycle plant arrangement, advantages, Effect of reheating, Performance of Gas turbine power plant. Components of GT power plant. Introduction to jet propulsion, Ramjet, turbojet.

Refrigeration and Air conditioning: Vapor compression Refrigeration and COP, vapor absorption refrigeration. Air conditioning: classification and applications. Psychometric charts elementary treatment with simple problems.

Non conventional energy sources: Introduction to non conventional energy sources i.e. Solar, Wind, Tidal & Ocean, Geothermal energy and Magneto Hydrodynamics, its advantages, disadvantages.

Text Books

1. Thermal Engineering by Mahesh M Rathore, 3rd Edition, Tata Mc-Graw Hill, 2010
2. Power Plant Engineering, P.K. Nag, 3rd Edition, Tata Mc-Graw Hill Publishing, 2008.

Reference Books:

1. Gas Turbines, V Ganesan, 3nd Edition, Tata McGraw Hill, 2010.
2. Thermodynamics-An Engineering Apporach, Y. A. Cengel and M. A. Boles, 3rd Edition, Mc-Graw Hill, 1998.
3. Refrigeration and air conditioning, C P Arora, Tata McGraw-Hill, 2nd edition, 2003

Course Outcomes: After completion of course, student will be able to:

MEU704D.1 Rectify basic thermal engineering components problems and their suggest suitable remedies

MEU704D.2 Select the proper type of IC engines, Boiler, condensers, Gasturbine for engineering applications

MEU704D.3 Identify the right types of Gasturbine turbines and air compressor

MEU704D.4 Implement general safety norms in mechanical engineering industries

MEU704D.5 Demonstrate common troubles / problems in IC engines, Boiler, condensers, Gasturbine turbines and air compressor

MEU704 INTERDISCIPLINARY ELECTIVE

(E) FOUNDATION SKILLS IN INTEGRATED PRODUCT DEVELOPMENT (FSIPD)

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs.30 min.

Course Objectives:

I. Explain the effects of various trends on product decision
II. Understand PESTLE analysis
III. Get an overview of various types of products and services
IV. Explore through different product development methodologies

Fundamentals of Product Development:

Global Trends Analysis and Product decision: Types of various trends affecting product decision - Social Trends (Demographic, Behavioral, Psychographic), Technical Trends (Technology, Applications, Tools, Methods), Economical Trends (Market, Economy, GDP, Income Levels, Spending Pattern, target cost, TCO), Environmental Trends (Environmental Regulations and Compliance), Political/Policy Trends (Regulations, Political Scenario, IP Trends and Company Policies); PESTLE Analysis.

Introduction to Product Development Methodologies and Management: Overview of Products and Services (Consumer product, Industrial product, Specialty products etc); Types of

Product Development (NPD/ Re-Engineering (Enhancements, Cost Improvements)/ Reverse Engineering/ Design Porting & Homologation); Overview of Product Development methodologies (Over the Wall/ Waterfall/ V-Model/ Stage-Gate Process/ Spiral/Systems Engineering/ Agile); Product Life Cycle (S-Curve, Reverse Bathtub Curve); Product Development Planning and Management (Budgeting, Risk, Resources and Design Collaboration, Scheduling, Change Management, Product Cost Management).

Requirements and System Design

Requirement Engineering: Types of Requirements (Functional, Performance, Physical, Regulatory, Economical, Behavioral, Technical, Stakeholder, Environmental, Industry specific, Internal-Company Specific); Requirement Engineering (Gathering (VOC), Analysis (QFD), Design Specification); Traceability Matrix and Analysis; Requirement Management.

System Design & Modeling: Introduction to System Modeling; System Optimization; System Specification; Sub-System Design; Interface Design.

Design and Testing

Conceptualization: Industrial Design and User Interface Design; Introduction to Concept generation Techniques; Concept Screening & Evaluation - Concept Design, S/W Architecture, Hardware Schematics and simulation.

Detailed Design: Component Design and Verification; High Level Design/Low Level Design of S/W Programs, S/W Testing; Hardware Schematic, Component design, Layout and Hardware Testing.

Prototyping: Types of Prototypes (Mockups, Engineering Assessment Prototype, Alpha, Beta, Gama); Introduction to Rapid Prototyping and Rapid Manufacturing.

System Integration, Testing, Certification and Documentation: Manufacturing/Purchase and Assembly of Systems; Integration of Mechanical, Embedded and S/W systems; Introduction to Product verification processes and stages – Industry specific (DFMEA, FEA, CFD); Introduction to Product validation processes and stages - Industry specific (Sub-system Testing/ Integration Testing/ Functional Testing/ Performance Testing / Compliance Testing); Product Testing standards and Certification – Industry specific; Product Documentation (Compliance Documentation, Catalogue, Brochures, user manual, maintenance Manual, Spares Parts List, Warranty, Disposal Guide, IETMS, Web Tools).

Sustenance Engineering and End-of-Life (EoL) Support

Sustenance: Maintenance and Repair; Enhancements.

Product EoL: Obsolescence Management; Configuration Management; EoL Disposal.

Business Dynamics – Engineering Services Industry

The Industry: Engineering Services Industry – overview; Product development in Industry versus Academia.

The IPD Essentials: Introduction to vertical specific product development processes; Product development Trade-offs; Intellectual Property Rights and Confidentiality; Security and configuration management.

Note: The course material for the subject will be provided by NASSCOM

Course Outcomes: After completion of course, student will be able to:
MEU704E.1 Analyze various global trends and decide on the scope of a new product
MEU704E.2 Identify requirement engineering and know how to collect, analyze and arrive at Requirements for new product development and convert them in to design specification
MEU704E.3 Identify system modeling for system, sub-system and their interfaces and arrive at The optimum system specification and characteristics
MEU704E.4 Develop prototype plan and coordinate the respective activities with prototype Manufacturing facility.

MEU705 REFRIGERATION AND AIR CONDITIONING LAB

Teaching Scheme: 02P **Total : 02** **Credit: 01**

Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**

Duration of ESE: 3 hrs.

Course Outcomes:

I. Identify the basic components of vapour compression refrigeration system
II. Explain the methodology adopted for the evaluation of COP
III. Explain the working principle of various refrigeration systems components
IV. Describe construction, working and applications of air-conditioning systems
V. Understand the location of various air conditioning system components
VI. Understand various controls of refrigeration and air conditioning systems

It is representative list of practical. The instructor may choose minimum **Six** experiments as per his/her requirement (so as to cover entire content of course MEU701 Refrigeration and Air conditioning) from the list given below

Minimum Six experiments should be performed:

1. Determination of COP of simple vapor compression system
2. Determination of Capacity of ice plant
3. Determination of temperature drop by desert cooler
4. Determine the capacity of water cooler
5. Determination of COP of Electrolux system
6. Determination of temperature separation by vortex tube.
7. Performance of household refrigerator
8. Trial on air conditioning tutor system

9. Trial of window/ split air conditioner
10. Visit and study of cold storage plant
11. Demonstration of various controls of refrigeration and air conditioning systems.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of course, student will be able to:

MEU705.1. Rectify basic refrigeration system components problems and their suggest suitable remedies
MEU705.2. Perform experiments on Refrigeration & Air-conditioning experimental tutor/test rig.
MEU705.3. Identify the location of various air conditioning system components & controls
MEU705.4. Implement general safety norms in refrigeration and Air-conditioning industry
MEU705.5. Suggest solutions to common problems in VCR systems through visit and case study of cold storage plants
MEU705.6 Evaluate the performance parameter (COP) from recorded data

MEU706 COMPUTER AIDED DESIGN LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**
Evaluation Scheme: 25 ICA +25 ESE **Total Marks: 50**
Duration of ESE: 3 hrs.

Course Objectives:

I. To learn 3D modeling software packages and hardware components used in CAD/CAM systems.
II. To create sketches 2D and 3D drawing of machine components using product modeling software packages.
III. To learn introduction of FEA and study performance of FEA software for structural, thermal and flow analysis.

It is representative list of practical. The instructor may choose minimum **Six** experiments as per his/her requirement (so as to cover entire content of course MEU702 Computer Aided Design) from the list given below

1) Study and introductory training on 3-D Modeling software packages like CATIA, PROE, and SOLID EDGE etc.
2) Study of hardware components used in CAD/CAM System.

3) Creation of 2-D drawing (sketching) of any three machine components using 3-D product modeling software package.- 2 experiments
4) Creation of 3-D drawing of any two machine parts using 3-D product modeling software package.- 2 experiments
5) Creation of 3-D detailed part of any two sheet metal components using 3-D product modeling software package.
6) Creation of any one assembly design using 3-D product modeling software package.
7) Introduction to Finite Element Analysis
8) Study and performance on FEA software package for structural, Thermal and flow analysis.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions

Course Outcomes: After completion of course, student will be able to:
MEU706.1. Use 3-D Modeling software packages like CATIA, PROE and SOLID EDGE etc,
MEU706.2. Create of 2-D and 3-D drawing (sketching) of machine components using 3-D product modeling software package.
MEU706.3. Create of 3-D detailed part of sheet metal components and assembly design using 3-D product Modeling software package.
MEU706.4. Perform basic structural, Thermal and flow analysis on FEA software package

MEU707 ELECTIVE – I LAB
(A) NEW AND RENEWABLE ENERGY SOURCES LAB

Teaching Scheme: 02P **Total : 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**
Duration of ESE: 3 hrs.

Course Objectives:

I. To acquire skill to solar radiations
II. describe the solar heating system
III. Perceive the fundamental characteristic of PV system
IV. Focus on the economical aspect of renewable energy generation plant

It is representative list of practical's. The instructor may choose experiments as per his/her requirements (so as to cover entire content of the course MEU703 (1) new and renewable energy sources lab) from the list or otherwise. Minimum 6 experiments should be performed:

1. Testing on measurement of global radiation.
2. Trial on a sunshine recorder.

3. Testing of a flat plate collector.
4. Testing on performance of wind mill.
5. Testing of a photovoltaic system.
6. Testing on concentrating collector.
7. Visit to wind mill and submission of report.
8. Visit to a Biogas plant and submission of report.
9. Trial on gasifier

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions

Course Outcomes: After completion of course, student will be able to:
MEU707A.1 Measure bright sunshine hours and solar radiation
MEU707A.2 Determine and compare the performance of solar heating system
MEU707A.3 Estimate the characteristic of PV system
MEU707A.4 Focus on fundamental and economical aspect of renewable energy generation plant

MEU707 ELECTIVE – I LAB
(B) TOOL ENGINEERING LAB

Teaching Scheme: 02P **Total : 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**
Duration of ESE: 3 hrs.

Course Objectives:

I. To demonstrate the fundamentals of machining processes and machine tools.
II. To develop knowledge and importance of metal cutting parameters.
III. To develop fundamental knowledge on tool materials, cutting fluids and tool wear mechanisms.
IV. To apply knowledge of basic mathematics to calculate the machining parameters for different machining processes.

It is representative list of practical. The instructor may choose minimum **Six** experiments as per his/her requirement (so as to cover entire content of course MEU703 (2) Tool Engineering) from the list given below:

1. Design and drawing of single point cutting tool.
2. Design and drawing of form tool.
3. Design and drawing of broach.
4. Measurement of cutting force in orthogonal cutting by Dynamometer.
5. Design and drawing of blanking die.

6. Design and drawing of bending die.
7. Design and drawing of jigs.
8. Design and drawing of fixtures.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions

Course Outcomes: After completion of course, student will be able to:

MEU707B.1 Apply cutting mechanics to metal machining based on cutting force and power consumption.

MEU707B.2 Operate lathe, milling machines, drill press, grinding machines, etc.

MEU707B.3 Select cutting tool materials and tool geometries for different metals.

MEU707B.4 Select appropriate machining processes and conditions for different metals.

MEU707 ELECTIVE – I LAB
(C) EXPERIMENTAL STRESS ANALYSIS LAB

Teaching Scheme: 02P **Total : 02** **Credit: 01**

Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**

Duration of ESE: 3 hrs.

Course Objectives:

I. To identify the tools used for the stress analysis.
II. To explain the concept of photo elasticity
III. To describe photo elastic analysis of a Notched Specimen
IV. To describe photo elastic analysis of a Crack.

It is representative list of practical. The instructor may choose experiments as per his/ her requirement (so as to cover entire content of the course MEU703 (3) Experimental Stress Analysis) from the list or otherwise. Minimum six experiments should be performed:

1. Electrical Resistance Strain Gages.
2. Static Analysis of a Loaded Ring.
3. Thermoelastic Stress Analysis.
4. Introductory Photoelasticity.
5. Photoelastic Analysis of a Notched Specimen.
6. Photoelastic Analysis of a Crack.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions

Course Outcomes: After completion of course, student will be able to:

I. Utilize the tools used for the stress analysis.
II. Describe the concept of photo elasticity
III. Perform photo elastic analysis of a Notched Specimen
IV. Analyze photo elastic analysis of a Crack.

MEU708 PROJECT PHASE- I

Teaching Scheme: 04P **Total: 04** **Credits: 02**

Evaluation Scheme: 50 ICA **Total Marks: 50**

Course Objectives:

I. To collect information on novel and latest development in core and allied area of the subject.
II. To encourage the process of independent thinking and working together in a group.
III. To implement innovative ideas for social benefit.
IV. To develop a prototypes/models, experimental set-up and software systems.
V. To improve the ability of presentation skill and communication techniques.

1 In general, a group of 3-6 students should be allowed to complete the project on Approved topic.
2 Preferably more than 25 % projects shall be Industry / Research based / oriented.
3 Exhaustive survey of literature based on a clear definition of the scope and focus of the topic should be carried out by the students.
4 Students should finalize the topic for the project after literature survey in consultation with the Guide.
5 The Synopsis/Abstract on the selected topic should be submitted to the H.O.D. for approval.
6 On approval of the topic, students should initiate the topic based work.
7 Approximately more than 30% work(of the total quantum) should be completed by the end of VII semester.
8 At the end of semester, each batch should submit the progress report in following format:
Title
Introduction
Concept
Work completed
Work to be completed

References

9 For uniform and continuous evaluation, the Evaluation Committee comprising of the Guide, Project Course Coordinator and Expert appointed by the Program Head will award the marks based on the work completed by the end of semester and the presentation based on the project work.

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted by the panel of examiners.

Course Outcomes: After completion of course, student will be able to:

MEU 708.1 Identify a topic in advanced areas of Mechanical Engineering.
MEU 708.2 Review literature to identify gaps and define objectives & scope of the work.
MEU 708.3 Generate and implement innovative ideas for social benefit.
MEU 708.4 Develop a prototypes/ models, experimental set-up and software systems necessary to meet the objectives.
MEU 708.5 Apply principles of ethics and standards, skill of presentation and communication techniques.

MEU709 SEMINAR

Teaching Scheme: 02P	**Total: 02**	**Credits: 01**
Evaluation Scheme: 50 ICA		**Total Marks: 50**

Course Objectives:

I. To collect information on novel and latest development in core and allied area of the subject.
II. To encourage the process of independent thinking and working together in a group.
III. To implement innovative ideas for social benefit.
IV. To develop the ability to describe, interpret and analyze technical issues.
V. To improve the ability of presentation skill and communication techniques.

1. Student shall select a topic for seminar which is not covered in curriculum.
2. Topics shall be registered within a month after beginning of VII Semester and shall be approved by the concerned guide and Program Head.
3. Students should know the functional and technical details of selected topic after carrying out the conceptual study.
4. Before the end of semester, student shall deliver a seminar and submit the seminar report in following format:
   Introduction
   Literature Survey
   Concept

Functional and Technical Details
Future scope
Applications
Comparison with similar topics / methods
References

5. Student shall deliver a seminar based on submitted report. The presentation and oral examination on selected seminar topic shall be assessed by panel of examiners

Note:

ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Seminar Topic and the knowledge acquired. The seminar shall be assessed by the examiner panel consisting of Project Guide, Course Coordinator Seminar and Expert appointed by Program Head.

Course Outcomes: After completion of course, student will be able to:

MEU709.1 Identify and compare technical and practical issues related to the area of course specialization.
MEU709.2 Outline interpreted bibliography of research demonstrating scholarly skills.
MEU709.3 Prepare a well organized report employing elements of technical writing and critical thinking.
MEU709.4 Demonstrate the ability to describe, interpret and analyze technical issues.
MEU709.5 Apply principles of ethics and standards, skill of presentation and communication techniques.
MEU709.6 Work in a group to develop the leadership/interpersonal skills for finishing task within timeframe.

MEU710 INDUSTRIAL TRAINING / VISIT

Teaching Scheme: 00 **Total: 00** **Credits: 02**
Evaluation Scheme: 50 ICA **Total Marks: 50**

Industrial Training shall have an option of Industrial Visit.

Industrial Training: List of renowned industries shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal and with the consultation of Industry personnel, 02 weeks trainings shall be arranged during the vacations (after the VI semester). The students may be permitted to undergo the trainings of 02 weeks as per their choices for which all the official formalities will be completed by the students under the guidance of course coordinator. The students shall submit the report based on the Industrial training to the course coordinator which will be evaluated during the VII semester

Industrial Visit: An Industry Visits to minimum three industries shall be arranged for the students unable to complete the Industrial Training. The visit shall be arranged preferably during the vacation period. However in non-availability of permission for the visit during vacation period,

same may be arranged during the regular VII semester. The students will be required to submit the report based on the Industrial Visit which will be evaluated by the course coordinator

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the training/visits and knowledge / skill acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head

MEU711 INDUSTRIAL LECTURE-II

Teaching Scheme: 01T **Total: 01** **Credit: 01**
Evaluation Scheme: 25 ICA **Total Marks: 25**

List of renowned persons from industry shall be prepared by the Departmental Coordinator of T & P Cell for the course. After approval from the Principal, Minimum twelve Industrial lectures shall be arranged, preferably once a week, which shall be delivered by the experts/Officials from Industries/Govt. organizations/ Private Sectors/Public Sectors covering the various aspects.
The assignments based on the Industry Lecture-I and Industry Lecture-II will be evaluated during VII semester

Topics of Industrial Lectures shall be Technical in nature and should not be the specific contents from the curriculum.

Students shall submit the report based on lectures.

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the lectures and knowledge acquired. The technical report submitted by the students shall be assessed, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by the Program Head

MEU712 SELF STUDY-III

Teaching Scheme: 00 P **Total: 00** **Credit: 02**
Evaluation Scheme: 25 TA **Total Marks: 25**

Self Study-III is based on one class test each on the basis of 20% curriculum of the courses MEU701 Refrigeration and Air Conditioning, MEU702 Computer Aided Design, MEU703 Elective I declared by the respective course coordinator at the beginning of the semester.

MEU801 INTERNAL COMBUSTION ENGINES

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs.30 min.

Course Objectives:

I. To understand types and configuration of spark ignition and diesel engines
II. To evaluate the engine performance parameters such as *bmep*, torque, *bsfc* and their relationship to operating conditions with conventional and alternative fuels and compare the performance parameters and emissions
III. To analyze air-standard, fuel-air and actual cycles of engine operation
IV. To understand the combustion process in both spark ignition and diesel engines with regards to flame structure, cycle-to-cycle variation, knock, ignition, fuel injection, octane number, ignition delay and cetane number
V. To investigate the constituents of engine exhaust emissions, influence of engine operating parameters on emissions, exhaust after treatment
VI. To introduce students to future internal combustion engine fuels and technology

Types of Cycles and their Analysis: Classification of I. C. engines, details of two stroke and four stroke cycles; air standard cycles, fuel air cycle and actual cycle, effect of variation of specific heat, dissociation, brief review of other losses

Fuels and alternative fuels: Elementary treatment to conventional and non-conventional fuels, fossil fuels and their limitations, potential alternative fuels-liquids and gaseous, additives and their functions.

Studies of fuel injection pump: Their working, different types of fuel feed systems, studies of injectors, nozzles, Bosch type fuel pump.

Combustion SI Engine: Combustion in SI engine, stages of combustion, normal and abnormal combustion, detonation, pre ignition, factors responsible for abnormal combustion, effect of detonation. octane rating of fuel, requirement of combustion chambers for SI engines, important types, relative advantages and disadvantages and application.

Combustion in CI Engine: Stages of combustion in CI engines, delay period, factor affecting delay period, effect of change in delay period. diesel knock, cetane rating, requirements of combustion chamber for CI engines, methods of generating turbulence in combustion chamber, types of combustion chambers for CI engines.

Performance test on IC engines: Methods of determination of BP, heat balance sheet, various modes of tests such as 5 mode, 8 mode, and 13 mode test.

Principles of Supercharging: Arrangements for supercharging, advantages and limitations of supercharging.

Review of Emissions from IC Engines: Effects of emissions on human health, causes of formation and approaches to control these pollutants, exhaust gas recirculation, water injection, after treatment technology, SCR, DPF, measurement of smoke, CO, HC, various smoke meters, infra Red detector, study of emission norms, BIS, EURO.

Recent trends in IC engine technology:

For SI engine: MPFI, direct in cylinder injection, after treatment, multi spark plug technology, variable valve timing

For CI engine: CRDI, catalytic convertor, microprocessor controls.

Text books:

1. Internal Combustion Engines, Ganesan V, Tata McGraw Hill, New Delhi, 1994
2. A course in Internal Combustion Engines, M. L. Mathur and R. P. Sharma, Dhanpat Rai and Sons, Delhi, 1994

Reference Books:

1. Internal Combustion Engines Fundamentals, John B. Heywood, McGrawHill, 1988.
2. Internal Combustion Engines, Colin R Ferguson, John Wiley and Sons, New York, 1986
3. Engineering Fundamentals of the Internal Combustion Engine, Pulkrabek Willard W, PHI, 2007

Course Outcomes: After completion of course, student will be able to:

MEU801.1 Identify the engine operation and apply engineering science (thermodynamics, fluid mechanics, heat transfer) to analyze the operation and performance of engines

MEU801.2 Demonstrate knowledge of the operating characteristic and thermodynamic analysis of common IC engine cycles

MEU801.3 Compare the engine performance and combustion characteristics for conventional and alternative fuels

MEU801.4 Identify the operational parameters governing exhaust emissions and investigate the emission control technologies

MEU801.5 Acquaint with future engine technologies and emission norms

MEU802 MECHATRONICS

Teaching Scheme: 03 L + 00T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15CT2 + 10TA + 60ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To provide knowledge on electrical circuits, signal conditioning
II. To make familiar about control system and power electronics in designing Mechatronics system

Introduction: Scope and applications of Mechatronics, Measurement System with its constituent elements; Open and Closed Loop Systems; Sequential Controllers; Micro-processor Based Controllers.

Electronics for Mechanical Engineers: Introduction to Conductors, Insulators and Semiconductors, Passive components used in Electronics, Transformers, Semiconductors, Transistors, Silicon Controlled Rectifiers, Integrated Circuits, Digital Circuits.

Construction and Configuration of CNC System: Machine Structure, Slide ways, Spindle, Drive Units, Elements of Motion Transmission, Location of Transducers/Sensors/Control, Configuration**,** Interfacing, Monitoring, Diagnostics, Machine Data, Compensations for Machine Accuracies.

Feedback System Devices: Sensors, Transducers, Types, Contact & Non Contact types, performance, Applications.

Mechanical Actuation System: Types of Motion, Kinematics chains, Cams, Gear Trains, Belt and Chain Drives, Bearings, Mechanical aspects of Motor Selection.
Electrical Actuation System: Electrical Systems, Mechanical Switches, Solid-State Switches, Solenoids, D.C. Motors, A.C. Motors, Stepper Motors.
Pneumatic & Hydraulic Actuation System: Actuation systems, Pneumatic and hydraulic systems, Directional control valves, Cylinders, Process control valves, Different control, Rotary actuators.
Digital Logic and Programmable Logic Controllers : A Review of Number Systems & Logic Gates; Boolean Algebra; Kanaugh Maps; Sequential Logic; Basic Structure of Programmable Logic Controllers; Input/ Output Processing; Programming; Timers, Internal Relays and Counters; Master & Jump Controls; Data Handling; Analogue Input/ Output; Selection of a PLC; Problems.

Text Books:

1. Mechatronics, HMT, Tata McGraw Hill, First Edition, 2005
2. Electronic Control Systems in Mechanical and Electrical Engineering, Bolton W., Pearsons Education, Third Edition, 2007

Reference Books:

1. Hydraulics and Pneumatics, S. Ilango, PHI, edition 2008
2. Feedback Control Systems, Bakshi U.A. ,Goyal S.C.,Technical Publications,Pune,2nd reprint 2003

Course Outcomes: After completion of course, student will be able to:
MEU802.1. Describe the mechatronic systems and overview of control systems & actuators.
MEU802.2. Differentiate between various sensors, transducers and actuators and their applications.
MEU802.3. Relate various signal conditioning units, amplifiers, logic gates and their role in programmable logic controllers.

MEU803 ELECTIVE- II
(A) POWER PLANT ENGINEERING

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**
Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2hrs.30 min.

Course Objectives:

I. To study basic power plants, site selection, comparison, working principle of hydro, thermal, and nuclear power plants with economics of power generation.
II. To study the working of various nuclear power plants along with nuclear waste disposal.
III. To study the fuels for thermal power plants including handling and storage, principle of fluidized bed combustion.

IV. To study the Working principle and thermodynamic analysis of Rankine cycle, steam nozzle and condenser.

V. To study the constructional details of impulse and reaction turbines along with velocity diagrams.

Introduction: Sources of Energy, Energy crisis and Development of Power in India.

Steam power plant: Plant Layout, Working of different Circuits, Types of coal, Properties of coal, coal handling equipments: traveling grate stokers, spreader stokers, retort stokers, overfeed and underfeed fuel beds, pulverized fuel burning system and its components, combustion needs and draught system, cyclone furnace, design and construction, Dust collectors, cooling towers and heat rejection. Corrosion and feed water treatment, Ash handling systems.

Internal combustion engine power plant: Introduction – IC Engines, Diesel power plant types, and construction– Plant layout with auxiliaries – fuel supply system, air starting equipments, lubrication and cooling systems – super charging.

Gas turbine power plant: Introduction-classification-construction-Layout with auxiliaries, Principles of working of closed and open cycle gas turbines. Combined Cycle Power Plants and their comparison.

Hydro-electric power plant: Water power – Hydrological cycle, flow measurement – drainage area characteristics – Hydrographs – storage and Pondage – classification of dams and spill ways. Hydro-projects Classification – Typical layouts – plant auxiliaries – plant operation pumped storage plants.

Non-conventional power sources: Utilization of Solar- Collectors- Principle of Working, Wind Energy – types – HAWT, VAWT -Tidal Energy, Solar energy, Fuel cells, Thermo electric and Thermo ionic, MHD generation.

Nuclear power plant: Nuclear fuel – breeding and fertile materials – Nuclear reactor types & their operation, Pressurized water reactor, Boiling water reactor, sodium-graphite reactor, fast Breeder Reactor, Homogeneous Reactor, Gas cooled Reactor, Radiation hazards and shielding – radioactive waste disposal.

Power plant economics & Environmental issues: Capital cost, investment of fixed charges, operating costs, general arrangement of power distribution, Load curves, Definitions of connected load, Maximum demand, demand factor, average load, load factor, diversity factor – related exercises. Effluents from power plants and Impact on environment, pollutants and pollution standards, Methods of Pollution control.

Text Books

1. A Text Book of Power Plant Engineering, R. K. Rajput, Laxmi Publications, New Delhi, 1995
2. A Course in Power Plant Engineering, S.C. Arora and S. Domkundwar, Dhanpat Rai, 1988

Reference Books

1. Power Plant Engineering, P.K.Nag, 2nd Edition, Tata McGraw-Hill Education, 2002
2. Power Plant Technology, M. M. ElWakil, McGraw-Hill, 1984
3. Power plant Engineering, K. K. Ramalingam, Scitech Publications (India) Pvt. Ltd., 2010
4. An Introduction to Power Plant Technology, G.D. Rai, 3rd Edition, Khanna publications, 1996
5. Power plant Engg, C. Elanchezhian, I K International Publishing House, 2007

Course Outcomes: After completion of course, student will be able to:

MEU803.1 describe the working principles of various power plants and their selection
MEU803.2 Identify the fuels for thermal power plants along with fluid handling systems.
MEU803.3 Describe the principle of working of various nuclear power plants, like BWR, PWR, CANDU types
MEU803.4 Describe the principles of working of high pressure boilers.
MEU803.5 Analyze the improved Rankine cycle to evaluate its performance.
MEU803.6 Evaluate cost of power generation.

MEU803 ELECTIVE- II
(B) PRODUCTION MANAGEMENT

Teaching Scheme: 03 L + 00 T **Total: 03** **Credits: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2hrs.30 min.

Course Objectives:

I. To produce the goods as per the quality demanded by the customers in most economic manner.
II. To sustain as well as to increase the level of customer satisfaction.
III. To make improvement in existing goods and services by regular innovations
IV. To maintain inventory at such levels that there may not be the blockage of working capital due to excessive stock and the production may not hamper due to unavailability of stock.
V. To ensure uninterrupted supply of goods and services in right quantity at right time and at right place.
VI. To keep proper maintenance of plant and machinery

Introduction to production and operation management

Introduction, evaluation of production management, concept of production, production system, classification of production system, production management, objective of production management. Plant location and layout, Introduction and meaning, need for selecting a suitable location, factor influencing the plant location, location theories, location economics, objectives and principles of plant layout, classification, organization of physical facilities.

Materials management

Introduction , meaning and scope, material planning parameters and procedures of purchasing, selection of supplier, stores management, codification and classification, inventory management, inventory control techniques, standardization and simplification and value analysis and engineering, EOQ, replenishment systems. Material handling-introduction and meaning, objectives and principles of material handling, selection of material handling equipments material handling equipments and guidelines for its utilization, relationship between plant layout and material handling

Production planning and control

Introduction, objectives and meaning of PPC**,** Phases of PPC, functions of PPC, operation planning and scheduling system, aggregate planning, master production schedule, routing, scheduling- inputs, strategies, types and methodology. Maintenance management**,** objective and types of maintenance, Maintenance planning and scheduling, control of waste and disposal of waste.

Work-study and productivity

Work and method study- objectives, scope of method study, steps involved in method study, recording techniques used in method study, motion study- principles, recording techniques, work measurement- objectives and methods, time study, steps in time study, computation of standard time and allowances. Factor influencing productivity, total and partial productivity measures, productivity improvement techniques.

Capacity planning: Roll of capacity planning in manufacturing, planning and control systems, capacity planning and control techniques. JIT in manufacturing planning and control, leveling the production, JIT applications, inventory control**,** inventory problems Computer aided materials management material requirement planning, Approaches to CAPP

Text Books:

1. Production and operations management, S. Anil Kumar and N. Suesh, ,New Age International Publishers
2. Production and operations management, P. Rama Murthy, New Age International Publishers Adam, Production and operations management
3. Production and operations management, K. C. Arora, Laxmi Publications, New Delhi

Reference Books:

1. Production and operations management, Buffa,
2. Materials management, PHI Publishers, Datta,

Course Outcomes: After completion of course, student will be able to:

MEU803.1 Explain major concepts in the functional areas of accounting, marketing, finance & management

MEU803.2 Evaluate the legal, social, and economic environments of business

MEU803.3 Describe the global environment of business

MEU803.4 Describe and explain the ethical obligations & responsibilities of business

MEU803.5 Apply decision-support tools to business decision making

MEU803.6 Apply knowledge of business concepts and functions in an integrated manner

MEU803.7 Use specialized knowledge in Operations Management to solve business processes.

MEU803 ELECTIVE- II

(C) MACHINE TOOL DESIGN

Teaching Scheme: 03 L + 00T **Total = 03** **Credits: 03**

Evaluation Scheme: 15 CT1 + 15CT2 + 10TA + 60ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To Study of various machine internal parts

II. To understand the dynamics of machining by varying parameters

III. To learn the automation of machine parts

Introduction: General requirements of Machine Tool Design, Kinematics of machine tool, Various driving systems used in machine tools, Mechanical, Electrical, Hydraulic, Stepless regulation of speeds

Regulation of Speed and Feed Rates: Basic design consideration in the design of variable speed range in the machine tools, Layout of speed in geometric, logarithmic and arithmetic progression, Saw diagram, Range ratio, Graphical representation of speed on Structural and Ray diagram, Design of speed and feed boxes and their classification, Gear box design

Machine Tool Structure (bed, column, cross-rail): Functions and their requirements, design criterion for machine tool structure, design procedure, factors affecting stiffness of machine tool structure and their profile

Machine Tool Spindles: Functions of spindle, Materials and requirements for spindles, Design of spindles, Effect of Machine Tool Compliance on Machine Accuracy, Bearings for spindles

Machine Tool Guide-ways and Slide-ways: Design based on force of beds, slide ways, carriage, tables of Lathes, shapes of guide-ways and slide-ways of Milling machines, Materials, Methods of adjusting clearance in guide-ways, Design of slide-ways for wear resistance, Hydraulic guide-way, Antifriction guide-way, Protecting devices for slide-way

Vibrations of Machine Tools: Effects of vibration on machine tool on cutting controls, work piece, tool life. Sources of vibrations, Types of vibrations (forced, chatter, stickup vibrations) and its minimization, Shock absorbers

Control systems in Machine Tools: Functions, Requirements and classification, control systems for speeds and feeds, various motions etc. Manual and Automatic control systems**.**

Machine Tools Testing: Static and Dynamic rigidity, Methods of increasing rigidity of structure, Procedure for assessing dynamic stability, Dynamic characteristics, Experimental determination of dynamic characteristics of machine tool, Dynamic characteristics of cutting process, Stability analysis, Static and dynamic testing of machines as per Schlesinger's test and Tobias stability.

Text Books:

1. Machine Tool Design and Numerical Control, N. K Mehta, Tata McGraw Hill, Second Edition, 2005
2. Design of Machine Tools, D. K. Pal and S. K. Basu, Oxford-IBH, Second Revised Edition, 2005

Reference Books:

1. Machine Tool Design Handbook, Central Machine Tool Institute, Bangalore, Tata McGraw Hill, First Edition, 2005
2. Principles of Machine Tools, A. Bhattacharya and G. C. Sen, New Central Book Agency, Calcutta, 3rd Edition,1973
3. Numerical Control and Computer Aided Manufacturing, T. Kundra, P.N. Rao, N. K. Tiwari, Tata McGraw Hill, 3rd Edition, 2000

Course Outcomes: After completion of course, student will be able to:

MEU803C.1. Demonstrate knowledge of standard machine tool movements

MEU803C 2. Define dimensional measurement and explain its importance

MEU803C.3. Describe tool design methods and punch and die manufacturing techniques

MEU803C.4.Select material for cutting tools and gages; classify various cutting tools and gages and identify their nomenclature
MEU803C.5. Describe the principles of clamping, drill jigs and computer aided jig design
MEU803C.6. Design fixtures for milling, boring, lathe, grinding, welding; identify fixtures and cutting tools for NC machine tools
MEU803C.7.Explain the principles of dies and moulds design

MEU 803 ELECTIVE – II
(D) LEAN MANUFACTURING

Teaching Scheme : 03 L + 00 T Total 03 Credit : 03
Evaluation Scheme : 15 CT1 + 15 CT2 +10 TA+ 60 ESE Total Marks :100
ESE duration : 2 hrs 30 min.

Course Objectives:

I. Understand the basic lean manufacturing
II. Explain the concepts of primary tools of lean manufacturing
III. Describe Secondary tool of lean manufacturing
IV. Learn the Different approaches for lean manufacturing implementation
V. Understand lean manufacturing assessment

Introduction to lean manufacturing: history, Need, Benefits, Limitations and Applications of lean Manufacturing

Concepts in lean manufacturing: Overview of the Toyota Production System (TPS), Concept of value in lean, concept of waste in lean, Eight sources of waste their causes and remedies.

Elements of lean manufacturing: Primary tools of lean manufacturing such as 5S, Value Stream Mapping, Tool Productive Maintenance and work cell

Secondary tool of lean manufacturing: Just in time Single minute exchange of die, design of manufacturing and assembly, poke yoke, Kanban system, Visual management, Lean Vs Push Manufacturing.

Implementation of lean Manufacturing: Different approaches for lean manufacturing implementation, important factors in lean implementation, barriers and limitations in lean implementations.

Lean Manufacturing assessment: introduction to Lean audits, Employee involvement in the change process improvement of working culture by lean Manufacturing.

TEXT BOOKS :
1. Lean thinking , James Womack and Daniel Jones, Free press, Revised Edition, 2003

2. The Toyota Way of Fieldbook, Jeffery Liker and David Meier, McGraw-Hill, 2006
3. The Kaizen Blitz by Laraia, Moody and Hall , Weily ,1999

REFERENCE BOOKS :

1. Lean production Simplified , Pascal Dennies , Productivity Press, 2007

Course Outcomes: After completion of course, student will be able to:

MEU803.1 Explain the concept, history and application of lean manufacturing
MEU803.2 Apply the elements and secondary tools of lean manufacturing
MEU803.3 Implement proper approach of lean manufacturing to real life situation
MEU803.4 Apply the process of lean audit

MEU804 ELECTIVE- III
(A) AUTOMOBILE ENGINEERING

Teaching Scheme : 03L+00T Total: 03 Credit: 03
Evaluation Scheme: 15CT1 + 15CT2 + 10TA + 60 ESE Total Marks: 100
Duration of ESE : 2 hrs. 30 min.

Course Objectives:

I. Introduction to engineering analysis of the automobile and its sub-systems.
II. Application of engineering principles to automotive design.
III. Familiarization with modelling and analysis methods.
IV. Familiarization with the automotive industry and its terminology

Engine: Introduction, History, Classification of automobiles, Major components of automobile and its functions, Chassis Types, Subsystems of automobile.

Engine Part and Mounting: Functions and locations, Power for propulsion, Vertical and horizontal engine acceleration, Merits and demerits, Hill climbing, Engine parts-types, Construction and functions

Multiple Cylinder Engine: General considerations, Engine balance, Vibration, Firing order, Road performance curves, Engine maintenance and trouble shooting, Electronic engine Management

Fuel System: Types of Inlet manifold, Fuel pumps, fuel injectors for diesel engine, fuel filters, fuel gauges, Air filters, Basic principles & working of MPFI and CRDI, Auto emission and its control

Cooling system: Purpose, Types of cooling system, Water jacket, cooling water additives, Liquid water pump and radiators, By pass recirculation system, Closed System, Temperature indicator, Anti-freeze mixtures, Troubles and remedies of cooling system, Heating and air conditioning

Ignition System: Battery: construction, Types, Rating, Battery coil and magneto ignition system, Ignition timing and its effect on engine performance, Ignition advance mechanisms, Electronic ignition system. Intelligent ignition system in two and four wheelers

Electrical Setup:. Battery Capacity, Standard capacity rating, Battery life, battery testing, recharging of battery, starter motor drive - Bendix drive, Over running clutch drive, Solenoid switch

Transmission System: Clutch, Construction, Operation, Types, Requirements, Maintenance and trouble shooting, Gear Boxes, Sliding mesh, Constant mesh and synchromesh gear box, Double synchromesh type, over drives, Automatic transmission system, , CVT, Four wheel drive, Torque tube drive, Differential, Propeller shaft and universal joint rear axle assembly, steering and front axle, Function, Types of steering, Linkages, Steering gears, Steering gear ratio, Power steering

Wheels and Tyres: Alignment, Balancing, Camber, Castor, King pin inclination, Toe-in & Toe-out effects, Types of tyres, Tyre thread maintenance

Brakes: Mechanical, hydraulic brakes, disc brakes, Air brakes, and Vacuum brakes, Fault finding and maintenance of brakes, antiskid brake control system

Suspension System: Introduction**,** Need of suspension, Types, Maintenance and Trouble shooting

Text Book:

1. Automobile Engineering, K. K. Jain and R. B. Asthana, 2nd Edition, Tata McGraw Hill publishing Co. Ltd., New Delhi, 2005
2. Automotive Mechanics, Willam H. Crouse, Donald L. Anglin, 1st Edition, Tata McGraw Hill Publishing Co. New York, 2002

Reference Books:

1. Automotive Mechanics, Joseph Heitner, 2nd Edition, CBS Publisher, New Delhi, 2004
2. Automobile Engineering, G. B. S. Narang, 2nd Edition, Khanna Publication, New Delhi, 2006

Course Outcomes: After completion of course, student will be able to:

MEU804.1 Demonstrate the vehicle construction, chassis, lubrication system and cooling system inautomobile, 3-way catalytic converter.

MEU804.2 Describe the principle and working of Carburettors, CRDI, MPFI, electronic fuel injection system and Ignition system.

MEU804.3 Differentiate between clutch, gear box, rear axle drives, fluid flywheel, and torque converter.

MEU804.4 Identify the wheels, tyres, steering gear box, suspension system-telescopic, and leaf spring

MEU804.5 Appraise the recent trends in alternate fuels and automobile safety system.

MEU804 ELECTIVE- III

(B) MECHANICAL VIBRATIONS

Teaching Scheme : 03L+00T Total: 03 Credit: 03
Evaluation Scheme: 15CT1 + 15CT2 + 10TA + 60 ESE Total Marks: 100
Duration of ESE : 2 hrs. 30 min.

Course Objectives:

I. To understand the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions
II. To develop the ability to analyze the mathematical model of a linear vibratory system to determine its response
III. To develop the ability to determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation
IV. Able to make free and forced vibrations (harmonic, periodic, non perodic) vibration analysis of single and multi degree of freedom linear systems

Fundamentals of Vibration:

Basic concepts, combination of springs, masses, Harmonic motion; harmonic analysis, Fourier series expansion, single degree system –undamped ,with viscous damping, with coulomb

damping response to harmonic single degree freedom forced vibration with elastically coupled viscous dampers, frequency response

Transient Vibration of single Degree of freedom Systems: response to impulse, arbitrary excitation, Laplace formulation, shock isolation, numerical methods for irregular forcing

Two Degree of Freedom System: Free vibration of spring, coupled system, mass coupled system, Bending vibration of two degree of freedom system, forced vibration, vibration absorber, Vibration isolation

Introduction to Multi Degree of Freedom Systems: Normal mode of vibration, Lagrange's equation

Vibration of Continuous Systems: Systems governed by wave equations, vibration of strings, vibration of rods, Lateral vibration of beams, effect of rotary inertia and shear deformation, vibration of membranes

Vibration Absorber

Tuned absorber, determination of mass ratio. Tuned and damped absorber, unturned viscous damper

Experimental Methods in Vibration Analysis

Vibration instruments, vibration exciters, measuring devices, vibration tests, free and forced vibration tests, Examples of vibration tests

Text Books:

1. Mechanical Vibrations, Singiresu S. Rao, Fourth Edition 2007, Pearson Education
2. Mechanical Vibrations, G.K. Grover, Seventh Edition, 2003, New Chand & Brothers
3. Mechanical Vibrations,Er.J.S.Mehta, First edition, 2012, S. Chand

Reference Books:

1. Theory of Vibrations with Applications, Willium T. Thomson, Marie Dillon Dahleh, Chandramouli Padmanabhan Fifth Edition 2008 Pearson Education
2. Theory and Practice of Mechanical Vibrations, J.S. Rao, K. Gupta New Age International

Course Outcomes: After completion of course, student will be able to:

MEU804B.1 Developed the skills to obtain mathematical model of real life engineering systems

MEU804B.2 Construct the equations of motion for free-body diagrams

MEU804B.3 Solve for the motion and the natural frequency of (1) a freely vibrating single degree of freedom undamped motion and (2) a freely vibrating single degree of freedom damped motion.

MEU804B.4 Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force

MEU804B.5 Solve Vibration problems that contain multiple degrees of freedom

MEU804 ELECTIVE- III
(C) FINITE ELEMENT METHOD

Teaching Scheme: 03 L + 00 T **Total: 03** **Credit: 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**
Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To develop a practical approach to Finite Element Method (FEM) as tool to solve engineering problems.
II. To introduce the FEM and its applications to common problems in engineering, especially structural and thermal areas.

Introduction: Basic concept, Historical background, engineering applications, general description, comparison with other methods, Need for weighted – integral forms, relevant mathematical concepts and formulae, displacement transformation matrix, stiffness matrix, weak formulation of boundary value problems, variational methods, Rayleigh –Ritz method and weighted residual approach

Finite Element Techniques: Model boundary value problem, finite element discretization, element shapes, sizes, and node locations, interpolation functions, shape functions, derivation of element equations, connectivity, boundary conditions, principal of potential energy, FEM solution, post-processing, Compatibility and completeness requirements, convergence criteria, higher order and isoparametric elements, natural coordinates, Langrange and Hermit olynomials

Applications to solid and structural mechanics problems: External and internal equilibrium equations, one-dimensional stress-strain relations, plane stress and strain problems, strain displacement relations, boundary conditions compatibility equations, analysis of trusses, frames and solids of revolution, computer programs.

Application to heat transfer problem: Variational approach, Galerkin approach, one-dimensional and two-dimensional steady state problems for conduction, convection and radiation

Application to fluid mechanics problems: In viscid incompressible flow, potential function and stream function formulation, incompressible viscous flow, stream function, velocity-pressure and stream function-vorticity formulation, solution of incompressible and compressible fluid film lubrication problems

Text Books:

1. An Introduction to Finite Element Method, J.N. Reddy, Tata McGraw Hill, New Delhi, 2nd Edition, 2005
2. Finite Element Analysis, P. Seshu, Prentice Hall India, New Delhi, First Edition, 2006

Reference Books:

1. Introduction to Finite Element Method, C S Desai, J F Abel, CBS Publishers, 2nd Edition, 2005
2. The Finite Element Method in Engineering, S. S. Rao, Elsevier India, Fourth Edition 2008

Course Outcomes: After completion of course, student will be able to:

MEU804C.1 Synthesise information and ideas for use in the evaluation process.
MEU804C.2 Develop governing equations of mechanical systems using domain knowledge and mathematical principles and apply principles of variation and integral forms of solution to formulate finite element problem.
MEU804C.3 Analyze and build FEA model for complex engineering problems.

MEU804C.4 Perceive the fundamental theory of the finite elements.

MEU804C.5 Develop skills to model the behaviour of structures under mechanical and thermo-mechanical loads.

MEU804 ELECTIVE- III
(D) COMPUTER INTEGRATED MANUFACTURING SYSTEMS

Teaching Scheme: 03 L + 00 T **Total : 03** **Credit : 03**

Evaluation Scheme: 15 CT1 + 15 CT2 + 10 TA + 60 ESE **Total Marks: 100**

Duration of ESE: 2 hrs. 30 min.

Course Objectives:

I. To learn automation, CIMS and various manufacturing systems.
II. To learn about CNC, robotics and material handling processes.
III. To learn the fundamentals of part programming, , computer aided process Planning.

Automation: Types, Automation for mass manufacturing and assembly, Automation of continuous processing systems, Detroit type automation, Automated flow lines, Methods of work transport, Partial automation, Assembly system and line balancing

Computer Integrated Manufacturing System: Introduction , Integration and Rationalization, Sequence of Functions in CIM, Elements of CIM system, CIM wheel, Benefits of CIM, Applications of CIM system.

Introduction to Various Manufacturing Systems: Single Station Manufacturing Cells, Group Technology, Cellular Manufacturing, Flexible Manufacturing Systems, Manual Assembly Lines, Transfer Lines, Automated Assembly Systems.

Computer Numerical Control: Fundamentals of NC machines, Classification of Numerical Control Machine, Basic components of NC system, Problems in conventional NC, Computer numerical control, CNC system design, direct numerical Control system, Adaptive control system.

Fundamentals of Part Programming: NC words, Rapid Transverse Functions, Linear Interpolation Functions, Circular Interpolation Functions, Dwell Functions, Programming Formats, Writing a Part Program, Cutter Radius Compensation.

Robotics: Robot Terminology, Types of Robots, Robot Characteristics, Robot Controllers, End Effectors, Programming of Robot, Robot Application, Benefits of Robot.

Material Handling Systems: Overview of Material Handling Systems, Material Transport Systems like AGVS, Monorail and other Rail Guided Vehicles, Storage Systems.

Computer Aided Process Planning: Role of Process Planning, Approach of Process Planning, Process Planning System, Benefits of CAPP, Advantages of CAPP.

Text Books:

1. Computer Aided Design and Manufacturing , Groover, M. P. , Prentice-Hall of India , 5th Edition ,2005.
2. Automation Production Systems and Computer Integrated Manufacturing, Groover, M.

P., Prentice-Hall of India, 2nd Edition.

Reference Books:

1. CAD/CAM, Zeid Ibrahim, Tata McGraw Hill,1st revised edition,2006
2. Robot System and Analysis, Shah S.K., Tata McGraw Hill ,1st edition, 2008

Course Outcomes: After completion of course, student will be able to:
MEU804.1 Classify automation, CIMS and various manufacturing systems.
MEU804.2 Identify CNC, robotics and material handling processes.
MEU804.3 Apply fundamentals of part programming , computer aided process Planning.

MEU805 INTERNAL COMBUSTION ENGINES LAB

Teaching Scheme: 02P **Total : 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**
Duration of ESE: 3 hrs.

Course Objectives:

I. To make students familiar with the design and operating characteristics of modern internal combustion engines
II. To apply analytical techniques to the engineering problems and performance analysis of internal combustion engines
III. To study the thermodynamics, combustion, heat transfer, friction and other factors affecting engine power, efficiency and emissions
IV. To introduce students to the environmental and fuel economy challenges facing the internal combustion engine

It is representative list of practical. The instructor may choose experiments as per his/ her requirement (so as to cover entire content of the course MEU801 IC Engines) from the list or otherwise. Minimum **Six** experiments should be performed:

1. Trial on Single Cylinder Diesel engine.
2. Trial on Multi Cylinder Diesel engine
3. Trial on Single Cylinder Petrol engine.
4. Trial on Multi Cylinder Petrol engine
5. Trail on VCR Engine
6. Morse test on Diesel engine
7. Morse test on Petrol engine

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions

Course Outcomes: After completion of course, student will be able to:
MEU805.1 Differentiate among different internal combustion engine designs and develop an understanding of real world engine design issues
MEU805.2 Recognize and understand reasons for differences among operating characteristics of different engine types and designs
MEU805.3 Given an engine design specification, predict performance and fuel economy trends with good accuracy
MEU805.4 Exposure to the engineering systems needed to set-up and run engines in controlled laboratory environments
MEU805.5 Develop skills to run engine dynamometer experiments
MEU805.6 Compare and contrast experimental results with theoretical trends, and to attribute observed discrepancies to either measurement error or modeling limitations
MEU805.7 Develop an ability to optimize future engine designs for specific sets of constraints (fuel economy, performance, emissions)

MEU806 MECHATRONICS LAB

Teaching Scheme: 02 P **Total : 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total Marks: 50**
Duration of ESE: 3 hrs.

Course Objectives:

I. Develop an understanding of the basic elements underlying mechatronic systems: analog electronics, digital electronics, sensors, actuators, microcontrollers, and embedded software.
II. Understand how to interface electromechanical systems to microcontrollers.
III. Gain hands-on experience with commonly used electronic test and measurement instrumentation.
IV. Improve written communication skills through laboratory and project reports.
V. Gain practical experience in applying knowledge gained in the course through a hands-on project.

It is representative list of practicals. The instructor may choose experiments as per his / her requirements (so as to cover entire content of the course MEU802 Mechatronics) from the list or otherwise. Minimum **Six** experiments should be performed:

1. Design and construction of Printed Circuit Board for confirmation of the sensor signal processing function.
2. Study the use of Proximity sensors to control the motion of objects using Mechatronics cube Assembly for conveyor system.
3. Performance of various elements of Mechatronics Cube Assembly for processing system
4. Performance of various elements of Mechatronics Cube Assembly for Automated Storage and Retrieval System.
5. Design of control algorithm to generate a “Traffic sequence” with appropriate timing.
6. PLC programming to sequentially moving parts on the conveyor system.

7. PLC programming to coordinate the functions in ASRS.-2 experiments.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions

Course Outcomes: After completion of course, student will be able to:

MEU8061. Analyse the velocity and direction of fluid power circuit with the help of simulation software.

MEU806 2. Demonstrate the fluid power circuits using PLC.

MEU806 3. Observe interface between stepper motor and 8051 micro controller.

MEU806 4. Simulate the basic electric, hydraulic and pneumatic system using simulation software.

MEU807ELECTIVE – III LAB.
(A) AUTOMOBILE ENGINEERING LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**

Evaluation Scheme: 25 ICA +25 ESE **Total Marks: 50**

Duration of ESE: 3 hrs.

Course Objectives:

I. To make the student understand about the various components of petrol engine and diesel engine by dismantling and assembling the parts like carburetor, alternator, water pump etc and we have the multi cylinder diesel and petrol engines for easy learning.

II. To make the student understand about the various electrical components of an automobile and the wiring circuits and to test the starter motor, ignition system, batteries etc. Study on engine components. Fuel systems. Ignition systems - Transmission systems - Steering systems. Suspension and braking systems. Layout of electrical wiring - Light and heavy vehicles.

It is representative list of practical. The instructor may choose minimum **Six** experiments as per his/her requirement (so as to cover entire content of course MEU804 (1) Automobile Engineering from the list given below:

1. Study of lubricating system.
2. Circuit tracing of 4 wheeler carburetor
3. Study of wiring diagram of electrical system.
4. Fault finding of ignition system.
5. Setting of ignition timing and spark plug gap.
6. Disassembly & assembly of two types of gear boxes.
7. Study of brake systems.

8. Study of steering system & its adjustment.
9. Disassembly & assembly of two stroke engine.
10. Exhaust analysis of S.I. Engine studies and measurement.
11. Smoke measurement in Diesel exhaust.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions

Course Outcomes: After completion of course, student will be able to:

MEU807A.1 Describe, explain and demonstrate the various aspects of automobile components and system which include engine components, fuel and ignition systems, transmission systems and steering systems, suspension and braking systems and electrical and electronics system.

MEU807ELECTIVE – III LAB.
(B) MECHANICAL VIBRATIONS LAB

Teaching Scheme: 02 P **Total: 02** **Credit: 01**

Evaluation Scheme: 25 ICA +25 ESE **Total Marks: 50**

Duration of ESE: 3 hrs.

Course Objectives:

I. To understand the need and importance of vibration analysis in mechanical design of machine parts that operate in vibratory conditions
II. To develop the ability to analyze the mathematical model of a linear vibratory system to determine its response
III. To develop the ability to determine vibratory responses of SDOF and MDOF systems to harmonic, periodic and non-periodic excitation
IV. Able to make free and forced vibrations (harmonic, periodic, non perodic) vibration analysis of single and multi degree of freedom linear systems

It is representative list of practical. The instructor may choose minimum **Six** experiments as per his/her requirement (so as to cover entire content of course MEU804 (2) Mechanical Vibrations) from the list given below

1. Verification of principle of gyroscope and gyroscopic couple, magnitude.
2. Study of any two gyro controlled instruments.
3. To study the dynamic balancing machine and to balance a rotor. (e. g. rotor of electric motor, flywheel, fan etc.)

4. To determine the natural frequency of damped vibration of single degree freedom system and to find its damping coefficient.
5. To verify natural frequency of torsional vibration of two rotor system and position of node.
6. To determine critical speed of single rotor system.
7. To determine resonance frequency of transverse vibration of beam.
8. To determine the frequency response curve under different damping conditions for single degree of freedom system of vibration.
9. To study shock absorbers and to plot transmissibility curve.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of course, student will be able to:

MEU807B.1 Developed the skills to obtain mathematical model of real life engineering systems

MEU807B.2 Construct the equations of motion for free-body diagrams

MEU807B.3 Solve for the motion and the natural frequency of (1) a freely vibrating single degree of freedom undamped motion and (2) a freely vibrating single degree of freedom damped motion.

MEU807B.4 Construct the governing differential equation and its solution for a vibrating mass subjected to an arbitrary force

MEU807B.5 Solve Vibration problems that contain multiple degrees of freedom

MEU807ELECTIVE – III LAB.
(C) FINITE ELEMENT METHODS LAB

Teaching Scheme: 02P **Total : 02** **Credit: 01**

Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**

Duration of ESE: 3 hrs.

Course Objectives:

I. To understand the Stress distribution computation for an element
II. To learn the Deflection in a cantilever / simply supported beam
III. To recognize the Temperature, Velocity & Pressure distribution in mechanical system components

It is representative list of practical. The instructor may choose minimum **Six** experiments as per his/her requirement (so as to cover entire content of course MEU804 (3) Finite Element Method) from the list given below:

The following assignments should be carried out using any of the FEM codes such as ANSYS / NASTRAN // FEMAP / MATLAB etc and a report thereof should be submitted.

1. Stress distribution computation for a cylindrical rod
2. Stress distribution in a flat plate
3. Deflection in a cantilever / simply supported beam
4. Temperature distribution in extended surfaces / fins
5. Velocity distribution in a flow channel
6. Pressure distribution in ducts

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of course, student will be able to:
MEU807C.1 Analyze the Stress distribution computation for an element
MEU807C.2 Perform the Deflection in a cantilever / simply supported beam
MEU807C.3 Identify the Temperature, Velocity & Pressure distribution in mechanical system components
MEU807C.4 Draw inferences FEM analysis of element

MEU807ELECTIVE – III LAB.
(D) COMPUTER INTEGRATED MANUFACTURING SYSTEMS LAB

Teaching Scheme: 02P **Total : 02** **Credit: 01**
Evaluation Scheme: 25 ICA + 25 ESE **Total marks: 50**
Duration of ESE: 3 hrs.

Course Objectives:

I. Develop an understanding of the basic elements of CNC lathe or Milling machine
II. Understand the Robot structure and types of Robot & group technology
III. Learn the Robot programming for simple task like Pick-n-Place in assembly line using Robot programming language
IV. Gain practical experience in applying knowledge gained in the course through a hands-on project.

It is representative list of practical. The instructor may choose minimum **Six** experiments as per his/her requirement (so as to cover entire content of course MEU804 (4) Computer Integrated Manufacturing) from the list given below

1. Write a part program and perform on CNC lathe or Milling machine- 3 experiments.
2. Study of Robot structure and types of Robot.
3. Robot programming for simple task like Pick-n-Place in assembly line using Robot programming language- 3 experiments.
4. Study of any real world application of group technology.

5. Case study on CAPP.

ICA: The Internal Continuous Assessment shall be based on practical record and knowledge/skills acquired. The performance shall be assessed experiment wise by using continuous assessment formats, A&B.

ESE: The end semester Exam for practical shall be based on performance in one of the experiments and may be followed by sample questions.

Course Outcomes: After completion of course, student will be able to:
MEU807D.1 Write a part program and perform on CNC lathe or Milling machine
MEU807D.2 Describe of Robot structure and types of Robot.
MEU807D.3 Perform Robot programming for simple task like Pick-n-Place in assembly line
MEU807D.4 Explore real world application of group technology.
MEU807D.5 Acquire skill to perform Case study on CAPP.

MEU808 PROJECT

Teaching Scheme: 06P **Total: 06** **Credits: 06**
Evaluation Scheme: 75 ICA +100ESE **Total Marks: 175**
Duration of ESE: 3 hrs.

Course Objectives:

I. To perform the test on a model also analyze and discuss the results to draw valid conclusions.
II. To encourage the student for publishing papers in peer reviewed journals/conference proceedings.
III. To reorganize the procedures with a concern for society, environment and ethics.
IV. To develop a prototypes/models, experimental set-up and software systems.
V. To improve the ability of presentation skill and communication techniques.

1. Project work decided in VII semester shall be continued.
2. Students should complete implementation of ideas given in synopsis, so that project work should be completed before end of semester.
3. Students shall submit the final project report in proper format as per guidelines given on the college website which shall include the work of both semesters.
4. For uniform and continuous evaluation, evaluation committee for each group shall be formed by Program Head in which guide must be a member. Internal marks should be awarded by committee at the end of semester based on continuous evaluation.
5. Final examination of project shall include demonstration, presentation of complete work and oral examination based on the project work.

Note:
ICA: The Internal Continuous Assessment shall be based on the active participation of the students in the Project work and knowledge / skill acquired. Oral examination shall be conducted on the Project report, by the panel of examiners consisting of Project Guide, Course Coordinator and Expert appointed by Program Head.

ESE: The End Semester Examination for Project shall consists of Demonstration if any, presentation and oral examinations based on the project report.

Course Outcomes: After completion of course, student will be able to:
MEU808.1. Identify methods and materials to carry out experiments/develop code.
MEU808.2. Reorganize the procedures with a concern for society, environment and ethics.
MEU808.3. Analyze and discuss the results to draw valid conclusions.
MEU808.4.Prepare a report as per recommended format and defend the work.
MEU808.5. Explore the possibility of publishing papers in peer reviewed journals/conference proceedings.
MEU808.6. Work in a group to develop the leadership/interpersonal skills for finishing task within timeframe.

MEU809 SELF STUDY-IV

Teaching Scheme: 00 P	**Total: 00**	**Credit: 02**
Evaluation Scheme: 25 TA		**Total Marks: 25**

Self Study-III is based on one class test each on the basis of 20% curriculum of the courses MEU801 IC Engines, MEU802 Mechatronics, MEU803 Elective II, MEU804 Elective III declared by the respective course coordinator at the beginning of the semester.