Dr. Mahalingam College of Engineering and Technology

(An Autonomous Institution)

Pollachi - 642 003

Curriculum and Syllabus

B.E. MECHANICAL ENGINEERING

SEMESTER I to VIII

2014 REGULATION

(2015 BATCH)

DR MAHALINGAM MCET

COLLEGE OF ENGINEERING AND TECHNOLOGY

Enlightening Technical Minds

DEPARTMENT OF MECHANICAL ENGINEERING (2015 -2019 Batch)

2014 REGULATION

Curriculum for B.E Mechanical Engineering from Semester I to VIII

SEMESTER I

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
140ME0101	Communication Skills - I	2	0	2	3
140ME0102	Engineering Mathematics – I	3	1	0	4
140ME0103	Applied Physics	2	1	0	3
140ME0104	Applied Chemistry	2	1	0	3
140ME0105	Introduction to Engineering	2	0	2	3
140ME0106	Engineering Graphics	1	3	0	4
PRACTICAL					
140ME0107	Engineering Practices Laboratory	0	0	2	1
140ME0108	Physics and Chemistry Laboratory	0	0	2	1
PROFESSIONAL SKILLS					
140ME0109	Promotion of Students' Wellness	0	0	2	1
TOTAL		**12**	**6**	**10**	**23**

SEMESTER II

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
140ME0201	Communication Skills - II	2	0	2	3
140ME0202	Engineering Mathematics – II	3	1	0	4
140ME0203	Material Science	2	0	2	3
140ME0204	Engineering Mechanics	3	1	0	4
140ME0205	Engineering Metrology and Measurements	2	0	2	3
140ME0206	Manufacturing Process - I	3	1	0	4
PRACTICAL					
140ME0207	Manufacturing Process Laboratory- I	0	0	2	1
140ME0208	Computer Aided Drafting and Modeling Laboratory	0	0	2	1
PROFESSIONAL SKILLS					
140ME0209	Sports For Wellness	0	0	2	1
TOTAL		**15**	**3**	**12**	**24**

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SEMESTER III

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
140ME0301	Engineering Mathematics – III	4	0	0	4
140ME0302	Engineering Thermodynamics	4	0	0	4
140ME0303	Manufacturing Processes – II	4	0	0	4
140ME0304	Fluid Mechanics and Machinery	4	0	0	4
140ME0305	Theory of Machines - I	3	0	2	4
140ME0306	Electrical Drives and Controls	2	0	2	3
PRACTICAL					
140ME0307	Manufacturing Processes Laboratory – II	0	0	4	2
140ME0308	Fluid Mechanics and Machinery Laboratory	0	0	4	2
PROFESSIONAL SKILLS					
140ME0309	Personal Effectiveness	0	0	2	1
OCC	One Credit Course	0	0	2	1
TOTAL		**21**	**0**	**16**	**29**

SEMESTER IV

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
140ME0401	Numerical Methods	4	0	0	4
140ME0402	Strength of Materials	4	0	0	4
140ME0403	Engineering Metallurgy	3	0	0	3
140ME0404	Theory of Machines - II	3	0	2	4
140ME0405	Thermal Engineering	4	0	0	4
140ME0406	C-Programming	3	0	2	4
PRACTICAL					
140ME0407	Strength of Materials and Metallurgy Laboratory	0	0	4	2
140ME0408	Thermal Engineering Laboratory	0	0	4	2
PROFESSIONAL SKILLS					
140ME0409	Ethical and Moral Responsibility	0	0	2	1
OCC	One Credit Course	0	0	2	1
TOTAL		**21**	**0**	**16**	**29**

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SEMESTER V

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
140ME0501	Heat and Mass Transfer	4	0	0	4
140ME0502	Design of Machine Elements	4	0	0	4
140ME0503	Design of Hydraulic and Pneumatic Systems	3	0	2	4
140ME0504	Engineering Economics and Cost Analysis	3	0	0	3
140ME0505	Microcontroller and Applications	3	0	2	4
XXX	Elective- I	3	0	0	3
PRACTICAL					
140ME0507	Heat Power Laboratory	0	0	4	2
140ME0508	Computer Aided Machine Drawing Laboratory	0	0	4	2
PROFESSIONAL SKILLS					
140ME0509	Teamness and Inter-Personal Skills(TIPS)	0	0	2	1
OCC	One Credit Course	0	0	2	1
TOTAL		**20**	**0**	**16**	**28**

SEMESTER VI

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
140ME0601	Finite Element Analysis	4	0	0	4
140ME0602	Design of Transmission Systems	4	0	0	4
140ME0603	Power Plant Engineering	3	0	0	3
140ME0604	Automobile Engineering	3	0	0	3
XXX	Elective II	3	0	0	3
PRACTICAL					
140ME0607	Simulation and Analysis Laboratory	0	0	4	2
140ME0608	Automobile Engineering Laboratory	0	0	4	2
PROFESSIONAL SKILLS					
140ME0609	Campus to Corporate	0	0	2	1
OCC	One Credit Course	0	0	2	1
TOTAL		**17**	**0**	**12**	**23**

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SEMESTER VII

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
140ME0702	Mechatronics	3	0	0	3
140ME0703	Environmental Studies	3	0	0	3
XXX	Elective-III	3	0	0	3
XXX	Elective-IV (Open)	3	0	0	3
PRACTICAL					
140ME0707	Mechatronics Laboratory	0	0	4	2
140ME0708	Product Design Laboratory	0	0	4	2
140ME0709	Innovative and Creative Project	0	0	8	4
TOTAL		**12**	**0**	**16**	**20**

SEMESTER VIII

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
THEORY					
XXX	Elective-V	3	0	0	3
XXX	Elective-VI	3	0	0	3
XXX	Elective-VII	3	0	0	3
PRACTICAL					
140ME0809	Project	0	0	20	10
TOTAL		**9**	**0**	**20**	**19**

SUMMARY	
Core Curriculum Credits	185
Professional Skills Credits	6
One Credit Courses Credits	4
Total No. of Credits	**195**
Core Curriculum Courses	58
Professional Skills Courses	6
One Credit Courses	4
Total No. of Courses	**68**

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ELECTIVES

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
Design Stream					
140ME9111	Automotive Aerodynamics	3	0	0	3
140ME9112	Noise Vibration and Harshness	3	0	0	3
140ME9113	Gas Dynamics and Jet Propulsion	3	0	0	3
140ME9114	Computational Fluid Dynamics	3	0	0	3
140ME9115	Design for Manufacture, Assembly and Environment	3	0	0	3
140ME9116	Product Design and Development	3	0	0	3
140ME9117	Failure Analysis and Design	3	0	0	3
140ME9118	Mechanical System Design	3	0	0	3
140ME9119	Composite Materials	3	0	0	3
140ME9144	Automotive Engine and Its Systems	3	0	0	3
140ME9147	Vehicle Design Engineering	3	0	0	3
140ME9148	Vehicle Dynamics	3	0	0	3
140ME9149	Design for Welding	3	0	0	3
140ME9150	Motor Cycle Dynamics	3	0	0	3
140ME9151	Design for Sheet Metal	3	0	0	3
140ME0701/ 140ME9152	Design of Jigs, Fixtures and Press Tools	3	0	0	3
Manufacturing Stream					
140ME9120	Computer Integrated Manufacturing	3	0	0	3
140ME9121	Non-destructive Testing Methods	3	0	0	3
140ME9122	Lean Manufacturing	3	0	0	3
140ME9123	Unconventional Machining Processes	3	0	0	3
140ME9124	Industrial Robotics and Automation	3	0	0	3
140ME9125	Rapid Prototyping and Tooling	3	0	0	3
140ME9126	Plant Layout and Material Handling	3	0	0	3
140ME9127	Micro Manufacturing	3	0	0	3
140ME9128	Process Planning and Cost Estimation	3	0	0	3
140ME9129	Production Planning and Control	3	0	0	3

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ELECTIVES

Course Code	Course Title	Hours/Week			Credits
		L	T	P	
140ME9142	Systems Approach for Engineers	3	0	0	3
140ME9143	Automotive Fundamentals and Manufacturing	3	0	0	3
140ME9145	Logistics Engineering	3	0	0	3
140ME9146	Manufacturing Systems Engineering	3	0	0	3
Service and Maintenance					
140ME9130	Transport Management	3	0	0	3
140ME9131	Instrumentation and control	3	0	0	3
140ME9132	Alternative Fuels And Energy Systems	3	0	0	3
140ME9133	Refrigeration and Air-Conditioning	3	0	0	3
140ME9134	Total Productive Maintenance	3	0	0	3
140ME9135	Reliability and Maintenance Engineering	3	0	0	3
140ME9136	Entrepreneurship Development	3	0	0	3
140ME9137	Principles of Management	3	0	0	3
140ME9138	Environmental Science and Engineering	3	0	0	3
140ME9140	Operations Research	3	0	0	3
140ME9141	Industrial Safety Management	3	0	0	3
Open Electives					
141OE0904	Total Quality Management	3	0	0	3
141OE0905	Automation Systems	3	0	0	3
141OE0906	Manufacturing of Automotive Electrical and Electronics Parts	3	0	0	3

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SEMESTER I

CourseCode:140ME0101	**Course Title:** COMMUNICATION SKILLS – I (Common to Automobile and Mechanical)	
Core/Elective: Core	**L : T : P : C**	2 : 0 : 2 : 3
Type: Theory& Practical	**Total Contact Hours:**	60 Hours

Course Objective

The course is intended to:

1. Listen and understand monologues and dialogues of a native speaker on par with A2 (basic user) of CEFR (Common European Framework)level
2. Emphasize specially the development of speaking skills amongst learners of Engineering and Technology
3. Read and infer a given text on par with A2 of CEFR level
4. Draft basic formal written communication on par with A2 of CEFR level

UNIT I FUNCTIONAL GRAMMAR AND VOCABULARY 6+6

Importance of learning a Language Need for a right attitude Nominal word group adjectival word group verbal word group complementation concord pronoun noun agreement subject verb agreement appropriate verb (tense and voice) vocabulary roots affixation and compounding collocation hyponym mnemonics homophones and homographs idioms and phrases condensing one word substitution

UNIT II LISTENING 6+6

Listening to informal conversations and participating situation based dialogues conversations Understanding the structure of conversations tone intonation sounds Listening to a telephone conversation video conferencing model interviews Theorysdialoguesfilm clippings with questions Listening for making inferences for main points and sub-points for note taking Listeningfor specific details and information themes and facts.

UNIT III SPEAKING 6+6

Elements of effective speech exchange of basic personal information, narration talk on general topics describing events and people Process description, Extempore GroupDiscussion debate marketing a product or service. Mock interview Just Minute talk pep talk small talk.

UNIT IV READING 6+6

Elements of effective reading skimming, scanning, intensive and extensive reading dictionary usage extractspecific information identify main and subordinate ideas summarize, précis writing, paraphrase comprehension making inferences reading

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critically determining fact versus opinion spoken interaction understand the description of events, feelings and wishes in personal letters understand familiar context specific names, words and sentences, for example on notices, posters and catalogues.

UNIT V WRITING **6+6**

Rules and conventions relating sentences, prewriting- paragraphs, essays cohesive devices and discourse markers thesis statement punctuation and proof reading Clarity and conciseness summarizing report writing, transcoding information business writing letters quotation seeking, order placing, complaint letter, cover letter, resume and email writing.

Course Outcomes

At the end of the course students will be able to:

CO1: Recognize and use a wide range of vocabulary in speaking and writing
CO2: Compose paragraphs, essays and write for academic and business purposes with coherence and accuracy
CO3: Organize and articulate ideas logically, lucidly and persuasively within a given time frame
CO4: Use various techniques to read, comprehend, appreciate and interpret content effectively

Text Books

1. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill Education Pvt. Ltd., New Delhi 2005.

References

1. Halliday M.A.K., Introduction to Functional Grammar, Routledge, London 2014
2. Stuart Redman, English Vocabulary in Use - Pre-intermediate and Intermediate, Second Edition, Cambridge University Press, U.K. 2003
3. Suzanne W. Woodward, Fun With Grammar, Prentice Hall, New Jersey 1997
4. Essentials of Effective Public Speaking, Research and Education Association, New Jersey, 2004
5. Clare West, Reading Techniques, Cambridge University Press, Cambridge, 2010
6. Julie Robitaille and Robert Connelly, Writer's Resources, Second Edition, Thomson Wadsworth, USA 2007.

Web references

- www.cambridgeenglish.org/exams/business.../business-preliminary/
- http://www.pearsonlongman.com/intelligent_business/bec_tests/preliminary.html

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CourseCode:140ME0102	Course Title: ENGINEERING MATHEMATICS – I (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	3: 1 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Course Objective

The course is intended to:

1. Determine the Eigen values and Eigen vectors for a given real matrix
2. Determine the curvature and equation of evolutes of a curve.
3. Identify the extreme values for two variable functions.
4. Determine the area of bounded curves and volume of solids.
5. Solve the various types of first order ordinary differential equations

UNIT I MATRICES **9+3**

Solution of system of equations-Eigen values and Eigenvectors of a real matrix – Characteristic equation – Properties of eigenvalues and eigenvectors – Cayley-Hamilton Theorem – Diagonalization of matrices by orthogonal transformation–Reduction of a quadratic form to canonical form by orthogonal transformation.

UNIT II DIFFERENTIAL CALCULUS **9+3**

Curvature – Cartesian and polar coordinates – Radius and Centre of curvature-Circle of curvature – Involutes andEvolutes – Envelopes.

UNIT III FUNCTIONS OF SEVERAL VARIABLES **9+3**

Partial derivatives – Homogeneous functions and Euler's theorem –Total derivative – Change of variables – Jacobians –Partial differentiation of implicit functions – Taylor's series for functions of two variables –Maxima and minima of functions of two variables – Lagrange's method of undetermined multipliers.

UNIT IV MULTIPLE INTEGRALS **9+3**

Double integration-Cartesian and polar coordinates-Change of order of integration-Transformation from Cartesian to polar, spherical and cylindrical coordinates-Triple integration in Cartesian Coordinates-Applications: Evaluating area and volume using multiple integrals.

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UNIT V ORDINARY DIFFERENTIAL EQUATIONS OF FIRST ORDER 9+3

Formation of ordinary differential equation-Solution of differential equations of first order and first degree: homogeneous form, linear form and exact differential equations - Applications to engineering problems related to resisted motion.

Course Outcomes

At the end of the course, the students will be able to:

CO1: Calculate Eigen values and Eigen vectors for a given real matrix

CO2: Apply the concepts of differentiation to curvatures

CO3: Identify the extreme values for two variable functions

CO4: Apply multiple integrals to find area and volume

CO5: Formulate simple problems of engineering dynamics as first order ordinary differential equations and state the underlying assumptions

Text Books

1. Ray Wylie C and Louis C Barret , "Advanced Engineering Mathematics", 6th Edition McGraw-Hill, 2003
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th Edition, Wiley India, 2007.

References

1. Peter V. O'Neil, Advanced engineering mathematics, 6thEdition, Thomson Nelson, Toronto, 2007.
2. K.A. Stroud and Dexter J. Booth Advanced Engineering Mathematics, 5thEdition, Palgrave, Macmillan,2011.

Web Reference

- http://nptel.ac.in/video.php?subjectId=122107036

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Course Code:140ME0103	Course Title: APPLIED PHYSICS (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	2 : 1 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Course Objective

The course is intended to:

1. Calculate the elastic and frictional properties of materials.
2. Apply the knowledge of conduction and radiation in materials for calculating the quantity of heat transfer.
3. Applyt the knowledge of Ultrasonics to inspect the quality of materials through NDT.
4. Use the process of vacuum creation and its measurement.
5. Apply lasers for various industrial applications.

UNIT I PROPERTIES OF MATTER **6+3**

Elasticity: Hooke's law , Elastic modulii Poisson's ratio relation between them Factors affecting elasticity Expression for bending moment, I-shaped girders determination of Young's modulus by cantilever depression method Static Tension Expression for couple per unit twist Torsional oscillation. Friction: Static friction, laws of friction, sliding friction, angle of friction, cone of friction.

UNIT II TRANSMISSION OF HEAT **6+ 3**

Conduction Co-efficient of the thermal conductivity Cylindrical flow of heat determination of thermal conductivity of bad conductor Lee's disc method. Experimental determination of Specific heat of liquid, variation of specific heat and atomic heat with temperature. Radiation Black body Wein's Law Rayleigh Jeans Law Stefan's law Experimental Determination of Stefan's constant Mathematical derivation of Stephan's law Solar constant Solar Spectrum.

UNIT III ULTRASONICS AND NDT **6+3**

Properties of Ultrasonic waves, Production of ultrasonics by magnetostriciton and piezoelectric methods Detection of ultrasonics: Kundt's tube, Thermal method, acoustic grating Cavitation -Industrial applications: ultrasonic cleaning, welding and cutting. Non Destructive Testing: Principle of Ultrasonic testing ultrasonic transducer Couplant *Inspection techniques:* Liquid Penetrant

Method, Radiographic testing, Ultrasonic flaw detector: Pulse echo system, transmission, A, B & C scan displays. Inspection standards.

UNIT IV VACUUM SCIENCE AND TECHNOLOGY **6+3**

Introduction concepts of vacuum throughput, pumping speed, effective pumping speed and conductance. Types of pumps working principle and construction of rotary pump, diffusion pump, turbo molecular pump. Operation of pressure gauges pressure range,

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measurement of vacuum using Pirani and Penning gauges, merits and limitations. Working of a vacuum system, applications and scope.

UNIT V LASER PHYSICS AND APPLICATIONS **6+3**

Laser principles: Stimulated and spontaneous emissions of radiations Population inversion and pumping methods Properties of lasers Nd: YAG laser and CO_2 molecular laser Applications of Lasers: welding, brazing, drilling, cutting and heat treatment of materials.

Course Outcomes

At the end of the course, the students will be able to:

CO1: Calculate the values of elastic and frictional properties of materials
CO2: Compute the amount of heat transfer by conduction and radiation in N materials
CO3: Apply the knowledge of ultrasonic's to Inspect the quality of materials through NDT
CO4: Use the different types of pumps and gauges
CO5: Apply lasers in various industrial applications

Text Books

1. D. S. Mathur, "Elements of Properties of Matter" S. Chand & Company Ltd., New Delhi, 2012
2. BrijLal and Dr. N. Subrahmanyam, "Heat and Thermodynamics", S. Chand & Company Ltd., New Delhi, 1997.

References

1. David Halliday, Robert Resnick, Jearl Walker, Fundamentals of Physics Extended, Ninth Edition, Wiley India.
2. R.K. Gaur, S.L. Gupta, Engineering Physics, DhanpatRai, 2013
3. Jayakumar S, "Engineering Physics", R K Publishers, Coimbatore, 2007.
4. Murugeshan, R., "Properties of Matter & Acoustics" S. Chand & Company Ltd., New Delhi, 2012
5. Rajendran, "Engineering Physics", Tata McGraw Hill Publishing Company limited. New Delhi, 2009.
6. Rao V V, Ghosh T. B. and Chopra K L, "Vacuum Science and Technology", Allied Publishers Limited, New Delhi, 1998
7. TarasovL,"Laser Physics and Applications", Mir Publications.

Web References

- http://nptel.ac.in/courses/115106061/
- www.apsu.edu
- www.physicsclassroom.com
- www.study.com
- www.physics.org

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Course Code: 140ME0104	Course Title: APPLIED CHEMISTRY (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	2 : 1 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Course Objective

The course is intended to:

1. Explain the chemistry of the water treatment processes.
2. Select batteries based on the life cycle,
3. Determine the rate of corrosion of a given metal
4. Select a polymeric material for a engineering application
5. Describe the efficiency of fuels in different state
6. Identify appropriate lubricant for engineering applications
7. Explain the significance of adsorption

UNIT I WATER AND IT'S TREATMENT **6+3**

Introduction, Hardness, Degree of hardness, Determination of hardness by Complex metric method (EDTA method), Municipal Water Supply, Requisites of drinking water, water quality standards- BIS, WHO, purification process. Water for steam making: Sludge and scale formation, caustic embrittlement and boiler corrosion. Methods of Boiler Water Treatment: Internal and external conditioning - Demineralization. Industrial wastewater and sewage treatment. Desalination -reverse osmosis.

UNIT II ELECTROCHEMISTRY AND BATTERIES **6+3**

Concept of Electro Chemistry, Electrochemical cells reversible and irreversible cells. EMF Single electrode potential Electrochemical series, Application of Nernst equation in electrochemical analysis - Galvanic Cells, Concentration Cells, Types of Electrodes- Reference Electrode (SCE), Ion Selective Electrodes (Glass Electrode), Electrochemical methods of analysis - Potentiometric titrations, conductometric titrations, pH metric titrations.

Batteries: Types Dry cell, Lead-Acid, Ni-Cd, Lithium ion construction, working and application. Fuel cells construction and working of hydrogen oxygen fuel cell, application.

UNIT III CORROSION AND CONTROL **6+3**

Chemical Corrosion Pilling-Bed worth rule Electrochemical corrosion different types galvanic corrosion, differential aeration corrosion, Galvanic series, factors influencing corrosion. Mass loss method of corrosion testing, units to express corrosion rate.
Corrosion control sacrificial anode and impressed cathodic current methods corrosion inhibitors protective coating galvanizing and tinning electroplating and electroless Nickel-plating. Paint and its constituents, Special paints fluorescent paint, high temperature paints, fire retardant paints constituents and functions.

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UNIT IV POLYMER CHEMISTRY AND SURFACE CHEMISTRY 6+3

Classification of polymers, Polymerization types Addition, condensation and copolymerization, Properties of polymers: Molecular weight, Tg, Tactility, polydispersity index. Compounding of plastics, Commodity plastics PVC, PE, and PET. Engineering plastics Preparation, properties and uses of PC, Teflon, Nylon. Recycling of plastics, biopolymers.

Surface Chemistry: Adsorption types, application of adsorption technology in industries activated carbon its applications in water purification and air purification, Catalysis types, application of catalytic convertors in IC engine emission control.

UNIT V FUELS AND LUBRICANTS 6+3

Calorific value Coal proximate and ultimate analysis (method only), metallurgical coke manufacture by Otto Hoffmann method Fractional distillation of petroleum knocking octane number and cetane number. Gaseous fuels CNG and LPG composition, properties and uses.

Lubricants types, mechanism of lubrication, liquid lubricants properties and impact on lubrication viscosity, viscosity index, flash and fire points, cloud and pour points, oiliness, aniline point, solid lubricants graphite and molybdenum sulphide structure properties and uses. Greases types, composition and uses.

Course Outcomes

At the end of the course, the students will be able to:

CO1: Explain the chemistry of water and specify the water treatment processes.
CO2: Select batteries based on the life cycle, working principle and their applications
CO3: Determine the rate of corrosion of a given metal in a given environment and identify appropriate control techniques to avoid corrosion.
CO4: Select a polymeric material for a specific engineering application and decide the handling, disposal methods and identify substitute bio-degradable polymeric materials for conventional polymeric materials
CO5: Describe the efficiency of fuels in different state based on its composition and calorific value
CO6: Identify appropriate lubricant for different engineering applications
CO7: Explain the significance of adsorption in catalytic phenomena and pollution abatement

Text Books

1. P.C.Jain and Monica Jain, "Engineering Chemistry", 16th Ed., DhanpatRai Pub, Co., New Delhi (2004).
2. S.S.Dara "A text book of Engineering Chemistry" S.Chand&Co.Ltd., New Delhi (2006).

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References

1. L. Brown and T. Holme, Chemistry for Engineering Students, 3rd edition, Cengage Learning (2010).
2. P.W. Atkins and de Paula Julio, "Physical Chemistry", Oxford University Press, 9th Ed. (Indian Student Edition) (2011).
3. S. Chawla, A Text Book of Engineering Chemistry, Dhanpat Rai Publishing Company, New Delhi (2013).
4. O.G. Palanna, Engineering Chemistry, Fourth Reprint. Tata McGraw Hill Education Pvt. Ltd. New Delhi (2009).
5. Wiley Engineering Chemistry, Second Edition, Wiley India Pvt. Ltd. New Delhi (2011).
6. V.R.Gowariker, N.V.Viswanathan and JayadevSreedhar, "Polymer Science", New Age International P (Ltd.,), Chennai (2006).

Web References

- http://nptel.ac.in/courses/122101001/downloads/lec-23.pdf
- http://nptel.ac.in/courses/122101001/downloads/lec-25.pdf
- http://nptel.ac.in/courses/104105039/

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Course Code: 140ME0105	Course Title: INTRODUCTION TO ENGINEERING (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	2 : 0 : 2 : 3
Type: Theory	Total Contact Hours:	60 Hours

Course Objective

The course is intended to:

1. Explain the outcome based curriculum.
2. Explain the learning enablers available in the institution
3. List and explain the parts , work/function , and engineering discipline of a product used in day-to-day life
4. Observe every product with an engineering perspective.

UNIT I ENGINEERING EDUCATION 6+6

Expectations and Aspirations of engineering students, Graduate Engineering Attributes, Outcome based Engineering Curriculum, Engineering Skills – Technical and Professional. Courses, course map, Concepts and Theories of Learning – Higher Order Thinking Skills, Multiple Intelligences, learning styles inventory, teaching/learning process and methodologies (Theorys, tutorials, activities, lab/workshop exercises, factory visits, internships, projects, alignment to co-curricular activities and hobby projects) Rubrics, Assessment.

UNIT II LEARNING RESOURCE MANAGEMENT 6+6

Awareness and effective use of resources for learning:- library resources, professional societies, centres of excellences, and value-added divisions. Code of conduct for resource utilization.

UNIT III SCIENCE AND ENGINEERING IN PRODUCTS 6+6

Products used in day-to-day life, functions, science and engineering principles applied in the products disciplines, Working of the product, individual parts of the product, Scientific / Engineering principle. + Demonstration with Refrigerator, Wet Grinder, Laptop, Motorbike. Activity to explore working of products used in day to day life.

UNIT IV MULTI-DISCIPLINARY ENGINEERING 6+6

Mechanical Engineering: Introduction to manufacturing methods, materials, relative motion between parts (Linear and Circular) Fastening methods
Electrical and Electronics Engineering: Electricity system used for domestic and industrial purpose (AC vs DC, AC signal, Single-phase, Three-phase, prime movers(motors) in

products used in day to day life, DC, Electrical components: resistor, capacitor, and inductor, Electronic components: diode, and transistor. IC and PCB.
Computer science Engineering: Processor board, Computer peripherals, Operating system.

UNIT V PRODUCT APPRECIATION **6+6**

Essential needs in day-to-day life, Connections between the needs and the products, Product appreciation with engineering perspective.

Course Outcomes

At the end of the course, the students will be able to:

CO1: Explain the outcome based curriculum, structure of the courses, learning and assessment methodologies.
CO2: Explain the lab facilities and learning resources available in the institution and how they can utilize them effectively.
CO3: List the products that are used in day-to-day life of students and family.
CO4: Explain how these products work/function.
CO5: Explain the different engineering disciplines used in this product.
CO5: Observe every product with an engineering perspective.

Textbooks

1. C. David, "How it works: Printing and Processes", LadyBird books publication
2. S. Peter, "How it works: Rockets and Space craft", LadyBird books publication

References

1. Granada, " How things work", Granada, 1978.
2. J. L. Adams, "Flying Buttresses, Entropy, and O-Rings: The World of an Engineer".
3. J. E. Gordon, "The New Science of Strong Materials or Why You Don't Fall through the Floor".
4. R.P. Feynman," Six Easy Pieces: Essentials of Physics Explained by Its Most Brilliant Teacher", 2011

Web References

- https://en.wikibooks.org/wiki/General_Engineering_Introduction/EngineeringScience
- http://science.howstuffworks.com/engineering-channel.htm

BoS Chairman

CoursCode:140ME0106	Course Title: ENGINEERING GRAPHICS (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	1: 3 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Course Objective

The course is intended to:

1. Sketch different engineering curves
2. Prepare orthographic and isometric drawings
3. Sketch the projection of line and plane
4. Prepare development of lateral surfaces
5. Prepare perspective drawings

UNITI CURVES USED IN ENGINEERING PRACTICES 3+9

Importance of graphics in engineering applications –BIS conventions and specifications – Size, layout and folding of drawing sheets – Lettering and dimensioning- Methods of Dimensioning. Conics – Construction of ellipse, Parabola and hyperbola by eccentricity method –Construction of cycloid and involutes of square and circle – Drawing of tangents and normal to the above curves. Mathematical representation of these curves and their applications.

UNITII ORTHOGRAPHIC AND ISOMETRIC PROJECTION 3+9

Representation of Three Dimensional objects – General principles of orthographic projection – Need for importance of multiple views and their placement – First angle projection – layout of views – Developing visualization skills through free hand sketching of multiple views from pictorial views of objects. Orthographic projection of solids – Practices on three view projection of solids. Isometric Projection of solids – practices on simple solids.

UNITIII PROJECTION OF LINES AND PLANE SURFACES 3+9

Projection of straight lines located in the first quadrant and inclined to both the planes – Concept of true lengths and true inclinations – Projection of polygonal surface and circular lamina inclined to both reference planes.

UNITIV PROJECTION OF SOLIDS AND ITS SECTION 3+9

Projection of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane. Need for sectioning of solids – Sectioning of simple solids like prisms, pyramids, cylinder and cone when the axis is inclined to one reference plane by cutting planes inclined to one reference plane and perpendicular to the other – Orthographic views of sections of simple solids.

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UNITV DEVELOPMENT OF SURFACES AND PERSPECTIVE PROJECTIONS 3+9

Development of lateral surfaces of simple and truncated solids – Prisms, pyramids, cylinders and cones. Concepts of Perspective projection of prisms, pyramids and cylinders by visual ray method.

Course Outcomes

At the end of the course, the students will be able to:

CO1 Sketch different engineering curves and explain its application.

CO2 Prepare orthographic and isometric drawings of simple solids

CO3 Prepare development of lateral surfaces of simple objects.

CO4 Prepare perspective drawings of regular solids

Text Book

1. K. V. Natrajan, "A Text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai (2013).
2. Dhananjay A. Jolhe, "Engineering Drawing with an introduction to AutoCAD" Tata McGrawHill Publishing Company Limited (2008).

References

1. Basant Agarwal and Agarwal C.M., "Engineering Drawing", Tata McGraw Hill Publishing Company Limited, New Delhi, (2008).
2. Cencil Jensen, Jay D. Helsel and Dennis R. Short Engineering Drawing and Design. Tata McGraw Hill Publishing Company Limited (2012).
3. John.K.C and Verghese.P.I "Machine Drawing", Jovast Publishers, Trissur,2007.

PUBLICATIONS OF BUREAU OF INDIAN STANDARDS

1. IS 10711 – 2001: Technical products Documentation – Size and lay out ofdrawing sheets.
2. IS 9609 (Parts 0 & 1) – 2001: Technical products Documentation – Lettering.
3. IS 10714 (Part 20) – 2001 & SP 46 – 2003: Lines for technical drawings.
4. IS 11669 – 1986 & SP 46 – 2003: Dimensioning of Technical Drawings.
5. IS 15021 (Parts 1 to 4) – 2001: Technical drawings – Projection Methods. The mode of delivery is like practical.

Web References

- http://nptel.ac.in/courses/112103019/
- https://en.wikipedia.org/wiki/Engineering_drawing

BoS Chairman

Code:140ME0107	Course Title: ENGINEERING PRACTICES LABORATORY (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	0: 0 : 2 :1
Type: Practical	Total Contact Hours:	45 Hours

Course Objective

The course is intended to:

1. Demonstrate the basic carpentry, fitting and plumbing operations.
2. Demonstrate the operations of different power tools.
3. Exhibit the proper connection in electrical wiring.
4. Interpret various characteristics of basic electronic components.
5. Demonstrate the installation, formatting and partitioning of computer system.

List of Experiments

1. Make a wooden window frame to the required dimensions.
2. Make a steel table using fitting process to the required dimensions
3. Make a Castor Bracket using welding process to the required dimensions
4. Make a winnowing basket in sheet metal to the required dimensions
5. Assemble a pipe line from overhead tank to kitchen sink and dining wash basin
6. a) Make a Domestic wiring circuit to connect a lamp, a fan with regulator and a socket.
   b) Make the internal wiring of a tube light and check the connection
7. Make a Stair case wiring for controlling a lamp from two different locations
8. Do the continuity check in the given PCB and rectify the faults
9. Make an electronic circuit for bi-cycle horn
10. Install the given OS in the computer system
11. Do formatting and partitioning of Hard Disk Drive

Course Outcomes

At the end of the course, the students will be able to:

CO1: Demonstrate the basic carpentry, fitting and plumbing operations.
CO2: Demonstrate the operations of different power tools.
CO3: Exhibit the proper connection in electrical wiring.
CO4: Interpret various characteristics of basic electronic components.
CO5: Demonstrate the installation, formatting and partitioning of computer system.

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Course Code:140ME0108	**Course Title:** PHYSICS AND CHEMISTRY LABORATORY (Common to Automobile and Mechanical)	
Core/Elective: Core	**L : T : P : C**	0 : 0 : 2 : 1
Type: Practical	**Total Contact Hours:**	45 Hours

PHYSICS LABORATORY

Course Objective

The course is intended to:

1. Use standard laboratory equipment's, modern instrumentation, and classical techniques to carry out experiments.

List of Experiments

1. Young's modulus of the material – Cantilever bending method
2. Rigidity modulus of the metallic wire – Torsional pendulum method
3. Thermal conductivity of insulator – Lee's disc method
4. Comparison Co-efficient of viscosity of the liquids
5. Wavelength of laser and determination of particle size using laser
6. Hysteresis loss of ferromagnetic material
7. Thickness of the sample using Air wedge
8. Efficiency of Solar cell

Course Outcomes

At the end of the course, the students will be able to:

CO1: Use standard laboratory equipment's, modern instrumentation, and classical techniques to carry out experiments.

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CHEMISTRY LABORATORY

Course Objective

The course is intended to:

1. Determine total hardness and DO content of water sample
2. Determine molecular mass of polymer
3. Determine concentration of a solution
4. Determine corrosion rate of metals

List of Experiments

I Water analysis

1. Determination of total hardness of water sample by EDTA method.
2. Determination of DO in water by Winkler's method.

II Viscometry

1. Determination of molecular weight of a polymer – Oswald viscometric method (demonstration only).

III Electrochemistry

1. To determine the strength of given acid – pH metrically
2. To determine the amount of Ferrous ions by potentiometry
3. To determine the strength of mixture of strong and weak acid by conductometric titrations.

IV Corrosion testing

1. Determination of corrosion rate and inhibitor efficiency– weight loss method.

Course Outcomes

At the end of the course, the students will be able to:

CO1: Determine total hardness and DO content of water sample
CO2: Determine molecular mass of polymer
CO3: Determine concentration of a solution through electrical method.
CO4: Determine corrosion rate of metals

References

1. Jeffery, G.H., Bassett, J., Mendham, J. and Denny, R.C., Vogel's Text book of quantitative Chemical Analysis, Oxford, ELBS, London,2002.
2. Shoemaker D.P. and C. W. Garland., Experiments in Physical Chemistry, Tata McGraw-Hill Pub. Co. Ltd., London, 2003.

BoS Chairman

Course Code:140ME0109	Course Title: PROMOTION OF STUDENTS WELLNESS (Common to all B.E/B.Tech Programmes)	
Core/Elective: Core	L : T : P : C	0 : 0 : 2 : 1
Type: PS	Total Contact Hours:	30 Hours

Course Objective

The course is intended to:

1. Maintain physical wellbeing.
2. Maintain mental wellbeing.
3. Maintain social wellbeing.

UNIT I PHYSICAL HEALTH

Physical structure and functions of human body – simplified physical exercises (hand exercises, Leg exercises, breathing exercises, eye exercises – kapalapathi – Maharasanas 1-2 – Massages – Acupuncture – relaxation – importance and benefits. Suryanamaskar.

UNIT II MENTAL HEALTH

Maintenance of youthfulness and life force – kayakalpa yoga – anti ageing process – benefits. Mind and its functions – mind wave frequency – meditation process – Agna, shanthi, thuriam – benefits

UNIT III PERSONALITY DEVELOPMENT – I

Purpose of life and analysis of thought – philosophy of life – introspection – practice. Moralization of desires and neutralization of anger - practices

UNIT IV PERSONALITY DEVELOPMENT – II

Eradication of worries and benefits of blessings – wave theory –practices. Genetic centre – purification – cause and effect theory

UNIT V SOCIAL HEALTH

Greatness of guru – cultural education – love and compassion – fivefold culture. Greatness of friendship and social welfare – individual, family and world peace.

Course Outcomes

At the end of the course, the students will be able to:

CO1 Maintain physical wellbeing - grooming, BMI, flexibility, muscle strength, body compositions (vatha, pitha, kapa)

CO2 Maintain mental wellbeing - perceptions, attention/concentration, memory, gunas

CO3 Maintain social wellbeing - etiquettes, emotional and psychological aspects, stress management, morality and values

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Text Books

1. Vethathiri Maharishi Institute for Spiritual and Intuitional Education, Aliyar ,"Value education for harmonious life (Manavalakalai Yoga)", Vethathiri Publications, Erode, I Ed. (2010)

References

1. Dr.R.Nagarathna, Dr.H.R.Nagendra, "Integrated approach of yoga therapy for positive health", Swami Vivekananda Yoga Prakashana, Bangalore, 2008 Ed.
2. Dr.R.Nagarathna, Dr.H.R.Nagendra , "New perspectives in stress management", Swami Vivekananda Yoga Prakashana, Bangalore, I Ed June 1986

OPERATIONAL MODALITIES

- 4-day programme of 6 hours /day for syllabus coverage
- Offered after the college orientation and bridge course to all 240 students at a stretch in a big hall.
- Two faculty members from Aliyar and 10 facilitators from local centre
- Programme Schedule

Forenoon		Afternoon	
9 am to 10.30 am	Session I	1.30 pm to 3.00 pm	Session III
10.30 am to 11.00 am	break	3.00 pm to 3.30 pm	Break
11.00 am to 12.30 pm	Session II	3.30 pm to 5.00 pm	Session IV
12.30 pm to 1.30 pm	Lunch	--	--

FOLLOW-UP PRACTICE

12 weeks x 2 hours/week: 24 hours

EVALUATION

During 4-day programme

Unit I : Practical

Unit II & Unit III : Written (Objective type test)

Unit IV & Unit V : Written (Objective type test)

Mid semester : Practical

End semester : Written and Practical

Assessment: Using measurement gadgets and questionnaires (as suggested by SVYASA and scoring sheets (from Aliyar)

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DIMENSIONS AND TOOLS IN MEASUREMENT

Dimension	Sub dimension	Measurement tools
Physical	BMI	Electronic Weighing Machine, Height Measurement
	Flexibility	Sit & Reach
	Muscle Strength	Handgrip Dynamometer
	Prakruti	Dr Ramakrishna's Prakruti Questionnaire
Mental	Perception	Critical Flicker Fusion
	Attention	Digit Letter substitution Test
		Six Letter Cancellation Test
		Stroop Test
	Memory	Digit backward & Forward
Social	Interpersonal Effectiveness & Self Concept	FIRO B
	Psychological Well Being	Short wellbeing scale
		Short Happiness scale
		Barrat Impulsive Scale

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END OF SEMESTER- I

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SEMESTER II

Course Code:140ME0201	**Course Title:** COMMUNICATION SKILLS – II (Common to Automobile and Mechanical)	
Core/Elective: Core	**L : T : P : C**	2 : 0 : 2 : 3
Type: Theory& Practical	**Total Contact Hours:**	60 Hours

Prerequisites

The student should have undergone the courses:

- Communication Skills – I

Course Objective

The course is intended to:

1. Use various strategies to listen, infer the meaning and respond
2. Use formal, informal language and appropriate non-verbal skills
3. Use appropriate reading techniques, make notes and respond critically
4. Write effectively for a variety of professional and social settings
5. Use modern technologies to enhance communication

UNIT I LISTENING **6+6**

Types of Listening - discriminative, comprehensive, therapeutic, critical and appreciative listening - competitive, attentive and reflective listening models - Perception, Bias, Red flag words, Emotions and language barriers - Wh questions, Open-ended and close-ended questions, Predict vocabulary - Recognizing stress and intonation – Comprehension - Listening to business Theory& presentation - SQL2R, Surveying, questioning,listening, recall and review.Symbols and abbreviations - metacognition, literal and critical comprehension - Inferring meaning, emotions, opinionsand contexts

UNIT II SPEAKING **6+6**

Informal conversation - day-to-day conversations - Small talk, conversation about other people, facts & opinions - conversing within oneself (intrapersonal) – **Informal language** - colloquial expressions, clichés, contraction, hesitation fillers, usage of personal pronouns, usage of verbs and adverbs, informal vocabularies, imperative sentences - **Non-verbal skills** – importance - types - kinesics - facial expressions, eye contact, gestures, postures, appearance, proxemics, time language, paralanguage, touch **Formal situations** - workplace conversations - downward, upward, horizontal, diagonal, inward, outward conversations - Oral Instructions, speeches, meeting, and negotiations **Formal language** modal auxiliaries, polite expressions, impersonal passive voice, avoiding second person pronouns.

UNIT III READING **6+6**

Reading techniques - skimming, scanning, intensive reading - **Extensive reading** and its importance - **Fast Reading** – strategies, speed reading, eye fixation, regression, read in chunks or phrases and linear reading - Newspaper, user manuals, understanding

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reports, proposals,short stories and novels - R.K. Narayan's "Swami and his Friends "**Note-making** – mechanics, tropicalizing, schematizing, reduction devices, organization techniques and sequencing **Critical Reading** - SQ3R - survey, question, read, recall and review - Usage of dictionary - Book review JumphaLahiri's*Interpreter of Maladies (9 stories)*

UNIT IV WRITING **6+6**

Importance of written business communication - Mind mapping- plotting ideas - accuracy of vocabulary, grammatical structures, appropriate register, connectives, signal words and format, notice, circular, agenda, minutes of the meeting, memo, E-mail, Proposal - difference between professional and social communication use of Imperative, modal auxiliary verbs- caption and slogan writing recommendations and instructions writing.

UNIT V MODERN TECHNOLOGY AND COMMUNICATION SKILLS **6+6**

Technology advances in learning language - tone and style of language - Pros and cons of modern technologies in language learning process - Do's and Don'ts on online content - Structure of podcast, blogging and social media sites - greetings, grammar, punctuation – sms informal and formal language.

Course Outcomes

At the end of the course students will be able to:

CO1: Use various strategies to listen, infer the meaning and respond
CO2: Use formal, informal language and appropriate non-verbal skills in speaking
CO3: Use appropriate reading techniques, make notes and respond critically
CO4: Write effectively for a variety of professional and social settings
CO5: Use modern technologies to enhance communication

Textbooks

1. Herta A. Murphy, Herbert W. Hildebrandt, Jane P. Thomas, Effective Business Communication, Tata McGraw Hill, New Delhi, 2008.
2. M. Ashraf Rizvi, Effective Technical Communication, McGraw Hill Education Pvt. Ltd., New Delhi, 2005.

References

1. Meenakshi Raman, Business Communication, Oxford University Press, New Delhi 2006
2. Sehgal M.K., VandanaKhetarpal, Business Communication, Excel Books, New Delhi 2006
3. R C. Sharma, Krishna Mohan, Business Correspondence and Report Writing, Tata McGraw Hill Publishing Co., Ltd., New Delhi 2002

Web References

- www.cambridgeenglish.org/exams/business.../business-preliminary/
- http://www.examenglish.com/BEC/BEC_Vantage.html
- www.splendid-speaking.com/exams/bec_speaking.htmlhtml

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Course Code:140ME0202	Course Title: ENGINEERING MATHEMATICS – II (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	3 : 1 : 0 : 4
Type: Theory &Tutorial	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Mathematics-I

Course Objective

The course is intended to:

1. Determine the solution of second and higher order ordinary differential equations
2. Solve directional derivative, integral theorems.
3. Determine the analytic function and behaviour of conformal mappings
4. Apply the concept of singularities to evaluate integrals.
5. Apply the Laplace transform techniques to solve differential equations.

UNIT I DIFFERENTIAL EQUATIONS OF SECOND AND HIGHER ORDER **9+3**

Second and higher order linear differential equations with constant coefficients.Solution by variation of parameters, first order simultaneous differential equations.

UNIT II VECTOR CALCULUS **9+3**

Gradient, divergence and curl, irrotational and solenoidal vector fields- Directional derivatives-Green's theorem in a plane (without proof)-Gauss divergence theorem (without proof) – Stoke's theorem (without proof)-evaluation of integrals using Green's, Gauss's and Stoke's theorem.

UNIT III ANALYTIC FUNCTIONS **9+3**

Function of a complex variable-Analytic function –Singular points –Cauchy Riemann equations (without proof) – Properties-Construction of analytic functions.

UNIT IV COMPLEX INTEGRATION **9+3**

Cauchy's fundamental theorem (without proof) – Cauchy's Integral formula- Taylor and Laurent expansions- Types of singularity – Residues-Cauchy Residue theorem.

UNIT V LAPLACE TRANSFORM **9+3**

Laplace transform-Conditions for existence-Transform of elementary functions-Properties-Transform of derivatives– Transformation of periodic functions-Inverse Laplace transform-Convolution theorem- Solution of linear ODE of second order with constant coefficients using Laplace transform.

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Course Outcomes

At the end of the course students will be able to:

CO1: Model simple physical phenomena into a set of differential equations.
CO2: Solve the second and higher order ordinary differential equations.
CO3: Apply the concepts of gradient, divergence and curl to solve engineering problems.
CO4: Construct an analytic function.
CO5: Apply the concept of complex integration to evaluate integrals.
CO6: Apply the Laplace transform techniques to solve differential equations.

Text Books

1. Ray Wylie C and Louis C Barret , "Advanced Engineering Mathematics", McGraw-Hill, 2001
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th edition, Wiley India, 2007.

References

1. Grewal B.S., "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40thEdition, 2007.
2. Bali &Iyengar, "A Text Book of Engineering Mathematics", Laxmi Publications (P) Ltd., New Delhi, 6th Edition, 2006
3. Ramanna B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2008.

Web Reference

- http://nptel.ac.in/video.php?subjectId=122107036

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Course Code:140ME0203	**Course Title:** MATERIAL SCIENCE (Common to Automobile & Mechanical)	
Core/Elective: Core	**L : T : P : C**	2: 0 : 2 : 3
Type: Theory& Practical	**Total Contact Hours:**	60 Hours

Course Objective

The course is intended to:

1. Calculate crystal parameters and analyze different crystal structures
2. Explain the mechanical, thermal and magnetic properties
3. Demonstrate the Mechanical and Thermal behaviors
4. Choose a suitable material

UNIT I CRYSTAL STRUCTURE ON MATERIAL BEHAVIOR 6

Introduction: Crystalline and Non crystalline Materials: Single crystals, polycrystalline materials, Anisotropy **Crystal Parameters:** Atomic radius, Number of atoms per unit cell, Co-ordination number, Atomic Packing factor for SC, BCC, FCC and HCP – Influence of grain structure on material behavior. **Crystal Planes:** Miller indices, Bragg's law, Debye Scherrer method, Interplanar distance – Polymorphism and allotrophy. **Crystal imperfections:** Point, line surface and Volume.

UNIT II MECHANICAL PROPERTIES OF METALS 6

Elasticity and plasticity of bulk material, Ductility, malleabililty and brittleness, Stress and strain behavior, Hooke's law, Yield strength, Impact strength, Tensile strength, Resilience, Hardness, Rockwell hardness, Brinell hardness, Vicker's hardness, Micro indentation hardness. **Failure of Metals (Quantitative):** Fracture behavior, Ductile and Brittle fracture, Toughness, Fatigue, Endurance limit, SN curve, Creep, Stages of creep.

UNIT III THERMAL & MAGNETIC PROPERTIES OF MATERIALS 6

Thermal Properties of materials: Melting Point, Specific heat, Thermal Expansion, Thermal conductivity, Thermal diffusivity, Thermal shock resistance, Thermal stability and Heat resistance.

Magnetic Properties of materials: Basic concepts, Diamagnetism, Paramagnetism, Ferromagnetism, Domains and hysteresis, Soft and Hard magnetic materials, Antiferromagnetism, Ferrimagnetism, Influence of temperature on magnetic behavior.

UNIT IV POLYMERS AND CERAMIC MATERIALS 6

Polymers: Introduction: Hydrocarbon molecules, Polymer molecules, Molecular weight and molecular shape, Molecular structure. **Classification of polymers:** Thermoplastics, Thermosets & Elastomers – Common polymeric materials and Industrial application of

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polymers (Quantative) **Ceramics** – Constituents, properties and applications of Diamond, silicon carbide (SiC), zirconia (ZrO_2), Alumina (Al_2O_3), boron carbide (B_4C), and titanium diboride (TiB_2).

UNIT V COMPOSITES 6

Introduction, properties, functions of matrix and reinforcement in composites – Law of mixtures. **Classification of composites**: Particle-reinforced, Fiber-reinforced and Structural composites **Types of composite materials:** Polymer-matrix composites, Metal-matrix composites, Ceramic-matrix composites, Carbon-carbon composites and Hybrid composite – Applications

Course Outcomes

At the end of the course students will be able to:

CO1: Calculate crystal parameters and analyze different crystal structures
CO2: Explain the mechanical, thermal and magnetic properties of bulk materials
CO3: Demonstrate the Mechanical and Thermal behaviors of bulk materials
CO4: Choose a suitable material for specific application

Textbooks

1. William D. Callister Jr, Materials Science and Engineering – an Introduction, John Wiley and Sons Inc., Sixth Edition, New York, 2007.
2. Khanna. O.P. A text book of Materials Science and Metallurgy, Khanna Publishers, 2003.

References

1. Vijaya. M.S. and G. Rangarajan, Material Science, Tata McGraw-Hill, 2007
2. P.K. Palanisamy, Material Science for Mechanical Engineers, Scitech Publication (India) Pvt Ltd, 2005.
3. 3.Raghavan.V "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 2007.

Web References

- www.nptel.ac.in
- www.ocw.mit.edu

MATERIAL SCIENCE LABORATORY

List of Experiments **30Hrs**

1. Coercivity, Retentivity, Saturated magnetism, Permeability – Hysteresis loop
2. Conductivity, Resistivity – Four Probe method
3. Melting point of wax – Thermocouple
4. Hardness and Toughness measurement of FRP
5. Stress strain behavior of FRP – Using UTM

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CourseCode:140ME0204	Course Title: ENGINEERING MECHANICS (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	3 : 1 : 0 : 4
Type: Theory &Tutorial	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course:

- Engineering Graphics

Course Objective

The course is intended to:

1. Use the laws of mechanics to determine the equilibrium condition of particles
2. Use the laws of mechanics to determine the equilibrium condition of rigid bodies
3. Calculate geometric properties
4. Analyze the effect of dry friction in contact surfaces
5. Calculate and plot the motion of a particle

UNIT I BASICS AND EQUILIBRIUM OF PARTICLES 9+3

Review of mathematical operations required for engineering mechanics -scalar and vector-vector operations-trigonometry. Review of Fundamental laws of mechanics-Newton's law of mechanics, Gravitational law.
Particles and rigid body, Concept of force and its effect on rigid body-system of forces-Free body diagram-Triangle law, parallelogram law and Lami's theorem-principle of transmissibility-equilibrium conditions-equilibrium of particles subjected to coplanar and non-coplanar force system.

UNIT II EQUILIBRIUM OF RIGID BODIES 9+3

Moment and couple. Free body diagram. Equilibrium conditions applicable to rigid bodies.Varignon's theorem. Moment about point and axis. Problems in equilibrium of rigid body.

Beams-types of supports and their reactions-types of forces-method of finding reactions in statically determinate beams.

Machine members subjected to coplanar and non-coplanar force systems -unknown forces necessary to ensure static equilibrium of machine members subjected to coplanar force system.Introduction to Supports and connections for 3D machine members and their reactions. Problems related to reactions in machine members supported with ball and socket joints only.

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UNIT III PROPERTIES OF SURFACES AND SOLIDS 9+6

Properties of surface-centroid, Centroid of simple regular sections using integration (Rectangle, circle and triangle).Method of calculating centroid of composite sections. Problems involving centroid for composite planes such as **L, I, T.** Area Moment of Inertia -important of moment of inertia. Moment of inertia for simple sections using integration such as Rectangle, circle and triangle. Parallel and perpendicular axis theorem- concept of polar moment of inertia. problems involving moment of inertia for composite sections such as T,I,L. principal MI and principal axis for composite section such as T,I,L.
properties of solid geometry- centroid and centre of gravity. Centre of gravity of simple solids. Mass moment of inertia for simple solids.PappusGuldinustheorem.Relation to area moment of inertia.Problems involving mass moment of inertia for composite solids consist of block, cylinder,cone, and sphere.

UNIT IV FRICTION 6+3

Characteristics of dry friction, law of dry friction, theory of friction- free body diagram for equilibrium and impending motion conditions. Equilibrium conditions involving dry friction, problems involving wedge, screw, ladder and flat belt drive. Problems in impending motion condition involving dry friction at some points.

UNIT V DYNAMICS OF PARTICLES 9+3

Kinematic parameters - displacement, velocity, acceleration and time. Types of motion-uniform, non-uniform motion, motion of particles in plane - Rectilinear and curvilinear motion of particles-normal and tangential component-motion of projectile- Relative motion- Dependent motion.Kinetics of particles-D'Alemberts principle-works energy and impulse momentum method.

Note: Use of Excel /MATLAB for solving the problems is encouraged (Not for external evaluation only for internal evaluation)

Course Outcomes

At the end of the course students will be able to:

CO1: Use the laws of mechanics to determine the equilibrium condition of particles and rigid bodies.
CO2: Construct free-body diagrams and calculate the unknown forces necessary to ensure static equilibrium.
CO3: Calculate geometric properties such as centroids and moment of inertia
CO4: Analyze the effect of dry friction in contact surfaces (ladder ,wedge, screw and belt)
CO5: Calculate and plot the motion of a particle

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Textbooks

1. R.C. Hibbeller, Engineering Mechanics: Combined Statics & Dynamics, Prentice Hall, 2009
2. F.P. Beer, and Jr. E.R Johnston, Vector Mechanics for Engineers – Statics and Dynamics, Tata McGraw-Hill Publishing Company, New Delhi, 2012

References

1. James L. Meriam and L.GlennKraige, "Engineering Mechanics (Statics and Dynamics)", John Wiley & Sons, 2008
2. Shames.I.H, and Krishna MohanaRao.G, "Engineering Mechanics (Statics and Dynamics)", Dorling Kindersley (India) Pvt. Ltd. Pearson Education,2006.
3. S. Rajasekaran and G. Sankarasubramanian, Fundamentals of Engineering Mechanics, Vikas Publishing House Pvt. Ltd., New Delhi, 2005.

Web References

- http://nptel.ac.in/courses/112103109/
- https://en.wikipedia.org/wiki/Mechanics

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Course Code:140ME0205	Course Title: ENGINEERING METROLOGY AND MEASUREMENTS (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	2 : 0 : 2 : 3
Type: Theory	Total Contact Hours:	60 Hours

Course Objective

The course is intended to:

1. Explain Metrology and Various Measuring Instruments and methods
2. Explain Geometric Dimensioning and Tolerancing (GD&T)
3. Evaluate dimensional accuracy of components
4. Demonstrate form measurement methods.
5. Describe advanced methods and automation in measurements

UNIT I INTRODUCTION TO ENGINEERING METROLOGY 6

General Concepts of metrology-Importance of metrology-Types of metrology-Dynamic, legal, deterministic-Measurement systems-units, standards, accuracy, precision-dimensional accuracy and precision-Methods of measurement-Sensitivity-Errors in measurements-Method of measurement-various measuring instruments.

UNIT II FORM AND SIZE TOLERANCE 6

Fundamental drawing rules-Tolerance grade and fundamental deviations- Fits, Limits and Tolerances and its needs on CAD/CAM –Datums- Application of datums- Datum feature identification - Cylindrical and Inclined- Form- Flatness, straightness, cylindricity and circularity-Orientation -Angularity, perpendicularity and parallelism –Position- Types of position - Clearance hole, Threaded hole and coaxiality-Concentricity and symmetry – Examples of concentricity and symmetry-Runout-Types of run out - circular, total-Profile-Profile tolerance-Profile of conical features-Profile inspection.

UNIT-III LINEAR AND ANGULAR MEASUREMENTS 6

Introduction to linear measurement-Linear measuring instruments-Scale, Vernier, micrometer-types-Gauges-slip gauges,pluggauge,ring gauge, snap gauge-comparators-mechanical, electrical, pneumatic-Introduction to Angular measurement-angular measuring instruments-Sine bar, bevel protractor, autocollimator, angle dekkor.

UNIT IV FORM MEASUREMENTS 6

Screw thread terminology - Errors in threads - Internal and external screw thread measurements - Screw thread measuring elements - Major diameter, Minor diameter, Pitch diameter & Thread form - Gear terminology - Types of gears - Gear errors - Gear measurement techniques -parkinson gear tester, Autocollimator ,Profile projector - Surface texture -Elements of surface texture - Surface finish methods- Average roughness, Peak to vally, Form factor - Surface finish measuring instruments – Surface Measurement - Straightness and Flatness - Roundness Measurements

BoS Chairman

UNITV LASER METROLOGY AND CMM 6

Laser metrology- Laser interferometer - Michelson, Dual frequency, Twyman green, Laser viewers -Types of CMM - Bridge, Cantilever, Horizontal boring mill type, Vertical mill type - Errors in CMM - Application, advantages & disadvantages of CMM - Coordinate Measuring Machine

NOTE: (Use of approved Data Book is permitted in the End semester examination)

Course Outcomes

At the end of the course, the students will be able to:

CO1: Explain Metrology and Various Measuring Instruments and methods
CO2: Explain the Geometric Dimensioning and Tolerancing (GD&T) Principles and Symbol
CO3: Evaluate dimensional accuracy of components using linear and angular measuring Instruments.
CO4: Demonstrate form measurement methods.
CO5: Describe advanced methods and automation in measurements

Textbooks

1. K.R.Gopalakrishna, "Machine Drawing" Subhas Publication, 2002
2. Jain R.K., "Engineering Metrology", Khanna Publishers, 2005

References

1. Cencel .H.Jensen and J.D.Helsel, "Engineering drawing and design" McGrawHill science 7th Edition,2007.
2. Gupta S.C, "Engineering Metrology", Dhanpat rai Publications, 2005
3. Jayal A.K, "Instrumentation and Mechanical Measurements", Galgotia Publications,2000
4. Alan S. Morris, "The Essence of Measurement", Prentice Hall of India, 1997

Web References

- http://nptel.ac.in/courses/112106138/
- https://en.wikipedia.org/wiki/Metrology

List of Experiments **30 Hrs**

1. Measure the dimensions of the given component using vernier calliper.
2. Determine the diameter of a cylindrical component to accuracy of 0.01mm using micrometer and to check the result with digital micrometer.
3. Measure the height of the machined component using vernier height gauge.
4. Determine the thickness of the ground MS plate using slip gauges.
5. Measure the thickness of gear tooth by using gear tooth vernier and profile projector.

BoS Chairman

CourseCode:140ME0206	Course Title: MANUFACTURING PROCESS – I (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	3 : 1 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Course Objective

The course is intended to:

1. Explain casting process.
2. Explain sheet metal process.
3. Choose appropriate welding process for the required weld joint
4. Describe procedural steps in forging process
5. Select appropriate processes and its sequence required for manufacture a given component.

UNIT I CASTING **9+3**

Sand casting process, Types of patterns, pattern materials and allowances, Types of sand and sand properties, Mould preparation, Tools and equipments, Core making, types, moulding sand, sand properties and operational characteristics, Non- disposable casting processes, Centrifugal casting processes (True, Semi, Centrifuging), Continuous casting, Casting metals, properties, Importance of thickness of casting, Gating and metal flow system, Working principle of Cupola furnace, Crucible furnace, Electric arc furnace, Induction furnace

UNIT II SHEET METAL PROCESSES **9+3**

Sheet metal characteristics, Shearing processes (Punching, Piercing, Perforation, Blanking process, Trimming, Notching, Nibbling, Shaving processes) Progressive, Compound and Combination dies, Types of shearing machines, Specifications of shearing presses, Working principle of shearing machines, Bending operations [Angle bending (Die bending, V-bending, Edge bending), Roll bending, Roll forming, Seaming], Spring back, Bending allowance, Force required for bending, Process parameters in bending, Drawing processes (Shallow drawing, Deep drawing, Reverse drawing and redrawing), Rigid die forming processes (Embossing, Coining and Stamping), Stretch forming, Defects in sheet metal operations.

UNIT III WELDING **9+3**

Fusion welding processes: Arc welding processes, Manual metal arc welding, TIG & MIG welding, Submerged arc welding, Electro slag welding, Gas welding process (Oxy-acetylene), Types of flames, Working principle of Oxy-acetylene welding, Equipments involved in Oxy-acetylene welding (Nozzle, cylinders, hoses, regulator), Gas cutting,

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Non- fusion welding processes: Electrical resistance welding (ERW), Types of ERW (Spot, seam, percussion, projection, flash butt), Soldering (Soldering iron, Fillers, Fluxes, Soft & Hard soldering), Brazing (Silver brazing, torch brazing, furnace brazing), Weld material preparation (Edge), Importance of Orientation, Direction , Weld speed, Types of electrodes, Significance of current characteristics, Weld symbol.

UNIT IV ADVANCED PROCESSES IN CASTING, SHEET METAL AND WELDING 9+3

Casting:

Lost wax process, Shell mould casting, Die casting (Cold chamber / Hot chamber), Process parameters in casting, Casting defects, Inspection and testing of cast components

Sheet Metal:

Flexible die forming processes (Rubber pad, Hydro forming), High energy rate forming (Explosive, electromagnetic), Metal spinning, Super plastic forming, Inspection and testing of Sheet metal components, Formability testing (Simulative drawing testing)

Welding:

Thermit welding, Electron beam welding, Laser beam welding. Process parameters in welding, types of weld defects. Testing methods of welds (Destructive, Non-destructive)

UNIT V MECHANICAL WORKING OF METALS 9+3

Hot working / Cold working of metals:

Rolling: Rolling mills, Load calculations, Roll passes and sequences, Rolling defects;
Forging: Types (Smith, Drop, Press & Machine), Forging operations (Drawing down / Swaging, Upsetting, Punching, Bending, Coining); Forging defects
Extrusion: Types (Direct, Indirect, Impact, Tube, etc.,), Extrusion operations (Tube extrusion, Wire drawing)

Course Outcomes

At the end of the course students will be able to:

CO1 Explain operational and procedural steps required in casting process
CO2 Illustrate operational and procedural steps required in sheet metal process
CO3 Choose appropriate welding process for the required weld joint
CO4 Describe procedural steps in forging process
CO5 Select appropriate processes and its sequence required for manufacture of a given. design requirement which involves casting, welding, forging and sheet metal processes

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Text Book

1. SeropeKalpakjian, Steven R Schmid, "Manufacturing Process for Engineering Materials" –Pearson Education, 4th Edition, 2003.
2. Sharma. P.C., "A Text Book of Production Technology", S. Chand and Company, 2001.
3. Jain. R.K., "Production Technology", Khanna Publishers, New Delhi, 2001.

Reference

1. HMT Bangalore, "Production Technology", Tata McGraw Hill Publishing Company Limited, New Delhi, 2001.
2. Hajra Choudhary etal, "Elements of Production Technology –Vol.II", Asia Publishing House, 2000.
3. Rao, P.N. "Manufacturing Technology", TMH Ltd., 2003

Web References

- http://nptel.ac.in/courses/112107144/

BoS Chairman

BoS Chairman

Course Code:140ME0207	Course Title: MANUFACTURING PROCESS LABORATORY – I (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	0: 0 : 2 : 1
Type: Practical	Total Contact Hours:	45 Hours

Course Objective

The course is intended to:

1. Produce a casted part.
2. Produce a welded part.
3. Produce a forged part.
4. Produce a sheet metal part.

List of Experiments

1. Casting of Aluminum wheel
    a. Review of melting properties of metal, Ex. Cast iron , steel, Aluminum
    b. Review of pattern allowances and pattern design
    c. Manufacture of pattern for the given cast product
    d. Preparation of mould cavity (with core, if needed)
    e. Casting of Aluminum wheel
2. Welding of support bracket
    a. Cutting of flats and preparation of weld edges
    b. Review of weld parameters
    c. Welding and finishing the component to the design requirement
3. Forging of wheel shaft
    a. Review of forging parameters for the given component
    b. Upsetting of pin head
    c. Punching hole for split pin
4. Fabricating sheet metal guard for the wheel
    a. Development of surface of the metal guard
    b. Forming the sheet to the required geometry
5. Assembly of castor wheel and validating for functional requirement

Course Outcomes

At the end of the course the student will be able to

CO1: Make a cast component using sand /die casting process for the given design requirement
CO2: Make a welded component using arc welding for the given design requirement
CO3: Make a forged component by hand forging process for the given design requirement
CO4: Make a sheet metal component by forming process for the given design requirement

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BoS Chairman

Course Code:140ME0208	Course Title: COMPUTER AIDED DRAFTING AND MODELING LABORATORY (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	0 : 0 : 2 : 1
Type: Practical	Total Contact Hours:	45 Hours

Course Objective

The course is intended to:

1. Develop part and assembly models .
2. Prepare production drawing for manufacturing process .

UNIT I STANDARDS, SYMBOLS& CONVENTIONS 6

Conventional representation of machine components and materials, Designation of Standard parts - keys, pin joints, fasteners, hexagonal and square head bolts and nuts, conventional representation of threads. BIS codes for practice of Machine Drawing - Dimensioning, abbreviations and conventions, welding symbols, surface finish symbols, screws, bolts, nuts and rivets.

UNITII CAD SOFTWARE FEATURES 12

Capabilities of CAD software - Parametric modeling-Concepts, 3D software packages features-reference planes – 2D sketching tools - relationships and constraints - partmodelling tools – extrusion, revolve, sweep – modifying tools.

UNIT III DEVELOPMENT OF PARTAND ASSEMBLY MODELS 12

Drawing front view, top view and side view of objects from the given pictorial views. Preparation of 2-D drawings of standard machine elements.-Assembly tools features of modelling software. Creation of assembly models with functional features.

UNIT IV PART DRAWING OF MACHINE COMPONENTS 9

Create part drawing using CAD software with manufacturing considerations. Exercise on bolt & nut (square and hexagon), studs and washers. Exercise on different types of keys, screws, spring etc.

UNIT- V PRODUCTION DRAWING 6

Preparation of Production drawing - Multiple views of part modelsand machine components –Bill of materials - Drawing Layout.

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List of Experiments

1. Preparation of isometric view for the orthographic views of simple parts
2. Exercise on square, hexagonal bolt and nuts
3. Exercise on different types of keys
4. Exercise on screws , rivets and springs
5. Preparation of part drawing - aluminum wheel.
6. Preparation of part drawing - support bracket
7. Preparation of part drawing -sheet metal guard
8. Preparation of Assembly drawing - castor wheel
9. Preparation of production drawing -aluminum wheel assembly

Course Outcomes

At the end of the course the student will be able to

CO1: Develop part and assembly models using CAD Software.
CO2: Prepare production drawing for manufacturing process using CAD software.

Text Book

1. Gopalakrishna,K.R, "Machine Drawing", 16th Edition Subhas publishing House, Bangalore, 2002 .
2. Maitra Prasad, "Hand Book of Mechanical Design", Second edition, Tata McGraw Hill, Noida 1995.

References

1. Cencil Jensen, Jay D. Helsel and Dennis R. Short Engineering Drawing and Design. Tata McGraw Hill Publishing Company Limited (2012).
2. Sidheswar.N, Kannaiah.P, Sastri.V.V.S "Machine Drawing", Reprint, TMH, New Delhi 2006.
3. Faculty of Mechanical Engineering,"PSG Design Data Book", DPV Printers, Coimbatore 2006.

BoS Chairman

CourseCode:140ME0209	**Course Title:** SPORTS FOR WELLNESS (Common to all B.E/B.Tech Programmes)	
Core/Elective: Core	**L : T : P : C**	0 : 0 :2 : 1
Type: PS	**Total Contact Hours:**	30 Hours

Course Objective

The course is intended to:

1. Explain the significance of physical fitness.
2. Maintain physical fitness.
3. Exhibit mental agility.

UNIT I HEALTH

Meaning of health - Components of health - physical, mental, social, emotional, spiritual - importance of health - Personal hygiene - Heredity and environment –Adopting healthy habits

UNIT II FITNESS & WELLNESS

Fitness and wellness – what is physical fitness - categories - components of health related physical fitness- components of skill related physical fitness-values of physical fitness – Physical fitness development.

What is wellness - importance of wellness for engineers –factors promoting wellness – Physiology and health: cardio-respiratory, muscular and nervous systems – ageing

UNIT III FOOD & HEALTH

Energy balance and body composition – nutrients- problems of surplus and deficiency - balanced diet - good food habits for better health – hazards of junk food - food and the gunas.

UNIT IV FITNESS DEVELOPMENT I

Exercises related ailment and injuries - safety and precautions - first aid.

Muscular strength – exercises (calisthenics): pull-up, sit-up, push-up and weight training.

Explosive power – exercises: vertical jump, long jump,

Cardio respiratory endurance– exercises: walking, jogging, treadmill, stair climbing, bicycling, skipping.

Flexibility –exercises: stretching

UNIT V FITNESS DEVELOPMENT II

Speed, agility, balance and coordination – exercises: sprint, cone drill, ladder drill, hurdle drill, ball throw - mental agility tests.

Dexterity - 12 minutes cooper test – long run – adventure games

Team games.

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Course Outcomes

At the end of the course students will be able to:

CO1: Explain the significance of physical fitness for healthy living
CO2: Maintain physical fitness through exercises
CO3: Exhibit mental agility

References

1. Tony Buzan, Harper Collins, The Power of Physical Intelligence (English)
2. Padmakshan Padmanabhan, Handbook of Health & Fitness, Indus Source Books, First Edition, 2014.

OPERATIONAL MODALITIES WITH PROGRAM SCHEDULE

Special Theorys by invited resource persons at semester beginning (for covering Units I, II, III)
3 Theorys x 4 hours = 12 hours
Practical:
2 hours/week; (6th and 7th hour)
12 weeks x 2 hours/week = 24 hours
Evaluation:
Unit I, II, III = Theory
Unit IV and V = Practical
Mid semester: Written (objective type and short answers) and Exercises: (40% weightage)
End semester exam: Written and exercises: (60% weightage)
Criteria for passing: 50% put together.

MEASUREMENTS: At the Beginning + At Semester End

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SCHEDULE OF EXERCISES FOR STUDENTS WITH DIFFERENT PHYSICAL CONDITIONS

Underweight	Normal	Obese
Flexibility exercises - stretching	Flexibility exercises - stretching	- Brisk walking
Minor games -forward running relay -backward running relay - over&under relay -circle games, etc.	-Walking - Walking-cum-jogging	- Minor games -
Strength Training - Calisthenics	Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling - long distance running	flexibility exercises - stretching - Cycling (static)
Cardio/Functional Fitness - Skipping - Stair climbing - jogging - bicycling	Agility - ladder drills - hurdle drill - cone drill	Cardio/Functional Fitness Skipping Jogging bicycling
Agility exercises - ladder drills - hurdle drill - cone drill	Strength Training -Calisthenics -gym workout for major muscles	Strength Training - Calisthenics - gym workouts
Diet Considerations	Diet considerations	Diet considerations
Measurements		
BMI Hand grip strength test 12 m Cooper run Sit&reach	BMI 12 m Cooper run Sit & reach test Illinois agility test	BMI Body fat percentage Waist-to-hip ratio Sit&reach

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END OF SEMESTER- II

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SEMESTER III

Course Code:140ME0301	Course Title: ENGINEERING MATHEMATICS- III (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Mathematics I
- Engineering Mathematics II

Course Objective

The course is intended to:

1. Compute the Fourier series expansion for given periodic functions.
2. Compute the Fourier transform for aperiodic functions.
3. Determine the solution of first and second order PDE.
4. Solve the one dimensional wave equation.
5. Solve one dimensional and two dimensional heat flow equations.

UNIT I FOURIER SERIES **12**

Periodic function - general Fourier series- Dirichlet's conditions- Euler's formulae - Fourier series expansion for a given periodic function - Fourier series expansion for a odd or even periodic function - half range Fourier cosine and sine series expansion for a given function - Parseval's identity.

UNIT II FOURIER TRANSFORM **12**

Fourier transforms - Fourier cosine and sine transforms - Inverse transforms - Convolution theorem and Parseval's identity for Fourier transforms.

UNIT III PARTIAL DIFFERENTIAL EQUATIONS **12**

Formation of partial differential equations - Solutions of standard types of first order partial differential equations - Lagrange's linear equation - Linear partial differential equations of second and higher order with constant coefficients.

UNIT IV SOLUTION OF ONE DIMENSIONAL WAVE EQUATION **12**

Method of separation of variables - Classification of second order linear partial differential equations - Variable separable solution of one dimensional wave equation.

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UNIT V SOLUTION OF ONE AND TWO DIMENSIONAL HEAT FLOW EQUATION 12

One dimensional equation of heat conduction - Steady state solution of two-dimensional equation of heat conduction (Insulated edges excluded) - Variable separable solutions of the heat equation

Course Outcomes

At the end of the course students will be able to:

CO1: Compute the Fourier series expansion for given periodic functions.
CO2: Compute the Fourier transform for aperiodic functions.
CO3: Determine the solution of first and second order PDE.
CO4: Solve the one dimensional wave equation.
CO5: Solve one dimensional and two dimensional heat flow equations.

Text Books

1. Erwin Kreyszig, "Advanced Engineering Mathematics", 8th edition, Wiley India, 2007.
2. Srimanta Pal &Subodh C. Bhunia. "Engineering Mathematics", Oxford University Press. First edition, 2015.

References

1. Grewal B.S. "Higher Engineering Mathematics", Khanna Publishers, New Delhi, 40thEdition,2007.
2. Bali &Iyengar, "A Text Book of Engineeing Mathematics", Laxmi Publications (P) Ltd, New Delhi, 7th Edition, 2007.
3. Ramana B.V. "Higher Engineering Mathematics", Tata McGraw Hill, New Delhi, 2008.

Web References

- http://nptel.ac.in/video.php/subjectId=122107036

BoS Chairman

Course 140ME0302	Course Title: ENGINEERING THERMODYNAMICS (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Mathematics I
- Applied Physics

Course Objective

The course is intended to:

1. Explain the basic concepts of thermodynamics.
2. Apply the first law of thermodynamics for closed and open systems.
3. Use second law of thermodynamics for evaluating the performance of various systems.
4. Evaluate the performance of vapor power cycles
5. Estimate the heating and cooling loads for air conditioning systems.

UNIT I BASIC CONCEPTS 12

Concept of continuum, classical and statistical thermodynamics, thermodynamic systems, concept of equilibrium, zeroth law of thermodynamics, quasi static process, thermodynamic equilibrium, state, path, process and cycle, point function and path function, properties of system, first law of thermodynamics, types of work, problems on heat and work interactions. Properties of Ideal and real gases - Gas laws, Ideal and real gas properties, vander walls equation, generalized compressibility chart – properties of gas mixtures – problems.

UNIT II FIRST LAW OF THERMODYNAMICS 12

Steady and unsteady flow processes, steady flow energy equation, first law of thermodynamics to open system viz. nozzles, diffuser, compressor, turbine, pump and heat exchanger. Modes of expansions of gases, first law of thermodynamics to closed (fixed mass) system, PMM-I, limitations of first law of thermodynamics.

UNIT III SECOND LAW OF THERMODYNAMICS 12

Need for second law of thermodynamics, Kelvin - Plank and Clausius statements, PMM-II. Carnot cycle, Carnot theorem and irreversibility, Clausius inequality, concept of entropy, entropy analysis for open and closed systems, availability.Heat engine, refrigerator and heat pump -performance.

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UNIT IV PROPERTIES OF PURE SUBSTANCE AND VAPOR POWER CYCLES 12

Phase rule, properties of pure substance (water) in three phases - P-V diagram, T-S diagram, H-S diagram, P-V-T surface. Third law of thermodynamics, thermodynamic properties of steam.Vapor power cycles- steam rate, heat rate, efficiency calculation of Rankine, Reheat and Regenerative cycles.

UNIT V PSYCHROMETRY 12

Psychrometry- properties, chart, properties of air vapour mixture, property calculations, psychrometric processes - sensible heating and sensible cooling processes, humidification and dehumidification. Heating and cooling loads for Automotive, Domestic and Industrial air conditioning systems.

(Use of Steam table, Mollier diagram and Psychometric chart are permitted in the End Semester examination)

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the basic concepts of thermodynamics and gas properties.
CO2: Apply the first law of thermodynamics to closed and open systems viz. Nozzle, diffuser, compressor, turbine, pump and heat exchanger.
CO3: Use second law of thermodynamics and the concept of entropy for evaluating the performance of heat engine, refrigerator and eat pump.
CO4: Evaluate the performance of vapor power cycles viz. rankine, reheat and regenerative cycles.
CO5: Estimate the heating and cooling loads for automotive, domestic and industrial air conditioning systems.

Text Book

1. Nag.P.K., "Engineering Thermodynamics", Tata McGraw-Hill,New Delhi,2007.
2. Cengel, "Thermodynamics – An Engineering Approach" 3rdEdition ,Tata McGraw Hill, New Delhi, 2003.

References

1. Holman.J.P., "Thermodynamics", 3rd Edition McGraw-Hill, 1995.
2. Venwylen and Sontag, "Classical Thermodynamics", Wiley Eastern, 1987
3. Arora C.P, "Thermodynamics", Tata McGraw-Hill, New Delhi, 2003.

Web References

- http://nptel.ac.in/courses/112105123/1
- https://en.wikipedia.org/wiki/Thermodynamics

BoS Chairman

Course Code: 140ME0303	**Course Title:** MANUFACTURING PROCESSES – II (Common to Automobile & Mechanical)	
Core/Elective: Core	**L : T : P : C : M**	3 : 1 : 0 : 4
Type: Theory	**Total Contact Hours:**	60 Hours

Prerequisites

The student should have undergone the course:

- Manufacturing Processes I

Course Objective

The course is intended to:

1. Select appropriate metal cutting to manufacture a machined part
2. Select the metal finishing processes for the given design requirement.
3. Develop process sequence for the given machined part .
4. Use different types of machines to manufacture a machined part.
5. Describe modern manufacturing systems.

UNIT I THEORY OF METAL CUTTING **9+3**

Metal removal processes, Orthogonal cutting, Oblique cutting, Cutting tools, Tool geometry of single point cutting tool, Types of chips, Continuous chips, Discontinuous chips, Chips with built up edge, Serrated chips, Characteristics of a cutting tool material, Materials for cutting tool, Mechanics of orthogonal cutting, Velocities in metal cutting, Cutting force, Machinability, Tool life using Taylors equation, Types of tool wear, Functions of cutting fluids, Types of cutting fluids, Introduction to Machine Tools (Rotary / Reciprocating metal cutting).

UNIT II MACHINING CYLINDRICAL FEATURES **9+3**

LATHE

Constructional Features, Parts of a Centre lathe, Functions of parts, Operations performed on Centre lathe, Operations, Taper turning methods, Thread cutting methods, Attachments/Accessories, Process parameters in turning and related operations, Calculation of Machining time and power required in lathe, Capstan lathe and Turret lathe, Parts, Functions, Types of automatic lathes, Constructional features of automatic lathes, Turret indexing mechanism, Bar feeding mechanism, Operations performed in semi -automatic and automatic lathes, Tooling layout for machining a job.

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DRILLING

Constructional features of drilling machine, upright drilling machine, radial drilling machine, Operations, Drilling, Boring, Reaming, Tapping, Process parameters, machining time, power required

UNIT III MACHINING PRISMATIC COMPONENTS WITH MILLING MACHINES **9+3**

Types of milling machines (Column and knee, fixed bed type),Types of milling cutters (Plain, Side, End, Face, Slit, Angle), Nomenclature of milling cutter, Horizontal milling machine, Vertical milling machine, Up milling & Down milling, Slab milling, Face milling, End milling, Straddle milling, Gang milling, Gear Form cutting, Process parameters in Milling, Machining time, Estimation of power required for machining in milling machine

UNIT IV GRINDING, HONING, LAPPING **9+3**

Grinding: Types of grinding machines (Portable, Bench, belt, cylindrical, centreless, surface, internal), Types of grinding wheels (Based on abrasive, bond, grade and structure: Based on shape: Straight, cup, cylinder, dish), Grinding wheel designation, Classification of grinding machines and grinding wheels, Constructional features of cylindrical grinding machines, Surface grinding machines, Significance of cutting speed, feed and depth of cut, Calculation of MRR and machining time. Honing, Types of honing, Lapping, Types of lapping (Equalising, form), Types of lapping machines, Burnishing, Polishing and Buffing.

UNIT V MODERN MANUFACTURING SYSTEMS **9+3**

Fundamentals of NC/CNC Machines, Constructional features, Machining centre, Part programming, Principles of Rapid Manufacturing, Applications in Product Development, Reverse Engineering Introduction to Powder metallurgy, powder milling, compounding, compaction, sintering, heat treatment, applications

Course Outcomes

At the end of the course students will be able to:

- CO1: Select appropriate metal cutting processes which involve Lathe, Drilling and Milling machines to manufacture a machined part.
- CO2: Select the metal finishing processes like grinding, honing, burnishing and lapping for the given design requirement
- CO3: Develop process sequence for the given machined part
- CO4: Use Lathe, Automat, Drilling and Milling machines to manufacture a machined part
- CO5: Describe modern manufacturing systems like CNC, RP & PM

BoS Chairman

Text Books

1. Rao P C, "Manufacturing Technology, Vol 2, Metal Cutting and Machine Tools", 2nd Edition, Tata McGraw Hill, New Delhi, 13th reprint 2012.
2. Kalpakjian, "Manufacturing Engineering and Technology", Addison Wesley Publishing Company, 3rdedition, 1995.

References

1. Rajput R K, "A Text Book of Manufacturing Technology", Laxmi Publications (P) Ltd., New Delhi, Reprint 2010
2. Sharma P C, "A Text book of Production Engineering", S Chand & Co Ltd., Reprint 2003
3. Jain R K, "Production Technology", Khanna Publishers, New Delhi, 4th edition, 1999.

Web References

- http://nptel.ac.in/courses/112107144/

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BoS Chairman

Course Code: 140ME0304	Course Title: FLUID MECHANICS AND MACHINERY (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C : M	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Mathematics I
- Applied Physics

Course Objective

The course is intended to:

1. Calculate the properties of fluids.
2. Apply the principles of kinematics and dynamics for fluid flow.
3. Determine flow rates, head loss in viscous and turbulent flow.
4. Evaluate the performance of hydraulic machinery

UNIT I FLUID PROPERTIES AND STATICS 12

Fundamental Units and Dimensions, Properties-mass density, specific weight, specific gravity, specific volume, surface tension, capillarity and compressibility- Problems, Viscosity- Newton's law of viscosity and dynamic viscosity, kinematic viscosity - Problems, types of Fluids, concept of Continuum, Statics - Pressure, Pressure head, Pascal's law- Problems, Simple and differential manometers- Problems, Centre of pressure and total pressure- Problems, buoyancy- Problems.

UNIT II PRINCIPLES OF KINEMATICS AND DYNAMICS IN FLUID FLOW 12

Types of Fluid flow-Steady, unsteady, uniform, non-uniform, Laminar, turbulent, rotational, ir-rotational, compressible, incompressible, 1D, 2D and 3D flows, application of control volume to continuity equation, Kinematics-Lagrangian and Eularian approach – Stream lines, path lines and streak lines, Dynamics-Euler's equation (Bernoulli's equation)-applications-VenturimeterOrificemater and pitot tube - Problems, Velocity and Acceleration of fluid flow, Newton's second law of motion - momentum equation for a fluid- Problems, Moment of momentum equation, Boundary layer Theory.

UNIT III FLOW THROUGH PIPES AND DIMENSIONAL ANALYSIS 12

Hagen Poiseulle's formulae- Problems in Viscous flow through pipes, Major Head losses in pipes - Darcy Weisbach's equation, Chezy's equation- Problems, Minor losses in Pipe bent, entry, exit, sudden enlargement, sudden contraction – Problems, Flow through Pipes - series pipe, Equivalent pipe, Parallel pipe, Branch pipe, Hydraulic Gradient line and total energy line, Dimensional Homogeneity and

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Buckingham's π Theorem– Problems, Dimensionless numbers, Model analysis, Similarities

UNIT IV HYDRAULIC TURBINES 12

Impact of jets - Stationary vertical plates, Stationary curved plates, Moving vertical Plate, Moving curved plate – Problems, Turbines - working principles, classification, Draft tube, heads and efficiency, specific speed, unit quantities, Velocity triangle-impulse and reaction turbines, Work done and Power delivered by the turbine-Performance of turbines.

UNIT V HYDRAULIC PUMPS 12

Centrifugal pumps - working principle and types, specific speed, unit quantities, heads and efficiency, Priming, Cavitation, Performance curves, Net Positive Suction Head, Reciprocating pump and rotary pump – working, types, Performance of positive displacement pumps

Course Outcomes

At the end of the course students will be able to:

CO1: Calculate the properties of fluids.
CO2: Apply the principles of kinematics and dynamics of fluid.
CO3: Determine flow rates and head losses in viscous and turbulent flows.
CO4: Evaluate the performance of hydraulic machinery such as pumps and turbines

Text Books

1. Bansal, R.K., "Fluid Mechanics and Hydraulics Machines", Laxmi Publications (P) Ltd., New Delhi, 2005.
2. YunusCengel, John Cimbalal , "Fluid Mechanics- Fundamentals and Applications", Tata McGraw-Hill Education, 2013.

References

1. Rajput, R.K., "A Text Book of Fluid Mechanics", Chand S and Co. New Delhi - 2007
2. Som S. K, Biswas G " Introduction to Fluid Mechanics and Fluid Machines", Tata McGraw-Hill, 2008
3. Ramamritham. S, "Fluid Mechanics, Hydraulics and Fluid Machines", DhanpatRai& Sons, Delhi, 1988.

Web References

- http://nptel.ac.in/courses/112105171/1

BoS Chairman

Course 140ME0305	Course Title: THEORY OF MACHINES I	
Core/Elective: Core	L : T : P : C	3 : 0 : 2 : 4
Type: Theory& Practical	Total Contact Hours:	75 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Mathematics I
- Engineering Mechanics

Course Objective

The course is intended to:

1. Calculate the DOF of simple mechanisms.
2. Calculate the kinematic parameters of simple mechanisms.
3. Calculate the static and dynamic forces involved in mechanisms
4. Develop CAM profile for follower motions
5. Calculate the kinematic parameters of gears and gear trains.

UNIT I BASICS OF MECHANISMS 9

Mechanism, Machine, Structure.Kinematic link, Kinematic pair and their types.Working of four bar mechanism, slider crank mechanism and their respective inversions.Gruebler's criteria and Grashof'slaw.Degrees of Freedom (DoF), Transmission angle, Mechanical advantage.Working of Pantograph, Straight line generator (Peaucellier mechanism), Ackerman Steering, Geneva indexing mechanisms.
Introduction to serial and parallel kinematics.

UNIT II KINEMATIC ANALYSIS 9

Linear, angular, absolute and relative velocities.Rubbingvelocity.Tangential and radial components of acceleration. Instantaneous centre (IC) of rotation- properties of IC, Kennedy's theorem of three centres, procedure of locating ICs for four bar and slider crank mechanisms. Finding velocity and acceleration of four bar and slider crank mechanisms using: relative velocity method, instantaneous centre method – loop closure equation – analytical expressions for the position, velocity and acceleration of the four bar and slider crank mechanisms.

UNIT III STATIC AND DYNAMIC FORCE IN MECHANISMS 9

Applied and constrained forces, D'Alembert's principle, Static equilibrium conditions, Two and three force members, Problems in static force analysis, Inertia force and Inertia torque, Dynamic analysis in reciprocating engine- Gas forces, Bearing loads,

BoS Chairman

Crank shaft torque, Dynamically Equivalent system, Turning moment diagrams, Flywheels, Coefficient of fluctuation of Energy and speed, mass of flywheel required.

UNIT IV KINEMATICS OF CAM **9**

Types of cams - Types of followers - Radial cam -Terminology of radial cam - Types of follower motions- uniform motion, simple harmonic motion, constant acceleration/deceleration motion, cycloidal motion. cam profile for knife edge, roller, flat faced follower.

UNIT V KINEMATICS OF GEARS AND GEAR TRAINS **9**

Types of gears, the spur gear terminologies, law of gearing, Conjugate action and conjugate curves, merits and demerits of involute and cycloidal profiles, The path of approach, Recess, length of path of contact - The arc of approach, Recess, length of arc of contact. - contact ratio, interference and undercutting - Derivation for the Minimum numbers of teeth on the pinion to avoid Interference - Classification of gear trains, calculation of velocities of Simple, Compound, Epicyclic& Reverted gear trains (tabulation method only).

Course Outcomes

At the end of the course students will be able to:

CO1: Calculate the DOF of simple mechanisms .
CO2: Calculate the kinematic parameters of simple mechanisms.
CO3: Calculate the static and dynamic forces involved in mechanisms
CO4: Develop CAM profile for different follower motions
CO5: Calculate the kinematic parameters of gears and gear trains such as simple, compound and epicyclic gear trains

Text Books

1. Ambekar A. G., "Mechanism and Machine Theory", Prentice Hall of India, New Delhi, 2007.
2. Rattan S S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd, New Delhi, 2007

References

1. UickerJ.J.Pennock G.R., Shigley J.E., "Theory of Machines and Mechanisms"(Indian Edition), Oxford University Press, 2003.
2. Thomas Bevan, "Theory of Machines", CBS Publishers and Distributors, 1984.
3. Sadhu Singh, "Theory of Machines", Pearson Publishers, 2012

BoS Chairman

List of Experiments **30 Hrs**

1. Cam Analysis
2. Study of mechanisms and their inversions
   a. Four bar mechanisms
   b. Double lever mechanism
   c. Crank lever mechanism
   d. Double crank mechanism
   e. Epicyclic gear train
   f. Differential gear train
3. Kinematics of gear trains
4. Computer simulation of simple mechanisms

Web References

- http://nptel.ac.in/courses/112104121/1

BoS Chairman

BoS Chairman

Course Code: 140ME0306	Course Title: ELECTRICAL DRIVES AND CONTROLS	
Core/Elective: Core	L : T : P : C	2 : 0 : 2 : 3
Type: Theory& Practical	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course:

- Engineering Mathematics I

Course Objective

The course is intended to:

1. Explain the fundamental parts of an electrical drives .
2. Explain the different types of speed control in DC & AC machines
3. Choose the special electrical drive for specific application
4. Select a power rating for a drive in home and industrial application.

UNIT I INTRODUCTION 6

Fundamentals of electric drives - characteristics of loads – different types of mechanical loads – four quadrant operation of electric drive- control circuit components: Fuses, circuit breakers, contactors, relays

UNIT II SPEED CONTROL OF DC MACHINES 6

Constructional features and working principle of a DC machine - Speed Torque characteristics of DC shunt & series motor – Methods of Speed control - Solid state DC drives: bridge rectifier fed DC drives, Chopper fed DC drives, Static Ward Leonard method.

UNIT III SPEED CONTROL OF AC MACHINES 6

Constructional details of induction motors – Types of rotors – Principle of operation – Slip - Speed torque Characteristics of Induction motors – speed control using: pole changing, stator frequency variation, stator voltage variation - basic inverter fed induction motor drive - variable voltage variable frequency drive.

UNIT IV SPECIAL ELECTRICAL DRIVES & CONTROLS 6

Stepper motor: Constructional and working – applications -BLDC motor : Constructional and working – applications – encoders - AC and DC Servo Motor : Constructional and working – applications.

UNIT V CONTROL AND SELECTION OF ELECTRIC DRIVES 6

Microcontroller, PLC & PC based control - Selection of an electric drive –IP classes - insulation testing and classes of electric motors - SF motors - continuous, intermittent and short time duty – Selection of drive for home appliances, machine tools, automobile applications, locomotives and steel rolling mills.

BoS Chairman

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the fundamental parts of an electrical drives and controls, operating principle of induction & DC machines

CO2: Explain the different types of speed control in DC & AC machines

CO3: Choose the special electrical drive such as stepper motor, BLDC and Servo motors for specific application

CO4: Select the drive for a particular application based on power rating and their role in home appliances, machine tools, automobiles, locomotives and specific industrial application

Text Books

1. N.K De and P.K Sen "Electric Drives" Prentice Hall of India Private Ltd.,2002.
2. VedamSubramaniam "Electric Drives" Tata McGraw Hill, New Delhi,2007.

References

1. Bhattacharya Brinjinder Singh S.K, "Control of Electrical Machines" New Age International Publishers, 2002.
2. Dubey.G.K., "Fundamental of Electrical Drives", Narosa publishing House, New Delhi 2013.
3. Krishnan R, "Electric motor drives Modeling, analysis and control", Pearson Education, New Delhi, 2003.

List of Experiments **30 Hrs**

1. Speed Torque Characteristics on DC Shunt and Series Motor
2. Speed Torque Characteristics on 3 Phase Induction Motor
3. Speed Control of DC Shunt Motor by Bridge Rectifier and Chopper
4. Speed Control of 3 Phase Induction Motor using VFD
5. Speed Control of BLDC Motor
6. Position Control using Stepper Motor
7. Insulation testing of motors using Megger

Web References

http://nptel.ac.in/courses/108108077/

BoS Chairman

Course Code: 140ME0307	Course Title: MANUFACURING PROCESSES LABORATORY-II (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	60 Hours

Course Objective

The course is intended to:

1. Develop process sequence for the given machined part .
2. Use different types of machines to manufacture a machined part.

List of Experiments

1. Exercise on Cylindrical Grinding
2. Exercise on Key-way Milling.
3. Exercise on Spur Gear Cutting.
4. Exercise on Surface Grinding.
5. Exercise on Machining of bolt.
6. Exercise on Shaping- Male dove tail part.
7. Exercise on Shaping-Female dove tail part.
8. Exercise on Drilling, Reaming and Tapping.
9. Exercise on Key-way Machining in Slotting machine.
10. Exercise on Assembly of machined components (may include welding of gear housing

Course Outcomes

At the end of the course students will be able to:

CO1: Develop process sequence for the given machined part

CO2: Use Lathe, Automat, Drilling and Milling machines to manufacture a machined part

BoS Chairman

Course Code: 140ME0308	Course Title: FLUID MECHANICS AND MACHINERY LABORATORY (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	60 Hours

Course Objective

The course is intended to:

1. Determine the actual and theoretical discharge of fluid flow.
2. Determine friction factor and Reynolds Number for a fluid flow.
3. Conduct performance tests on hydraulic machineries.

List of Experiments

1. Determination of the Coefficient of discharge of given Orificemeter.
2. Determination of the Coefficient of discharge of given Venturimeter
3. Determination of the velocity of flow using Pitot Tube
4. Calculation of the rate of flow using Rota meter.
5. Determination of friction factor of given set of pipes.
6. Draw the characteristic curves of Centrifugal pump
7. Draw the characteristic curves of Reciprocating pump.
8. Draw the characteristic curves of Gear pump.
9. Draw the characteristic curves of Pelton wheel.
10. Draw the characteristics curves of Francis turbine.
11. Draw the characteristic curves of Kaplan turbine.
12. Study of Impact of jets
13. Visualization of Reynolds Number

Course Outcomes

At the end of the course students will be able to:

CO1: Determine the actual and theoretical discharge of fluid flow using various flow measuring devices.

CO2: Determine friction factor and Reynolds Number for a fluid flow through pipe.

CO3: Conduct performance tests and draw the characteristics curves of pumps and turbines

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Course Code: 140ME0309	**Course Title:** PERSONAL EFFECTIVENESS (Common to all B.E/B.Tech Programmes)	
Core/Elective: Core	**L : T : P : C**	0 : 0: 2 : 1
Type: PS	**Total Contact Hours:**	30 Hours

Course Objective

The course is intended to:

1. Identify the strengths, weaknesses and opportunities
2. Set goals for academics, career, and personal aspirations
3. Establish the road map for goals
4. Apply time management techniques
5. Create time and pursue activities of self-interest

UNIT I THE IMPORTANCE OF ENVISIONING

Importance of positive self-perception – Principle of dual creation (Everything gets created twice – Envisioning) - Understanding vision and mission statements - Writing personal mission statements – 'Focus' as a way of life of most successful people – Importance of goal setting –Importance of planning and working to time

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UNIT II FUNDAMENTAL PRINCIPLES OF GOAL SETTING AND WORKING TO TIME

Clarifying personal values, interests and orientations – Awareness of opportunities ahead – Personal SWOT analysis - Principles driving goal setting: Principle of response and stimuli, Circle of influence and circle of concern, What you see depends on the role you assume.

UNIT III GOAL SETTING AND ACTION ORIENTATION

Potential obstacles to setting and reaching your goals - Five steps to goals setting: SMART goals, Inclusive goals, Positive stretch, Pain vs gain, Gun-point commitment – Importance of action orientation - Converting goals to actionable tasks – Establishing road map – Using Gantt chart for planning and progress

UNIT IV TIME MANAGEMENT - TOOLS AND TECHNIQUES

Pareto 80-20 principle of prioritization – Time quadrants as a way to prioritize weekly tasks – The glass jar principle - Handling time wasters – Assertiveness, the art of saying 'NO' – Managing procrastination

UNIT V PUTTING INTO PRACTICE

Practicals: Using the weekly journal – Executing and achieving short term goals Periodicreviews

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Course Outcomes

At the end of the course the student will be able to:

CO1: Identify the strengths, weaknesses and opportunities
CO2: Set well-articulated goals for academics, career, and personal aspirations
CO3: Establish the road map to realize the goals
CO4: Apply time management techniques to complete planned tasks on time
CO5: Create time and pursue activities of self-interest that add value

Course handouts (compiled by PS team, MCET)

1. Learner's workbook
2. Personal efficiency Journal
3. Reading material for Personal Effectiveness

Further Reading

1. Stephen R Covey, "First things first", Simon & Schuster UK, Aug. 1997.
2. Sean Covey, "Seven habits of highly effective teenagers", Simon & Schuster UK, 2004.
3. College student's guide to time management (e-book)
4. Michael S Dobson, Susan B Wilson, "Goal setting" (e-book)

Operational modality

Enablement through learning workshops	Conducted by external experts and trained internal faculty	2 days7 hours each	14 hours
Progress monitoring (face to face interaction with student and checking workbook/Journal	Internal faculty	1 hour per week for a minimum of 10 weeks	10 hours
Mid semester reinforcement-workshop	External expert	1 day	6 hours
Total			30 hours
No: of credits			1

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Assessments

Assessment	Details	Weightage	Administration	By Whom	When
Knowledge Test*	Multiple choice questions (20)	20%	Pen and paper	Internal team	Immediately after the initial workshop
Final comprehensive Knowledge test*	Multiple choice questions (40)	30%		Internal team	End of semester
Scenario based knowledge test*	Multiple choice scenario responses (15)	30%	Pen and paper	Internal team	Immediately after mid-semester reinforcement
Review of student journal	Student held journal with enough pages for the whole semester	10%	Student journals to be reviewed	Trained Internal faculty	Once in a week.
Review of student journal by external expert		10%	Student journal comprehend sive review	External expert and Internal reviewer	End of semester

END OF SEMESTER- III

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Course Code:140ME0401	Course Title: NUMERICAL METHODS (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Mathematics I
- Engineering Mathematics II
- Engineering Mathematics III

Course Objective

The course is intended to

1. Determine the solution of linear equations and calculate the dominant Eigen value
2. Determine the solution of non-linear equations and fit a curve for the given data.
3. Determine the unknown values, derivatives and integrals from the given data
4. Compute the solution of first order ordinary differential equations.
5. Compute the solution of partial differential equations

UNIT I SOLUTION OF SYSTEM OF LINEAR EQUATIONS 12

Solution of system of linear equations-Direct method: Gaussian elimination method, Choleski method, Iterative methods: Gauss-Seidel - sufficient conditions for convergence. Power method to find the dominant Eigen value and the corresponding Eigen vector.

UNIT II SOLUTION OF NON-LINEAR EQUATION & CURVE FITTING 12

Solution of non-linear equation: Method of false position - Newton- Raphson method -Order of convergence of these methods. Curve fitting - Method of least squares.

UNIT III INTERPOLATION, NUMERICAL DIFFERENTIATION & INTEGRATION 12

Newton's forward, backward interpolation – Lagrange's interpolation. Numerical Differentiation and Integration – Trapezoidal rule – Simpson's 1/3 rule – Gaussian two point and three point quadrature formula –Double integration using Trapezoidal rule.

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UNIT IV SOLUTION OF FIRST ORDER ORDINARY DIFFERENTIAL EQUATIONS 12

Numerical solution of first order ordinary differential equation-Single step method: Taylor's series- Euler's method - Runge-Kutta method of fourth order – Multi step method: Adams' method.

UNIT V SOLUTION OF PARTIAL DIFFERENTIAL EQUATIONS 12

Numerical solution of Laplace equation and Poisson equation by Liebmann's method - solution of one dimensional heat flow equation - Bender - Schmidt recurrence relation - Crank - Nicolson method.

Course Outcomes

At the end of the course, the students will be able to

CO1: Solve the system of linear equations and calculate the dominant Eigen value.

CO2: Solve the non-linear equations and apply the principle of least squares to fit a curve for the given data.

CO3: Predict the unknown values from the given set of data's; apply numerical techniques to find derivatives and to evaluate integrals.

CO4: Solve first order ordinary differential equation using numerical techniques.

CO5: Solve partial differential equation using numerical techniques.

Text Books

1. Srimanta Pal and Subodh C. Bhunia, "Engineering Mathematics", First Edition, Oxford University Press, New Delhi, 2015.
2. Grewal, B.S. and Grewal, J. S., "Numerical Methods in Engineering and Science", Sixth Edition, Khanna Publishers, New Delhi, 2004.

References

1. Gerald, C. F. and Wheatley, P. O., "Applied Numerical Analysis", Sixth Edition, Pearson Education Asia, New Delhi, 2006.
2. Jain M. K., Iyengar, S. R. and Jain, R. K, "Numerical Methods for Scientific and Engineering Computation", Wiley Eastern Company.
3. Sastry.S.S "Introductory Methods of Numerical Analysis", 3rd Edition, PHI, 2003

Web References

- http://nptel.ac.in/courses/122102009/

BoS Chairman

CourseCode:140ME0402	Course Title: STRENGTH OF MATERIALS (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course:

- Engineering Mechanics

Course Objective

The course is intended to

1. Calculate the stresses and strains of a structural member.
2. Determine shear force, bending moment and deflections of beam structures.
3. Analyze the torsion of shafts and springs
4. Analyze the columns subjected to buckling loads
5. Calculate the stresses and strains for thin-wall cylindrical pressure vessels.

UNIT I STRESS AND STRAIN OF SOLIDS 12

Rigid body and deformable body, Stiffness - types of stresses and strains-stresses in simple and compound bars under axial load- factor of safety- Poisson's ratio- elastic constants - Modulus of Elasticity- bulk Modulus- modulus of rigidity-Relationship between elastic constants- temperature stress and strain- Strain energy.

UNIT II ANALYSIS OF STRESSES IN TWO DIMENSION 12

Stresses on inclined planes-principal planes and stresses-Mohr's circle for biaxial stresses (Concepts only), Truss- Method of joints.
Thin wall pressure vessel and it types- The Longitudinal Stress - Hoop stress - application - Stresses and Strain in cylindrical thin shells

UNIT III BEAMS - LOADS AND STRESSES 12

Beam- Types of beams- transverse loads and its types- Shear force and bending moment - cantilever simply supported beams and overhanging beams (simple problems only).
Theory of simple bending - bending equation – bending stress -neutral axis – transverse shear stress - shear stress for I section and T section of beams.

UNIT IV DEFLECTION OF BEAM AND COLUMN 12

Deflection beams- Macaulay's method, Moment area method
Failure of a column-Euler's Column Theory - Limitation of Euler's formula- End conditions for long columns-Effective length-Slenderness Ratio- Rankine's formula.

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UNIT V TORSION 12

Torsion- assumptions in the theory of pure torsion- torsional rigidity – torque transmitted by a solid and hollow bar of circular cross section- torque transmitted by a stepped shaft - torque transmitted by a compound shafts. Springs and its types- closed coil Helical springs subjected to compressive loads

NOTE: (Use of approved Design Data Book is permitted in the End semester examination)

Course Outcomes

At the end of the course students will be able to:

CO1: Calculate the stresses and strains on normal and inclined plane of a structural member subjected to external loading such as axial loads and thermal loads

CO2: Determine and illustrate shear force, bending moment and deflections of beam structures experiencing a combined loading

CO3: Analyze the torsion of shafts and springs

CO4: Analyze columns subjected to buckling loads

CO5: Calculate the stresses and strains associated with thin-wall cylindrical pressure vessels.

Text Books

1. Hibbeller RC, "Mechanics of Materials", Prentice-Hall of India, New Delhi, 2013.
2. James M Gere, " Mechanics of Materials", Cengage Learning, India, 2012.

References

1. Popov E.P, "Engineering Mechanics of Solids", Prentice-Hall of India, New Delhi, 1997
2. Beer F. P. and Johnston R," Mechanics of Materials", McGraw-Hill Book Co, Third Edition, 2002.
3. Nash W.A, "Theory and problems in Strength of Materials", Schaum Outline Series, McGraw-Hill Book Co, New York, 1995

Web References

- http://nptel.ac.in/courses/112107147/

BoS Chairman

Course Code 140ME0403	Course Title: ENGINEERING METALLURGY (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	3: 0 : 0 : 3
Type: Theory& Practical	Total Contact Hours	45 Hours

Prerequisites

The student should have undergone the course:

- Material Science

Course Objective

The course is intended to

1. Analyze iron carbon equilibrium diagram.
2. Select an appropriate heat treatment process.
3. Select an appropriate surface treatment process.
4. Choose an appropriate alloying element for a given ferrous alloy.
5. Choose an appropriate alloying element for a given non ferrous alloy.

UNIT I CONSTITUTION OF ALLOYS AND PHASE DIAGRAMS 9

Constitution of alloys- Solid solutions- Substitutional and Interstitial. Phase diagrams- Interpretation of Phase diagram, Lever rule, Gibbs phase rule. cooling curve for pure metal, binary solid solution and binary eutectic system. Iron – Iron Carbide equilibrium diagram. Micro constituents in Fe_3C diagram (Austenite, Ferrite, Cementite, Pearlite, Martensite, Bainite), Pearlite transformation.

UNIT III HEAT TREATMENT 9

Heat treatment process-purpose heat treatment. Types of heat treatment: Full Annealing, Process annealing, Stress relief annealing, Speroidising, Isothermal annealing, Normalizing, Hardening, Tempering of steel-Low tempering, medium tempering, high tempering. Austempering and Mar tempering.Quenching and quenching media.Isothermal transformation Diagram (TTT Diagram). Cooling curves superimposed on TTT diagram.CCR. Harden ability- Definition. Method to determine Harden ability- Jominy end quench test. Ideal Critical diameter.

UNIT III SURFACE TREATEMENT 9

Surface treatment process – Purpose of surface treatment . Case hardening- Carburizing- types –Pack carburizing Liquid carburizing, Gas carburizing, Nitriding, Cyaniding, Flame and Induction hardening-working principle, merits, demerits and applications.

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UNIT IV FERROUS ALLOYS 9

Ferrous metals - Definition. Steel - Types (Low carbon, medium carbon and High carbon steels). Effect of alloying elements on properties of steel (Ms, Si, Cr, Mn, Va and W). Properties and applications of Stainless Steel and Tool steel. HSLA steels-Maraging steels. TRIP steels. Cast Iron-Types - White, Malleable, Grey and Spheroidal – Microstructure, properties and applications.

UNIT V NON-FERROUS ALLOYS 9

Non-ferrous metals – Types – Aluminium and its alloys -Designation system, Copper and its alloys, Nickel and its alloys Magnesium and its alloys, Titanium and its alloy – Composition, Properties, Applications,

Course Outcomes

At the end of the course students will be able to:

CO1: Analyze a phase diagram and explain iron-carbon equilibrium diagram.

CO2: Select an appropriate heat treatment process to impart a desired property for a given ferrous alloy and determine its harden ability.

CO3: Select an appropriate surface treatment process for ferrous and non-ferrous alloys.

CO4: Choose an appropriate alloying element to impart a desired property for a given ferrous alloy.

CO5: Choose an appropriate alloying element to impart a desired property for a given non ferrous alloy.

Text Books

1. William D Callister "Material Science and Engineering", John Wiley and Sons, 2010.
2. AnupGoel, SSSabharwal, "Engineering Materials and Metallurgy", Technical Publication, 2014.

References

1. Raghavan.V "Materials Science and Engineering", Prentice Hall of India Pvt., Ltd., 2007.
2. Dieter G. E., "Mechanical Metallurgy", McGraw Hill Book Company, 2006.
3. Sydney H.Avner "Introduction to Physical Metallurgy" McGraw Hill Book Company, 2007.

Web References

- http://nptel.ac.in/courses/113106032/
- http://www.nptel.ac.in/courses/112108150/
- https://en.wikipedia.org/wiki/Materials_science

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Course Code:140ME0404	Course Title: THEORY OF MACHINES - II	
Core/Elective: Core	L : T : P : C	3: 0 : 2 : 4
Type: Theory& Practical	Total Contact Hours:	75 Hours

Prerequisites

The student should have undergone the course:

- Theory of Machines I

Course Objective

The course is intended to

1. Calculate the characteristics of control mechanisms.
2. Balance the rotating and reciprocating unbalances.
3. Analyze the characteristics of free and forced longitudinal vibration.
4. Analyze the characteristics of transverse.
5. Analyze the characteristics of torsional vibration

UNIT I GOVERNORSANDGYROSCOPES 9

Governors - types - centrifugal governors – watt governor, gravity controlled-Porter and Proell governor and spring controlled- Hartnell governor. Centrifugal governors characteristics – stability- sensitiveness-hunting, isochronisms-effect of friction - controlling force.
Gyroscopes - gyroscopic forces and torques - gyroscopic stabilization - gyroscopic effects in automobiles, ships and airplanes

UNIT II BALANCING 9

Static and dynamic balancing - balancing of rotating masses - balancing of single rotating mass by a single mass in the same plane. Balancing of single rotating mass by two masses in different plane and balancing of several rotating masses in the same plane, balancing of several masses in different planes - balancing of reciprocating masses-balancing of primary and secondary unbalanced forces of reciprocating masses. Partial balancing in locomotive engines – balancing of coupled locomotives.

UNIT III LONGITUDINAL VIBRATION 9

Undamped free vibration of single degree of freedom system- simple and compound pendulum.springs in series, springs in parallel and combinations. Natural frequency, Damped free vibration of single degree of freedom system, types of damping-viscous damping- critically damped- under damped system, Logarithmic decrement. Forced

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vibration of single degree of freedom system, constant harmonic excitation, steady state vibration, magnification factor.Vibration isolation and transmissibility.

UNIT IV TRANSVERSE VIBRATION 9

Natural frequency of free transverse vibrations, Natural frequency of transverse vibration due to point load, uniformly distributed load over a cantilever beam-simply supported shaft-shaft fixed at both the ends, shaft subjected to number of point loads- Dunkerly's method, Critical speed –whirling of shafts.

UNIT V TORSIONAL VIBRATION 9

Torsional systems- natural frequency, natural frequency of single, two and three rotor systems, equivalent shafts, free torsional vibration of geared systems, Holzer's method, Signature Analysis.

Course Outcomes

At the end of the course students will be able to:

CO1: Analyze the control mechanisms such as Governors and gyroscopes
CO2: Balance the rotating and reciprocating unbalances
CO3: Analyze the characteristics of free and forced longitudinal vibration
CO4: Analyze the characteristics of transverse vibration
CO5: Analyze the characteristics of torsional vibration

Text Books

1. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Ltd., New Delhi, 2007.
2. Shigley J.E. and Uicker J.J., "Theory of Machines and Mechanisms", McGraw-Hill, Inc.,1995.

References

1. Rao J.S and Dukkipati R.V, "Mechanism and Machine Theory", New Age International, New Delhi, 2007.
2. R.S.Khurmi and J.K Gupta., "Theory of Machines",14th revised edition, S Chand Publications,2005.
3. Ballaney.P.L "Theory of Machines", Khanna Publishers, 1990.

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List of Experiments 30 Hrs

1. Governors - Determination of sensitivity, effort, etc. for Watt, Porter, Proell, Spring
   controlled Governors
2. Motorized Gyroscope-Verification of laws -Determination of gyroscopic couple.
3. Balancing of reciprocating masses and rotating masses.
4. Vibrating system – spring mass system –Determination of damping co-efficient of single degree of freedom system.
5. Determination of transmissibility ratio - vibrating table.
6. Whirling of shaft-Determination of critical speed of shaft with concentrated loads.
7. Determination of torsional frequencies for compound pendulum and flywheel system with lumped Moment of inertia.
8. Demonstration on Fast Fourier Transform (FFT) analyzer.

Web References

- http://nptel.ac.in/courses/112104114/
- https://en.wikipedia.org/wiki/Dynamics_(mechanics)

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CourseCode:140ME0405	Course Title: THERMAL ENGINEERING	
Core/Elective: Core	L : T : P : C	4: 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course:

- Engineering Thermodynamics

Course Objective

The course is intended to

1. Evaluate the thermodynamic characteristics of IC engines
2. Calculate the performance characteristics of steam boiler and condenser.
3. Analyze the performance characteristics of steam nozzles and steam turbines.
4. Evaluate the performance characteristics of air compressors.
5. Appraise the performance of refrigeration and air-conditioning systems.

UNIT I GAS POWER CYCLESAND PERFORMANCE OF IC ENGINES 12

Air standard cycles- Otto, Diesel, Dual, Brayton cycles.Calculation of mean effective pressure and air standard efficiency. Engine tests - performance, heat balance, retardation and Morse test.

UNIT II STEAM BOILERS AND CONDENSERS 12

Steam boilers- Definition, Types – Fire tube and water tube, Mountings and Accessories, performance calculations, Indian Boilers Regulation (IBR) Act, Energy conservation opportunities in boiler. Steam condensers-Functions, elements of a condensing plant, types, estimation of cooling water requirement, condenser efficiency.

UNIT III STEAM NOZZLES AND TURBINES 12

Steam nozzles- flow through steam nozzles, effect of friction, critical pressure ratio and super saturated flow, nozzle design calculations. Steam turbines- impulse and reaction turbines, compounding, velocity diagram, governing of turbines.

UNIT IV AIR COMPRESSORS 12

Introduction to air-compressors - Reciprocating air compressor, performance characteristics, effect of clearance volume, free air delivery and displacement, intercooler, after cooler - Rotary compressor - vane type, centrifugal and axial, flow performance characteristics, Application of various types of compressors.

BoS Chairman

UNIT V REFRIGERATION AND AIR CONDITIONING 12

Fundamentals of refrigeration – COP - vapour compression refrigeration system - cycle, p-h chart, vapour absorption system- comparison, properties of refrigerants, performance calculations.
Fundamentals of air conditioning system, simple cooling and heat load estimation. Air-conditioners -window, split, summer and winter, centralized air-conditioning systems.

NOTE: (Use of Steam table, Mollier diagram, Psychometric chart and Refrigeration property table are permitted in the end semester examination)

Course Outcomes

At the end of the course students will be able to:

CO1 Evaluate the thermodynamic characteristics of IC engines using air-standard cycles.
CO2 Calculate the performance characteristics of steam boiler and condenser.
CO3 Analyze the performance characteristics of steam nozzles and steam turbines.
CO4 Evaluate the performance characteristics of air compressors.
CO5 Appraise the performance of refrigeration and air-conditioning systems.

Text Books

1. Kothandaraman C.P, Domkundwar and A.V. Domkundwar, "A Course in Thermal Engineering", DhanpatRai& Sons, Fifth Edition, 2002.
2. Rajput R.K. "Thermal Engineering", Laxmi Publications (P) Ltd., New Delhi, 6th edition, 2005.

References

1. Mahesh M Rathore, "Thermal Engineering", Tata McGraw-Hill,3rd edition,2013.
2. Arora C.P., "Refrigeration and Air conditioning", Tata McGraw-Hill, New Delhi, 2005.
3. Sarkar B.K., "Thermal Engineering", Tata McGraw-Hill, New Delhi New Delhi, 2001.

Web References

- http://www.nptel.ac.in/courses/112104039/
- http://www.ignou.ac.in/

BoS Chairman

Course Code: 140ME0406	Course Title: C -PROGRAMMING	
Core/Elective: Core	L : T : P : C	3: 0 : 2 : 4
Type: Theory& Practical	Total Contact Hours:	75 Hours

Course Objective

The course is intended to

1. Draw a flowchart for a problem.
2. Build program using appropriate programming paradigms.
3. Implement the modular program
4. Apply pointers for effective memory usability.
5. Articulate the necessity of structures and unions

UNIT I INTRODUCTION 9

Basics of computers- Algorithm – Flow Chart-Introduction of C program-Identifier-Keywords -Data Types-Variables and Constants-Operators and Expressions – Managing Input and Output operations.

UNIT II CONTROL STATEMENTS AND ARRAYS 9

Decision Making and Branching-Looping statements-Nested looping- Arrays-Declaration-Initialization – One dimensional and two dimensional arrays-Advantages and Limitations of Arrays.

UNIT III STRINGS AND FUNCTIONS 9

String-Character Arrays-String operations--Arrays of Strings.Function –Built in function-User defined function— Declaration of function – Definition of function-Pass by value – Pass by reference– Recursion.

UNIT IV POINTERS AND FILES 9

Pointers - Operations on Pointers– Arithmetic & Relational operations on pointers-Void Pointer- Null Pointer – Relationship between Pointers and Arrays - Array of Pointers- Applications of Pointers- Files-File Operations.

UNIT V STRUCTURES AND UNIONS 9

Structure definition – Structure declaration – Operations on Structures–Pointer to Structures-
Array of structures– Nested Structures-functions and structures-Union - Practical applications of Unions and structures.

BoS Chairman

Course Outcomes

At the end of the course students will be able to:

CO1: Write and draw a flowchart for given problems.
CO2: Recognize and build program using appropriate programming paradigms.
CO3: Implement modular programs using functions and files.
CO4: Apply pointers for effective memory usability.
CO5: Articulate the necessity of structures and unions.

Text Books

1. Anita Goel, Ajay Mittal, "Computer Fundamentals and programming in C" , First Edition, Pearson Education, 2013.
2. PradipDey, ManasGhosh, "Fundamentals of Computing and Programming in C", First Edition, Oxford University Press, 2009

References

1. Yashavant P. Kanetkar. "Let Us C", BPB Publications, 2011.
2. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006
3. R.G. Dromey, "How to Solve it by Computer", Pearson Education, Fourth Reprint, 2007

List of Experiments

30Hrs

1. Program to evaluate an Expression using various types of operators
2. Program using Decision making and Branching statements
3. Program using Loops
4. Program using Arrays
5. Program using Strings
6. Program using Functions
7. Program using Pointers
8. Program using structures
9. Program using union
10. Program Using Files

Reference

1. Kernighan,B.W and Ritchie,D.M, "The C Programming language", Second Edition, Pearson Education, 2006.

BoS Chairman

Course Code:140ME0407	Course Title: STRENGTH OF MATERIALS AND METALLURGY LABORATORY (Common to Automobile & Mechanical)	
Core/Elective: Core	**L : T : P : C**	0: 0 : 4 : 2
Type: Practical	**Total Contact Hours:**	60 Hours

Course Objective

The course is intended to

1. Demonstrate the basic concepts of strength and mechanics
2. Demonstrate the micro structural characterization

Strength of Materials Lab

1. Study of UTM and Test specimen- specification and standards
2. Conduct tension test on the given mild steel rod using universal testing machine for determining the yield stress, ultimate stress, breaking stress, percentage of reduction in area and percentage of elongation over a gauge length and Young's modulus.
3. Conduct shear test on Mild steel and Aluminium rods by Double shear.
4. Calculate the modulus of rigidity of mild steel rod by Torsion test
5. Determine the toughness of the given mild steel specimen using IZOD and CHARPY impact test.
6. Analyse the Hardness Number of metals by Brinell and Rockwell Hardness
7. Determine the flexural rigidity and verify the Maxwell Reciprocal Theorem of given rectangular beam by deflection test.
8. Estimate the stiffness and modulus of rigidity of the helical spring by Compression test.

Metallurgy Lab

9. Prepare a specimen using mounting press for metallographic examination.
10. Draw the microstructure of cast iron, copper and aluminum using Metallurgical microscope
11. Compare the hardness number and impact strength for unhardened, hardened and tempered mild steel specimens
12. Determine the harden ability of steel by Jominy End Quench

Course Outcomes

At the end of the course the student will be able to

CO1: Demonstrate the basic concepts of strength and mechanics of a given material under external loading

CO2: Demonstrate the micro structural characterization and the effect of heat treatment on a given material

BoS Chairman

Course Code: 140ME0408	Course Title: THERMAL ENGINEERING LABORATORY	
Core/Elective: Core	L : T : P : C	0: 0 : 4 : 2
Type: Practical	Total Contact Hours:	60 Hours

Course Objective

The course is intended to

1. Draw the valve and port timing diagrams
2. Evaluate the performance of IC engines
3. Determine the fuel properties
4. Evaluate the performance of steam boilers and turbines

I.C Engine Lab and Fuels Lab **30 Hrs**

1. Valve timing and port timing diagrams.
2. Performance test on single cylinder, 4-stroke high speed diesel engine.
3. Performance test on single cylinder, 4-stroke computerized VCR petrol/diesel engine.
4. Heat balance test on twin cylinder, 4-stroke diesel engine.
5. Morse test on multi-cylinder petrol engine.
6. Retardation test to find frictional power of single cylinder, slow speed diesel engine.
7. a). Determination of viscosity using Redwood viscometer.
   b). Determination of flash point and fire point using Pensky-Martens closed cup apparatus

Steam Lab **15 Hrs**

1. Study of steam generators and turbines.
2. Performance and energy balance test on a steam generator.
3. Performance and energy balance test on steam turbine.

Course Outcomes

At the end of the course, the students will be able to

CO1: Draw the valve and port timing diagrams of IC engines.
CO2: Evaluate the performance of IC engines
CO3: Determine the fuel properties
CO4: Evaluate the performance of steam boilers and turbines

BoS Chairman

Course Code:140ME0409	Course Title: ETHICAL AND MORAL RESPONSIBILITY (Common to all B.E/B.Tech Programmes)	
Core/Elective: Core	L : T : P : C	0: 0 : 2 : 1
Type: PS	Total Contact Hours:	30 Hours

Course Objective

The course is intended to

1. Articulate the importance of ethical and moral responsibilities
2. Explain the fundamental aspects of ethics and morality
3. Validate one's appropriate and inappropriate behaviors.
4. Elaborate code of conduct
5. Explain the importance of professional practices.

UNIT I ETHICAL PRACTICES - IMPORTANCE **8***

Why ethical practices; The current day scenario of ethical practices – parents, society, politics & business; Awareness of skewedness of information – news, advertisements and other media; The need for ethical and moral responsibility on a personal level; Handling oneself amidst peer pressure and societal pressure;

UNIT II ETHICAL PRACTICES - FUNDAMENTALS **6***

Morality & Ethics; Moral issues, inquiry, moral dilemmas; Moral autonomy – Kohlberg's theory and Gilligan's refinement; Theories on "right action" – virtue ethics, utilitarianism, duty ethics, rights ethics – resolving moral dilemmas; justifying moral obligations;

UNIT III CODES OF CONDUCT **8***

Importance of code of conduct and its role;Evolving draft Code of conduct for different roles – son/daughter, student, future employee & citizen; Reflectionon real time incidences at the college

Engineers as responsible experimenters; Faith of the Engineer (ABET); Pledge and Code of ethics as per National Society of Professional Engineers (NSPE); Code of Ethics of Institution of Engineers (India); Case studies and discussions in professional context

UNIT IV PROFESSIONAL PRACTICES AT WORK **8***

Transition from a student to a professional; Importance of professional practices at work; Integrity as the topmost virtue of a professional; Self-awareness: Where competence ends and professionalism takes over; Professional qualities;

Need to align oneself to culture & values of organizations; Need to embrace diversity in organizations.

*- Includes review sessions

BoS Chairman

Assessments

Assessment	Details	Wt:	Administration	When
Class room participation	Group assignments presentation; Case discussions participation	70%	Continuous assessment in class	During class
Knowledge test	Multiple choice questions	10%	Pen and Paper	End of course
Scenario based assessments	Multiple choice questions	20%	Pen and Paper	End of course

No. of hours& credits:

Enablement through class room Theory, case discussions and group presentations	Conducted by trained internal faculty	30 hours – 1 credit
At least two guest Theory's	Delivered by senior people from Industries/Government organizations	

Course Outcomes

At the end of the course the student will be able to:

CO1: Articulate the importance of ethical and moral responsibilities

CO2: Explain the fundamental aspects of ethical practices

CO3: Validate one's appropriate and inappropriate behaviors in various roles

CO4: Elaborate code of conduct of professional bodies

CO5: Explain the importance of professional practices as a future employee/entrepreneur

Course handouts (compiled by Professional Skills team, MCET)

1. Instructor's Manual (for the faculty)
2. Learner's workbook (for the student)

References

1. Mike W Martin & Roland Schinzenger, "Ethics in Engineering", Latest Edition, Tata McGraw-Hill
2. Code of conduct document, MCET student handbook
3. Gail D Baura, "Engineering Ethics - an industrial perspective", Academic Press, Elsevier,
4. SubratoBagchi, "The professional - Defining the new standard of Excellence at work", Penguin Books India.

END OF SEMESTER- IV

BoS Chairman

SEMESTER V

Course Code:140ME0501	Course Title: HEAT AND MASS TRANSFER (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Mathematics
- Fluid Mechanics & Machinery
- Engineering Thermodynamics

Course Objective

The course is intended to

1. Solve one dimensional steady state conduction heat problems.
2. Solve forced and natural convection heat transfer for fluid flows.
3. Apply phase change heat transfer in heat exchanger design
4. Calculate radiation heat transfer between different sections
5. Solve diffusion mass transfer through plane membrane
6. Describe the different applications

UNIT I ONE DIMENSIONAL STEADY STATE CONDUCTION 12

Basic concepts-Modes of heat transfer – Conduction, Convection and Radiation-Cartesian coordinate- Simple geometries-Plane wall, Cylinder, Sphere, Composite wall , cylinder and Sphere – simple problems.

Fins – Short fin end insulated, Short fin end not insulated and long fin – Simple problems. Internal heat generation – Plane wall and cylinder – Simple problems. One dimensional Unsteady state heat conduction (Qualitative treatment only)

UNIT II CONVECTION 12

Basics – dimensionless numbers, boundary layer concepts- external flow – flow over plates, cylinders and spheres – bank of tubes – Simple problems, internal flow – flow through cylinders – simple problems.

Free convection – flow over horizontal plate, flow over vertical plate and flow through cylinders and spheres – simple problems.

UNIT III PHASE CHANGE HEAT TRANSFER AND HEAT EXCHANGERS 12

Phase change heat transfer – boiling- pool and flow boiling - condensation – simple problems.

Heat exchangers – Classifications - parallel flow, counter flow and cross flow- LMTD and NTU methods –simple problems.

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UNIT IV RADIATION 12

Basic concepts – absorptivity, reflectivity and transmissivity – black body and grey body concepts – Laws of radiation – Stefan Boltzmann law, Kirchoff's law, Planck's law, Wien's law and Lambert's cosine law – shape factor algebra – between plates and discs – simple problems, Radiation shield – single and 'n' number of shields – simple problems.

UNIT V DIFFUSION MASS TRANSFER AND HEAT TRANSFER APPLICATIONS 12

Basic concepts – properties of mixtures – mass concentration and mass fraction – mole concentration and mole fraction – diffusion mass transfer – Fick's law of diffusion – diffusion through plane membrane- simple problems.
Applications of heat transfer – domestic applications – Refrigerator, Air conditioning, process industrial applications- Food industry, Sugar Industry and automotive applications – Engine, radiators.

NOTE: (Use of Steam table&Heat & Mass Transfer Datebook are permitted)

Course Outcomes

At the end of the course students will be able to:

CO1: Solve one dimensional steady state conduction heat transfer in simple geometries, fins and internal heat generation
CO2: Solve forced and natural convection heat transfer for external and internal flows
CO3: Apply phase change heat transfer in heat exchanger design
CO4: Calculate radiation heat transfer between different sections
CO5: Solve diffusion mass transfer through plane membrane
CO6: Describe the different applications of Heat transfer

Text Books

1. Kothandaraman C.P "Fundamentals of Heat and Mass Transfer" New Age International, New Delhi, 2012.
2. Sachdeva R C, "Fundamentals of Engineering Heat and Mass Transfer" New Age International, 2010.

References

1. Yadav R "Heat and Mass Transfer" Central Publishing House, 1995.
2. Nag P.K, " Heat Transfer", Tata McGraw-Hill, New Delhi, 2011
3. Ozisik M.N, "Heat Transfer", McGraw-Hill Book Co., 1994.

Web References

- http://nptel.ac.in/courses/112101097/
- http://nptel.ac.in/courses/Webcourse-contents/IISc-BANG/Heat%20and%20Mass%20Transfer/New_index1.html

BoS Chairman

Course Code:140ME0502	Course Title: DESIGN OF MACHINE ELEMENTS (Common to Automobile & Mechanical)	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course(s):

- Theory of Machines-II
- Strength of Materials

Course Objective

The course is intended to

1. Design the machine elements subjected to static loads.
2. Design the machine elements against fluctuating and impact loads
3. Calculate the design parameters for power transmitting element .
4. Determine the design parameters of helical and leaf spring.
5. Design/Select a suitable bearing.

UNIT I DESIGN FOR STATIC LOAD OR STEADY STRESSES 12

Design Processes and its types. Static stress- yield stress and ultimate stress, direct, bending bearing and shear stresses - factor of safety, selection. Selection of materials and its properties - eccentric loading-stress due to eccentric loading, problems. Theories of failure, simple problems.

UNIT II DESIGN FOR FLUCTUATING AND IMPACT LOADS 12

Fatigue, types, Endurance limit, modifying factors, relation between endurance limit, ultimate tensile strength and yield strength, problems on different fatigue loading conditions. Stress concentration, stress concentration factor, causes of stress concentration, method of reducing stress concentration, stress concentration factor for different material configuration. Notch sensitivity, factors affecting of notch sensitivity.Impact loading, shock loading, simple problems.

UNIT III DESIGN OF SHAFTS, KEYS, AND COUPLINGS 12

Difference between shaft, axle and spindle, Shaft materials, criteria of shaft design, different transmitting elements on a shaft, shaft design against static loading for given application. Shaft design for fatigue loading. Keys, types of keys, stresses developed in the key. Spline, stresses in spline shaft, design of shunk key and spline. Couplings, types of coupling, design of coupling based on given speed and load conditions, Design of flexible coupling based on given speed and load conditions.

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UNIT IV DESIGN OF SPRINGS 12

Springs, types of springs, applications, spring terminology. Stresses in helical springs, Design of helical and concentric spring for given loading. Leaf springs, NIP in leaf springs Design of leaf spring for given application.

UNIT V DESIGN OF BEARING 12

Bearings, bearing types, Parts of the bearing, rolling contact bearing, its applications. Load carrying capacity, equivalent load, Life of bearing, Load life relationship, Problems. Selection of ball bearings from manufacturing catalogue. Sliding contact bearings, types and Nomenclature. Hydrodynamic bearing, load carrying capacity, lubrication, selection of lubricant, equivalent load, minimum oil film thickness- length to diameter ratio- bearing pressure, radial clearance. Mckees equation, Somer field equations -Bearing characteristic number problems.

NOTE: (Use of approved Design Data Book is permitted in the End semester examination)

Course Outcomes

At the end of the course students will be able to:

CO1: Design the machine elements subjected to simple and combined static loads.

CO2: Design the machine elements against fluctuating loads and impact loads

CO3: Calculate the design parameters for power transmitting element such as shaft, key, and coupling.

CO4: Determine the design parameters of helical and leaf spring for given application.

CO5: Design/Select a suitable bearing for the given application.

Text Books

1. V.B. Bhandari. "Design of Machine Elements" Tata McGraw Hills Education, 3rd edition2014.
2. P. C Sharma and A. K Agarwal. "Machine Design" (SI units). S.K. Kataria& Sons. Reprint 2013.

References

1. Shigley J.E and Mischke C.R., "Mechanical Engineering Design", Sixth Edition, Tata McGraw Hill, 2012.
2. Ugural A.C, "Mechanical Design – An Integral Approach", McGraw-Hill Book Co., 2010.
3. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2012.

BoS Chairman

Web References

- http://nptel.ac.in/courses/112105124/
- http://www.nptel.ac.in/downloads/112105125/
- http://nptel.ac.in/courses/112106137/
- http://www.skf.com/in/index.html

BoS Chairman

BoS Chairman

Course Code:140ME0503	Course Title: DESIGN OF HYDRAULIC AND PNEUMATIC SYSTEMS	
Core/Elective: Core	L : T : P : C	3: 0 : 2 : 4
Type: Theory& Practical	Total Contact Hours:	75 Hours

Prerequisites

The student should have undergone the course(s):

- Fluid Mechanics and Machinery
- Theory of Machines - II

Course Objective

The course is intended to

1. Explain the fluid power systems.
2. Explain construction and working of hydraulic system .
3. Design hydraulic circuit to perform the desired function.
4. Explain construction and working of pneumatic system
5. Design of pneumatic circuit to perform the desired function.

UNIT I FLUID POWER SYSTEM AND FUNDAMENTALS 6

Introduction to Fluid power - Types of fluid power systems - Hydraulic system components -Pneumatic system components - Application of Pascal's Law in hydraulics-Advantages of fluid power system -Applications of Fluid power system - Properties of hydraulic fluids - Types of fluids.

UNITII HYDRAULIC SYSTEM AND COMPONENTS 12

Pumping theory - Pump classification - Construction and working of gear pumps, Vane pumps, Piston pumps - Construction and working of linear actuators - Special cylinder - Rotary actuator – Construction and operation of direction control valves (DCV), Pressure control valve, Flow control valve – Construction and operation of accumulators, Intensifiers.

UNIT III DESIGN OF HYDRAULIC CIRCUITS 9

Hydraulic symbols - Hydraulic circuits for linear actuators - Hydraulic circuits using different actuating devices - Speed control circuits - Sequencing circuit - Synchronizing circuit - Regenerative circuit - Accumulator circuit – Application of intensifier - Hydraulic circuit for Milling operation, Grinding Machine - Hydraulic braking in Automobile.

BoS Chairman

UNIT IV PNEUMATIC SYSTEM AND COMPONENTS 9

Properties of air – Compressor - Types of compressor - Construction and operation of air filter, air regulator, air lubricator - Pneumatic linear actuator - Rotary actuator - Constriction and working of pneumatic direction control valve – Flow control valve - Pneumatic symbols

UNIT V DESIGN OF PNEUMATIC CIRCUITS 9

Pneumatic circuits for single acting cylinder, Double acting cylinder - Pneumatic circuits using manual, mechanical, electrical actuating devices - Cascade method for sequencing: two and three Cylinders - Step counter method- Hydro-Pneumatic circuit - Material handling system circuit - Multiple operation Machining.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the fluid power systems with advantages and applications.
CO2: Explain construction and working of hydraulic system components.
CO3: Design hydraulic circuit to perform the desired function.
CO4: Explain construction and working of pneumatic system components
CO5: Design of pneumatic circuit to perform the desired function.

List of Experiments **30 Hrs**

1. Design a hydraulic circuit for the actuation of hydraulic cylinder using Mechanical actuation.
   a) Using 4/2 DCV.
   b) Using 4/3 DCV.
2. Design a hydraulic circuit for the actuation of hydraulic cylinder using Electrical actuation.
   a) Using 4/2 DCV.
   b) Using 4/3 DCV.
3. Design a hydraulic circuit for Speed regulation of a double-acting cylinder (Meter in & Meter out).
4. Design a hydraulic circuit for Clamping and Drilling function (Pressure reducing valve).
5. Design a Pneumatic circuit for the actuation of single and double acting cylinder using Mechanical actuation.
6. Design a Pneumatic circuit for the actuation of single and double acting cylinder using Electrical actuation.
7. Develop a CASCADE circuit for given sequence operation (two and three cylinders).
8. Develop a Pneumatic circuit for Material handling application.

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Text Books

1. Esposito Anthony, "Fluid Power with Applications", Pearson Education Inc., New York, 2008.
2. Majumdar, S.R., "Oil Hydraulic Systems – Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2006.

References

1. Srinivasan.R, "Hydraulic and Pneumatic controls", Vijay Nicole, 2006.
2. Andrew Parr, "Hydraulics and Pneumatics, A technician's and engineer's guide", Third Edition, Butterworth-Heinemann, 2011.
3. Majumdar, S.R., "Pneumatic Systems – Principles and Maintenance", Tata McGraw-Hill, New Delhi, 2006

Web References

- http://www.nptel.ac.in/courses/112106175/
- http://nptel.ac.in/courses/112105046/
- http://www.nitc.ac.in/dept/me/jagadeesha/mev303/Chapter2_Hydraulics_control_in_machine_tools.pdf
- http://maysaaiat.weebly.com/uploads/5/8/8/3/5883161/atm1122_hydraulics_module_1.pdf

BoS Chairman

BoS Chairman

Course Code:140ME0504	Course Title: ENGINEERING ECONOMICS AND COST ANALYSIS (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Mathematics-I
- Manufacturing Processes II

Course Objective

The course is intended to

1. Calculate the breakeven point
2. Application of interest formula
3. Comparison of economic alternatives
4. Replacement analysis of equipment.
5. Calculate depreciation of an equipment

UNIT I INTRODUCTION TO ECONOMICS **8**

Introduction to Economics- Flow in an economy, Law of supply and demand, Concept of Engineering Economics – Engineering efficiency, Economic efficiency, Scope of engineering economics - Elements of costs, Marginal cost, Marginal Revenue, Sunk cost, Opportunity cost, Break-even analysis- V ratio, Elementary economic Analysis

UNIT II VALUE ENGINEERING **10**

Make or buy decision, Value engineering – Function, aims, and Value engineering procedure. Interest formulae and their applications –Time value of money, Single payment compound amount factor, Single payment present worth factor, Equal payment series sinking fund factor, Equal payment series payment Present worth factor- equal payment series capital recovery factor-Uniform gradient series annual equivalent factor, Effective interest rate, Examples in all the methods with problems.

UNIT III CASH FLOW **9**

Methods of comparison of alternatives – present worth method (Revenue dominated cash flow diagram), Future worth method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), Annual equivalent method (Revenue dominated cash flow diagram, cost dominated cash flow diagram), rate of return method, Examples in all the methods.

BoS Chairman

UNIT IV REPLACEMENT AND MAINTENANCE ANALYSIS 9

Replacement and Maintenance analysis – Types of maintenance, types of replacement problem, determination of economic life of an asset, Replacement of an asset with a new asset – capital recovery with return and concept of challenger and defender, Simple probabilistic model for items which fail completely.

UNIT V DEPRECIATION 9

Depreciation- Straight line method of depreciation, declining balance method of depreciation-Sum of the years digits method of depreciation, sinking fund method of depreciation/ Annuity method of depreciation, service output method of depreciation-Evaluation of public alternatives- introduction, Examples, Inflation adjusted decisions – procedure to adjust inflation, Examples on comparison of alternatives and determination of economic life of asset. Case study

Course Outcomes

At the end of the course students will be able to:

CO1: Categorize different cost and calculate the breakeven point for a given business situation

CO2: Apply different interest formulae and their application in decision making process.

CO3: Evaluate present value, future value and annual worth analysis on one or more economic alternatives.

CO4: Determine the economic value of an asset and develop a better replacement policy for a given equipment.

CO5: Evaluate the depreciation of equipment per period.

Text Books

1. Panneerselvam R, "Engineering Economics", Prentice Hall of India Ltd, NewDelhi, 2014
2. Chan S.Park, "Contemporary Engineering Economics", Prentice Hall of India, 2010.

References

1. Donald.G. Newman, Jerome.P.Lavelle, "Engineering Economics and analysis" Engg. Press, Texas, 2010.
2. Degarmo, E.P., Sullivan, W.G and Canada, J.R, "Engineering Economy", Macmillan, New York, 2010.
3. Grant.E.L., Ireson.W.G., and Leavenworth, R.S, "Principles of Engineering Economy", Ronald Press, New York,1990.

Web References

- https://en.wikipedia.org/wiki/Engineering_economics
- https://en.wikipedia.org/wiki/Cost%E2%80%93benefit_analysis

BoS Chairman

Course Code:140ME0505	Course Title: MICROCONTROLLER AND APPLICATIONS	
Core/Elective: Core	L : T : P : C	3 : 0 : 2 : 4
Type: Theory& Practical	Total Contact Hours:	75 Hours

Course Objective

The course is intended to

1. Describe the basics of digital system
2. Illustrate the Microcontroller Architecture .
3. Explain the various Microcontroller Peripherals
4. Design various Microcontroller Peripherals .
5. Design the Microcontroller concept in automation field

UNIT I INTRODUCTION TO DIGITAL SYSTEM **6**

Introduction to number system, Logic gates , Encoder , Decoder – Registers and Flip flops – Introduction to Microprocessor & Microcontroller .

UNIT II 8-BIT MICROCONTROLLER **10**

Architecture of 8051 – Pin configuration – Memory Organization – SFRs – Interrupts – Addressing modes – Instruction set – Assembly Language Programming – Timer – Counter .

UNIT III MICROCONTROLLER INTERFACING **12**

Interfacing concepts – Input /Output port configuration – Interfacing of LED, Switch, Matrix keyboard, Display Interfacing – 7 segment, LCD. DC Motor Interfacing – ADC /DAC interface, simple sensor interfacing.

UNIT IV MICROCONTROLLER WITH EMBEDDED ' C ' PROGRAMS **9**

Introduction to Embedded 'C' –IDE – Simple Assembly Language Programming using IDE. Embedded C Programming using IDE: Interfacing of LED, Switch, 7 segment, LCD, DC Motor, ADC Sensor and Serial port.

UNIT V APPLICATIONS OF MICROCONTROLLER **8**

Case study of Wind Screen Wiper Motion, a Pick and Place Robot, Car Engine Management, Controlling of AC & DC Appliances, Measurement of Frequency.

Course Outcomes

At the end of the course students will be able to:

CO1: Describe the basics of digital system

CO2: Illustrate the Microcontroller Architecture with programming concepts

BoS Chairman

CO3: Explain the various Microcontroller Peripherals
CO4: Design various Microcontroller Peripherals using Embedded 'C' Concept
CO5: Design the Microcontroller concept in automation field

Text Books

1. M.A. Mazidi and J.G. Mazidi, "The 8051 Microcontroller and Embedded Systems", PHI/ Pearson Education, 2006.
2. M.MorrisMano,"Digital Design",3rdEdition,Pearson Education Pvt. Ltd., New Delhi, 2008.

References

1. Kenneth J. Ayala,"The 8051 Microcontroller, Architecture, Programming and Applications", Thomson Delmar Learning, Indian Edition, 2007.
2. Krishna Kant, "Microprocessor and Microcontroller", Prentice Hall of India, 2007.
3. William Botton, "Mechatronics – A Multidisciplinary Approach", Pearson Education Pvt. Ltd., New Delhi, 4th Edition, 2010.

List of Experiments **30Hrs**

1. Arithmetic operation using Microcontroller (ADD, SUB, MUL, DIV)
2. ALP based Compare instructions (GR, LR)
3. Study of Integration Development Environment
4. Simple Arithmetic operation using IDE
5. Write an Embedded C programming using IDE to interface the following
   I. LED
   II. Switch
   III. Display
   IV. DC Motor
   V. Temperature sensor using ADC
   VI. Serial port programming

Web References

- http://www.daenotes.com/electronics/digital-electronics/
- http://www.engineersgarage.com/microcontroller
- www.intorobotics.com

BoS Chairman

Course Code:140ME0507	Course Title: HEAT POWER LABORATORY (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	0: 0 : 4 : 2
Type: Practical	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Mathematics
- Fluid Mechanics & Machinery
- Thermal Engineering

Course Objective

The course is intended to

1. Determine the thermal conductivity of insulating materials.
2. Calculate the heat transfer coefficient and fin efficiency.
3. Calculate the Stefan boltzman constant and emissivity of grey surfaces.
4. Evaluate the performance of heat exchangers
5. Evaluate the performance of reciprocating air compressor, refrigeration and air-conditioning systems.

Heat Transfer

1. Thermal conductivity measurement using guarded plate method.
2. Thermal conductivity measurement of pipe insulation using lagged pipe approach.
3. Heat transfer through composite wall
4. Thermal conductivity of insulating powder in a concentric sphere
5. Determination of heat transfer coefficient under natural convection from a vertical cylinder.
6. Determination of heat transfer coefficient under forced convection inside tube.
7. Heat transfer from pin-fin (Natural and Forced convection mode)
8. Determination of Stefan Boltzman constant.
9. Determination of emissivity of grey surface.
10. Effectiveness of parallel/counter flow heat exchanger.
11. Performance test on Cooling tower.

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Refrigeration & Air-Conditioning

1. Study of Refrigeration & Air-conditioning systems
2. Determination of COP of Refrigeration system.
3. Determination of COP of Air-conditioning system.
4. Performance test on two stage reciprocating air compressor

Course Outcomes

At the end of the course students will be able to:

CO1: Determine the thermal conductivity of insulating materials viz. wood, asbestos powder and glass wool using conduction mode of heat transfer.

CO2: Calculate the heat transfer coefficient and fin efficiency under natural and forced convection modes of heat transfer.

CO3: Calculate the Stefan Boltzmann constant and emissivity of grey surfaces using radiation heat transfer.

CO4: Evaluate the performance of heat exchanger and to calculate its effectiveness under parallel and counter flow modes.

CO5: Evaluate the performance of reciprocating air compressor, refrigerating and air- conditioning systems to calculate its volumetric efficiency, isothermal efficiency and Coefficient of Performance (COP).

BoS Chairman

Course Code:140ME0508	Course Title: COMPUTER AIDED MACHINE DRAWING LABORATORY (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	0: 0 : 4 : 2
Type: Practical	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Graphics
- Metrology & Measurements
- Computer Aided Drafting and Modeling Laboratory

Course Objective

The course is intended to

1. Develop part models .
2. Prepare assembly drawings.

List of Experiments

1. Exercise on Knuckle joint
2. Exercise on Flange coupling
3. Exercise on Plummer Block
4. Exercise on Screw Jack
5. Exercise on Piston and Connecting rod
6. Preparation of Knuckle joint assembly drawing
7. Preparation of Flange coupling assembly drawing
8. Preparation of Plummer block assembly drawing
9. Preparation of Screw Jack assembly drawing
10. Preparation of Piston and Connecting rod assembly drawing

Course Outcomes

At the end of the course the student will be able to

CO1: Develop part models of machine components

CO2: Prepare assembly drawings of machine components

References

1. Gopalakrishna, K. R., "Machine Drawing", SubhasPublishing House, 20th Edition, 2007.
2. Cecil Jensen, Jay D. Helsel, Dennis R. Short , "Engineering Drawing & Design", McGraw-Hill Higher Education, 7th edition, 2007.

BoS Chairman

BoS Chairman

Course Code:140ME0509	Course Title: TEAMNESS AND INTER-PERSONAL SKILLS(TIPS) (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	0 : 0 : 2 : 1
Type: PS	Total Contact Hours:	30 Hours

Course Objective

The course is intended to

1. Be aware of attitudinal, behavioral and emotional aspects of self
2. Learn continuously and be in harmony with self
3. Understand others' preferences, values, roles & contexts
4. Identify barriers to harmonious relationships
5. Work collaboratively as a team

UNIT I HARMONY WITH SELF

Importance of learning about self continuously; Approaches to learn about self: introspection, being open to feedback, critical incidences as opportunities; Understanding life stages and challenges associated with them; Healthy ways of handling self in response to life's challenges;
Instruments/inventories to understand self and others: A) Know your temperament, B) Mayer Briggs Type Indicator, C) Interpersonal Needs Inventory (tentative).

UNIT II HARMONY WITH OTHERS

Importance of living in harmony with others; What it takes to live in harmony with others; Understanding preferences, values, roles and contexts of others; Approaches to navigating through differences between self and others;
Barriers to harmonious relationships - Perceptions, Judgments, and Emotional instability; Ways to handle each of the barriers; Importance of reaching-out to others

UNIT III GROUP DYNAMICS AND CONFLICTS RESOLUTION

Group dynamics: overt and covert processes at micro and macro levels; Understanding the basis of conflicts; Understanding one's own conflict handling style; Methods to handling conflicts effectively.

UNIT IV WORKING IN TEAMS

Effectiveness in communication; Forming – storming – norming and performing model; Competition vs collaboration – impact of both on team tasks; TEAM Questionnaire – components of a healthy team and approaches to improving them.

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Course Outcomes

At the end of the course, students will

CO1: Be aware of attitudinal, behavioral and emotional aspects of self
CO2: Prefer to learn continuously about self and be in harmony with self
CO3: Understand others' preferences, values, roles & contexts and be in harmony with others
CO4: Identify barriers to harmonious relationships and derive ways to handle them
CO5: Work collaboratively as a team to deliver expected outcomes

Mode of delivery:

1. A 2-day learning workshop
1. Activities (experiential learning)
2. Audio visuals (affective learning)
3. Case discussions (cognitive learning)
4. Instruments/questionnaires (reflective learning) Guided by Learner's workbook.

2. Continuous learning guided by learning journal, and reviews by faculty
3. Half-day reinforcement session towards the end of the semester

Assessments and Evaluation:

Assessment	Details	Weightage	Administration	By Whom	When
Continuous Assessment					
Initial Knowledge Test	Multiple choice questions (20)	10%	Pen and paper	Internal team	Immediately after the initial workshop.
Review of student journal	Student held journal book.	50%	Student journals to be reviewed	Trained Internal faculty	Once in a week.
Semester End Examination:					
Final comprehensive Knowledge test	Multiple choice questions (40)	10%	Pen and paper	Internal team	End of semester after the reinforcement program.
Viva-Voce	Scenario based questions	30%		Internal team	

Continuous Assessment = 60%
Semester end examination = 40%
An overall mark of 50 is to be scored for a pass in the course

END OF SEMESTER V

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SEMESTER VI

Course Code:140ME0601	Course Title:FINITE ELEMENT ANALYSIS (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Mathematics - I
- Numerical Methods
- Strength of Materials
- Heat and Mass Transfer

Course Objective

The course is intended to

1. Convert physical problems into mathematical model
2. Solve the one dimensional structural problems
3. Solve the 2D vector variable problems
4. Solve the 1D and 2D scalar variable problems
5. Determine the shape function, Jacobean matrix, element stiffness matrix for 2D Quadrilateral element

UNIT I FINITE ELEMENT FORMULATION 12

Finite element methods - general applicability of the methods, general finite element procedure, discretization of the domain, degree of freedom, basic element shapes and nodes, numbering of element and nodes, displacement models, local, global coordinates, Spring element - derivation of element stiffness matrices, global stiffness matrix and force vector using minimum potential energy principle, incorporation of boundary conditions, solution of numerical problems.

UNIT II ONE DIMENSIONAL VECTOR VARIABLE PROBLEMS 12

Finite element modeling – Natural Coordinates and shape functions - linear bar element, - total potential energy approach - element stiffness matrix and force vector – global stiffness matrix and force vector - boundary condition – problems- quadratic element, Plane Trusses - development of shape function - element equations , element stiffness matrix and force vector – global stiffness matrix and force vector – boundary condition- problems, beam element –finite element formulation – Load vector –boundary condition- problems.

UNIT III TWO DIMENSIONAL VECTOR VARIABLE PROBLEMS USING CONSTANT STRAIN TRIANGLES 12

Finite element modeling – constant strain triangular element – Iso-parametric representation – Potential Energy approach - Element stiffness matrix and force

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vector – global stiffness matrix and force vector –Boundary condition – Problems, Axisymmetric solids subjected to Axisymmetric loading - axis symmetric formulation - Element stiffness matrix and force vector – global stiffness matrix and force vector – Boundary condition – Problems.

UNIT IV HEAT TRANSFER / SCALAR VARIABLE PROBLEM 1 D & 2D 12

Scalar variable problems- steady state heat transfer- 1D,2Dconduction& convection – Global stiffness matrix and global thermal load vector - Boundary condition – Problems.

UNIT V TWO DIMENSIONAL VECTOR VARIABLE PROBLEM USING QUADRILATERAL ELEMENTS 12

Iso parametric elements – the four node quadrilateral- derivation of shape function, element stiffness matrix, element force vector- global stiffness matrix and force vector- Boundary condition-problems.

Course Outcomes

At the end of the course students will be able to:

CO1: Convert physical problems into mathematical model using finite element procedure and solve simple problem using spring element

CO2: Solve the one dimensional structural problems such as bar, truss and beam using natural co ordinate system.

CO3: Solve the 2D vector variable problems by applying plane stress, strain and axi-symmetric conditions using CST element.

CO4: Solve the 1D and 2D scalar variable problems such as conduction and convection.

CO5: Determine the shape function, Jacobean matrix, element stiffness matrix for 2D Quadrilateral element and find out the coordinates of a point in a element by applying interpolation technique.

Text Books

1. Chandrupatla & Belagundu, "Introduction to Finite Elements in Engineering", Prentice-Hall of India, 3rd Edition, Eastern Economy Editions, 2011.
2. Logan D.L., "A first course in Finite Element Method", Thomson Asia Pvt. Ltd., 2002

References

1. David V.Hutton, "Fundamentals of Finite Element Analysis", Tata McGraw-Hill Edition, 2005.
2. J.N.Reddy, "An Introduction to the Finite Element Method", McGraw-Hill International Editions(Engineering Mechanics Series), 2005.
3. Seshu, P, "Text Book of Finite Element Analysis", Prentice-Hall of India Pvt. Ltd., New Delhi, 2007.

BoS Chairman

Web References

- http://nptel.ac.in/courses/112104115/4
- http://textofvideo.nptel.iitm.ac.in/105106051/lec1.pdf
- http://nptel.ac.in/courses/112104116/

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Course Code:140ME0602	Course Title: DESIGN OF TRANSMISSION SYSTEMS	
Core/Elective: Core	L : T : P : C	4 : 0 : 0 : 4
Type: Theory	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course(s):

- Theory of Machines – I & II
- Design of Machine Elements

Course Objective

The course is intended to

1. Select a suitable flexible element drives
2. Design a spur gear and helical gear drives
3. Design and analyze a bevel and worm gear drives
4. Design a single/multi stage sliding mesh gear box
5. 5 Design single & multi plate clutch and brakes

UNIT I SELECTION OF FLEXIBLE ELEMENT DRIVES 12

Mechanical drives-types of drives -power and motion transmission drives-stepped and steeples transmission-speed ratio-under direct and over drives and its applications-reversible and irreversible drives and its applications-belt drives and its applications-Select suitable flat belt and V-belt drives and pulleys for industrial applications-chain drives-hoisting and hauling chains -Conveyor Chains -Power transmitting chains-block chain- roller chain-silent chain-select suitable roller chains and sprockets for industrial applications

UNIT II DESIGN OF SPUR GEAR AND HELICAL GEAR DRIVES 12

Toothed gearing and its applications- gear tooth terminology- failures in gears- gear materials- law of gearing- tooth forces and stresses- Design of spur gear for given situations, helical gear - Tooth terminology - equivalent number of teeth – Design of Helical Gear drives for given situations, Cross helical: Terminology (Qualitative Treatment only)

UNIT III DESIGN OF BEVEL AND WORM GEAR DRIVES 12

Types of bevel gear - Tooth terminology - equivalent number of teeth gear, Design the bevel gear, Materials- Worm Gear terminology , Types of worm gears - equivalent number of teeth, gear Materials, Thermal capacity, Efficiency - Tooth forces and stresses of worm gears, Design of worm gear drives.

UNIT IV DESIGN OF SLIDING MESH GEAR BOX 12

Preferred numbers- Geometric progression- standard step ratio- kinematic layout-ray diagram- Design 3, 6, 9 and 12 sliding mesh speed gear box.

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UNIT V DESIGN OF CLUTCHES AND BRAKES 12

Needs and role of clutch- types of clutch-positive clutch- square jaw clutch- spiral jaw clutch- friction clutch- types of friction clutch-plate clutches- cone clutch- centrifugal clutch- Design of plate clutches- needs and role of brakes- types of brakes -single block or shoe brake- pivoted block or shoe brake- double block or shoe brake- simple band brake- differential band brake- band and block brake- internal expanding brake- Design of shoe brake, band and block brake, internal expanding brake, Disc Brake.

NOTE: (Use of approved Data Book is permitted in the End semester examination)

Course Outcomes

At the end of the course students will be able to:

CO1: Select a suitable flexible element drives such as flat belt, V-belt and chain drives for power transmitting applications.

CO2: Design a spur gear and helical gear drives considering the tooth bending and surface strength for given application.

CO3: Design and analyze a bevel and worm gear drives for strength and surface durability.

CO4: Design a single/multi stage sliding mesh gear box having maximum of 12 speeds and calculate the output speeds for machine tool applications.

CO5: Design single, multi plate clutch and brakes such as shoe brake, band brake, block brake, disc brake and internal expanding type brakes for given applications.

Text Books

1. Shigley J.E and Mischke C.R, "Mechanical Engineering Design" 9th Edition, Tata McGraw-Hill,2011.
2. Bhandari V.B, "Design of Machine Elements" 3rdEdition,Tata McGraw-Hill, 2010.

References

1. Prabhu. T.J., "Design of Transmission Elements", Mani Offset, Chennai, 2000.
2. GitinMaitra, L. Prasad "Hand book of Mechanical Design", 2nd Edition, Tata McGraw-Hill, 2001.
3. Sundararajamoorthy T.V, Shanmugam N, "Machine Design", Anuradha Publications, Chennai, 2003.

Web References

- http://nptel.ac.in/courses/112106137/
- http://nptel.ac.in/courses/112102014/38
- http://dunloptransmissions.com/
- http://www.renold.in/Products/TransmissionChainSprockets/TransmissionChainIndexPage.asp
- http://khkgears.net/gear-knowledge/

BoS Chairman

Course Code:140ME0603	Course Title: POWER PLANT ENGINEERING
Core/Elective: Core	L : T : P : C : M – 3 : 0 : 0 : 3 : 100
Type : Theory	Total Contact Hours: 45 Hours

Prerequisites

The student should have undergone the course(s):

- Thermal Engineering
- Engineering Economics and Cost Analysis

Course Objective

The course is intended to

1. Explain the construction and working principle of steam power plant
2. Explain the working principle of hydroelectric and nuclear power plants
3. Explain the operation and maintenance of diesel and gas turbine power plant
4. Explain the working principle of non conventional power plants
5. Calculate the cost of power generation for various power plants

UNIT I STEAM POWER PLANT 12

Layout of Steam power plant- Fuel and Ash handling systems - Combustion equipment for burning coal- Mechanical Stokers – Pulveriser – Gas cleaning systems- Electrostatic Precipitator and Mechanical dust collector. Draught – Different types- Surface Condenser and Cooling Towers. Steam Boilers– High Pressure, Super Critical Boilers and Ultra supercritical boilers– Fluidised Bed Boilers, Pollution Control methods.

UNIT II HYDROELECTRIC AND NUCLEAR POWER PLANT 9

Layout of Hydroelectric Power Plant – Essential Elements –Types – Standalone and Pumped storage- Site selection - Indian Scenario.

Nuclear Energy – Fission, Fusion Reaction- Layout of Nuclear power plant-Types of Reactors- Pressurized water , Boiling water , Gas cooled , Fast breeder Reactor- Waste Disposal and safety - site selection- Indian scenario – Recent Developments.

UNIT III DIESEL AND GAS TURBINE POWER PLANT 9

Layout of Diesel Power Plant -Types and Components - Engine Selection based on Application-Recent developments.

Gas Turbine Power Plant – Layout – Fuels - Gas Turbine Material - Types of Combustion Chambers – Performance Improvement Methods - Reheating, Regeneration, Inter cooling, Combined Cycle Power Plant- Recent developments.

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UNIT IV NON-CONVENTIONAL POWER PLANTS 8

Solar Power Plants-Low, Medium and High Temperature Systems -Wind Energy Conversion System-Horizontal and Vertical Wind Turbines –Geo-Thermal Power Plant – Bio Gas Power Plant – MHD - OTEC Systems - Tidal Power Plants.

UNIT V POWER PLANT ECONOMICS, RENOVATION AND MODERNIZATION7

Load duration curves - Cost of Electric Energy, Types of Tariffs- Economics of Load Sharing - Comparison of Economics of Various Power Plants. Energy Conservation and Energy Audit in steam power plant - Renovation and Modernization of aged power plants.

Course Outcomes

At the end of the course students will be able to:

CO1: Describe the construction and working principle of various subsystem of a steam power plant and pollution control methods in a steam power plant

CO2: Explain the working principle of various components of hydroelectric and various types of nuclear reactor used in nuclear power plants

CO3: Describe the various components, working principle and performance improvement methods in diesel and gas turbine power plant

CO4: Explain the working principle of various types of non conventional power plants viz Solar, Wind, Geothermal, Bio Gas, MHD, OTEC, Tidal

CO5: Calculate the cost of power generation for various power plant using different types of tariff system.

Text Books

1. S. C. Arora and S. Domkundwar, "A course in Power Plant Engineering", DhanpatRai& Sons, New Delhi, 2008.
2. P. K. Nag, "Power Plant Engineering", Tata McGraw Hill Company Pvt Ltd., New Delhi,2007.

References

1. M. M. El-Wakil, "Power Plant Technology", Tata McGraw Hill Publishing Company Pvt Ltd., New Delhi,1985.
2. G. R. Nagpal, "Power Plant Engineering", Khanna Publishers, New Delhi,2002.
3. G.D. Rai, "Introduction to Power Plant Technology", Khanna Publishers, New Delhi,1995.

Web References

- http://nptel.ac.in/courses/108105058/8
- http://www.ignou.ac.in/

BoS Chairman

Course Code:140ME0604	Course Title: AUTOMOBILE ENGINEERING	
Core/Elective: Core	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Electrical Drives and Controls
- Design of Machine Elements
- Thermal Engineering

Course Objective

The course is intended to

1. Explain the vehicle structure and components
2. Explain the IC Engines and lubricating systems
3. Explain the construction and working principle of Transmission system
4. Explain the construction and working principle of steering, braking and suspension system
5. Explain electrical system, accessories and emission norms

UNIT I VEHICLE STRUCTURE AND ENGINES 9

Types of automobiles , vehicle construction and different layouts chassis, frame and body, resistances to vehicle motion and need for a gearbox, Introduction to IC Engines-types, working principles, components of engines-their forms functions and materials.

UNIT II FUELS AND LUBRICATION SYSTEM 9

Petrol fuel feed system: Feed pump – mechanical, electrical type – Carburetors – fixed venturi type (carter), variable venturi type (SU), multiple barrel type (Solex, Mikuni), carburetors for two wheelers -Petrol injection – Multi Point Fuel Injection (MPFI), VVT (petrol engines),Turbo chargers, Diesel fuel system: Jerk type fuel injection pump–Methods of fuel injection–common rail, distributor types-Nozzles–Cold starting aids, Cooling system: Direct and indirect cooling, Lubricating system: Mist, wet and dry sump.

UNIT III TRANSMISSION SYSTEMS 9

Clutch-types and construction , gear boxes- manual and automatic, gear shift mechanisms, Over drive, transfer box, fluid flywheel –torque converter, propeller shaft, slip joints, universal joints ,Differential, and rear axle, Hotchkiss Drive and Torque Tube Drive

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UNIT IV STEERING, BRAKES AND SUSPENSION SYSTEMS 9

Steering geometry and types of steering gear box-Power Steering, Types of Front Axle, Types of Suspension Systems , Pneumatic and Hydraulic Braking Systems, Antilock Braking System and Traction Control.

UNIT V ELECTRICAL SYSTEMS, ACCESSORIES AND EMISSION NORMS 9

Ignition system- coil ignition and magneto ignition system – Spark plug, Battery – Construction and maintenance, Starter motor – types, alternator, distributor, generator, cut out relay, panel board instruments and: Power operated windows-Vehicle Air conditioning-Air bags- Air pollution control- Catalytic converter working principle-Emission norms-Bharat and Euro emission Standards

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the vehicle structure chassis layouts and different types of IC Engines

CO2: Describe the fuels and lubrication system used in SI & IC engines. viz carburetors, APFI, VVT, Turbo charger, CRDI, Lubrication system viz mist, wet and dry sump system

CO3: Explain the construction and working principle of various components of a Transmission system viz gear box,, clutch, torque converter, fluid flywheel, differential etc.

CO4: Describe the construction and working principle of steering and suspension system of a Automotive vehicle

CO5: Explain the electrical system and its accessories viz battery, starter motor, panel board, power operated windows, air bags and the emission norms.

Text Books

1. Kirpal Singh, "Automobile Engineering Vol. 1 &Vol 2", Standard Publishers, 7th Edition, 2012.
2. Sethi H.M, "Automobile Technology", Tata McGraw-Hill, 2003.

References

1. Jain, K.K., and Asthana .R.B, "Automobile Engineering" Tata McGraw Hill Publishers, New Delhi, 2002.
2. Srinivasan.S, "Automotive Mechanics" 2nd edition, Tata McGraw-Hill, 2003.
3. Joseph Heitner, "Automotive Mechanics", 2nd edition, East-West Press, 1999.

Web References

- https://en.wikipedia.org/wiki/Automotive_engineering
- http://auto.howstuffworks.com/

BoS Chairman

Course Code:140ME0607	Course Title: SIMULATION AND ANALYSIS LABORATORY (Common to Automobile and Mechanical)	
Core/Elective: Core	L : T : P : C	0 : 0 : 4 : 2
Type: Practical	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the course(s):

- Numerical Methods
- Thermal Engineering
- Strength of Materials
- Theory of Machines-I&II
- Design of Hydraulics & Pneumatics System

Course Objective

The course is intended to

1. Apply finite element simulation software
2. Write programmes in a mathematical simulation software

Simulation Lab

1. Simulation of Air conditioning system with condenser temperature and evaporator temperatures as input to get COP using C /MAT Lab.
2. Simulation of free vibration characteristics of spring, mass and damper system.
3. Simulation of Hydraulic / Pneumatic cylinder using C / MAT Lab.
4. Simulation of cam and follower mechanism using C / MAT Lab.

Analysis (Simple Treatment Only)

1. Stress analysis of beams (Cantilever, Simply supported, Fixed ends)
2. Stress analysis of a plate with a circular hole.
3. Stress analysis of rectangular L bracket
4. Stress analysis of an Axi-symmetric component
5. Mode frequency analysis of a 2 D component
6. Mode frequency analysis of beams(Cantilever, Simply supported, Fixed ends)
7. Harmonic analysis of a 2D component
8. Thermal stress analysis of a 2D component
9. Conductive heat transfer analysis of a 2D component
10. Convective heat transfer analysis of a 2D component

Course Outcomes

At the end of the course students will be able to:

CO:1 Apply finite element simulation software to solve simple problems such as structural, thermal and vibration problems in Mechanical Engineering.

CO:2 Write programmes in a mathematical simulation software to solve mathematical model of mechanical engineering applications

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Course Code: 140ME0608	Course Title: AUTOMOBILE ENGINEERING LABORATORY	
Core/Elective: Core	L : T : P : C	0: 0 : 4 : 2
Type: Practical	Total Contact Hours:	60 Hours

Prerequisites

The student should have undergone the courses

- Design of Machine Elements
- Design of Hydraulic and Pneumatic Systems
- Electrical Drives and Control
- Thermal Engineering Laboratory

Course Objective

The course is intended to

1. Identify the components of Automotive Engine and Transmission system.
2. Construct a automotive vehicle Body and Electrical system Components
3. Develop a automotive braking system and steering assembly system

List of Experiments

1. Study of various tools used in Automobile workshop.
2. Dismantling and assembling of following types of engine – Single cylinder petrol and diesel engine.
3. Dismantling and assembling the components of Single plate clutch and Multi-plate clutch.
4. Dismantling and assembling the components of Sliding mesh gearbox and Constant mesh gearbox.
5. Study and prepare report on the constructional details, working principles and operation of the Manual Steering Systems [Rack & Pinion steering] and Power steering Systems.
6. Study and prepare report on the constructional details, working principles and operation of the Automotive Brake systems.
   (a) Hydraulic & Pneumatic Brake systems.
   (b) Drum Brake System.
   (c) Disk Brake System
7. Check wiring diagram of battery coil ignition system.
8. Check wiring diagram of electronic ignition system.
9. Check the circuit diagram of an electric horn and to carry out its adjustments.
10. Dismount, dismantle and reassemble a wiper motor

Course Outcomes

At the end of the course students will be able to:

CO1: Identify the components of Automotive Engine and Transmission system.
CO2: Construct a automotive vehicle Body and Electrical system Components
CO3: Develop a automotive braking system and steering assembly system for an IC engines

BoS Chairman

Course Code: 140ME0609	**Course Title:** CAMPUS TO CORPORATE (Common to Automobile and Mechanical)	
Core/Elective: Core	**L : T : P : C**	1 : 0 :2 : 2
Type: PS	**Total Contact Hours:**	30 Hours

Course Objective

The course is intended to

1. Display gratitude and social responsibility
2. Understand various business environments
3. Explain the transition from a campus mindset to corporate mindset
4. Be prepared to the work culture
5. Choose to be presentable and agile

UNIT I GRATITUDE AND SOCIAL RESPONSIBILITY

Importance of gratitude; Finding opportunities to give back to society; Responsible behavior in public places; Volunteerism during calamities;Social relevancy during engineering design and manufacturing – how social issues could be tackled by engineering solutions;

UNIT II THE WORLD OF BUSINESS (get to the specifics of behavioral responses to certain specific contexts)

World of business - Perceptions vs reality; Various business types - B2B, B2C, & other business models; Various industry verticals – fundamentals, dynamics & nuances; Nature of work as per various functions – Sales & Marketing, Service, Research & Development, Production etc; Self-reflective questionnaire to identify the fitment to a particular field/function;

UNIT III TRANSITION FROM A CAMPUS MINDSET TO CORPORATE MINDSET

ROCK as an acronym (Responsibility, Ownership, Contribution, Knowledgeable (continuous learning)); Responsibility – ways in which responsibility should be demonstrated; Ownership – owning one's career, owning mistakes, desisting from complaining; Contribution – focus on creating value, giving more than receiving (salary & perks); Knowledgeable(continuous learning) – learning just begins after campus, aspects of learning mindset, various opportunities to learn and how they can be utilised at work;

UNIT IV PREPAREDNESS TO ADAPT TO WORK CULTURE

Skills to get through selection process – Interview conversations, resume writing, group discussion & presentation;

Handling Cultural differences; Handling Gender dynamics; Alignment to Ethics and values; Alignment to work processes & code of conduct; Handling multiple (often conflicting) demands; Handling peer influence; Conducting sensitively with subordinates, peers &boss;Managing personal finance; Maintaining work-life balance – work & social life, hobbies etc;

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UNIT V PRESENTABLE AND AGILE

Dressing & grooming – Reasons for good dressing & grooming; Professional etiquette – what is etiquette, professional etiquette vs social etiquette, Aspects of professional etiquette; Wellness – Healthy eating habits, Importance of sleep, Importance of fitness; Importance of cleanliness of surroundings – desk, work area, place of stay (5S);

Course Outcomes

At the end of the course students will be able to:

CO1: Display gratitude and social responsibility
CO2: Understand various business environments – industry & function wise
CO3: Explain the transition from a campus mindset to corporate mindset
CO4: Be prepared to adapt to the future work culture
CO5: Choose to be presentable and agile

MODE OF DELIVERY:

1. A 2-day learning workshop guided by Learner's workbook.
2. Continuous learning guided by learning journal, and reviews by faculty

ASSESSMENTS AND EVALUATION:

Assessment	Details	Weigh tage	Administrati on	By Whom	When
Workbook record assessment	Assess the necessary elements to be entered in the workbook	20%	Individual workbooks reviewed by the faculty		Immediately after the learning workshop
Initial Knowledge Test and Scenario based knowledge test	Multiple choice questions (20)	25%	Pen and paper,	Internal team	Immediately after the learning workshop
Review of student journal	Student held journal for the whole semester	30%	Individual journals reviewed by the faculty	Trained faculty members	Once in a week.
Final Knowledge test and Scenario based knowledge test	Multiple choice questions (40)	10%		Internal team	End of semester
Review of student journal by external expert		15%	Student journal comprehensiv e review	Trained faculty members	End of semester

END OF SEMESTER VI

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SEMESTER VII

Course Code: 140ME0701	**Course Title:** MECHATRONICS	
Core/Elective: Core	**L : T : P : C**	3 : 0 : 0 : 3
Type: Theory	**Total Contact Hours:**	45 Hours

Prerequisites

The student should have undergone the courses:

- Design of Hydraulic and Pneumatic systems
- Microprocessor and its application

Course Objective

The course is intended to

1. Explain the fundamentals of mechatronics systems
2. Select sensors for various measurements
3. Write logic programs
4. Design user interface
5. Design automation systems

Course Content

UNIT I INTRODUCTION **9**

Introduction to Mechatronics- Systems- Concepts of Mechatronics approach-Need for Mechatronics- Emerging area of Mechatronics- Classification of Mechatronics - Control system- Open Loop and Feedback Control –PID Control

UNIT II SENSORS AND SIGNAL CONDITIONING **9**

Introduction – Performance Terminology- Potentiometers-LVDT- Capacitance sensors-Strain gauges- Eddy current sensor-Hall effect sensor- Temperature sensors-Pressure sensors-Flow sensors- Light sensors- Selection of sensors- Signal processing.

UNIT III PROGRAMMABLE LOGIC CONTROLLERS **10**

Introduction- Basic structure- Input and output processing- PLC Programming - Timers, Counters and internal relays- Data handling and manipulation – subroutine – Master control reset- Selection of PLC, HMI

UNIT IV SYTEM DESIGN USING VIRTUAL INSTRUMENTATION **10**

Front Panel and Block Diagram – Tools, Controls and Functions palette. Modular programming – SubVI. Structures – FOR, WHILE Loops, Case, Sequence, event structures, Formula node. DAQ hardware – AI, AO, DIO. DAQ Assistant and configuration Applications - Speed, Vibration, strain & temperature Measurement

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UNIT V DESIGN OF MECHATRONICS SYSTEMS 7

Pick and place Robot- Autonomous mobile robot-Wireless surveillance balloon- Engine Management system- Automatic car park barrier.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the fundamentals of mechatronics systems such as the components and control schemes with block diagrams

CO2: Select sensors for various measurements including pressure, temperature, flow, level and light used in different systems

CO3: Write logic programs for real time applications such as home automation, machine tool control, process control using PLC

CO4: Design user interface for arithmetic, logical, sequencing data acquisition operations in analog and digital modes using virtual instrumentation.

CO5: Design automation systems such as pick and place , autonomous mobile robots, wireless surveillance balloons, engine management system, car park barrier using sensors , actuators and control systems

Text Book

1. Bolton,W, "Mechatronics" , Pearson education, fourth edition, 2011.
2. Jovitha Jerome, 'Virtual Instrumentation using LabVIEW' PHI Learning Private Limited, New Delhi, Second Printing, 2011.

References

1. Godfrey C. Onwubolu, "Mechatronics Principles and Applications", Elsevier, 2006.
2. Devadas Shetty and Richard A.Kolk, "Mechatronics systems design", PWS Publishing company 2007.
3. Nitaigour Premchand Mahalik, "Mechatronics Principles, Concepts and Applications" Tata McGraw-Hill Publishing company Limited, 2003.

Web References

- https://en.wikipedia.org/wiki/Mechatronics
- http://www.cedrat.com/en/publications/categories/devicesystems/systems/mechatronics.html
- http://nptel.ac.in/courses/112103174/

BoS Chairman

Course Code: 140ME0703	Course Title: ENVIRONMENTAL STUDIES	
Core/Elective: Core	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the courses:

- Nil

Course Objective

The course is intended to

1. Describe the multidisciplinary nature of environmental studies
2. Explain the importance of ecosystem and biodiversity
3. Identify the causes and propose suitable methods of control for various types of environmental pollution
4. Brief the importance of environmental protection in social and global context
5. Explain the relationship between environment and human beings

Course Content

UNIT I MULTIDISCIPLINARY NATURE OF ENVIRONMENTAL STUDIES 9

Definition, scope and importance; Need for public awareness; Natural resources and associated problems - Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources; Role of individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT II ECOSYSTEMS AND BIODIVERSITY 9

Concept of an ecosystem; Structure and function of an ecosystem; Producers, consumers and decomposers; Energy flow in the ecosystem; Ecological succession; Food chains, food webs and ecological pyramids; Introduction, types, characteristic features, structure and function of the following ecosystem - Forest, Grassland, Desert, Aquatic; Biodiversity and its conservation: Introduction; Biogeographically classification of India; Value of biodiversity; Biodiversity at global, national and local levels; India as a mega diversity nation; Threats to biodiversity; Endangered and endemic species of India; Conservation of biodiversity : In-situ and Ex-situ conservation.

UNIT III ENVIRONMENTAL POLLUTION 9

Definition; Cause, effects and control measures of Air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear pollution; Solid waste Management: Causes, effects and control measures of urban and industrial wastes;

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Role of an individual in prevention of pollution; Pollution case studies; Disaster management : floods, earthquake, cyclone and landslides

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT 9

From Unsustainable to Sustainable development; Urban problems related to energy; Water conservation, rain water harvesting, watershed management; Environmental ethics: issues and possible solutions; Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Wasteland reclamation ; Consumerism and waste products; Environment Protection Act; Air Act; Water Act ; Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislation; Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT 9

Population growth, variation among nations; Population explosion - Family Welfare Programme; Environment and human health; Human Rights; Value Education; HIV/AIDS; Women and Child Welfare; Role of information Technology in Environment and human health; Case studies; Field work – Visit to a local area to document environmental assets –river/forest/grassland/hill/mountain; Visit to a local polluted site Urban /Rural /Industrial /Agriculture; Study of simple ecosystems – pond, river, hill, slopes, etc.

Course Outcomes

At the end of the course students will be able to:

CO1: Describe the multidisciplinary nature of environmental studies
CO2: Explain the importance of ecosystem and biodiversity
CO3: Identify the causes and propose suitable methods of control for various types of environmental pollution
CO4: Brief the importance of environmental protection in social and global context
CO5: Explain the relationship between environment and human beings

Text Book

1. Benny Joseph, "Environmental Studies", Tata McGraw Hill, New Delhi, 2006.
2. Mackenzie Davis and Susan Masten, "Principles of environmental engineering and science", Mc-Graw Hill, 3rd edition, 2014.

References

1. Trivedi R.K. "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media.
2. Cunningham, W.P.Cooper., T.H. Gorhani, "Environmental Encyclopedia", Jaico Publishing House, Mumbai, 2001.
3. Rajagopalan. R, "Environmental Studies - From Crisis to Cure", Oxford University Press, 2005

BoS Chairman

Course Code: 140ME0707	**Course Title:** MECHATRONICS LABORATORY	
Core/Elective: Core	**L : T : P : C**	0 : 0 : 4 : 2
Type: Practical	**Total Contact Hours:**	60 Hours

Prerequisites

The student should have undergone the courses:

- Design of Hydraulic and Pneumatic systems
- Microcontroller and its application

Course Objective

The course is intended to

1. Calculate process control parameters in closed loop system
2. Develop logic Program for real time interfacing
3. Develop a user interface for measurements

List of Experiments

1. Closed loop response of Pressure process
2. Closed loop response of Temperature process
3. Closed loop response of flow process
4. Closed loop response of fluid level process
5. Basics logic using PLC Programming - AND, OR, Latch, Interlock
6. Control of multiple actuators in Hydraulic and pneumatic System by using PLC
7. Control of Bottle filling system using PLC
8. Creating simple VIs, Editing and Debugging
9. Creating Sub VI
10. Temperature signal interface using Lab VIEW
11. Vibration Measurement using Lab VIEW

Course Outcomes

At the end of the course students will be able to:

CO1: Construct process control parameters in control loop system in temperature, pressure, floe and liquid level.

CO2: Develop a logic Programme for real time interfacing using plc for fluid power system, logic function and bottle filling.

CO3: Develop a user interface for temperature and vibration measurement using virtual instrumentation. .

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Course Code: 140ME0708	**Course Title:** PRODUCT DESIGN LABORATORY	
Core/Elective: Core	**L : T : P : C**	0 : 0 : 4 : 2
Type: Practical	**Total Contact Hours:**	60 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Practices Laboratory
- Manufacturing Processes Laboratory- I
- Manufacturing Processes Laboratory- II
- Simulation and Analysis Laboratory
- Computer Aided Machine Drawing Laboratory
- Design of Machine Elements

Course Objective

The course is intended to

1. Realise the mechanical engineering product
2. Formulate the product design requirement from the customer.
3. Create 3D solid model parts of mechanical components and assemble the parts using CAD software.
4. Work collaboratively on a team to successfully complete a design project

List of Experiments:

Part 1

The students in a group (maximum of three) have to realise a mechanical engineering product and submit a report based on their realisation. The mark will be awarded based on the report and oral examination on the same by internal examiners.

Part 2

The students in a group (maximum of three) have to develop digital and physical prototype models using 3D Printing machine / clay models of a new product/ existing product with enhanced feature involving the following areas:

- Automotive components
- Tool and die components
- Press tool components
- Consumer product
- Injection moulded products.

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The fabricated models may be in the form of Rapid prototype models, clay models, sheet metal models or cardboard models etc... The design and development of the product will be reviewed in two stages for awarding internal marks. The end semester examination mark will be based on the report, demonstration of the new product developed and oral examination on the same by internal examiners.

Course Outcomes

At the end of the course students will be able to:

CO1: Realise the Mechanical Engineering product
CO2: Formulate the product design requirement from the customer
CO3: Create 3D solid models of mechanical components and assemble the parts using CAD software
CO4: Work collaboratively on a team to successfully complete a design project

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Course Code: 140ME0709	Course Title: INNOVATIVE AND CRATIVE PROJECT	
Core/Elective: Core	L : T : P : C	0 : 0 : 8 : 4
Type: Practical	Total Contact Hours:	120 Hours

Course Objective

The course is intended to

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Work collaboratively on a team to successfully complete a design project
3. Effectively communicate the results of projects in a written and oral format

The goal of this course is to help students to identify innovative projects that promote creativity to explore the variables that affect creativity and innovation. By the end of the semester, the students should be familiar with current thinking in their field, and able to apply the concepts to relevant research problems or practical applications. The goal of this course is to drive them to learn concepts, models, frameworks, and tools that engineering graduates' need in a world where creativity and innovation is fast becoming a precondition for competitive advantage. Each student will choose a frequently/commonly encountered workplace problem or socially relevant problems that have been difficult for them to "solve." At the end of the semester, each or group of students have to submit a report for evaluation.

Course Outcomes

At the end of the course students will be able to:

CO1: Take up any challenging practical problems and find solution by formulating proper methodology.
CO2: Work collaboratively on a team to successfully complete a design project
CO3: Effectively communicate the results of projects in a written and oral format

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Course Code: 140ME0809	**Course Title:** PROJECT	
Core/Elective: Core	**L : T : P : C**	0 : 0 : 20 : 10
Type: Practical	**Total Contact Hours:**	300 Hours

Course Objectives

The course is intended to:

1. Take up any challenging practical problems and find solution by formulating proper methodology.
2. Work collaboratively on a team to successfully complete a design project
3. Effectively communicate the results of projects in a written and oral format

The students in a group of 2 to 3 works on a topic approved by the head of the department under the guidance of a faculty member and prepare a comprehensive project report after completing the work to the satisfaction of the supervisor. The progress of the project is evaluated based on a minimum of three reviews. The review committee may be constituted by the Head of the Department. A project report is required at the end of the semester. The project work is evaluated based on oral presentation and the project report.

Course Outcomes

At the end of the course students will be able to:

CO1: Take up any challenging practical problems and find solution by formulating proper methodology.
CO2: Work collaboratively on a team to successfully complete a design project
CO3: Effectively communicate the results of projects in a written and oral format

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Course Code: 140ME0701/ 140ME9152	Course Title: DESIGN OF JIGS, FIXTURES AND PRESS TOOLS	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the courses:

- Manufacturing Processes - I
- Manufacturing Processes – II
- Design of Machine Elements

Course Objectives

The course is intended to:

1. Apply the basic locating and clamping principles in designing general jigs and fixtures.
2. Design a jig for a simple components
3. Design a fixtures for the milling , turning ,welding and grinding operations
4. Design progressive, compound and combination dies for simple components.
5. Design dies for bending, forming and drawing operations

Course Content

UNIT I LOCATING AND CLAMPING PRINCIPLES 9

Objectives of Tool design – Function and advantages of Jigs and fixtures - Materials used in Jigs and Fixtures – principles of location – Locating methods and devices - Principles of clamping- Mechanical actuation-pneumatic and hydraulic actuation-Analysis of clamping force-Tolerance and error analysis.

UNIT II JIGS 9

Different types of jigs-plate latch, channel, box, post, angle plate, angular post, turnover, pot jigs-Indexing jigs ,Drill bushes, Automatic drill jigs-Rack and pinion operated, Air operated Jigs components. Design and development of Jigs for given components.

UNIT III FIXTURES 9

General principles of boring, lathe, milling and broaching fixtures- Grinding, planing and shaping fixtures, assembly, Inspection and welding fixtures- Modular fixtures-Quick change fixtures. Design and development of fixtures for given component.

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UNIT IV PRESS WORKING TERMINOLOGIES AND ELEMENTS OF CUTTING DIES **9**

Press working terminology-Operations-Types of Presses and press accessories-Computation of capacities and tonnage requirements. Elements of progressive and compound dies: Die block, die shoe. Bolster plate-punch plate - punch holder-guide pins and bushes – strippers –knockouts-stops – pilots-Selection of standard die sets, Design and development of progressive and compound dies for Blanking and piercing operations ,strip lay out-strip lay out calculations

UNIT V BENDING, FORMING AND DRAWING DIES **9**

Bending ,forming and drawing operations –Blank development for above operations-Types of Bending dies – Press capacity – Spring back – knockouts – direct and indirect - pressure pads – Ejectors – Variables affecting Metal flow in drawing operations – draw die inserts – draw beads- ironing – Design and development of bending, forming, drawing and combination dies – Blank development for axi-symmetric, rectangular and elliptic parts – Single and double action dies. Design considerations in forging, extrusion, casting and plastic dies

Course Outcomes

At the end of the course students will be able to:

CO1: Apply the basic locating and clamping principles in designing general jigs and fixtures.
CO2: Design a jig for a simple components
CO3: Design a fixtures for the milling , turning ,welding and grinding operations
CO4: Design progressive, compound and combination dies for simple components.
CO5: Design dies for bending, forming and drawing operations

Text Book

1. Edward G Hoffman, "Jigs & Fixture Design", Thomson – Delmar Learning, 2004
2. Donaldson.C,"ToolDesign",TataMcGraw-Hill,1986

References

1. Kempster, "Jigs & Fixtures Design", The English Language Book Society, 1978
2. Joshi, P.H., "Jigs & Fixtures", Second Edition, Tata McGraw-Hill Publishing Company Limited, 2004
3. Hiram E Grant, "Jigs and Fixture", Tata McGraw-Hill, 2003
4. Fundamentals of Tool Design", CEEE Edition, ASTME, 1983

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Web References

- http://nptel.ac.in/courses/112105126/35
- https://en.wikipedia.org/wiki/Fixture_(tool)
- http://engineeringhut.blogspot.in/2010/11/design-principles-common-to-jig-and.html
- http://www.brighthubengineering.com/machine-design/47195-the-3-2-1-principle-of-jig-fixture-design/

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Course Code: 140ME9111	Course Title: AUTOMOTIVE AERODYNAMICS (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Fluid Mechanics and Machinery

Course Objectives

The course is intended to:

1. Describe the Potential of vehicle aerodynamics
2. Calculate the drag coefficient of cars
3. Explain the shape optimization of cars
4. Calculate forces and moments
5. Demonstrate the use of wind tunnel for automotive aerodynamics

UNIT I INTRODUCTION **9**

Scope – historical development trends – Fundamentals of fluid mechanics – Flow phenomenon related to vehicles – External & Internal flow problems – Resistance to vehicle motion – Performance – Fuel consumption and performance – Potential of vehicle aerodynamics.

UNIT II AERODYNAMIC DRAG OF CARS **9**

Car as a bluff body – Flow field around car – drag force – types of drag force – analysis of aerodynamic drag – drag coefficient of cars – strategies for aerodynamic development – low drag profiles.

UNIT III SHAPE OPTIMIZATION OF CARS **9**

Front and modification – front and rear wind shield angle – Boat tailing – Hatch back, fast back and square back – Dust flow patterns at the rear – Effect of gap configuration – effect of fasteners.

UNIT IV VEHICLE HANDLING **9**

The origin of force and moments on vehicle – side wind problems – methods to calculate forces and moments – vehicle dynamics under side winds – the effects of forces and moments – Characteristics of forces and moments – Dirt accumulation on the vehicle – wind noise – drag reduction in commercial vehicles.

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UNIT V WIND TUNNELS FOR AUTOMOTIVE AERODYNAMICS 9

Introduction – Principles of wind tunnel technology – Limitation of simulation – Stress with scale models – full scale wind tunnels – measurement techniques – Equipment and transducers – road testing methods – Numerical methods.

Course Outcomes

At the end of the course students will be able to:

CO1 Describe the Potential of vehicle aerodynamics
CO2 Calculate the drag coefficient of cars
CO3 Explain the shape optimization of cars
CO4 Calculate forces and moments due to side winds
CO5 Demonstrate the use of wind tunnel for automotive aerodynamics

Textbooks

1. Hucho, W.H., "Aerodynamics of Road Vehicles", Butterworths Co. Ltd., 1998.
2. Pope, A, "Wind Tunnel Testing, John Wiley & Sons", 2nd Edn., New York, 1999.

References

1. "Automotive Aerodynamics" Update SP-706, SAE, 1987.
2. "Vehicle Aerodynamics", SP-1145, SAE, 1996.
3. T.YomiObidi "Theory and Applications of Aerodynamics for Ground Vehicles"SAE International, ISBN 978-0-7680-2111-0, 2014.

Web References

- http://web-aerodynamics.webs.com/backgroundresearch
- https://en.wikipedia.org/wiki/Automotive_aerodynamics

BoS Chairman

Course Code: 140ME9112	Course Title: NOISE, VIBRATION AND HARSHNESS (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Theory of Machines-II

Course Objectives

The course is intended to:

1. Describe fundamentals of noise and vibration
2. Explain Noise and vibration effects on human
3. Explain the effects of noise and vibration on external environment
4. Explain the effects of noise and vibration on internal environment
5. Describe the measurement of noise and vibration

UNIT I FUNDAMENTALS OF ACOUSTICS AND NOISE, VIBRATION 8

Theory of Sound—Predictions and Measurement, Sound Sources, Sound Propagation in the Atmosphere, Sound Radiation from Structures and Their Response to Sound, General Introduction to Vibration, Vibration of Simple Discrete and Continuous Systems, Random Vibration, Response of Systems to Shock, Passive Damping

UNIT II EFFECTS OF NOISE, BLAST, VIBRATION, AND SHOCK ON PEOPLE 7

General Introduction to Noise and Vibration Effects on People and Hearing Conservation, Sleep Disturbance due to Transportation Noise Exposure, Noise-Induced Annoyance, Effects of Infrasound, Low-Frequency Noise, and Ultrasound on People, Auditory Hazards of Impulse and Impact Noise, Effects of Intense Noise on People and Hearing Loss, Effects of Vibration on People, Effects of Mechanical Shock on People, Rating Measures, Descriptors, Criteria, and Procedures for Determining Human Response to Noise.

UNIT III TRANSPORTATION NOISE AND VIBRATION 10

Introduction to Transportation Noise and Vibration Sources, Internal Combustion Engine Noise Prediction and Control—Diesel, Exhaust and Intake Noise and Acoustical Design of Mufflers, Tire/Road Noise—Generation, Measurement, and Abatement, Aerodynamic Sound Sources in Vehicles—Prediction and Control, Transmission and Gearbox Noise and Vibration Prediction and Control, Brake Noise Prediction and Control.

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UNIT IV INTERIOR TRANSPORTATION NOISE AND VIBRATION 10

Introduction to Interior Transportation Noise and Vibration Sources, Automobile, Bus, and Truck Interior Noise and Vibration Prediction and Control, Noise and Vibration in Off-Road Vehicle Interiors- Prediction and Control

UNIT V NOISE AND VIBRATION TRANSDUCERS 10

General Introduction to Noise and Vibration Transducers, Measuring Equipment, Measurements, Signal Acquisition, and Processing, Acoustical Transducer Principles and Types of Microphones, Vibration Transducer Principles and Types of Vibration Transducers, Sound Level Meters, Noise Dosimeters, Analyzers and Signal Generators, Equipment for Data Acquisition, Noise and Vibration Measurements, Determination of Sound Power Level and Emission Sound Pressure Level, Sound Intensity Measurements, Noise and Vibration Data Analysis, Calibration of Measurement Microphones, Calibration of Shock and Vibration Transducers, Metrology and Traceability of Vibration and Shock Measurements.

Course Outcomes

At the end of the course, the student will be able to

CO1: Explain the sources of noise & vibration and types of vibrations such as Discrete Continuous Systems and random Vibration

CO2: Explain the effects of noise, blast, vibration and shock on people and its prevention & control

CO3: Explain the effects of transportation noise & vibration and its control methods.

CO4: Explain the effects of Interior transportation noise & vibration and its control methods.

CO5: Describe the noise & vibration measurement techniques using microphones and transducers

Text Books

1. Clarence W. de Silva, "Vibration Monitoring, Testing and Instrumentation",CRC Press, 2007.
2. David A.Bies and Colin H.Hansen "Engineering Noise Control: Theory and Practice Spon Press", London, 2009.

References

1. Munjal M.L., "Acoustic Ducts and Mufflers", John Wiley, 2014.
2. Norton M P, "Fundamental of Noise and Vibration", Cambridge University Press,1998.
3. Allan G. Piersol ,Thomas L. Paez Harris "Shock and Vibration Handbook" , McGraw-Hill, New Delhi, 2010.

Web References

- https://en.wikipedia.org/wiki/Noise,_vibration,_and_harshness
- https://Griffin. Handbook of Human Vibration.

BoS Chairman

Course Code: 140ME9113	**Course Title:** GAS DYNAMICS AND JET PROPULSION (Common to Automobile and Mechanical)	
Core/Elective: Elective	**L : T : P : C**	3 : 0 : 0 : 3
Type: Theory	**Total Contact Hours:**	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Thermodynamics
- Fluid Mechanics & Machinery
- Heat and Mass Transfer

Course Objectives

The course is intended to:

1. Explain the basics and energy equations for compressible flow
2. Calculate the isentropic fluid flow properties
3. Evaluate fluid flow properties with normal shock
4. Identify fluid flow in constant area duct
5. Describe the various types of Aircraft and Rocket Propulsion engines

UNIT I BASICS OF COMPRESSIBLE FLOW **9**

Basics-compressible flow, flow process and non-flow process, Mach number, Energy Equations-Energy Equation for Flow and Non- Flow process, adiabatic energy equation, stagnation states, various region of flow, Mach waves and Mach cone, reference velocities, Bernoulli equation.

UNIT II ISENTROPIC FLOWS **9**

Isentropic and adiabatic processes-Mach number variation in Nozzle and diffuser-stagnation and critical states-area ratio as function of Mach number-impulse function-mass flow rate in terms of pressure ratio, area ratio, Mach number-flow through nozzles and diffusers.

UNIT III NORMAL SHOCK **9**

Development of shock wave-Prandtl Mayer relation-variation of flow parameters across the normal shock-impossibility of shock wave in subsonic flow-Mach number of supersonic flow-supersonic wind tunnels- Introduction to oblique shock.

UNIT IV FLOW THROUGH DUCTS **9**

Rayleigh flow-Rayleigh curve, Rayleigh flow equations, variable flow properties, maximum heat transfer

Fanno flow -Fanno curve, Fanno flow equations, variable flow properties, variation of Mach number with duct length.

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UNIT V AIR CRAFT AND SPACE PROPULSIONS 9

Aircraft Propulsion- types-construction and working-ramjet engine, turbojet engine, turbofan engine, turbo propeller engine, Rocket Propulsion –types-construction and working-liquid propellant engine, solid propellant engine, hybrid propellant engine, nuclear propellant engine.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the basics and energy equations for compressible flow
CO2: Calculate the isentropic fluid flow properties with variable duct area
CO3: Evaluate fluid flow properties with normal shock wave in one dimensional flow
CO4: Identify fluid flow in constant area duct with heat transfer and friction
CO5: Describe the various types of Aircraft and Rocket Propulsion engines

Text Books

1. S.M. Yahya, "Fundamentals of Compressible Flow", New Age International (P) Limited, New Delhi, 2010.
2. V. Babu, "Fundamentals of a Propulsion", Ane's Books Pvt. Ltd., 2009

References

1. H. Cohen, G.E.C. Rogers and Saravanamutto, "Gas Turbine Theory", Pearson India, 2001.
2. Anderson, J.D., "Modern Compressible flow", McGraw Hill, 3rd Edition, 2012.
3. Robert D. Zucker, Oscar Biblarz, "Fundamentals of Gas Dynamics", John Wiley and Sons, 2002.

Web References

- http://nptel.ac.in/courses/112106166/

BoS Chairman

Course Code: 140ME9114	Course Title: COMPUTATIONAL FLUID DYNAMICS (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Fluid Mechanics & Machinery
- Heat and Mass Transfer

Course Objectives

The course is intended to:

1. Explain the governing equations and partial differential equation
2. Discretize governing equations using finite difference method.
3. Discretize governing equations using finite volume method.
4. Solve incompressible viscous flow problems.
5. Discuss basics of turbulence.

UNIT I GOVERNING EQUATIONS **9**

Introduction to fluid mechanics – Reynolds Transport Theorem- Continuity Equation – Momentum Equation - Energy Equation – Classification of PDE's – Initial and Boundary conditions.

UNIT II FINITE DIFFERENCE METHOD **9**

Taylors Series – Forward, Backward and Central differencing schemes – FDM Formulation – Explicit scheme – FTCS and Dufort-Frankel method – Implicit scheme- Laasonen and Crank Nicolson method –1D Heat conduction –Problems - Errors (Qualitative).

UNIT III FINITE VOLUME METHOD **9**

Introduction – 1D Steady state diffusion – 2D Steady state diffusion - 1D Steady state convection-diffusion - Central differencing schemes –UPWIND Scheme – Problems

UNIT IV VISCOUS FLOW **9**

Incompressible flow using MAC and Simple algorithm - Stream function and Vorticity formulation for viscous incompressible flow. Two dimensional incompressible viscous flow.

UNIT V TURBULENCE AND ITS MODELLING **9**

Introduction to turbulence- Turbulence models- One equation model - Mixing length model – Two equation model – K-Ɛ Model – Implementation of boundary condition in practical applications.

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Course Outcomes

At the end of the course students will be able to:

CO1: Explain the governing equations, classification of partial differential equation, initial and boundary conditions.
CO2: Discretize governing equations using finite difference method.
CO3: Discretize governing equations using finite volume method.
CO4: Solve incompressible viscous flow problems using MAC and SIMPLE algorithms.
CO5: Discuss basics of turbulence, its modeling and boundary conditions in real life problems.

Text Books

1. Anderson D.A., Tannehil J.C, Pletcher R.H, "Computational Fluid Mechanics & Heat Transfer", Hemisphere Publishing Corporation, New York, 2004.
2. Versteeg H.K, Malalasekara W, "An Introduction to Computational Fluid Dynamics: The Finite Volume Method", Second Edition, Pearson Publishers, 2007.

References

1. Klaus A. Hofmann, Steve T. Chiang, "Computational Fluid Dynamics", Fourth Edition, Engineering Education System, 2000.
2. John D. Anderson, "Computational Fluid Dynamics: The Basics with Applications", First Edition, McGraw-Hill Education, 2012
3. Murlidhar.K.,Sunderrajan.T, "Computational Fluid Mechanics and Heat Transfer", Narosa Publishing House, 2008.

Web References

- http://nptel.ac.in/courses/112105045/
- http://www.cfd-online.com/

BoS Chairman

Course Code: 140ME9115	Course Title: DESIGN FOR MANUFACTURE, ASSEMBLY AND ENVIRONMENT (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II
- Design of Machine Elements

Course Objectives

The course is intended to:

1. Explain the design principles required for manufacture and assembly.
2. Explain the factors influencing form design.
3. Explain the machining consideration on component design.
4. Explain the casting consideration on component design.
5. Explain the environmental consideration on component design.

UNIT I INTRODUCTION 9

General design principles for manufacturability - strength and mechanical factors, mechanisms selection, evaluation method, Process capability - Feature tolerances - Geometric tolerances - Assembly limits -Datum features - Tolerance stacks, GD & T

UNIT II FACTORS INFLUENCING FORM DESIGN 9

Working principle, Material, Manufacture, Design- Possible solutions – Materials choice - Influence of materials on form design - form design of welded members, forgings and castings.

UNIT III COMPONENT DESIGN - MACHINING CONSIDERATION 9

Design features to facilitate machining - drills - milling cutters - keyways - Doweling procedures, counter sunk screws - Reduction of machined area- simplification by separation - simplification by amalgamation - Design for machinability - Design for economy - Design for clampability - Design for accessibility - Design for assembly.

UNIT IV COMPONENT DESIGN – CASTING CONSIDERATION 9

Redesign of castings based on Parting line considerations - Minimizing core requirements, machined holes, redesign of cast members to obviate cores. Identification of uneconomical design - Modifying the design - group technology - Computer Applications for DFMA

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UNIT V DESIGN FOR THE ENVIRONMENT AND DFMA TOOLS 9

Introduction – Environmental objectives – Global issues – Regional and local issues – Basic DFE methods – Design guide lines – Example application Design for energy efficiency – Design to regulations and standards. AT&T life cycle assessment methods.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the design principles required for manufacture and assembly.
CO2: Describe the factors influencing form design.
CO3: Explain the machining consideration on component design.
CO4: Explain the casting consideration on component design.
CO5: Explain the environmental consideration on component design.

Text Books

1. Geoffrey Boothroyd, Peter Dewhurst, Winston A. Knight , "Product Design for Manufacture and Assembly", Third Edition, CRC Press, 2010
2. Boothroyd, G, "Design for Assembly, Automation and Product Design"., Marcel Dekker, New York 2005

References

1. Harry Peck , "Designing for Manufacture", Pitman Publishing, 1973
2. Dickson, John. R, and Corroda Poly, "Engineering Design and Design for Manufacture and Structural Approach", Field Stone Publisher, USA, 1999
3. Fixel, J. "Design for the Environment" McGraw hill., 2011

Web References

- http://www.nptel.ac.in/courses/112101005/

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Course Code: 140ME9116	Course Title: PRODUCT DESIGN AND DEVELOPMENT (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II
- Design of Machine Elements

Course Objectives

The course is intended to:

1. Understand the process to plan and develop products.
2. List the process of collecting information and develop product specifications.
3. Discuss the concept generation, selection and testing processes.
4. Explain the concepts of industrial design and design for manufacture.
5. Describe the basics of prototyping, economic analysis and project planning.

UNIT I INTRODUCTION 9

Product Development process – Product development organizations, Gather raw data – Interpret raw data- organize the needs into a hierarchy – Relative importance of the needs, voice of customer

UNIT II PRODUCT SPECIFICATIONS 9

Establishing the product specifications,– Target specifications – Refining specification Concept generation-Clarify the problem – Search internally – Search externally – Explore systematically.

UNIT III COMPONENT CONCEPT SELECTION 9

Concept selection- Screening – scoring, Product architecture – Implication of architecture – Establishing the architecture – Related system level design issues.

UNIT IV INDUSTRIAL DESIGN 9

Need for industrial design – Impact of industrial design – Industrial design process – Management of industrial design process – Assessing the quality of industrial design, design for manufacturing- cost considerations, Impact of DFM decisions on other factors.

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UNIT V PROTOTYPING & COST ANALYSIS 9

Principles of prototyping – Planning for prototypes, economics of product development projects, Elements of economic analysis – Base – Case financial model – Sensitivity analysis – Influence of the quantitative factors.

Course Outcomes

At the end of the course students will be able to:

CO1: Understand the process to plan and develop products.
CO2: List the process of collecting information and develop product specifications.
CO3: Discuss the concept generation, selection and testing processes.
CO4: Explain the concepts of industrial design and design for manufacture.
CO5: Describe the basics of prototyping, economic analysis and project planning

Text Books

1. Karal, T.Ulrichsteven D.Eppinger, "Product Design and Development", McGraw Hill, International Editions, 2011.
2. Kevien Otto and Kristin Wood, "Product Design". Pearson Publication, 2004

References

1. S.Rosenthal, "Effective Product Design and Development", Irwin, 1992.
2. Charles Gevirtz "Developing New products with TQM", McGraw Hill International Editions, 1994.
3. Dieter.G.E., "Engineering Design," McGraw Hill Company International Edition 2012.

Web References

- http://users.encs.concordia.ca/~andrea/inse6411/Lecture2.pdf.
- http://www.me.umn.edu/courses/me4054/lecnotes/archive.html

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Course Code: 140ME9117	Course Title: FAILURE ANALYSIS AND DESIGN (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Strength of Materials
- Design of Machine Elements

Course Objectives

The course is intended to:

1. Explain reliability concepts
2. Describe different types of fracture failure
3. Explain the importance of fatigue fracture
4. Explain the corrosion and wear mechanism
5. Describe different types of creep failure

UNIT I RELIABILITY **9**

Reliability concept and hazard function, life prediction, condition monitoring, application of Poisson, exponential and Weibull distribution for reliability - bath tub curve - parallel and series system - mean time between failures and life testing. Introduction to FMEA

UNIT II INTRODUCTION TO SOLID MECHANICS **9**

STRESSES IN A BODY: Two dimensional and three dimensional state of stress, Mohr's circle in two and three dimensions, hydrostatic stress, Von-mises, maximum shear stress (Tresca), octahedral shear stress, torsional stresses for large plastic strain. FRACTURE :Types of fracture, Griffith crack theory, stress analysis of cracks, metallographic aspects of fracture. Brittle, ductile fractures, notch effects, fracture curve, R curve, fracture under combined stresses, probabilistic aspects of fracture mechanics, toughness of materials.

UNIT III FRACTURE FAILURE **9**

FATIGUE: Statistical nature of fatigue, S-N curve, LCF, HCF, strain life equations, structural feature of fatigue, fatigue crack propagation, effect of stress concentration, size, surface properties, metallurgical variables on fatigue, case studies, designing against fatigue, detail design, improvements after failure and service, fatigue of bolts, welded and adhesive joints. FATIGUE TESTS: Purpose, specimen, fatigue test procedures, evaluation of fatigue test results, crack growth measurement

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UNIT IV WEAR AND CORROSION FAILURE 9

WEAR FAILURES: Type of wear, role of friction in wear, lubricated and non-lubricated wear, analysing wear failures, wear tests SOAP, ferrography. CORROSION FAILURES: Factors influencing corrosion failures, analysis of corrosion failures, overview of various types of corrosion, stress corrosion cracking - sources, characteristics of stress corrosion cracking, procedure of analysing stress corrosion cracking, various types of hydrogen damage failures, corrective and preventive action

UNIT V CREEP FAILURE 9

ELEVATED TEMPERATURE FAILURES: Creep, stress rupture, elevated temperature fatigue, metallurgical instabilities, environmental induced failure, elevated temperature effects on certain gas turbine components and petroleum refinery components, tests for analysis of failure at elevated temperatures.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain reliability concepts used in failure analysis
CO2: Describe different types of fracture failure
CO3: Explain the importance of fatigue fracture in design
CO4: Explain the corrosion and wear mechanism in failure analysis
CO5: Describe different types of creep failure

Text Books

1. Richard W Hertzberg, "Deformation and Fracture Mechanism of Engineering Materials", John Wiley & Sons,Inc.,2012.
2. George E Dieter, "Mechanical Metallurgy", McGraw Hill Book Company, 2013.

References

1. JaapSchijve, "Fatigue of Structures and Materials", Kluwer Academic Publishers, 2013.
2. ASM Metals Handbook, "Failure Analysis and Prevention", ASM Metals Park, USA, Vol. 10, 10th Edition, 1995.
3. Rajput R.K, "Engineering Materials& Metallurgy", S.Chand Publication, 2006.

Web Reference

- https://en.wikipedia.org/wiki/Failure_mode_and_effects_analysis
- https://en.wikipedia.org/wiki/Failure Modes_effects_and_criticality Analysis

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Course Code: 140ME9118	Course Title : MECHANICAL SYSTEM DESIGN (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Mathematics -I
- Numerical Methods

Course Objectives

The course is intended to:

1. Explain the engineering process and system approach
2. Explain the system theories and system modeling concepts
3. Apply the mathematical formulation in system design and optimization concepts
4. Apply the decision analysis principles and system simulation concepts
5. Apply the financial analysis to evaluate the system performance

UNIT I SYSTEM APPROACH AND PROBLEM FORMULATION 9

Engineering processes- Role of an Engineer in Mechanical system Design, Engineering Problem solving. System approach-Application of system concepts, Characteristics of systems, elements of systems, Types of systems. Problem formulation-Problems and forming models, nature of engineering problems, problem characteristics, problem environment, problem statement and techniques involved in defining a problem, a case study.

UNIT II SYSTEM THEORIES AND SYSTEM MODELING 9

System Theories-Black box approach, state theory approach, component integrated approach, decision theory approach. System Modeling-Need of modeling, modeling process, principles, modeling types-static physical model, dynamic physical model, static mathematical model, dynamic mathematical model, a case study on system modeling.

UNIT III MATHEMATICAL FORMULATION IN MECHANICAL DESIGN 9

Mathematical Formulation in System Design-Linear Programming Problem-Graphical method, Simplex method, Network Flow analysis- critical path method, and probability of completion time. Optimization Concepts-optimization in engineering applications, ingredients and classifications, statement of optimization, design vector, constraints, objective function, Optimization concept in single variable optimization and multi variable optimization problem.

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UNIT IV DECISION ANALYSIS AND SYSTEM SIMULATION 9

Decision analysis-Elements of decision problem, decision making under certainty, decision making under uncertainty, decision models- quantitative methods, decision tree. System Simulation concepts- types of simulation models, simulation programs and languages, Monte Carlo simulation , waiting line simulation.

UNIT V SYSTEM EVALUATION 9

System evaluation-Request for proposals, Evaluation factors, stage of evaluation, Needs and benefits, Feasibility assessment, planning horizon. Financial analysis of system performance-Average rate of return method, Payback period, Balance sheet-profit and loss statement, a case study.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the engineering process and system approach to formulate a problem.

CO2: Explain the system theories and system modeling concepts to study the system behavior.

CO3: Apply the mathematical formulation in system design and optimization concepts to optimize the system.

CO4: Apply the decision analysis principles and system simulation concepts optimize the system.

CO5: Apply the financial analysis to evaluate the system performance.

Text Books

1. R.C Mishra and Simant, "Mechanical System Design-PHI" learning New Delhi, 2009.
2. K.U. Siddiqui and Manojkumarsingh, "Mechanical system Design"-New Age international Publishers, 2010.

References

1. S.S.Rao "Engineering Optimization-Theory and Practice" New Age international Publishers, 1996.
2. S.Kalavathy "Operations Research" Vikas Publishing House,2012
3. Ramachandran Aryasry&VV.Ramana Murthy, "Engg Economics & Financial Accounting", Tata McGraw-Hill Company, NewDelhi, 2004.

Web References

- http://content.asce.org/files/pdf/team2010-2Mechanical_systems_designpresentation.pdf
- http://www.engr.mun.ca/~yuri/Courses/MechanicalSystems/Design.pdf
- http://www.coursera.org

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Course Code: 140ME9119	Course Title: COMPOSITE MATERIALS (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Materials Science
- Strength of Materials
- Metallurgical Engineering.

Course Objectives

The course is intended to:

1. Explain the properties of reinforcements and matrix
2. Explain the properties of fibers
3. Explain types of composite manufacturing methods
4. Explain the material properties and lamination theory for fiber reinforced composites
5. Explain the load bearing behavior of ccomposite and ccomposite structures

UNIT I INTRODUCTION 9

Definition – Classification of Composite materials based on structure – based on matrix. Advantages of composites – application of composites – functional requirements of reinforcement and matrix. Reinforcement types – Fibres – continuous, particulate and whisker reinforcements – Properties -Applications – Comparison of fibre strengths –. Matrix materials – Properties. Wettability fibre with matrix – Effect of surface roughness – Interfacial bonding

UNIT II REINFORCEMENTS AND MATRICES 9

Different types of fibers - Manufacturing , properties and applications of glass fibers, carbon fibers, Kevlar fibers. Thermoset and thermoplastic matrices - properties of polyester, epoxy and nylon matrices , polypropylene and PEEK matrices

UNIT III MANUFACTURING OF COMPOSITES 9

Polymer matrix composites: Preparation of Moulding compounds and pre-pregs – hand lay up method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding.

UNIT IV MECHANICS OF COMPOSITES 9

Rule of mixture -volume and mass fractions – density - void content, Evaluation of four elastic moduli based on strength of materials approach and Semi - Empirical

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model - Longitudinal Young's modulus-transverse Young's modulus – major Poisson's ratio-In- plane shear modulus, Ultimate strengths of a unidirectional lamina. Characteristics of Fiber-reinforced lamina – laminates – lamination theory, Inter laminar stresses.

UNIT V COMPOSITE STRUCTURES 9

Fatigue – S-N curves – Fatigue behaviors of CMCs – Fatigue of particle and whisker reinforced composites. Introduction to structures - selection of material, manufacturing and laminate configuration -design of joints - bonded joints - bolted joints - bonded and bolted.

Course Outcomes

At the end of the course students will be able to:

CO:1 Explain the properties of reinforcements such as continuous, particulate and whisker and the matrix

CO:2 Explain the properties of fibers such as glass, carbon, Kevlar and matrices such as polyester, epoxy and nylon matrices , polypropylene and PEEK.

CO: 3 Explain composites manufacturing methods such as hand layup, Autoclave, Filament winding, Compression moulding and Reaction injection moulding.

CO: 4 Explain the longitudinal Young's modulus, transverse Young's modulus, major Poisson's ratio, In- plane shear modulus and lamination theory for fiber reinforced composites

CO:5 Explain the Fatigue behaviors of particle and whisker reinforced composites and composite structures such as bonded joints and bolted joints.

Text Books

1. Krishnan K.Chawla, "Composite Materials Science and Engineering", Springer 2006.
2. Mallick, P.K., "Fiber Reinforced Composites: Materials, Manufacturing and Design",Manee Dekker Inc, 2007.

References

1. Agarwal, B.D., and Broutman L.J., "Analysis and Performance of Fiber Composites",John Wiley and Sons, New York, 2012.
2. Gibson, R.F., "Principles of Composite Material Mechanics", McGraw-Hill, 2011.
3. Srinivasan K , "Composite Material" NarosaPublication , 2009.

Web References

- http://nptel.ac.in/courses/101104010/
- http://nptel.ac.in/courses/Webcourse-contents/IISc BANG/Composite%20Materials/New_index1.html

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Course Code: 140ME9120	Course Title: COMPUTER INTEGRATED MANUFACTURING (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Write NC, DNC and CNC program in CIM.
2. Design manufacturing solution based on CAD System in CIM.
3. Select Materials handling and Storage in CIM.
4. Write coding for Group Technology in CIM
5. Design automated manufacturing based on Artificial Intelligent system, Expert system and FMS in CIM.

UNIT I INTRODUCTION TO CIM 9

Automated Manufacturing system – Needs, Types. CIM - CIM wheel - Components, Evolution, needs, Benefits. NC system - Components, NC motion control system, application, advantages and disadvantages. Computer Numerical control System – Components, functions, advantages. Direct Numerical Control System – Components, functions, advantages.

UNIT II COMPUTER AIDED DESIGN 9

Concept of CAD as drafting and designing facility, desirable features of CAD package, drawing features in CAD – Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate. - typical CAD command structure - Types CAD modeling - wire frame modeling, surface modeling and solid modeling.

UNIT III MATERIAL HANDLING AND STORAGE SYSTEMS 9

Materials handling and Storage Systems - Automated storage and retrieval systems, carousel storage systems - Interfacing of Handling and Storage with Manufacturing system. AGVs - types, advantages and application. Robot – Basic concepts, applications.

UNIT IV GROUP TECHNOLOGY 9

GroupTechnology - RoleofG.TinCAD/CAM Integration, partfamilies, part Classificationandcoding–DCLASSandMICLASSandOPITZcodingsystems - facility designusingG.T, benefitsofG.T - Cellular Manufacturing.

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UNIT V **ARTIFICIAL INTELLIGENT SYSTEM, EXPERT SYSTEM AND FMS** **9**

Artificial Intelligence System, Basic concepts of Artificial intelligence, Intelligent systems and expert systems. Flexible manufacturing systems – Configurations, workstations, planning, applications and benefits – Automated inspection and testing - Machine vision.

Course Outcomes

At the end of the course students will be able to:

CO1- Write program for NC, DNC and CNC in Automated Manufacturing systems such as CIM.

CO2- Design manufacturing solution with the features of CAD System such as Scaling, rotation, translation, editing, dimensioning, labeling, Zoom, pan, redraw and regenerate in design and modeling for CIM

CO3- Select appropriate Materials handling and storage systems such as AGVs, AS/RS and Robots for material handling and Storage System in CIM

CO4- Write codes using DCLASS, MICLASS and OPITZ for Group Technology in CIM

CO5- Design Automated Manufacturing based on Artificial Intelligent system, Expert system and FMS to gradually convert Traditional Manufacturing environment in CIM.

Text Books

1. Mikell. P. Groover "Automation, Production Systems and Computer Integrated Manufacturing", Pearson Education 2015.
2. Mikell. P. Groover and Emory ZimmersJr.,"CAD/CAM", Prentice hall of India Pvt. Ltd., 2013.

References

1. James A. Regh and Henry W. Kreabber, "Computer Integrated Manufacturing", Pearson Education second edition, 2005.
2. Chris McMahon and Jimmie Browne, "CAD CAM Principles, Practice and Manufacturing Management", Pearson Education second edition, 2005.
3. Ranky, Paul G., "Computer Integrated Manufacturing", Prentice hall of India Pvt. Ltd., 2005.

Web References

- https://en.wikipedia.org/wiki/Computer-integrated_manufacturing
- https://en.wikipedia.org/wiki/Computer-aided_manufacturing
- https://en.wikipedia.org/wiki/Integrated_Computer-Aided_Manufacturing
- http://www.simflow.net/publications/books/cimie-part1.pdf
- https://prezi.com/tnl5tme5rwr6/computer-integrated-manufacturing-cim

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Course Code: 140ME9121	**Course Title:** NON-DESTRUCTIVE TESTING METHODS (Common to Automobile and Mechanical)	
Core/Elective: Elective	**L : T : P : C**	3 : 0 : 0 : 3
Type: Theory	**Total Contact Hours:**	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Metrology and Measurements.

Course Objectives

The course is intended to:

1. Explain Visual Inspection and Eddy Current Testing Method.
2. Prepare Magnetic Particle Testing Method
3. Prepare Liquid Reentrant Testing Method
4. Plan for Ultrasonic Testing Method
5. Plan for Radiographic Testing Method

UNIT I VISUAL INSPECTION AND EDDY CURRENT TESTING METHOD **9**

Scope and advantages of NDT-Compare NDT with DT-Principle of Visual Inspection theory- Optical aids used for Visual Inspection-Microscope, Boroscope, Endoscope, Flexiscope, Telescope and Hollography- Principles of Eddy Current Theory-surface mounted coils-Encircling coils-types of Probes-Eddy current sensing Probes-Flux leakage sensing Probes-Eddy Current Techniques, Advanced Eddy Current Techniques-applications, Limitations and standards.

UNIT II MAGNETIC PARTICLE TESTING METHOD **9**

Basic Principle of magnetic particle testing(MPT)-induced magnetic fields-circular and longitudinal fields-Hysteresis curve-magnetic flux strips and coils-residual fields and demagnetization-MPT techniques-magnetization using a permanent magnet, magnetization using a Electro magnet, contact current flow method, wet and dry particle inspection methods, remote magnetic particle inspection, probe power inspection, light weight UV lamps inspection, semi automatic inspection, applications and limitations of MPT.

UNIT III LIQUID PENETRANT TESTING METHOD **9**

Physical properties of liquid penetrant-penetrant testing materials-penetrants, cleaners,emlusifiers developers, lint free cloth-Basic Principle, applications and limitations of liquid penetrant testing(LPT)-different LPT methods-Post-Emulsification

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Fluorescent penetrant process, Reverse Fluorescent Dye penetrant process, Visible Dye penetrant process, Water-Emulsification visible Dye penetrant process, solvent clean visible Dye penetrant process.

UNIT IV ULTRASONIC TESTING METHOD 9

Basic properties of sound beam-sound waves-velocity of ultrasonic waves, Acoustic Impedencebehaviour of ultrasonic waves-ultrasonic transducers-characteristics of ultrasonic beam, Flaw sensitivity, Beam divergence, Attenuation-Principle of ultrasonic testing methods, applications and limitations-Ultrasonic testing method-normal incident pulse echo inspection method, normal incident through transmission testing method, angle beam pulse echo inspection method.

UNIT V RADIOGRAPHIC TESTING METHOD 9

Basic Principle of Radiography-Electromagnetic radiation sources-X ray source, Gamma ray source-properties of X and Gamma rays-Radiographic Imaging-Geometrical factors- radiographic film-film density-Radiographic sensitivity-Penetrameter-Radiographic Inspection Techniques-single wall single image technique, wall penetration technique, Latitude technique-Applications and Limitations of Radiographic Inspection Techniques.

Course Outcomes

At the end of the course students will be able to:

CO1- Explain the testing procedure for Visual Inspection and Eddy Current Testing Method in Quality Assurance.

CO2- Explain testing procedure for Magnetic Particle Testing Method for Quality Assurance.

CO3- Explain testing procedure for Liquid Reentrant Testing Method for Quality Assurance.

CO4- Plan inspection sequence for Ultrasonic Testing Method for Quality Assurance.

CO5- Plan inspection sequence for Radiographic Testing Method for Quality Assurance.

Text Books

1. Baldev Raj, T.Jayakumar, M.Thavasimuthu,"Practical Non-Destructive Testing", Narosa Publishing House, 2009.
2. J Prasad, C G K Nair, "Non-Destructive Testing and Evaluation of Materials", Tata McGraw-Hill Education Private Limited, 2003.

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References

1. Ravi Prakash, "Non-Destructive Testing Techniques", 1st revised edition, New Age International Publishers, 2010.
2. American Metals Society, "Non-Destructive Examination and Quality Control", Metals Hand Book, Vol.17, 9th Edition, Metals Park, 1989.
3. Paul Mix, "Introduction to Non-destructive testing: a training guide", Wiley, 2nd Edition,New Jersey,2005.

Web References

- https://www.nde-ed.org/index_flash.htm
- http:// http://117.55.241.6/library/E-Books/NDT%20Notes.pdf
- http:// www.slideshare.net/ndtindia123/introduction-uses-of-non-destructive-testing-24377016
- http:// www.eis.hu.edu.jo/ACUploads/10526/Ultrasonic%20Testing.pdf
- http://www.hse.gov.uk/comah/sragtech/ndt2.pdf

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Course Code: 140ME9122	Course Title: LEAN MANUFACTURING (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Understand the Lean Manufacturing principles
2. Apply various Lean tools
3. Apply value stream management
4. Apply the lean principles in manufacturing and service industries
5. Evaluate various lean metrics

UNIT I INTRODUCTION TO LEAN MANUFACTURING 7

Manufacturing systems-Types-Ford Production System, Lean Manufacturing Paradigm-History of Lean Manufacturing-Traditional Vs Lean Manufacturing, TQM vs. Lean, Toyota Production System. Lean Principles-Value Added Activities-Non-Value Added Activities-Necessary Non-Value added Activities- 3Ms-Muda, Mura and Muri-Types of wastes, Lean objectives-Need for lean manufacturing.

UNIT II LEAN TOOLS AND METHODOLOGIES 9

Problem solving tools-Cause and Effect Diagram, Pareto analysis, FMEA, Work cell and equipment management tools- Process Mapping, Spaghetti diagram, U shaped Layout, Poke Yoke, Kanban , Andon, SMED, One Piece Flow , GenchiGenbutsu, Milk run , Visual workplace, Quality at the source Methodologies-Pillars of Lean Manufacturing-Just in Time, Jidoka, 5S, TPM, Six sigma, DFMA, Kaizen.

UNIT III VALUE STREAM MANAGEMENT 10

Value stream Mapping-Value stream icons-Road map-Current State, Future State-Demand stage-Market Dynamics, Customer Demand; PQ Analysis; PR Analysis; Takt Time; Pitch; Finished Goods Stock, Cycle Stock Buffer Stock; Safety Stock-Flow Stage-Continuous flow, work cells, Line balancing, Standardized work, Quick change over, Autonomous maintenance, In process Super markets, Kanban systems, FIFO Lanes, Production Scheduling, Leveling Stage-Paced Withdrawal, Heijunka(Load Leveling), Heijunka Box, The Runner-a Case Study.

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UNIT IV LEAN IMPLEMENTATION 10

Training Stage-Management Commitment, Identify the value stream manager/Champion and core Implementation team Members, Training of team members, Planning stage-Customer Focus, Go to the floor, Hosin Planning, Brain storming, Prepare Tree Diagram, Select the cross functional team, Prepare project plan, Improvement stage-Production and Productivity-Operator, Process, Machinery and Equipment, Work place Organization, Inventory management, Planning and Procurement of Materials, A case study on Lean implementation in manufacturing and service industries.

UNIT V LEAN METRICS 9

Lean Metrics-the fundamentals, steps in identifying Lean Metrics, WIP inventory, Total Product cycle time, Total value stream lead time, On time delivery, Defective PPM, Uptime, OEE, Throughput rate, Through put yield, Utilization rate, Lean Manufacturing assessment-Radar Chart- a case study.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the Lean Manufacturing principles such as -Value Added Activities-Non-Value Added Activities-Necessary Non-Value added Activities- 3Ms-Muda, Mura and Muri to eliminate the waste

CO2: Design manufacturing solutions based on various Lean tools and methodologies such as Process Mapping, Spaghetti diagram, U shaped Layout, Poke Yoke, Kanban , Andon, SMED, One Piece Flow .

CO3: Prepare value stream maps such Current state, Future state mapping, Standardized work, Quick change over, Autonomous maintenance to eliminate the non value added activities.

CO4: Design manufacturing solutions for manufacturing and service industries based on Hosin Planning.

CO5: Compare various lean metrics such as Lead time, Cycle Time, through put time, PPM, Uptime, OEE, Throughput rate, Through put yield for Lean assessment.

Text Books

1. Don Tapping, Tom Luyster, and Tom Shuker, "Value stream Management Eight steps to planning", Mapping and sustaining Lean Improvements, Productivity Press, New York, ,2002.
2. N.Gopalakrishnan, "Simplified Lean Manufacture Elements, Rules", Tools and Implementation, PHI Learning, New Delhi, 2010.

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References

1. James P. Womack, Daniel T Jones, Daniel Ross "The Machine That Change the world", Free Press trade paperback edition, U.S.A, 2007.
2. Ronald G. Askin& Jeffrey B.Goldberg, "Design and Analysis of Lean Production Systems",2003, John Wiley & Sons,2003.
3. Rother M. and Shook J, "Learning to See: Value Stream Mapping to Add Value and Eliminate Muda" , Lean Enterprise Institute, Brookline, MA,1999.

Web References

- https:// www.learning –to-see.co.uk.
- https://www.lean.org.
- https://www.leanproduction.com.

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Course Code: 140ME9123	Course Title: UNCONVENTIONAL MACHINING PROCESSES (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objective

The course is intended to:

1. Explain the Classification of UCM
2. Describe Mechanical energy based UCM
3. Explain Electrical energy based unconventional machining processes
4. Explain Chemical & Electro chemical energy based UCM
5. Describe Thermal energy based unconventional UCM

UNIT I INTRODUCTION **9**

Need for unconventional machining process-Advantages of UCM - Disadvantages of UCM - Comparison of conventional and unconventional machining processes - Process parameters - Processes based on type of energy required to shape the material- Processes based on mechanism of material removal- Processes based on transfer media- Processes based on source of energy

UNIT II MECHANICAL ENERGY BASED UCM PROCESSES **9**

Principle of Mechanical energy based UCM Processes - Mechanical energy based unconventional machining processes: Ultrasonic machining process, Abrasive Jet machining process, Water Jet Machining process - Principle, Working of various elements, Mechanism of metal removal, Applications, Advantages and Disadvantages. Comparison of Mechanical energy based unconventional machining processes

UNIT III ELECTRICAL ENERGY BASED UCM PROCESSES **9**

Principle of Electrical energy based UCM Processes - Electrical energy based unconventional machining processes: Electric Discharge machining - Principle, Layout of EDM process, Functions and types of dielectric fluid, Properties of different tool materials, Working of R-C (Relaxation) circuit, R-C-L circuit, rotary pulse generator circuit, controlled pulse generator circuit, Process parameters in EDM Process, Mechanism of metal removal, Applications, Advantages and Disadvantages. Wire cut EDM (WCEDM) process: Layout, Construction and working of various elements,
Applications, Advantages and Disadvantages. Drilling and Die sinking by EDM process. Comparison of Electrical energy based unconventional machining processes

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UNIT IV CHEMICAL & ELECTRO CHEMICAL ENERGY BASED UCM PROCESSES 9

Principle of Chemical & Electro chemical energy based UCM Processes - Chemical & Electro chemical energy based unconventional machining processes: Chemical machining, Electro chemical machining, Electro chemical grinding, Electro chemical honing processes - Principle, Working of various elements, Mechanism of metal removal, Applications, Advantages and Disadvantages. Comparison of Chemical & Electro chemical energy based unconventional machining processes

UNIT V THERMAL ENERGY BASED UCM PROCESSES 9

Principle of Thermal energy based UCM Processes - Thermal energy based unconventional machining processes: Electron Beam machining (EBM), Laser Beam machining (LBM), Plasma Arc machining (PAM) processes - Principle, Working of various elements, Mechanism of metal removal, Applications, Advantages and Disadvantages. Comparison of Thermal energy based unconventional machining processes.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the various methods of Unconventional Machining Processes based on type of energy required, mechanism of material removal, transfer media and source of energy.

CO2: Select mechanical energy based unconventional machining processes such as Ultrasonic machining process, Abrasive Jet machining process and water jet machining process based on machining requirements for a product.

CO3: Choose Electrical energy based unconventional machining processes such as EDM based on machining requirements for a product.

CO4: Select Chemical & Electro chemical energy based unconventional machining processes such as Chemical machining, Electro chemical machining and Electro chemical grinding based on machining requirements for a product..

CO5: Choose Thermal energy based unconventional machining processes such as Electron Beam machining (EBM), Laser Beam machining (LBM), Plasma Arc machining (PAM) processes for special applications

Text Books

1. Vijay.K. Jain "Advanced Machining Processes" Allied Publishers Pvt. Ltd., New Delhi, 2007
2. Pandey P.C. and Shan H.S. "Modern Machining Processes" Tata McGraw-Hill, New Delhi, 2007.

References

1. Benedict.G.F."Nontraditional Manufacturing Processes" Marcel Dekker Inc., New York ,1987.
2. Paul De Garmo, J.T.Black, and Ronald.A.Kohser, "Material and Processes in manufacturing" Prentice Hall of India Pvt. Ltd., New Delhi ,8th Edition, 2001.
3. Ghosh and Malik, "Manufacturing Science", 1st ed., EWP Private Ltd., 2008.

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Web References

- https://en.wikipedia.org/wiki/Machining
- https://en.wikipedia.org/wiki/Laser_beam_machining
- https://en.wikipedia.org/wiki/Electrical_discharge_machining
- http://mechteacher.com/manufacturing-technology/
- http://www.engineershandbook.com/MfgMethods/nontraditionalmachining

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Course Code: 140ME9124	Course Title: INDUSTRIAL ROBOTICS AND AUTOMATION (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Kinematics of Machinery
- Electrical Drives & Controls
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Explain the fundamentals of robot.
2. Choose robot drive systems and end effectors
3. Explain the working principle of various sensors.
4. Explain robot kinematics and programming.
5. Explain the implementation of robotics

UNIT I FUNDAMENTALS OF ROBOT 7

Robot – Definition – Robot Anatomy – Co-ordinate Systems, Work Envelope, types and classification – Specifications – Pitch, Yaw, Roll, Joint Notations, Speed of Motion, Pay Load – Robot Parts and Functions – Need for Robots – Different Applications.

UNIT II ROBOT DRIVE SYSTEMS AND END EFFECTORS 10

Pneumatic Drives – Hydraulic Drives – Mechanical Drives – Electrical Drives – D.C. Servo Motors, Stepper Motor, A.C. Servo Motors – Salient Features, Applications and Comparison of Drives End Effectors – Grippers – Mechanical Grippers, Pneumatic and Hydraulic Grippers, Magnetic Grippers, Vacuum Grippers; Two Fingered and Three Fingered Grippers; Internal Grippers and External Grippers; Selection and Design Considerations

UNIT III SENSORS AND MACHINE VISION 10

Requirements of a sensor, Principles and Applications of the following types of sensors – Position of sensors (Piezo Electric Sensor, LVDT, Resolvers, Optical Encoders, Pneumatic Position Sensors), Range Sensors (Triangulation Principle, Structured, Lighting Approach, Time of Flight Range Finders, Laser Range Meters), Proximity Sensors (Inductive, Hall Effect, Capacitive, Ultrasonic and Optical Proximity Sensors),

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Touch Sensors, (Binary Sensors, Analog Sensors), Wrist Sensors, Compliance Sensors, Slip Sensors Camera, Frame Grabber, Sensing and Digitizing Image Data – Signal Conversion, Image Storage, Lighting Techniques. Image Processing and Analysis – Data Reduction: Edge detection Feature Extraction and Object Recognition - Algorithms. Applications – Inspection, Identification Visual Serving and Na vigation.

UNIT IV ROBOT KINEMATICS AND ROBOT PROGRAMMING 10

Forward Kinematics, Inverse Kinematics and Differences; Forward Kinematics and Reverse Kinematics of Manipulators with Two, Three Degrees of Freedom (In 2 Dimensional), Four Degrees of Freedom (In 3 Dimensional) – Deviations and Problems. Teach Pendant Programming, Lead through programming, Robot programming Languages – VAL Programming – Motion Commands, Sensor Commands, End effecter commands, and Simple Programs.

UNIT V IMPLEMENTATION AND ROBOT ECONOMICS 8

Industrial applications like pick & place, welding, painting, inspection, etc. ; RGV, AGV; Implementation of Robots in Industries, Safety Considerations for Robot Operations; Economic Analysis of Robots – Pay back Method, EUAC Method, Rate of Return Method.

Course Outcomes

At the end of the course students will be able to:

CO1 Explain the fundamentals of robot.
CO2 Describe the working of various robot drive systems and end effectors
CO3 Discuss the working principle of various sensors.
CO4 Explain the concepts of robot kinematics and robot programming.
CO5 Understand the implementation of robotics in industries.

Text Books

1. M.P.Groover, "Industrial Robotics – Technology, Programming and Applications", McGraw-Hill, 2012.
2. Fu.K.S. Gonzalz.R.C., and Lee C.S.G., "Robotics Control, Sensing, Vision and Intelligence", McGraw-Hill Book Co., 1987

References

1. YoramKoren, "Robotics for Engineers", McGraw-Hill Book Co., 1992
2. Janakiraman.P.A., "Robotics and Image Processing", Tata McGraw-Hill, 1995
3. S.R.Deb and ShankaDeb "Robotics Technology and Flexible Automation", Tata McGraw Hill,2009.

Web References

- http://www.cdeep.iitb.ac.in/nptel/Mechanical/Robotics%20Course/TOC.htm
- http://nptel.ac.in/video.php?subjectId=112101099

BoS Chairman

Course Code: 140ME9125	Course Title: RAPID PROTOTYPING AND TOOLING (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I &II

Course Objectives

The course is intended to:

1. Explain the importance of Rapid Prototyping Technology
2. Select liquid based and solid based rapid prototyping.
3. Design RPT solutions for data preparation
4. Select Three Dimensional Printing
5. Design RPT solutions based on tooling.

UNIT I INTRODUCTION **6**

Introduction: Need for time compression in product development, Product development – conceptual design – development – detail design – prototype – tooling.

UNIT II LIQUID BASED AND SOLID BASED RAPID PROTOTYPING SYSTEMS **10**

Classification of RP systems, Fusion Deposition Modeling – Principle – process parameters –Applications. Laminated Object Manufacturing – Principle – process parameters – Applications, Stereo lithography systems – Principle – process parameters –process details – Applications.- Selective laser sintering (SLS) - Direct Metal Laser Sintering (DMLS) system – Direct Metal Deposition- Principle – process parameters –Applications-Solid ground curing.

UNIT III DATA PREPARATION FOR RAPID PROTOTYPING TECHNOLOGIES **10**

Basic concept- Digitization techniques – Model Reconstruction – Data Processing for Rapid Prototyping: CAD model preparation, Data Requirements – geometric modeling techniques: Wire frame, surface and solid modeling – data formats - Data interfacing, Part orientation and support generation, Support structure design, Model Slicing and contour data organization, direct and adaptive slicing, Tool path generation.

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UNIT IV THREE DIMENSIONAL PRINTING 10

Three dimensional Printing (3DP):Principle, basic process, Physics of 3DP, types of printing process capabilities, material system. Solid based, Liquid based and powder based 3DP systems, strength and weakness, Applications and case studies.

Shape Deposition Manufacturing (SDM): Introduction, basic process, shape decomposition, mold, SDM and applications. Selective Laser Melting, Electron Beam Melting – Rapid manufacturing

UNIT V RAPID TOOLING 9

Classification: Soft tooling, Production tooling, Bridge tooling; direct and indirect – Fabrication processes, Applications. Case studies - automotive, aerospace and electronic industries.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the importance of Rapid Prototyping Technology over the existing traditional methods in present competitive scenario in terms of product development cycle and cost.
CO2: Select appropriate liquid based and solid based rapid prototyping systems such as Stereo lithography, Selective laser sintering, Direct Metal Laser Sintering and Direct Metal Deposition for modeling.
CO3: Design RPT solutions such as Model Slicing, direct slicing and adaptive slicing and Tool path generation for data preparation.
CO4: Select a suitable three Dimensional Printing from Selective Laser Melting and Electron Beam Melting for Shape Deposition Manufacturing for making prototype.
CO5: Design RPT solutions for automotive, aerospace and electrical industry.

Text Books

1. Chua C.K., Leong K.F., and Lim C.S., "Rapid prototyping: Principles and applications", Second edition, World Scientific Publishers, 2010
2. Pham,D.T. &Dimov.S.S., "Rapid manufacturing", Springer-Verlag, 2001.

References

1. Andreas Gebhardt, Hanser "Rapid prototyping", Gardener Publications, 2003.
2. LiouW.Liou, Frank W.Liou, "Rapid Prototyping and Engineering applications: A tool box for prototype development", CRC Press, 2007.
3. Paul F Jacobs, "Rapid Prototyping and manufacturing – Fundamentals of Streolithography", Society of Manufacturing Engineering Dearborn, 1992.

Web References

- https://www.nde-ed.org/index_flash.htm

BoS Chairman

Course Code: 140ME9126	Course Title: PLANT LAYOUT AND MATERIAL HANDLING (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Explain the concept of plant layout and required equipments
2. Explain the various types of layouts and planning procedures
3. Choose an appropriate environment for industrial buildings
4. Explain an efficient material handling
5. Explain the difficulties in material handling

UNIT I PLANT LOCATION AND PHYSICAL FACILITIES 9

Factors to be considered – Influence of location on plant layout, selection of plant site, consideration in facilities planning and layout – Equipment required for plant operation, Capacity, Serviceability and flexibility and analysis in selection of equipments, space and man power requirements

UNIT II PLANT LAYOUT 9

Need for layout, types of layout, factors influencing product, process, fixed and combination layout, tool and techniques for developing layout, process chart, flow diagram, string diagram, template and scale models – machine data. Layout planning procedure – visualization of layout, revision and improving existing layout, balancing of fabrication and assembly lines

UNIT III INDUSTRIAL BUILDINGS AND UTILITIES 9

Centralized electrical, pneumatic, water line systems. Types of buildings, lighting, heating, air-conditioning and ventilation utilities – planning and maintenance, waste handling, statutory requirements, packing and storage of materials: Importance of packaging, layout for packaging – packaging machinery – wrapping and packing of materials, cushion materials.

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UNIT IV MATERIAL HANDLING 9

Importance and Scopes – Principles of material handling – engineering and economic factors - planning, relationship to plant layout – types and selection of material handling systems, factors influencing their choice – concept of containerization and palletization.

UNIT V ANALYSIS OF MATERIAL HANDLING 9

Factors involved – motion analysis, flow analysis, graphical analysis, safety analysis, equipment cost analysis, palletization analysis, analysis of operation, material handling surveys – Designing of material handling systems – System equation - Planning chart, Unit load design – principle - efficiency of containers, pallet sizes.

Course Outcomes

At the end of the course students will be able to:

CO1: Understand the concept of plant layout and required equipments for plant operations
CO2: Explain the techniques for developing various types of layouts and layout planning procedure
CO3: Identify the suitable environment for industrial buildings and utilities
CO4: Understand the benefit of an efficient material handling system
CO5: Understand difficulties in material handling system on process layout

Text Books

1. G.K Agrawal, "Plant Layout and Material Handling", Jain Publishing, 2012
2. Khanna, O. P., "Industrial Engineering and Management", Dhanpatrai and Sons, 2003.

References

1. James A. Tompkins , John A. White, Yavuz A. Bozer and J. M. A. Tanchoco "Facilities Planning", 3rd edition , John Wiley & Sons, 2003.
2. Fred E Meyers, "Plant Layout and Material Handling", 2nd edition, Prentice Hall, 1999.
3. James MacGregor Apple, "Plant Layout and Material Handling", Wiley Publishing, 1977.

Web References

- https://en.wikipedia.org/wiki/Plant_layout_study
- https://en.wikipedia.org/wiki/Material_handling
- http://nptel.ac.in/courses/Webcourse-contents/IIT-Delhi/project%20and%20production%20management/mod7/mod73.htm

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Course Code: 140ME9127	Course Title: MICRO MANUFACTURING (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II
- Engineering Material Science

Course Objectives

The course is intended to:

1. Explain the properties and mechanics of various materials in micro state
2. Analyze the microscopic and macroscopic properties
3. Explain the micro fabrication and machining process
4. Explain principles of different micro machining process
5. Explain the different applications of MEMS.

UNIT I INTRODUCTION **9**

Introduction to Micro System design, Material properties, micro fabrication Technologies. Structural behavior, sensing methods, micro scale transport – feed back systems

UNIT II MICROMECHANICS **9**

Microstructure of materials, its connection to molecular structure and its consequences on macroscopic properties – Phase transformations in crystalline solids including marten site, ferroelectric, and diffusional phase transformations, twinning and domain patterns, smart materials.

UNIT III MICRO-FABRICATION **8**

Bulk processes – surface processes – sacrificial processes and Bonding processes – special machining: Laser beam micro machining-Electrical Discharge Machining – Ultrasonic Machining- Electro chemical Machining. Electron beam machining. Clean room-yield model – Wafer IC manufacturing – PSM – IC industry-New Materials-Bonding and layer transfer- devices.

UNIT IV MECHANICAL MICROMACHINING **10**

Theory of micromachining-Chip formation-size effect in micromachining-micro-turning, micro- milling, micro-drilling- Micromachining tool design-Precision Grinding-

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Partial ductile mode grinding-Ultra precision grinding- Binder less wheel – Free form optics

UNIT V MICRO ELECTRO MECHANICAL SYSTEM FABRICATION 9

Introduction – advance in Micro electronics – characteristics and Principles of MEMS – Design and application of MEMS: Automobile, defence, healthcare, Aerospace, industrial properties etc., - Materials for MEMS – MEMS fabrication- Bulk Micro Machining-LIGA – Microsystems packaging- Future of MEMS.

Course Outcomes

At the end of the course students will be able to:

CO1: Understand the properties, design and behaviour of various micro materials.
CO2: Analyze the microscopic and macroscopic properties of micro materials.
CO3: Understand the concept of various micro fabrication process.
CO4: Impart the principles of different micro machining process.
CO5: Understand the principles and applications of Micro Electro Mechanical Fabrication Systems.

Text Books

1. Sámi Franssila, "Introduction to Micro Fabrication", John Wiley and sons Ltd., UK, 2004,
2. Jain V.K, "Micro manufacturing Processes", CRC Press, 2012.

References

1. Madore J, "Fundamental of Micro fabrication", CRC Press, 2002.
2. Mark J. Jackson, "Micro fabrication and Nanomanufacturing", CRC Press, 2006.
3. Peter Van Zant, "Microchip fabrication", McGraw Hill, 2004.

Web References

- https://en.wikipedia.org/wiki/Microfabrication
- http://www.micromanufacturing.net/didactico/Desarollo/microforming/1-introduction

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Course Code: 140ME9128	Course Title: PROCESS PLANNING AND COST ESTIMATION (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Explain the basic concepts of process planning.
2. Apply manual and computer aided process planning and costing.
3. Explain both direct and indirect costs.
4. Analyze various cost calculation methods
5. Explain the Break Even Analysis & Cost Management

UNIT I PROCESS PLANNING, DESIGN AND CONCEPTS OF PROCESS PLAN **9**

Introduction- Place of process planning-economics- Process & Production Planning, Process Planning & Concurrent Engineering-Types of production- standardization-Production design & selection. Selection of processes, tools, cutting parameters & machine tools- Jigs and Fixtures - Grouping of processes- Sequencing of operations- Selecting primary manufacturing processes for rough & refined needs-Process capability, Process Charts

UNIT II MANUAL AND COMPUTER AIDED PROCESS PLANNING ESTIMATING AND COSTING **9**

Retrieval type/variant approach, group technology – generative approach, logics decision tress and tables, axiomatic approach – AI expert systems – feature recognition – applications Concepts, differences, different costing methods – classification of costs – cost grid-problems.

UNIT III DIRECT AND INDIRECT COST COMPONENTS **8**

Labour cost–direct, indirect–estimation–labour norms–time study rating – labour cost variances; material cost–direct, indirect–estimation–material issue valuation – material cost variances–problems. Overhead cost - Elements – factory, administrative, sales and distribution expenses–methods of absorbing overheads – Direct Labour, Direct Material Machine Hour Rate methods – depreciation – methods –accounting for service department expenses – problems.

UNIT IV COST CALCULATIONS **10**

Machined components–welded components, forged components, powder metallurgy parts, calculation of sales cost, case studies, use of computers in cost estimation, cost of rejection.

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OPTIMUM MACHINING CONDITIONS: Taylor's equation, deriving the equation for optimum economic cutting velocity– selection of cutting speed for optimum cost, problems process capability analysis

UNIT V BREAK EVEN ANALYSIS & COST MANAGEMENT 9

Concept, make or buy decision, assumptions, merits and demerits of break even analysis. Applications. Linear, multi product break-even analysis
Learning curves, product life cycle cost analysis -Tools and techniques–activity based costing - concepts, cost drivers; introduction to target costing - need and applications.

Course Outcomes

At the end of the course students will be able to:

CO1: Understand the basic concepts of process planning.
CO2: Evaluate the various approaches of manual and computer aided process planning and costing.
CO3: Understand the different components involved in direct and indirect costs.
CO4: Analyze the cost calculation methods of different manufacturing process.
CO5: Understand the concept of Break Even Analysis & Cost Management.

Text Books

1. Kannappan D, "Mechanical Estimating and Costing", Tata McGraw Hill, New Delhi, 2003.
2. Banga T R and Sharma S C, "Mechanical Estimating and Costing", Khanna Publishers, New Delhi, 2010.

References

1. Russell R.S and Tailor B.W, "Operations Management", PHI, 4th Edition, 2003.
2. Chitale A.V and Gupta R.C, "Product Design and Manufacturing", PHI, 2nd Edition, 2002.
3. Kesavan R "Process Planning and Cost Estimation", New Age International Pvt. Ltd., Chennai, 2005.

Web References

- https://en.wikipedia.org/wiki/Planning
- http://nptel.ac.in/courses/Webcourse-contents/IIT Delhi/Computer%20Aided%20Design%20&%20ManufacturingII/Module%20G /Module%20G(5)/p3.htm
- https://en.wikipedia.org/wiki/Cost_estimate

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Course Code: 140ME9129	Course Title: PRODUCTION PLANNING AND CONTROL (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes - I
- Manufacturing Processes - II
- Engineering economics and cost analysis.

Course Objectives

The course is intended to:

1. Explain the fundamentals of production planning control
2. Prepare work measurement techniques
3. Create production plan based on product information
4. Prepare production schedule
5. Select recent trends in production process control

UNIT I INTRODUCTION 9

Objectives and benefits of planning and control-Functions of production control-Types of production- job- batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational aspect-Durability and dependability aspect-aesthetic aspect. Profit consideration- Standardization, Simplification & specialization-Break even analysis-Economics of a new design.

UNIT II WORK STUDY 9

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study - work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III PRODUCT PLANNING AND PROCESS PLANNING 9

Product planning-Extending the original product information-Value analysis-Problems in lack of product planning-Process planning and routing - Pre requisite information needed for process planning - Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi-product system.

UNIT IV PRODUCTION SCHEDULING 9

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance - Flow production scheduling- Batch production scheduling-Product

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sequencing - Production Control systems-Periodic batch control- Material requirement planning kanban – Dispatching-Progress reporting and expediting-Manufacturing lead time-Techniques for aligning completion times and due dates.

UNIT V INVENTORY CONTROL AND RECENT TRENDS IN PPC 9

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system -Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis-Recorder procedure-Introduction to computer integrated production planning systems- elements of Just in time systems Fundamentals of MRP II and ERP.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the fundamentals of production planning control for Product development and design based on Marketing, Functional and Operational aspects.

CO2: Prepare a routing plan based on work measurement techniques and method-study for productivity improvement.

CO3: Create a production plan based on information such as Machine capacity and Process planning and routing.

CO4: Prepare production schedule based on completion times and due dates.

CO5: Select suitable inventory management protocols such as Two bin system, Ordering cycle system, Economic order quantity, economic lot size and ABC analysis for inventory control.

Text Books

1. MartandTelsang, "Industrial Engineering and Production Management", First Edition,S. Chand and Company, 2006.
2. James.B.Dilworth,"Operations Management – Design, Planning and Control for manufacturing and services" McGraw Hill International Edition 1992.

References

1. Andrew Sloss, Dominic Symes& Chris Wright, "ARM system Developer's guide", Elsevier,2005.
2. Samson Eilon, "Elements of Production Planning and Control", Universal Book Corpn.1984
3. Elwood S.Buffa, and RakeshK.Sarin, "Modern Production / Operations Management", 8th Ed. John Wiley and Sons, 2000..

Web References

- http://www.managementstudyguide.com/production-planning-and-control.htm
- http://www.tandfonline.com/toc/tppc20/current
- http://infocenter.arm.com/help/index.jsp
- http://www.yourarticlelibrary.com/production-management/elements-of-production-planning-and-control-in-an-organization/26170/

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Course Code: 140ME9130	Course Title: TRANSPORT MANAGEMENT (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Course Objectives

The course is intended to:

1. Explain the legislative laws of motor vehicle
2. Explain the vehicle insurance and the importance
3. Explain the operation of passenger transport system
4. Explain the operation of goods transport system
5. Describe taxation and traffic management

UNITI MOTOR VEHICLE ACT 9

Motor Vehicle Act: Short titles & definitions, Laws governing to use of motor vehicle & vehicle transport, Licensing of drivers & conductors, Registration of vehicle, State & interstate permits, Traffic rules, Signals & controls, Offences, penalties & procedures, Different types of forms. Government administration structure, Personnel, Authorities &duties,Rules regarding construction of motorvehicles

UNITII INSURANCE ANDROAD SAFETY 9

Insurance types & significance, Comprehensive, Third party insurance, Furnishing of particulars of vehicles involved in accident, MACT (Motor Accident Claims Tribunal), Solatium Fund, Hit & Run case, Duty of driver in case of accident, Surveyor & Surveyor's report

UNIT III PASSENGERTRANSPORTOPERATION 9

Structure of passenger transport organizations, typical depot layouts, requirements, Fleet maintenance -Scheduling operation &control.Propaganda, passenger amenities, Parcel traffic. Theory of fares, Basic principles of fare charging , Needs, straight and tapered scales,Differential rates for different types of services, Depreciation & debt charges, operation cost, Economics & records.

UNIT IV GOODSTRANSPORTOPERATION 9

Structure of goods transport organizations, Typical depot layouts, requirements ,scheduling of goods transport, materials Handling equipments in the goods transport operation, , storage & transportation of petroleum products

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UNIT V **TAXATION AND TRAFFIC MANAGEMENT** 9

Objectives, Structure & methods of laving taxation, One-time tax, Tax Exemption & tax renewal, Global positioning system- Traffic navigation, advanced traffic control devices.

Course Outcomes

At the end of the course students will be able to:

CO1 Explain the legislative laws governing the use of motor vehicle
CO2 Explain the types of vehicle insurance and the importance of road safety
CO3 Explain the operation of passenger transport system
CO4 Explain the operation of goods transport system
CO5 Describe taxation and traffic management

Text Books

1. "Motor Vehicle" Act - Govt. of India Publications.
2. Santosh Sharma, "Productivity in Road Transport", 2nd Edition, Association of State Roadtransport Undertakings, New Delhi.

Reference Books

1. P.G.Patankar, "Road Passenger Transport in India", CIRT,Pune.
2. S.K.Srivastava, "Transport Development in India", S. Chand & Co. Pvt. Ltd., New Delhi.
3. Edmund J. Gubbins "Managing Transport Operations", Kogan Page Publishers, 2003.

Web References

- https://en.wikipedia.org/wiki/Transportation_management_system

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Course Code: 140ME9131	**Course Title:** INSTRUMENTATION AND CONTROL (Common to Automobile and Mechanical)	
Core/Elective: Elective	**L : T : P : C**	3 : 0 : 0 : 3
Type: Theory	**Total Contact Hours:**	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Metrology and measurements
- Electrical drives and controls

Course Objectives

The course is intended to:

1. Explain the working principles of Transducers and various elements in automobiles.
2. Describe the wheel alignment and balancing techniques.
3. Explain the measurement of vibrations in chassis.
4. Explain NVH measurement
5. Explain the basics of control systems in automotive

UNIT I INTRODUCTION **10**

Transducers, types, thermistor, LVDT, inductive pickup, capacitance, strain gauges, semiconductors, photocells, piezoelectric accelerometer, proximity sensors, micro switches, encoders, piezo-electric pressure sensors, instruments, ammeter, voltmeter, odometer, speedometer, fuel level indicator, pressure gauge, vacuum gauge, analog and digital, calibration, cathode ray oscilloscope, study of microprocessors 8085, micro controller, PLC.

UNITII ENGINE SYSTEM ANALYZER **10**

Introduction, exhaust gas analyzer, emission norm standards, flasher instrumentations, accelerometer, real time DAQ , fuel injection calibration, calibration rig ignition timer calibration, stroboscope, smoke meter, macro inspection of interior parts using fiber optics.

UNIT III CHASSIS INSTRUMENTATION **8**

Introduction Wheel alignment gauges, laser alignment, measurement different wheel parameters system wheel balancing, calibrations, wind tunnel testing and drag estimation and profile optimization

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UNIT IV NVH, DYNAMOMETERS AND GAUGES 8

Sound level meters, acoustic measurement, FFT analyzer, anechoic chamber, varechoic chamber, sound level measurements, NVH standards. Torque measuring instruments, Study of different dynamometers, chassis dynamometer for two and four wheelers

UNITV CONTROL SYSTEMS FUNDAMENTALS 9

Basics of controls systems –different types , PID controller, sliding mode control-design and analysis, automotive applications of control systems.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the working of various measuring instruments used in automobiles.
CO2: Describe the working of engine system analyzer
CO3: Explain wheel alignment, wheel balancing and wind tunnel testing
CO4: Explain NVH measurement and chassis dynamometers
CO5: Explain the basics of control systems in automotive applications

Text Books

1. Beckwith T G and Buck N L "Mechanical Measurements" Wesley publishing company limited, USA,2006.
2. UWE Kiencke , Lars Nielsen "Automotive control systems" Springer, 2005.

References

1. Peter Elgan "Sensors for Measurements and control", 2nd edition, Pearson Education Limited, England,2001.
2. Longman "TecQuipmentmanual" Patent No. 20070261482, In-cylinder pressure detection device and method for internal combustion engine.
3. Holman "Experimental methods for engineers", McGraw hill publishing company,1994.

Web References

- https://www.prospects.ac.uk/job-profiles/control-and-instrumentation-engineer
- http://www.iicta.org/

BoS Chairman

Course Code: 140ME9132	Course Title: ALTERNATIVE FUELS AND ENERGY SYSTEMS (Common to Automobile and Mechanical)	
Core/Elective: Elective	**L : T : P : C**	3 : 0 : 0 : 3
Type: Theory	**Total Contact Hours:**	45 Hours

Prerequisites

The student should have undergone the course(s):

- Power plant Engineering
- Thermal Engineering

Course Objectives

The course is intended to:

1. Describe the different types of alternate energy sources and fuels
2. Explain the suitability of ethanol and methanol as automotive fuel.
3. Explain the suitability of LPG, CNG, Hydrogen and Bio gas as IC engine fuels.
4. Explain the Performance and emission characteristics of vegetable oils
5. Explain the layout and working principle of electric, hybrid, fuel cell and solar cars.

UNIT I INTRODUCTION **9**

Alternate energy sources

Introduction to alternate energy sources, Man and energy, energy forms, Need for alternate sources of energy, availability, Merits and demerits. Scope of alternate energy sources in India, Energy management, Global Energy Issues, National & State Level Energy Issues

Alternate fuels

Need for alternate fuel, Availability and properties of alternate fuels, General use of alcohols LPG, hydrogen, ammonia, CNG and LNG, vegetable oils, biogas, EV, hybrid vehicles, Fuel cells and solar cells ,Merits and demerits of alternate fuels,

UNIT II ALCOHOLS **9**

Properties as engine fuels, alcohols and gasoline blends, Performance in SI engine using methanol blends, Performance in SI engine using gasoline blends, Combustion characteristics in CI engine, Emission characteristics, DME, DEE properties, Performance analysis of DME, DEE, Performance in SI engine, Performance in CI engine

UNIT III NATURAL GAS, LPG, HYDROGENANDBIOGAS **9**

Availability of CNG, properties, Modification required to be done in engines for CNG Performance and emission characteristics of CNG, Performance and emission characteristics of LPG, LPG in SI and CI engines, Hydrogen storage and handling, Performance and safety aspects. Biogas, Properties, production methods, Performance and emission characteristics

BoS Chairman

UNIT IV VEGETABLEOILS 9

Various vegetable oils for engines, Etherification process in vegetable oils, Performance of engines using vegetable oils, Performance and emission characteristics of a engine using vegetable oils, Bio-diesel and its characteristics

UNIT V ELECTRIC, HYBRID, FUEL CELL AND SOLARCARS 9

Layout of electric vehicles, Advantages and limitations of electric vehicles, Specifications and system components, Electronic control system, High energy and power density batteries, Hybrid vehicles, Fuel cell vehicles, Solar powered vehicles.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the different types of alternate energy sources, alternate fuels and the properties and suitability of Alcohol, LPG, CNG, Hydrogen, Bio gas and Vegetable oils as automotive fuels

CO2: Explain the properties, suitability, engine modifications required, performance and emission characteristics of IC engines using ethanol and methanol as fuel.

CO3: Explain the properties, suitability, engine modifications required, performance and emission characteristics of IC engines using LPG, CNG, Hydrogen and Bio gas as IC engine fuels.

CO4: Explain the properties, suitability, engine modifications required, performance and emission characteristics of vegetable oil as IC engine fuel.

CO5: Explain the layout and working principle of electric, hybrid, fuel cell and solar Cars with their merits and demerits.

Text Books

1. Richard.L.Bechtold, "Alternative Fuels Guide Book", SAE, 1997.
2. G.D. Rai, "Non-Conventional Energy Sources", Khanna Publishers, New Delhi, 1999.

References

1. Nagpal, "Power Plant Engineering", Khanna Publishers, 1991.
2. MaheswarDayal, "Energy today & tomorrow", I & B Horishr India, 1982.
3. "Alcohols as motor fuels progress in technology", Series No.19, SAE Publication,1980

Web References

- https://en.wikipedia.org/wiki/Alternative_fuel

BoS Chairman

Course Code: 140ME9133	Course Title: REFRIGERATION AND AIR-CONDITIONING (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Thermodynamics
- Thermal Engineering

Course Objectives

The course is intended to:

1. Calculate the performance of vapor compression refrigeration systems.
2. Explain the major components in vapor compression refrigeration systems.
3. Estimate the heating and cooling loads in air-conditioning systems.
4. Explain the various applications of refrigeration and air conditioning systems.
5. Explain the installation and servicing methods used in refrigeration and air conditioning systems.

UNIT I REFRIGERATION 9

Thermodynamic principles of refrigeration – Types of Refrigeration Systems – Vapour compression refrigeration cycle, use of Ts and P-H diagrams, Performance calculation – Refrigerants: Primary& secondary refrigerants, Nomenclature of Refrigerants, properties and selection – Environment friendly alternatives.

UNIT II COMPONENTS OF REFRIGERATION SYSTEM 9

Refrigerant Compressors- Different Types, Performance, Capacity Control – Evaporators, Evaporators Circuitry, Different Types and application – Condensers- Types-air cooled- water cooled - evaporative condensers- Optimum Cooling Water Rate and Velocity – Expansion Devices.

UNIT III AIR CONDITIONING SYSTEM AND ITS COMPONENTS 9

Characteristics of Human comfort condition – Different types of Air Conditioner , Construction Details of Room Air Conditioner , Window Type, Package Type, Split Type Central Units – Automotive Heater –Air conditioning Equipments , air filters , humidifiers & dehumidifiers, fans & blowers , control system – Thermal insulation and Ventilation in air conditioning system – Types of load - Cooling Load Calculations, Air Distribution Patterns.

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UNIT IV APPLICATION OF REFRIGERATION AND AIR CONDITIONING SYSTEMS 9

General layout, Working Principle, Advantages & Disadvantages - Food Preservation, Food Storage & Distribution - Beverage Coolers, LNG – Ice Manufacturing – Solar Air Conditioning, Solar dehumidifier – Automobile air conditioning, Refrigerated trucks, Aircraft air conditioning, Railway Refrigerator Cars, Marine Air conditioning

UNIT V INSTALLATION AND SERVICING 9

Duct installation - Charging of refrigerant - Servicing of central, packaged, split air-conditioning, – Safety procedures, Leak detection procedures- safety controls, trouble shooting. – Basic Elements of Control systems - temperature control, Bimetal thermostat, Electric resistance thermostat, Electronic thermostat- Humidity control elements- Automatic Dew point recorder - Energy conservation methods.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the concepts of refrigeration system and evaluate the performance of vapor compression refrigeration cycles

CO2: Explain the various components of vapor compression refrigeration system viz. evaporator, compressor, condenser and expansion valve.

CO3: Calculate the heating and cooling loads in an air conditioning system using psychrometric concepts.

CO4: Discuss the applications of refrigeration and air conditioning systems viz. food preservation, automobile air conditioning, aircraft air conditioning and marine air conditioning.

CO5: Explain the refrigerant charging procedure, leakage detection and various temperature and humidity control methods

Text Book

1. Manohar Prasad, "Refrigeration and Air Conditioning", New Age International, 2004
2. Arora. C.P., "Refrigeration and Air conditioning", 2nd edition. Tata McGraw-Hill, 2000.

References

1. Dossat, R.J. "Principles of Refrigeration", Prentice-Hall, 1997.
2. Stoecker N.F and Jones, "Refrigeration and Air Conditioning", McGraw Hill Education (Asia) 2nd Edition 2001
3. ASHRAE 2012 Hand book (Fundamentals &Equipments)

Web References

- http://nptel.ac.in/courses/112105128/
- https://www.ashrae.org/

BoS Chairman

Course Code: 140ME9134	Course Title: TOTAL PRODUCTIVE MAINTENANCE (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Describe modern maintenance concepts and practices
2. Apply analytical tools in maintenance management
3. Apply Reliability Centered Maintenance for industrial systems
4. Illustrate TPM and global trends in maintenance management
5. Demonstrate simple instruments used for condition monitoring

UNIT I MODERN MAINTENANCE CONCEPTS AND PRACTICES 9

Maintenance definition –Maintenance management – Maintenance Concepts: Objectives, Organization and Functions of Maintenance, Maintenance strategies, Types of Maintenance – Maintenance systems – (Planned, Unplanned / Breakdown, Corrective, Opportunistic, Routine, Preventive, Predictive, Condition based maintenance systems),Maintenance planning and scheduling, Maintenance Logistics, Human factors in Maintenance and Staffing methods, Maintenance manuals, Maintenance costs

UNIT II ANALYTICAL TOOLS IN MAINTENANCE MANAGEMENT 9

Failure Data Analysis, MTBF,MTTF, Useful life-Survival curves, Repair time, Breakdown time distributions- Poisson's, Normal, Exponential,Availability, Reliability, Maintainability, Maintainability prediction – System effectiveness- Overhaul / Repair / Replace maintenance policy, Queuing applications, simulation, spare parts management, Replacement Decisions: Optimal interval between preventive replacements, Overall Equipment Effectiveness

UNIT III RELIABILITY CENTERED MAINTENANCE 9

Reliability Centered Maintenance (RCM), Objectives and function, Steps in RCM implementation, steps in RCM analysis, System selection, Tero technology – RCM effectiveness indicators, RCM tasks Proactive Maintenance, Reliability models - System reliability- Series, Parallel and mixed configuration, System reliability determination; Reliability improvement, Scheduled restoration and scheduled discard, The P-F interval and P-F curves, linear as non linear PF curves , Default actions, RCM Decision diagrams.

BoS Chairman

UNIT IV TPM AND GLOBAL TRENDS 9

Concept of TPM, Characteristics of TPM, Zero breakdown concepts, Zero Defects and TPM, FMECA – Maintainability prediction– Design for maintainability, Maximizing equipment effectiveness, Autonomous maintenance program, Five pillars of TPM, TPM Small group activities. Implementing TPM. Philosophy / Indications of TPM. TPM Development - Preparation phase, Master Plan, Initiatives, Promotion, Planning, Organization, Awareness, Training, Establishment of basic policies and goals, TPM organization, Implementation phase; Consolidation phase. Measuring TPM effectiveness: Measuring TPM effectiveness Indicators, Plant effectiveness and Measuring; TPM Benefits and Global trend

UNIT V CONDITION MONITORING IN MAINTENANCE 9

Condition Based Maintenance: Machine signatures, Signature Analysis-MMIS Expert systems, Temperature noise, vibration and wear particle analysis, on line and off line techniques. Online Monitoring Condition Monitoring Techniques, Vibration Monitoring and Signature Analysis. Wear Debris Monitoring, Maintenance Management Information System, Expert systems, Corrosion Monitoring and Control, Case Studies in Maintenance, Measurement and benchmarking of performance, MIS for maintenance.

Course Outcomes

At the end of the course students will be able to:

CO1: Describe modern maintenance concepts and practices
CO2: Apply analytical tools in maintenance management
CO3: Apply Reliability Centered Maintenance for industrial systems
CO4: Illustrate TPM and global trends in maintenance management
CO5: Demonstrate use of simple instruments used for condition monitoring in maintenance

Text Books

1. Seiichi Nakajima, "Introduction to TPM|", Productivity Press, Chennai, 1998.
2. Gopalakrishnan, P. and Banerji, A.K., "Maintenance and Spare Parts Management", Prentice – Hall of India Pvt. Ltd., 2013.

References

1. Goto, F., "Equipment planning for TPM Maintenance Prevention Design", Productivity Press, 1992.
2. Shirose, K., "Total Productive Maintenance for Workshop Leaders", Productivity Press, 1992.
3. David J. Sumanth, "Total Productivity Management : A Systematic and Quantitative Approach to Compete in Quality, Price and Time", Productivity Press, 1997

Web References

- http://www.plant-maintenance.com/articles/tpm_intro.pdf
- http:// www.ame.org/sites/default/files/TPM-introduction-AME.pdf
- http://www.ijettjournal.org/volume-4/issue-5/IJETT-V4I5P85.pdf
- http:// www.rsareliability.com/TPM%20Materials.pdf

BoS Chairman

Course Code: 140ME9135	Course Title: RELIABILITY AND MAINTENANCE ENGINEERING (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Distinguish between reliability and quality, availability and maintainability
2. Apply Redundancy Techniques to Improve Higher Reliability of System.
3. Evaluate system reliability from reliability of sub systems.
4. Explain the principles, functions and practices adopted in industry for the maintenance activities.
5. Conduct hazard and safety analysis for material handling equipments

UNIT I BASIC CONCEPTS OF RELIABILITY MAINTENANCE AND AVAILABILITY **9**

Reliabilty –Definition, Reliability vs quality, Failure and failure modes,Bath tub curve,causes of failures and unreliability. Maintainability, Availability- Concepts, Definition. System down time, uptime – MTBF,MTTR,MTBM. Types of availability- Inherent availability, Achieved availability and Operation availability. Reliability and Maintanability trade off.

UNIT II DESIGN FOR RELIABILITY **9**

Reliability analysis, Mathematical models and numerical evaluation. Designing for higher reliability. Redundancy Techniques, Application. Various forms of redundancy.

UNIT III SYSTEM RELIABILITY **9**

Determination of system reliability from subsystems. Series configuration, Parallel configuration, Mixed configuration, R out of N structure. Component redundancy vs Unit redundancy, Stand by redundancy, Mixed redundancy- Simple problems to calculate system reliability. Reliability cost trade off.

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UNIT IV MAINTENANCE POLICIES – PREVENTIVE MAINTENANCE 9

Maintenance categories – comparative merits of each category – preventive maintenance, maintenance schedules, repair cycle – Principles and methods of lubrication – TPM.

UNIT V SAFETY AND OTHER ASPECTS OF MAINTENANCE 9

Repair methods for material handling equipment – Equipment records – Job order systems – use of computer in maintenance.

Course Outcomes

At the end of the course students will be able to:

CO1: Distinguish between reliability and quality, availability and maintainability
CO2: Apply Redundancy Techniques to Improve Higher Reliability Of System.
CO3: Evaluate system reliability from reliability of sub systems.
CO4: Explain the principles, functions and practices adopted in industry for the successful management of maintenance activities.
CO5: Conduct hazard and safety analysis for material handling equipments

Text Books

1. Srivastava S.K., "Industrial Maintenance Management", - S. Chand and Co., 2002.
2. Bhattacharya S.N., "Installation, Servicing and Maintenance", S. Chand and Co., 2001.

References

1. White E.N., "Maintenance Planning", I Documentation, Gower Press, 1979.
2. Mishra R.C. and Pathak K. "Maintenance Engineering and Management" Prentice Hall of India Pvt. Ltd. 2012.
3. Garg M.R., "Industrial Maintenance", S. Chand & Co., 1987.

Web References

- http://catalog.flatworldknowledge.com/bookhub/reader/5?cid=41991&e=carpenter-ch01
- http://www.nios.ac.in/media/documents/VocInsServices/m1-4f.pdf
- http://discovery.bits-pilani.ac.in/dlpd/courses/coursecontent/courseMaterial/mgtszc211.pdf
- http://faculty.mercer.edu/jackson_r/Ownership/chap02.pdf

BoS Chairman

Course Code: 140ME9136	Course Title: ENTREPRENEURSHIP DEVELOPMENT (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Course Objectives

The course is intended to:

1. Describe the requirement of entrepreneurship.
2. Explain the different motivational theories and government policies.
3. Classify the types of enterprises
4. Explain the various processes in managing an enterprise
5. Explain the government norms and policies

UNIT I ENTREPRENEURSHIP 9

Definition, requirements to be an entrepreneur, entrepreneur and manager, growth of entrepreneurship in India, women entrepreneurship, rural and urban entrepreneurship.

UNIT II ENTREPRENEURIAL MOTIVATION 9

Motivating factors, motivation theories-Maslow's Need Hierarchy Theory, McClelland's Acquired Need Theory, government's policy actions towards entrepreneurial motivation, entrepreneurship development programmes.

UNIT III TYPES OF ENTERPRISES AND OWNERSHIP STRUCTURE 9

Small scale, medium scale and large scale enterprises, role of small enterprises in economic development; proprietorship, partnership, Ltd. companies and co-operatives: their formation, capital structure and source of finance.

UNIT IV MANAGEMENT OF ENTERPRISES 9

objectives and functions of management, scientific management, general and strategic management; introduction to human resource management: planning, job analysis, training, recruitment and selection, etc.; marketing and organizational dimension of enterprises; enterprise financing : raising and managing capital, shares, debentures and bonds, cost of capital; break- even analysis, balance sheet its analysis..

UNIT V INSTITUTIONAL SUPPORT AND POLICIES 9

Institutional support towards the development of entrepreneurship in India, Technical consultancy organizations, government policies for small scale enterprises.

BoS Chairman

Course Outcomes

At the end of the course students will be able to:

CO1: Describe the requirements for entrepreneurship
CO2: Explain different motivational theories and policies for entrepreneur development
CO3: Explain the types of enterprises and ownership structure
CO4: Explain the various processes in managing an enterprise
CO5: Explain the government norms and policies that govern small scale enterprises

Text Books

1. Ram Chandran, "Entrepreneurial Development", Tata McGraw Hill, New Delhi, 2008.
2. Khanka, S S. "Entrepreneurial Development", S Chand & Company Ltd. New Delhi, 2007.

Reference Books

1. Saini, J. S., "Entrepreneurial Development Programmes and Practices", Deep & Deep Publications (P), Ltd, 2001.
2. Badhai, B "Entrepreneurship for Engineers", DhanpatRai& co. (p) Ltd,2013.
3. Desai, Vasant, "Project Management and Entrepreneurship", Himalayan Publishing House, Mumbai, 2013.

Web References

- http://www.ediindia.org/

BoS Chairman

Course Code: 140ME9137	Course Title: PRINCIPLES OF MANAGEMENT (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Course Objectives

The course is intended to:

1. Describe the role of managers
2. Explain the significance of planning, decision making and strategies for international business
3. Explain the significance of organizing the tasks
4. Explain the motivational theories
5. Explain the control techniques

UNIT I OVERVIEWOFMANAGEMENT 9

Organization – Management – Role of managers – Evolution of Management thought – Organization and the environmental factors – Managing globally – Strategies for International Business.

UNIT II PLANNING 9

Nature and Purpose planning – Planning process – Types of plans – Objectives – Managing by objective (MBO) Strategies – Types of strategies – Policies – Decision Making – Types of decision –Decision Making Process - Rational Decision Making Process – Decision Making under different conditions.

UNIT III ORGANISING 9

Nature and purpose of organizing – Organization structure – Formal and informal groups / organization – Line and Staff authority – Departmentation – Span of Control – Centralization and Decentralization – Delegation of authority – Staffing – Selection and Recruitment – Orientation Career Development – Career stages – Training – Performance Appraisal.

UNIT IV DIRECTING 9

Creativity and Innovation – Motivation and Satisfaction – Motivation Theories Leadership – Leadership theories – Communication – Hurdles to effective communication – Organization Culture – Elements and types of culture – Managing cultural diversity

UNIT V CONTROLLING 9

Process of controlling – Types of control – Budgetary and non-budgetary control techniques – Managing Productivity – Cost Control – Purchase Control – Maintenance Control – Quality Control – Planning operations.

BoS Chairman

Course Outcomes

At the end of the course students will be able to:

CO1: Describe the role of managers with reference to an organization context and business.

CO2: Explain the significance of planning, decision making and strategies for international business to accomplish the organizational goal.

CO3: Explain the significance of organizing the tasks to accomplish the organizational goal.

CO4: Explain the motivational theories to increase the productivity and retention rate of employees.

CO5: Explain the control techniques such as budgetary, maintenance, quality to accomplish the organizational goal.

Text Books

1. Stephen P. Robbins and Mary Coulter, "Management", Prentice Hall of India, 8th edition, 2009.
2. Charles W.L Hill, Steven L McShane, "Principles of Management", Mcgraw Hill Education, 2007.

References

1. Hellriegel, Slocum & Jackson, "Management – A Competency Based Approach", Thomson South Western, 10th edition, 2007.
2. Harold Koontz, Heinz Weihrich and mark V Cannice, "Management – A global & Entrepreneurial Perspective", Tata McGraw Hill, 12th edition, 2007.
3. Andrew J. Dubrin, "Essentials of Management", Thomson Southwestern, 7th edition, 2007.

Web References

- http://www.managementstudyguide.com/all-subjects.htm

BoS Chairman

Course Code: 140ME9138	Course Title: ENVIRONMENTAL SCIENCE AND ENGINEERING (Common to Automobile and Mechanical)	
Core/Elective: Elective	**L : T : P : C**	3 : 0 : 0 : 3
Type: Theory	**Total Contact Hours:**	45 Hours

Course Objectives

The course is intended to:

1. Describe environment, ecosystem and Biodiversity
2. Explain the causes, effects and remedies for environmental pollution
3. Describe various natural resources and the effect of depleting them
4. Explain the environmental legislation and social issues
5. Explain the effect of human population on environment

UNIT I ENVIRONMENT, ECOSYSTEMS AND BIODIVERSITY 12

Definition, scope and importance of Risk and hazards; Chemical hazards, Physical hazards, Biological hazards in the environment – concept of an ecosystem – structure and function of an ecosystem – producers, consumers and decomposers- Oxygen cycle and Nitrogen cycle – energy flow in the ecosystem – ecological succession processes – Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries) – Introduction to biodiversity definition: genetic, species and ecosystem diversity – bio geographical classification of India – value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values – Biodiversity at global, national and local levels – India as a mega-diversity nation – hot-spots of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India – conservation of biodiversity: In-situ and ex-situ conservation of biodiversity. Field study of common plants, insects, birds Field study of simple ecosystems – pond, river, hill slopes, etc.

UNIT II ENVIRONMENTAL POLLUTION 10

Definition – causes, effects and control measures of: (a) Air pollution (Atmospheric chemistry- Chemical composition of the atmosphere; Chemical and photochemical reactions in the atmosphere – formation of smog, PAN, acid rain, oxygen and ozone chemistry;- Mitigation procedures- Control of particulate and gaseous emission, Control of SO2, NOX, CO and HC) (b) Water pollution : Physical and chemical properties of terrestrial and marine water and their environmental significance; Water quality parameters – physical, chemical and biological; absorption of heavy metals – Water treatment processes. (c) Soil pollution – soil waste management: causes, effects and control measures of municipal solid wastes – (d) Marine pollution (e) Noise pollution (f) Thermal pollution (g) Nuclear hazards–role of an individual in

prevention of pollution – pollution case studies – Field study of local polluted site – Urban / Rural / Industrial / Agricultural.

UNIT III NATURAL **10**

Forest resources: Use and over-exploitation, deforestation, case studies- timber extraction, mining, dams and their effects on forests and tribal people – Water resources: Use and overutilization of surface and ground water, dams-benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies – Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Energy Conversion processes – Biogas – production and uses, anaerobic digestion; case studies – Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification – role of an individual in conservation of natural resources – Equitable use of resources for sustainable lifestyles. Introduction to Environmental Biochemistry: Proteins –Biochemical degradation of pollutants, Bioconversion of pollutants. Field study of local area to document environmental assets – river / forest / grassland / hill / mountain.

UNIT IV SOCIAL ISSUES AND THE ENVIRONMENT **7**

From unsustainable to sustainable development – urban problems related to energy – water conservation, rain water harvesting, watershed management – resettlement and rehabilitation of people; its problems and concerns, case studies – role of non-governmental organization- environmental ethics: Issues and possible solutions – 12 Principles of green chemistry- nuclear accidents and holocaust, case studies. – wasteland reclamation – consumerism and waste products – environment production act – Air act – Water act – Wildlife protection act – Forest conservation act –The Biomedical Waste (Management and Handling) Rules; 1998 and amendments-scheme of labeling of environmentally friendly products (Ecomark). Enforcement machinery involved in environmental legislation- central and state pollution control boards- disaster management: floods, earthquake, cyclone and landslides. Public awareness.

UNIT V HUMAN POPULATION AND THE ENVIRONMENT **6**

Population growth, variation among nations – population explosion – family welfare programme – environment and human health – human rights – value education – HIV / AIDS – women and child welfare –Environmental impact analysis (EIA)- -GIS-remote sensing-role of information technology in environment and human health – Case studies.

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Course Outcomes

At the end of the course students will be able to:

CO1 Describe environment, ecosystem and Biodiversity
CO2 Explain the causes, effects and remedies for environmental pollution
CO3 Describe various natural resources and the effect of depleting them
CO4 Explain the environmental legislation and social issues
CO5 Explain the effect of human population on environment

Text Books

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", 2nd edition, Pearson Education, 2004.
2. Benny Joseph, "Environmental Science and Engineering", Tata McGraw-Hill, New Delhi, 2006.

References

1. Trivedi.R.K., "Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards", Vol. I and II, Enviro Media, 3rd edition, BPB publications, 2010.
2. Cunningham, W.P. Cooper, T.H. Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
3. Dharmendra S. Sengar, "Environmental law", Prentice hall of India PVT LTD, New Delhi, 2007.

Web References

- http://coe.berkeley.edu/students/EngAnn08.pdf
- http://web.mit.edu/catalogue/degre.engin.civil.shtml

BoS Chairman

BoS Chairman

Course Code: 140ME9140	Course Title: OPERATIONS RESEARCH (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Mathematics I
- Engineering Mathematics II

Course Objectives

The course is intended to:

1. Solve linear programming problems
2. Select the optimal solution for transportation and assignment problems
3. Calculate EOQ and EBQ for manufacturing and purchase models
4. Select critical paths using CPM and PERT
5. Select the replacement policy and shortest queuing time

.UNIT I LINEAR PROGRAMMING **9**

Introduction - Formulation of linear programming models – Assumptions-Graphical solution procedure – solving LPP using simplex algorithm – Degeneracy, Revised Simplex Method Duality theory - Interpretation of dual variables- Primal Dual Relationships – Role of duality in sensitivity analysis - Dual simplex method.

UNIT II TRANSPORTATION & ASSIGNMENT MODELS **9**

Transportation problems, transportation simplex method– Assignment problems, Hungarian method- LP formulation of transportation and Assignment networks- Traveling sales man problem

UNIT III INVENTORY MODELS **9**

Purchase model with no shortages – manufacturing model with no shortage – Purchase model with shortage – Manufacturing model with shortages –model with price breaks.

UNIT IV NETWORK MODELS **9**

Maximal flow problem – Shortest route problem – Minimal spanning tree problem - Project networks, CPM, PERT, Crashing of networks, L P model for crashing – project costing and control.

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UNIT V QUEUING AND REPLACEMENT MODELS 9

Queuing theory terminology – Single server, multi server, Limited queue capacity – applications – Markov chains. Replacement models – Money value, present worth factor and discount rate.

Course Outcomes

At the end of the course students will be able to:

CO1: Solve linear programming problems with simplex and graphical methods after formulation and assumption of required parameters.

CO2: Select the optimal solution for transportation and assignment problems, based on cost, using Northwest, Least Cost, Vogals Approximation and Hungarian methods.

CO3: Calculate EOQ and EBQ for manufacturing and purchase models operating with or without shortage.

CO4: Select critical paths using CPM and PERT in projects based on minimum duration of activities.

CO5: Select the replacement policy and shortest queuing time based on economic cost for various replacement and queuing models. them in domain specific situations

Text Books

1. Hillier and Lieberman "Introduction to Operations Research", TMH, 2011.
2. R.Panneerselvam, "Operations Research", PHI, 2006

References

1. Philips, Ravindran and Solberg, "Operations Research", John Wiley,2002
2. Hamdy A Taha, "Operations Research – An Introduction", Prentice Hall India,2003
3. Ronald L Rardin, "Optimization in Operations Research", Pearson, 2003

Web References

- http://nptel.ac.in/courses/112106134/1
- http://www.mit.edu/~orc/

BoS Chairman

Course Code: 140ME9141	Course Title: INDUSTRIAL SAFETY MANAGEMENT (Common to Automobile and Mechanical)	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Physics
- Engineering Chemistry

Course Objectives

The course is intended to:

1. Explain the importance of safety management
2. Explain the measurement and monitoring techniques
3. Explain the roles and responsibilities of Safety department
4. Describe the importance of Industrial safety acts
5. Explain the classes of fires and controlling techniques.

UNIT I INTRODUCTION TO SAFETY MANAGEMENT 9

Principles of Safety Management ,Need of safety in organisation, Occupational Health & hygiene, modern safety concept-Safe operating procedure (SOP's), Safety permits, Social and physiological effects, Accident - Near Miss, injury, Cost of accident, Unsafe act , Unsafe condition, Environmental safety - air pollution, water pollution ,industrial noise & vibration control ,physical hazards - chemical hazards , biological hazards, electrical hazards.

UNIT II SAFETY PERFORMANCE MONITORING 9

Incident Recall Technique (IRT), disaster control, job safety analysis, safety survey, safety inspection, safety sampling, Components of safety audit, types of audit, audit methodology, permanent total disabilities, permanent partial disabilities, temporary total disabilities - Concept of an accident, reportable and non-reportable accidents, unsafe act and condition – principles of accident prevention incident rate, accident rate, safety "t" score, safety activity rate Records of accidents, accident reports.

UNIT III SAFETY ORGANISATION 9

Role and responsibilities of management and line staffs Supervisors and Employees, Safety committee, Motivation, budgeting for safety, safety policy, Safety Education and Training, Importance of training-identification of training needs-Training methods –programme, seminars, conferences, role of government agencies and private consulting agencies in safety training – creating awareness, awards, celebrations, safety posters, safety displays, safety pledge, safety incentive scheme, safety campaign – Domestic Safety and Training, Personal Protective Equipment (PPE) - Requirements of PPE, Selection and Usage of PPE, Importance of IS Standard, Types of PPE

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UNIT IV INDUSTRIAL ACTS 9

Indian Factories act 1948, Tamilnadu Factories rule 1950 – Environmental protection act 1986- Indian electricity act 1910, Indian electricity rule 1956 – Indian boiler act 1923 – Workmen's compensation act 1923 – Explosive act1983 - Noise pollution rules 2000

UNIT V DISASTER MANAGEMENT AND EMERGENCY PREPAREDNESS 9

Fire properties of solid, liquid and gases - fire spread - toxicity of products of Combustion - sources of ignition – fire triangle – principles of fire extinguishing – active and passive fire protection systems – various classes of fires – a, b, c, d, e – fire extinguishing agents - fire stoppers, Emergency preparedness and responsibilities, On site and off site emergency plan, Mock drill Bhopal Gas tragedy - faulty handling of equipment's, failure of hoist, crane.

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the importance of safety management to control the accidents, pollution and hazards.
CO2: Explain the measurement and monitoring techniques to report the safety performance.
CO3: Explain the roles and responsibilities of Safety department in an organization to eliminate the unsafe act and conditions.
CO4: Describe the importance of Industrial safety acts related to safety environment pollution in India.
CO5: Explain the classes of fires and controlling techniques and plan for an onsite and offsite emergency.

Text Books

1. Deshmukh .L.M "Industrial Safety Management" McGraw-Hill 2006.
2. C.RayAsfahl "Industrial Safety and Health management" Pearson Prentice Hall,2003

References

1. John V. Grimaldi and Rollin H. Simonds, "Safety Management", All India Travellers bookseller, New Delhi-1989.
2. Heinrich H.W. "Industrial Accident Prevention" McGraw-Hill Company, New York, 1980
3. Subramanian.V., "The Factories Act 1948 with Tamilnadu factories rules 1950", Madras Book Agency, 21st ed., Chennai, 2000.

Web References

- http://www.icebookshop.com
- http://nptel.ac.in/courses/112107143/40

BoS Chairman

Course Code: 140ME9142	Course Title: SYSTEMS APPROACH FOR ENGINEERS	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Use system thinking and system engineering approaches.
2. Establish the systems output
3. Document the details of the problem
4. Establish the technical output
5. Identify the tools and methods to diagnose and interpret the transformation

UNIT I SYSTEMS ENGINEERING AND SYSTEMS THINKING 9

System Thinking - Global economy and its impact on the workers – across the globe; & inside of India - Need of Engineers in Company - – Introduction – System Definition by Experts – Principles of System – Systems with simple elements – Apparent and Subtle System - Systems Engineering - its Significance- Description of Industrial processes – Business Functions - Definition of Manufacturing System - Physical Processes Vs. Service Processes - Solutions - New Solutions Vs. Replication Solutions - System approach Frame work for Industrial Processes and their solutions – Need of System approach. Engineer as a "System thinker" and "Solution provider" - Industrial Organization and the various jobs or departments where engineers are required. Defining the problem or assignment as an "Input/Transformations/Output" system. Typical Input and output variables in any Company, Industry and process.

UNIT II SYSTEM APPROACH FRAMEWORK 9

Inputs - Machine Tool/Platform/Equipment (Fixed Cost) - Tooling / Consumables /Software (Variable Cost) - Component/ Application / End user need - Operational parameters / Constraints/Specifications.

UNIT III SYSTEM OUTPUTS 9

Transformation: Phenomenon in process - Quantification of the Transformation using the vital signs -Diagnostic tools and their use - Vital signs of the "transformation" and their recognition - Portable diagnostic tools - Benefits and exploitation of Digital data

Outputs: Technical outputs - System outputs

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UNIT IV SYSTEM SOLUTION 9

Engineering the solution system - Levels of System thinking: Awareness, Analysis and Synthesis - System Documentation and its use - Vital signs and their use - Signature Analysis - Ability to change all four input groups simultaneously for large scale changes in the outputs.

UNIT V SYSTEM APPROACH – CASE STUDIES 9

Engineer as a Manager: Integration of Science, Engineering and Management pertinent to the chosen "transformation" - Strategic aspects of any solution or the "system" - The relationship between the Technical and System Outputs - Operational aspects of the solution as a "system" – Case studies on System approach usage - Student Project (Development, Review and Presentation)

Course Outcomes

At the end of the course the student will be able to:

CO1: Use system thinking and system engineering approaches to define problem on hand comprehensively.
CO2: Establish the stake holders and outputs of value to them (systems output)
CO3: Document the details of the problem on hand and the solution required as input, transformation and output system.
CO4: Establish the technical outputs of the process.
CO5: Identify the tools and methods to diagnose and interpret the transformation at heart of the system or solution it represents.

Text Books:

1. Dr. K. (Subbu) Subramanian, "Thriving in the 21st century economy – Transformational skills for Technical Professionals", ASME Press 2013.

Reference Books:

1. Donella H. Meadows, "Thinking in systems" published by Chelsea Green Publishing

BoS Chairman

Course Code: 140ME9143	Course Title: AUTOMOTIVE FUNDAMENTALS AND MANUFACTURING	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Suggest a suitable vehicle configuration based on the required function and performance.
2. Explain various parameters of given sub-system in chassis system of automotive products.
3. Explain various parameters of given sub-system in power train of automotive products.
4. Explain various parameters of given sub-system in Electrical and Electronic System of automotive products.
5. Identify the manufacturing processes that are used for automotive products.

UNIT I INTRODUCTION TO AUTOMOTIVE PRODUCTS 9

Automotive Products -Two wheelers: mopeds, scoters, motorcycles, bebek, moto-scooters (skubek) Three wheelers: Auto-rickshaws, Pick-up/delivery vehicles Four wheelers: LCV (hatchback, edan/saloon, coupe, convertible, limousine, estate), MCV(cut away vehicle, van), HCV (bus, truck) – Functions - Configuration: specifications of automotive products (Engine type, displacement, transmission, power, torque, battery rating, battery capacity, ground clearance, tire width, wheel base, kerb weight, fuel tank capacity).

UNIT II CHASSIS SYSTEM 9

Functions and Types: Steering system, Steering geometry, Steering lock angle, Turning circle Radius, Self Aligning moment, Wobble and Weave, Rolling behaviour, Frames: Functions, Types, mountings and support, centre of gravity, Suspension system: Functions, Types: Rigid, Independent - Pitch, bounce, roll, Angle of suspension, sprung and un sprung mass, Pitch frequency, squat and dive, Braking system: Functions, Types: Mechanism - drum, disc braking effort - brake balance, Stopping distance, braking efficiency, Wheels and Tires: Functions, types, Aspect ratio, tyre material, inflation pressure, Rolling resistance, Tractive effort.

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UNIT III POWER TRAIN SYSTEM 9

Engine and EHV's prime mover (motor), Engine location, Brake power, torque, load conditions, resistance, Indicated thermal efficiency, brake thermal efficiency, mechanical efficiency, volumetric efficiency, efficiency ratio, mean effective pressure, mean piston speed, specific power output, specific fuel consumption, Inlet valve Mach index, Air-fuel ratio, Calorific value. Power Train: Functions-Clutch, gear box, propeller shaft, final drive, axles, Types of gear box, speed, torque, Propeller shaft: centre-to-centre distance, gear ratio, speed ratio, torque ratio, noise.

UNIT IV ELECTRICAL AND ELECTRONIC SYSTEMS 9

Electrical and electronic systems in automobiles- Importance, List of electrical and elctronic systems in vehicle, Functions of electrical and electronic systems in a vehicle, Function Block Diagram with Components, Functions of System and parts. Effect of Non Conformance of Quality Characteristics to the product and customers.

UNIT V MANUFACTURING OF AUOTMOTIVE PRODUCTS 9

Casting: Cylinder heads, engine block – conventional and expandable pattern. Forging: crank shaft, connecting rod and gudgeon pins; Upset forging: Valves. Sheet metal work: wheel disc, body components, fuel tanks. Plastic, Rubber and Glass: door trims, dash board, bumpers, handles and knobs.
Automotive Products: performance requirements and evaluation procedure.

Course Outcomes

At the end of the course the student will be able to:

CO1: Suggest a suitable vehicle configuration based on the required function and performance.
CO2: Explain the functions, design parameters and performance parameters of given sub-system in chassis system of automotive products.
CO3: Explain the functions, design parameters and performance parameters of given sub-system in power train of automotive products.
CO4: Explain the functions and quality parameters of given sub-systems in Electrical and Electronic System of automotive products.
CO5: Identify the manufacturing processes for the given automotive products and explain the manufacturing process for automotive products

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Text Books:

1. Kirpal Singh, " Automobile Engineering Vols 1 & 2 ", Standard Publishers, 7th Edition,1997, New Delhi.
2. Jack Erjavec, "Systems approach to Automotive Technology", Prentice Hall, 2008.

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Reference Books:

1. Philip F Ostwald and Jairo Munuz, "Manufacturing Processes and Systems", John Wiley & Sons, New York, 1998.
2. Kalpakjian, "Manufacturing Engineering and Technology", Pearson Education, 2005.
3. Tony Foale, "Motorcycle Handling and Chassis Design", 2nd Edition, Tony Foale, 2006.
4. Crouse and Anglin, "Automotive Mechanics", 10th Edition, Tata-McGraw Hill Publishers ,2004.
5. Joseph Heitner, "Automotive Mechanics,", Second Edition ,East-West Press ,1999.
6. Martin W. Stockel and Martin T Stockle , " Automotive Mechanics Fundamentals", The Good heart –Will Cox Company Inc, USA ,1978.
7. Ganesan V." Internal Combustion Engines" ,Third Edition, Tata Mcgraw-Hill 2007.

Web References:

- http://nptel.ac.in/courses/125106001/

BoS Chairman

BoS Chairman

Course Code: 140ME9144	Course Title: AUTOMOTIVE ENGINE AND ITS SYSTEMS	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Explain the construction details of the power train.
2. Describe the combustion and emission characteristics of IC engines.
3. Describe the functions of various engine subsystems.
4. Interpret the performance characteristics of the vehicle.
5. Examine various advanced engines and alternate fuels.

UNIT I INTRODUCTION TO POWER TRAIN 9

Power train – Types – Engine (SI and CI) – Torque converter – Valve train layout & crank train layout- valve timing and timing chain layout – Piston components – importance of B/S and L/r – Crank offset.

UNIT II COMBUSTION AND EMISSION IN IC ENGINES 9

Chemistry of combustion, Stoichiometric equations of combustion – Introduction to SI and CI combustion – Engine knocking – Combustion chamber and its types – Combustion chamber design – Temperature – Fuel (include load /speed) – Fuel properties/characteristics (temperatures, Octane, Cetane no. etc) – Emission norms (Indian, European – US emission norms – Emission testing and certification) – Fuel Norms(BS1, BS2) – Environmental effects of Emissions – Emission relation with AFR – After treatment devices (include SAI,2WC), Chemical reactions involved in after treatment.

UNIT III ENGINE SUBSYSTEMS 9

Energy balance and cooling load estimation – Typical operating temperatures of engine parts – Types of cooling system – Cooling system design (Air cooled and water cooled) – Schematic layout of Cooling system for a two wheeler engine – Engine friction – Lubrication requirements of engine – Functions of Lubricating oil – Parts to be lubricated and not to be lubricated – Schematic layout of lubricating system – Oil filtering – Lubricating oils, types and properties – Functions of induction system – Schematic layout (2W and 4W) – Air Filtering and its importance – Exhaust and after treatment – Functions of exhaust system – Muffler layout – Schematic layout of exhaust system (2W and 4W)

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UNIT IV PERFORMANCE CHARACTERISTICS 9

Volumetric efficiency – Factors affecting volumetric efficiency, ram effect, engine tuning, Fuel control systems (Carburetor, Fuel Injection) – Meeting demands of Vehicle (drivability, emissions and fuel economy) by controlling air and fuel – sensors – Vehicle performance characteristics, Road resistance, Wheel force in different gears, predict acceleration from engine performance graph – Various relations between AFR, Ignition timing and injection timing – Emission, performance (fuel consumption) – Sensors and devices used for performance and emission measurements.

UNIT V ADVANCED ENGINE CONCEPTS 9

Engines (Wankel, six stroke, lean burn, GDI, HCCI etc.) Hybrid vehicles – VVT, Turbo/super charging – Benefits of different engine concepts – Alternate fuels, compare performance – Fuel economy & emission with fuels (alcohol, vegetable oils, LPG, CNG etc.) – Limiting factors and practical problems.

Course Outcomes

At the end of the course the student will be able to:

CO:1 Explain the construction details of the power train used in motor cycles.

CO:2 Describe the combustion and emission characteristics of four stroke IC engines used in motor cycles.

CO:3 Describe the functions of various engine subsystems such as cooling system, induction system and exhaust system.

CO:4 Interpret the performance characteristics of the vehicle considering the volumetric efficiency of engine emission norms and wheel force in different gears.

CO:5 Examine various advanced engines and alternate fuels used in automobiles.

Text Books:

1. Edward F. Obert, "Internal Combustion Engines and Air Pollution" First Edition, Addison-Wesley Educational Publishers, Incorporated, reprint, 2012.
2. V. Ganesan, "Internal Combustion Engines" McGraw-Hill, reprint 2012.

Reference Books:

1. John B. Heywood, "Internal Combustion Engine Fundamentals", McGraw-Hill, reprint 2012.
2. Richard Stone, "Introduction to Internal Combustion Engines", Third edition, Society of Automotive Engineers, Incorporated 1999.

Web References:

- https://en.wikibooks.org/wiki/Automotive_Systems
- https://bajatutor.net/online-baja-crash-course-for-atv-enthusiasts/

BoS Chairman

Course Code: 140ME9145	Course Title: LOGISTICS ENGINEERING	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Assess the potential failure modes in material storage and handling between POM/POS to POC.
2. Apply REBA/RULA tools and techniques in storage and material handling design.
3. Verify produced part quality is delivered to the point of consumption.
4. Design material storage and handling system to prevent potential failure modes.
5. Develop standardized storage and handling work procedures.

UNIT I MATERIAL HANDLING - SYSTEMS AND FACILITIES 9

Material Handling System - Need, scope, definitions and terminologies, types, elements, Organization for logistics management and control. Introduction Process flow charting/mapping techniques.

Material Handling Facilities - Types of Material Handling Equipments (AGVs, Fork lift, prime movers, stackers, lifts etc), selection criteria for MHES. Design considerations, selection of materials. Estimation of number of facilities required; cost estimation and control. Introduction to thermoforming/injection molded crate design and manufacturing for kitting of the parts.

UNIT II ERGONOMICS IN DESIGN 9

Application of RULA & REBA in MHF design, MHF design considerations for plastic parts, painted Parts, machined parts, fragile parts, c class parts, inter-plant material movement, and in-direct areas.

UNIT III MEASURES OF MATERIAL HANDLING SYSTEM 9

Reliability, maintainability, serviceability, availability factors, Supply supports, TPM for MHF, manufacturing consideration: processes, methods and tools, assembly and dismantling of MHF, system feasibility analysis, system operational requirements, Supportability analysis, functional analysis, MTBF and MTTR for MHFs, flexibility in MHFs, traceability of MHFs and MHEs, salvaging of MHFs and MHEs

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UNIT IV STORAGE SYSTEMS 9

Creation of modern stores and storage systems: concept of stores, types of stores, storage facilities, considerations for creation of stores, estimation of docks, truck turn-around time, truck window time, inventory and types, WIP, material retention point, model store concept

UNIT V ANALYSIS OF MATERIAL TRANSPORT SYSTEMS 9

Analysis of Vehicle based system- determination of number of vehicles in AGVs and determination of delivery distance. Conveyor analysis – single direction, continuous loop and re-circulating conveyors.

Course Outcomes

At the end of the course the student will be able to:

CO1: Identify the potential failure modes in material storage and handling between POM/POS to POC.

CO2: Use REBA/RULA tools and techniques to study ergonomics in storage and material handling design.

CO3: Verify produced part quality is delivered to the point of consumption.

CO4: Design material storage and handling system to prevent potential failure modes.

CO5: Develop standardized storage and handling work procedures.

Text Books:

1. Mikel P.Groover, "Automation, Production Systems, and Computer-Integrated Manufacturing", PHI Publishers, 3rd Edition 2016.
2. Blanchard and Benjamin S, "Logistics Engineering and Management", 6th International Edition, Prentice Hall Inc, 2015.

Reference Books:

1. Christopher M, "Logistics and Supply Chain Management - Creating Value Adding Networks", Prentice Hall, 2010.
2. James M. Apple, "Plant Layout and Material Handling" John Wiley, 3rd Edition, 1977.
3. Prauss L,"The Green Multiplier - a Study of Environmental Protection and Supply Chain", Antonn Rauss Limited, Palgrave Macmillan, 2005.
4. Taylor G.D, "Logistics Engineering handbook", CRC Press, 2008.

BoS Chairman

Course Code: 140ME9146	Course Title: MANUFACTURING SYSTEMS ENGINEERING	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Explain the components of manufacturing systems engineering.
2. Identify seven types of wastes.
3. Describe flow production and level production using "JIT".
4. Differentiate appropriate performance metrics.
5. Develop cell level standardized work procedures.

UNIT I PRODUCTION SYSTEM **7**

Generalized model of production systems- types of production systems and its impact on system design- lifecycle concepts of production systems- Basic IE tools.

UNIT II PRODUCTION MANAGEMENT AND JIT PRODUCTION MANAGEMENT **8**

Approach to production management- Introduction & overview of JIT production system- Relations among sales price- cost and profit, ten arguments against the JIT production revolution- "wastology"- types of waste- waste removal and secrets for not creating waste- the "5s" approach.

UNIT III FLOW PRODUCTION AND MULTI PROCESS OPERATION **10**

Introduction to flow production- flow production within factories & between factories- precautions and procedures for developing multi-process operations- level production,-various ways to create production schedules- leveling techniques- difference between shish-kabob production and level production.

UNIT IV BASICS OF KANBAN, KAIZEN AND JIDOKA **10**

Differences between kanban and conventional systems -functions and rules of kanban- variety and quantity of kanban, administration of kanban, visual controls – andons, changeover improvement kaizen- seven rules for improving changeover- steps toward jidoka -difference between jidoka and automation - functions of jidoka, extension of jidoka to the assembly lines - labour cost reduction steps.

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UNIT V STANDARD OPERATIONS, QUALITY ASSURANCE, MAINTENANCE AND SAFETY 10

Overview of standard operation, establishment of standard operation and charts- overall plan for achieving zero defects- the poka-yoke system- types of maintenance- CCO -three lessons in maintenance- importance of safety- waste related forms -5s forms - engineering related forms -JIT Introduction related forms.

Course Outcomes

At the end of the course the student will be able to

CO1: Explain the components and characteristics of manufacturing systems engineering.

CO2: Identify seven types of waste through value added and non value added analysis.

CO3: Describe flow production and level production using "JIT" tools (Kanban, flow, level, synchronization).

CO4: Differentiate appropriate performance metrics of different manufacturing systems.

CO5: Develop cell level standardized work procedures by applying concepts of JIT.

Text Books:

1. Chase, Jacobs, Aquilano, "Production and Operations Management" 8th Edition, Tata McGraw Hill Companies Inc, 2008.
2. Paneer Selvam R "Production and Operations Management" Prentice Hall of India, 2010.
3. Hiroyuki Hirano, "JIT Implementation Manual", English Translation Copy Right Productivity Press, 1990.

Reference Books:

1. Kotsundo Hitomis's, "Manufacturing System Engineering", Second Edition, Taylor & Francis, 1996.
2. Adam Jr, Everette E. and Ebert, "Production and Operations Management-Concepts; Models and Behavior" 5th Edition, Prentice-Hall of India, 1992.
3. Samuel Eilon, "Elements of Production Planning and control", 1st edition, Collier Macmillan Ltd, 1962.
4. Chary "Theory and Problems in Production and Operations Management" Tata Mc-Hraw Hill, 2009.
5. Buffa E.S. and Sarin, R.K, "Modern Production/Operations Management" Eighth edition, John Wiley & Sons, 1987.

BoS Chairman

Course Code: 140ME9147	Course Title: VEHICLE DESIGN ENGINEERING	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Engineering Mechanics

Course Objectives

The course is intended to:

1. Convert customers' voice into vehicle specifications.
2. Explain the function of structural parts & dynamic sub systems.
3. Design the part of a sub-system or the entire sub-systems.
4. Explain the various material/design standards.
5. Recommend a suitable test for testing of parts/subsystem of the vehicle.

UNIT I QUALITY FUNCTION DEPLOYMENT **9**

Translation of customer's voice into engineering requirements – HOQ for converting customer voice into technical specifications & enlisting design parameters against each voice -Mapping customers voice & technical specification of different manufacturers -Interactions between technical requirement &specifications – Identification &contribution of stake holders in product life cycle.

UNIT II SUB –SYSTEMS – SPECIFICATIONS **6**

Functions of structural parts and sub systems - frame, body and cover parts, footrest, handle bar, parking systems & other peripheral system - Key specification of sub systems to deliver the required functions and the impact of their non-conformance.

UNIT III STATIC SUB - SYSTEMS **10**

Various forms and geometries adopted for delivering the functions of various static sub-systems - Basic design calculations of various forms and geometries of chassis frame- calculation of Section modulus, Moment of Inertia and dimensions of various cross sections. Selection of material manufacturing process and costing for the part / sub-system - Optimization of design specification of the parts including special requirements to achieve target cost.

UNIT IV DYNAMIC SUB - SYSTEMS **10**

Functions–Influence of Vehicle layout - Suspension, Brakes and Wheels -Various forms and geometries adopted for delivering the functions of various dynamic sub-systems. Basic design calculations of various dynamic sub-systems -Selection of material& manufacturing process and costing for the part / sub-system - Optimization of design specification of the parts including special requirements to achieve target cost.

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UNIT V TESTING AND STANDARDS 10

Global material/design/regulatory & automotive standards for automobile industry - Introduction of standards like IS, ARAI, ECE, AIS and other test standards. Design of tests & test conditions to verify part against all failure modes - Design of test fixtures, loads – case studies -Failure analysis &counter-measures, Formulation of design verification plan - Working environment of part / sub system / vehicle in usage &handling by various stake holders –Identification of various applicable tests - Stake holders requirements including handling, touch & feel areas and visual appeal, emission norms.

Course Outcomes

At the end of the course the student will be able to:

CO1: Convert customers' voice into appropriate vehicle specifications using HoQ.

CO2: Explain the function of structural parts & dynamic sub systems and identify the key specifications.

CO3: Design the part of a sub-system or the entire sub-system like Structural parts, suspension, brakes and wheels.

CO4: Explain the various material/design standards applicable globally for automobile industry.

CO5: Recommend a suitable test for testing of parts/subsystem of the vehicle as per the requirements of stake holders/regulation standards.

Text Books:

1. Tony Foale, "Motorcycle Handling and chassis design" Tony Foale designs, 2006.

Reference Books:

1. Jason C. Brown, A. John Robertson, Stan T. Serpento, "Motor vehicles structures: Concepts and Fundamentals - Automotive Engineering Series", Butterworth-Heinemann Limited, 2002.
2. Tom Birch, Thomas Wesley Birch, "Automotive Chassis Systems", Delmar, Thomson Learning, 1999.

BoS Chairman

Course Code: 140ME9148	Course Title: VEHICLE DYNAMICS	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the courses:

- Automobile Engineering
- Automotive Fundamentals and Manufacturing
- Theory of Machines I & II

Course Objectives

The course is intended to:

1. Determine the suitable geometrical parameters of a motor cycle layout
2. Design a Spring and Damper system for a motor cycle suspension.
3. Determine the dimensions of various structural members of motor cycle.
4. Design the plastic parts used in the motor cycle.
5. Explain the use of systems approach in the part and sub system design.

UNIT I DESIGN OF VEHICLE LAYOUT 9

Various methods of capturing customer requirements - Translation of customer's requirements into engineering requirements – Design Philosophy – Engineering requirements –Introduction to vehicle layout and packaging – Vehicle layout parameters and definitions – Design calculations for vehicle layout.

UNIT II DESIGN OF SUSPENSION SYSTEM 9

Suspension characteristics – Types of suspension – Design calculation on various aspects – Design of Spring and Damper.

UNIT III DESIGN OF STRUCTURAL PARTS 9

Various factors affecting structure - Loads and boundary conditions – Simple problems – Design calculation for various structures.

UNIT IV DESIGN OF PLASTIC PARTS 9

Introduction to plastic parts – Fit and finish of plastic parts – Design of plastic parts.

UNIT V CONCEPT OF PART, SUB SYSTEM AND SYSTEM 9

Importance of the system design approach and part design – Study of part design in different systems and its applications

BoS Chairman

Course Outcomes

At the end of the course the student will be able to:

CO1: Determine the suitable geometrical parameters of a vehicle layout to achieve the desired performance of a motor cycle.

CO2: Design a Spring and Damper system for a vehicle suspension used in motor cycle.

CO3: Determine the dimensions of various structural members of motor cycle based on the given boundary conditions.

CO4: Design the plastic parts used in the vehicles considering its impact on motor cycle performance.

CO5: Explain the use of systems approach in the part and sub system design of a motor cycle.

Text Books:

1. Tony Foale, "Motorcycle Handling and chassis design" Tony Foale designs, 2006.
2. V Cossalter, "Motorcycle Dynamics" Published by Race dynamics, 8421 Midland Dr., Greendale, 2002.
3. Thomas D.Gillespie, "Fundamentals of vehicle dynamics" Published by Society of Automotive Engineers, Inc, 1992.

Reference Books:

1. Jason C. Brown, A. John Robertson, Stan T. Serpento,"Motor vehicles structures: Concepts and Fundamentals - Automotive Engineering Series", Butterworth-Heinemann Limited, 2002.
2. Tom Birch, Thomas Wesley Birch, "Automotive Chassis Systems", Delmar, Thomson Learning, 1999.

Web References:

- http://www.derby.ac.uk/courses/motorcycle-engineering-beng-hons/-Website of Derby University

BoS Chairman

Course Code: 140ME9149	Course Title: DESIGN FOR WELDING	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the courses:

- Engineering Metrology and Measurements
- Manufacturing Process – I
- Engineering Metallurgy

Course Objectives

The course is intended to:

1. Choose a suitable welding process.
2. Identify the potential failure modes of a weld joint.
3. Explain the types of fixtures used in welding processes.
4. Design a suitable welding fixture.
5. Explain inspection, maintenance and calibration procedure.

UNIT I INTRODUCTION **9**

Fundamentals of Arc Welding Process – Arc Welding Processes Principle and operation - Advantages and Limitations of Processes - Characteristics of each process - Power sources and other subsystems of Welding process and their Influence on the Process behavior - MIG / MAG Welding - Various types of GMAW process and its applications - Process requirements of GMAW process - Impact of Process parameters - Defects of GMAW, Causes and their remedies - Resistance Welding - Various types of Resistance welding process and its applications - Consumables of the processes - Process requirements of Resistance Welding process - Impact of Process parameters - Defects, Causes and their remedies.

UNIT II DESIGN OF WELD JOINTS **9**

Types of Weld Joints and their applications - Styles and practices of Edge preparation - Representation of Weld symbols - Loads acting on the Weld Joints - Calculation of Stresses in Weld Joints - Determination of Weld size for Fatigue Applications - Behavior of Tubular Weld Joint - Procedure to perform Tubular Weld Joints -Influence of Attributes on Material - Effect of Temperature on Metallurgical properties - Causes of Distortion - Analysis of Distortion using FEA - Causes for Residual Stresses - Process development for Component specification - Quality requirement for Welders and Process - Skills required by a operator - Qualification Tests for Operator - Qualification Tests for Process - Optimization of Weld Process - Various automation and Mechanization techniques - Estimation of Welding Costs for a given application.

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UNIT III INTRODUCTION TO WELDING FIXTURES 9

Fixtures and its types - Datum and its importance of the Part - Location and its importance of the Part - Orientation and its importance of the Part - Resting & Clamping and its importance of the Part - Elements of the welding fixture - Different welding fixture accessories used for different welding application - Raw material used for welding fixture - Manufacturing process for different welding fixture elements. Welding Fixtures Application -Types of welding application -Different types of welding fixtures for Resistance welding application (Manual/Auto) -Different types of welding fixtures for MIG welding application

UNIT IV DESIGN OF FIXTURES FOR WELD PARTS 9

Critical & Major dimension of the part -Datum used in the weld part - Location, orientation, resting & clamping for the weld part - Design of welding fixture concept for given part- Design FMEA for the pre designed concept fixture -Welding distortion control by using fixture clamping - Design of Assembly welding fixture drawing for a given part - Design of Elemental drawing of given welding fixture.

UNIT V INSPECTION AND VALIDATION OF WELDING FIXTURES 9

Inspection & method of Inspection -Critical fit function of fixture hold part - fixture dimension & tolerance - fixture inspection procedure - Possible failure modes while inspection - Fixture validation - Fixture Maintenance and Calibration - Fixture maintenance procedure - Different fixture maintenance tools - fixture calibration procedure

Course Outcomes

At the end of the course the student will be able to:

CO1: Choose a suitable welding process based on the given part geometry, material and desired weld quality.
CO2: Identify the potential failure modes of a weld joint based on the given constraints.
CO3: Explain the types of fixtures used in Manual/Auto welding processes.
CO4: Design a suitable welding fixture based on the type of weld and geometry.
CO5: Explain inspection, maintenance and calibration procedure for weld fixtures.

Text Books:

1. O.P Khanna "A Textbook of Welding Technology", Dhanpat Rai & Sons, Twentieth Reprint, 2011.
2. Omer. W.Blodgett, James F. Lincoln, "Design of Welded Structures,rc Welding Foundation", 1st Edition 1996.

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Reference Books:

1. S.J Maddox, "Fatigue Strength of Welded Structures", Woodhead Publishing, 1991.
3. T.R Gurney, Tim Gurney, "Fatigue Strength of Transverse Fillet Welded Joints: A Study of the Influence of Joint Geometry", Woodhead Publishing, 1991.

Web References:

- https://ocw.mit.edu/courses/materials-science-and-engineering/3-37-welding-and-joining-processes-fall-2002/lecture-notes/
- http://www.esabna.com/euweb/awtc/lesson1_1.htm

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Course Code: 140ME9150	Course Title: MOTOR CYCLE DYNAMICS	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the courses:

- Vehicle Design Engineering

Course Objectives

The course is intended to:

1. Determine the magnitude of design parameters in a braking system of motorcycle
2. Determine the magnitude of design parameters in a suspension system
3. Determine the magnitude of design parameters for stability and maneuverability
4. Choose a suitable tyre for a given condition based on the characteristics of tyres
5. Explain the impact of aerodynamic parameters on the vehicle performance

UNIT I BASICS OF MOTORCYCLE DYNAMICS AND BRAKES 9

Introduction to Motorcycle dynamics – Basics of motorcycle dynamics – Coordinate system and important definitions Frictional force, deceleration & Simple brake calculations – Dynamics during braking – Introduction to CBS, ABS.

UNIT II DYNAMICS OF SUSPENSION 9

Sprung mass, Un-sprung mass and vibration modes Quarter car and half car models – Suspension elements and design parameters.

UNIT III STABILITY AND MANEUVERABILITY 9

Introduction – Definitions – Vibration modes – Study of dynamics in steady turn – SHM, Transient maneuvers, input & output parameters – Design parameters for stability and maneuverability, geometrical, mass and structural stiffness.

UNIT IV TYRE DYNAMICS 9

Introduction to tyre – Types of tyres – Tyre characteristic curve, vertical, cornering, camber stiffness, rolling resistance, magic formula.

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UNIT V ERGONOMICS AND AERODYNAMICS 9

Introduction and importance – Elements of ergonomics – Riding posture design, 'H' point, seat design. Aerodynamics - Introduction – Definitions – Aerodynamics parameters – Effect on vehicle performance

Course Outcomes

At the end of the course the student will be able to

CO1: Determine the magnitude of design parameters in a braking system of motorcycle such as friction force and stopping distance.

CO2: Determine the magnitude of design parameters in a suspension system such as type of springs, spring stiffness and pitch.

CO3: Determine the magnitude of design parameters for stability and maneuverability such as geometrical, mass and structural stiffness.

CO4: Choose a suitable tyre for a given condition based on the characteristics of tyres such as vertical, cornering, camber stiffness, rolling resistance.

CO5: Explain the impact of aerodynamic parameters on the motorcycle performance

Text Books:

1. Tony Foale, "Motorcycle Handling and chassis design" Tony Foale designs, 2006.
2. V Cossalter, "Motorcycle Dynamics", Published by Race dynamics, 8421 Midland Dr., Greendale, 2002.

Reference Books:

1. Tom Birch, Thomas Wesley Birch, "Automotive Chassis Systems", Delmar, Thomson Learning, 1999.

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Course Code: 140ME9151	Course Title: DESIGN FOR SHEET METAL	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the courses:

- Manufacturing Process – I & II
- Strength of materials

Course Objectives

The course is intended to:

1. Calculate the forces involved in bending and drawing operations
2. Select appropriate press tools
3. Select appropriate press machines
4. Suggest a suitable bending process
5. Estimate the cost required for forming and tube bending
6. Choose a suitable sequence and tool for forming and tube bending processes

UNIT I SHEET METAL & FORMING PROCESS 9

Basics of forming, bending & drawing process, Advantages and its Applications in Automotive Parts. Terminology of forming & bending- Bending force & Blank holding force Calculations, Spring Back, Bending defects and remedies. terminology of drawing -Working principle of drawing operations and reverse drawing, Calculation of Draw force, Calculation of cutting force, Blanking & Piercing, Blank holding force (Die cushion), Blank development - No of Draws - Selection of Press tonnage, defects, causes and remedies in drawing operation.

UNIT II PRESS TOOLS 8

Types of forming and press tools, Basis of selection of forming and press tool, Tool steel and merits, demerits and its applications, Tool Design, Tool Maintenance, Punches Types of Punches and Punch tool requirements.

UNIT III PRESS MACHINES 8

Presses - Types of Press machines based on Source of Power, Press tonnage, Slide Actuation & Capacity and its merits & demerits and application of presses and Material handling devices or equipment's and its types- Economic factor & selection of press.

UNIT IV TUBE BENDING PROCESS AND EQUIPMENTS 9

Tube bending process -Types of tube bending operation - Compression Bending, Rotary Draw Bending, Press Bending, Roll Bending, Single or double bend ,3D Bend,

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Tube on Tube bend, Tube bending related to shapes & size-Round, Rectangular & Square, Materials used Tube bending parts. Equipment's of Tube bending – Conventional type pipe bending machine - clamp - wiper shoe - Bend form – Mandrel, Single axis pipe bending machine, 3 axis & 5 axis pipe bending machine.

UNIT V TOOL COSTING AND SELECTIONS 11

Cost drivers for formed part – Tool cost estimation - Trial & Inspection cost overhead cost & profit. Determination of Sequence and Tool selection - Sequence of operation available in the given part - Blanking tool & Piercing tool design - Draw the component drawing & Strip layout - stripping force - Draw the assembly of tool drawing & BOM - Draw the individual tool elements part drawing for Manufacturing. Prepare the process planning chart. Inspection, trials and Troubleshooting - checklist for tool in static condition - checklist for tool in Dynamic condition - general inspection methods. Specific inspection methods (Panel checker/acceptance gauge).

Course Outcomes

At the end of the course the student will be able to:

CO1: Calculate the forces involved in bending and drawing operations such as bending force, drawing force and blank holding forces.
CO2: Select appropriate press tools for forming processes based on the geometry and material of the given part.
CO3: Select appropriate press machines for forming processes based on the geometry and material of the given part.
CO4: Suggest a suitable bending process based given part geometry and material.
CO5: Estimate the cost required for forming and bending for the given part.
CO6: Choose a suitable sequence and tool for forming and bending processes for the given part.

Text Books:

1. Serope Kalpakjian and Steven R. Schmid, "Manufacturing Engineering and Technology", Addition Wesley Longman Pvt. Ltd., First Indian reprint, 2000.
2. S.K. HajraChoudhury and A.K. HajraChoudhury, "Elements of Work shop Technology", Vol – I Manufacturing Processes, Media Promoters and Publishers Pvt. Ltd, 1986.

Reference Books:

1. S.L. Semiatin "ASM Handbook Volume 14B: Metalworking: Sheet Forming", 2006.
2. Schuler "Metal Forming Handbook", Springer-Verlag Berlin Heidelberg 1998
3. Kurt Lange, "Handbook of Metal Forming", Society of Manufacturing Engineers,1985

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Course Code: 141OE0904	Course Title: TOTAL QUALITY MANAGEMENT	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Manufacturing Processes I
- Manufacturing Processes II

Course Objectives

The course is intended to:

1. Explain the views of different quality gurus
2. Explain the principles and concepts inherent in a Total Quality Management (TQM) approach
3. Evaluate an industrial process
4. Explain the various quality tools for identifying appropriate process improvements
5. Explain the quality management

UNIT I INTRODUCTION **9**

Definition of Quality, Dimensions of Quality, Quality Planning, Quality costs - Analysis Techniques for Quality Costs, Basic concepts of Total Quality Management, Historical Review, Principles of TQM, Leadership – Concepts, Role of Senior Management, Quality Council, Quality Statements, Strategic Planning, Deming Philosophy, Barriers to TQM Implementation.

UNIT II TQM PRINCIPLES **9**

Customer satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment, Teams, Recognition and Reward, Performance Appraisal, Benefits, Continuous Process Improvement – Juran Trilogy, PDSA Cycle, 5S, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure

UNIT III STATISTICAL PROCESS CONTROL (SPC) **9**

The seven tools of quality, Statistical Fundamentals – Measures of central Tendency and Dispersion, Population and Sample, Normal Curve, Control Charts for variables and attributes, Process capability, Concept of six sigma, New seven Management tools.

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UNIT IV TQM TOOLS 9

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, overview of FMEA – Stages of FMEA

UNIT V QUALITY SYSTEMS 9

Need for ISO 9000 and Other Quality Systems, ISO 9000:2004 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, TS 16949, ISO 14000 – Concept, Requirements and Benefits .

Course Outcomes

At the end of the course students will be able to:

CO1: Explain the views of different quality gurus towards Total Quality Management.

CO2: Explain the principles and concepts inherent in a Total Quality Management (TQM) approach for managing a manufacturing or service organization

CO3: Evaluate an industrial process using control charts, process capability indices and six sigma.

CO4: Explain the various quality tools for identifying appropriate process improvements such as Bench marking, QFD,TPM and FMEA.

CO5: Explain the quality management with respect to the ISO 9000 & ISO 14000 quality management standards.

Text Books

1. Dale H. Besterfiled, et al., "Total Quality Management", Pearson Education, Inc. 2011(Indian reprint 2004).
2. Subbarajramasamy, " Total Quality Management" McGraw-Hill, 2008.

References

1. James R.Evans& William M. Lidsay, "The Management and Control of Quality", 5th Ed., South-Western (Thomson Learning), 2002
2. Feigenbaum.A.V. "Total Quality Management", McGraw-Hill, 1991.
3. Oakland.J.S. "Total Quality Management", Butterworth Hcinemann Ltd., Oxford, 2014.

Web References

- https://en.wikipedia.org/wiki/Total_quality_management

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Course Code: 141OE0905	Course Title: AUTOMATION SYSTEMS	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Describe the need of automation
2. Describe various pneumatic control elements
3. Describe the role of plc in industrial automation
4. Analyze the current trends in Automation

UNIT I FUNDAMENTAL CONCEPTS OF AUTOMATION 9

History and developments in industrial automation, vertical integration of industrial automation, fundamental concepts in manufacturing and automation, definition of automation, reasons for automating. Types of production and types of automation, automation strategies, levels of automation control elements in industrial automation

UNIT II PNEUMATIC SYSTEMS 10

Pneumatic fundamentals - control elements, position and pressure sensing -logic circuits - switching circuits - fringe conditions modules and integration - sequential circuits - cascade methods - step counter method. Electrical elements to control pneumatic equipments - selection of components - design calculations -application - fault finding – low cost automation - robotic circuits.

UNIT III PROGRAMMABLE LOGIC CONTROLLERS 9

Basics of PLC, advantages, capabilities of PLC, architecture of PLC, scan cycle, types of PLC, types of I/O modules, configuring a PLC, PLC wiring, PLC programming

UNIT IV PLC PROGRAMMING 10

Types of programming - simple process control programs using relay ladder logic - PLC arithmetic functions - timers and counters –data transfer-comparison and manipulation instructions, PID instructions, PTO / PWM generation.

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UNIT V CASE STUDIES 7

Case studies of machine automation, process automation, Automation system design and selection parameters for PLC and real time interfacing

Course Outcomes

At the end of the course the student will be able to:

CO1: Describe the need of automation
CO2: Describe various pneumatic control elements for automation.
CO3: Describe the role of plc in industrial automation
CO4: Analyze the current trends in Automation

Text Books:

1. Esposito anthony, "Fluid Power With Applications", pearson education inc., new york, 2008.
2. Petruzella, Frank D,"Programmable logic controllers", The McGraw-Hill Companies, Inc 4th edition 2011.

Reference Books:

1. Devadas shetty and richard a.kolk, "Mechatronics Systems Design", pws publishing company 2011.

Web references

- https://en.wikipedia.org/wiki/mechatronics
- http://www.cedrat.com/en/publications/categories/devicesystems/systems/mechatronics.html
- http://nptel.ac.in/courses/112103174/

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Course Code: 141OE0906	Course Title: MANUFACTURING OF AUTOMOTIVE ELECTRICAL AND ELECTRONICS PARTS	
Core/Elective: Elective	L : T : P : C	3 : 0 : 0 : 3
Type: Theory	Total Contact Hours:	45 Hours

Prerequisites

The student should have undergone the course(s):

- Nil

Course Objectives

The course is intended to:

1. Explain the characteristics and effects of components on circuit board.
2. Explain the parameters and methods involved in integration of electrical and electronics parts
3. Explain the steps involved in fabrication of Electrical parts
4. Explain the steps involved in fabrication of Electronic parts
5. Explain the process involved in manufacturing of lighting system

UNIT I BASICS OF ELECTRICAL AND ELECTRONICS 6

Introduction of Resistor capacitor inductor and characteristics under AC & DC, Power dissipation, Fuse and fuse selection. Electromagnetic compatibility (EMC), Interference

UNIT II INTEGRATION OF ELECTRICAL & ELECTRONIC PARTS ON VEHICLE 10

Overview of ADV Prod Quality Planning /New Prod Develop, Vehicle Integration-Mounting methods, Routing methods, Fastening, Clearance/Interference fit.

UNIT III MANUFACTURING OF AUTOMOTIVE ELECTRICAL PARTS 10

Process flow, process specifications and Inspection methodologies for Starter motor, Relay, Horn, Switches, Magneto and Wiring Harness.

UNIT IV MANUFACTURING OF AUTOMOTIVE ELECTRONIC PARTS 10

Process flow, Manufacture of PCB, PCB assembly and Testing, Electronic Packaging.

UNIT V MANUFACTURING OF AUTOMOTIVE LIGHTING SYSTEM 9

Basic principles and working of lighting system, Process flow and process specifications for automotive lighting system

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Course Outcomes

At the end of the course the student will be able to:

CO1: Explain the characteristics and effects of components on circuit board that are used in a motorcycle

CO2: Explain the parameters and methods involved in integration of electrical and electronics parts in a motorcycle

CO3: Explain the steps involved in fabrication of Electrical parts used in a motorcycle

CO4: Explain the steps involved in fabrication of Electronic parts in a motorcycle

CO5: Explain the process involved in manufacturing of lighting system used in a motorcycle

Text Books:

1. Raymond H. Clark, "Handbook of Printed Circuit Manufacturing" Springer 1st edition, 1985.
2. H. Richard Stillwell, "Electronic Product Design for Automated Manufacturing" CRC Press, 1st edition, 1988.

Reference Books:

1. V K Mehta Rohit Mehta, "Principles of Electrical and Electronics" 3rd edition S Chand Publishers, 2014.

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