ACADEMIC CURRICULA 2018 - 2022

BACHELOR'S DEGREE PROGRAMME
B. Tech in Mechanical (Automobile) Engineering

Curricula & Syllabi

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
Bhubaneswar, Odisha, India

ACADEMIC CURRICULA
2018 - 2022

B. TECH
MECHANICAL (AUTOMOBILE) ENGINEERING

Course Structure and Detailed Syllabi
for students admitted in
2018 - 22
Academic Session

Kalinga Institute of Industrial Technology (KIIT)
Deemed to be University U/S 3 of UGC Act, 1956
Bhubaneswar, Odisha, India

B. TECH IN MECHANICAL (AUTOMOBILE) ENGINEERING

Programme Educational Objectives (PEOs):

The B. Tech programme in Mechanical (Automobile) Engineering aims to prepare the graduates with the following objectives:

1. Graduates shall be able to provide solutions to automobile engineering problems involving design, manufacturing, heat power, and operational management issues.
2. Graduates shall be able to perceive the limitation and impact of engineering solutions in social, legal, environmental, economical, and multidisciplinary contexts.
3. Graduates shall demonstrate professional responsibility and thrive to reinforce their knowledge being a part of formal or informal education programmes.

Programme Outcomes (POs):

The programme outcomes are:

a) Engineering knowledge: Ability to apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
b) Problem analysis: Ability to identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
c) Design/Development of solutions: Ability to design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
d) Conduct investigations on complex problems: Ability to use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
e) Modern tool usage: Ability to create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
f) The engineer and society: Ability to apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
g) Environment and sustainability: Ability to understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
h) Ethics: Ability to apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
i) Individual and team: Ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
j) Communication: Ability to communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
k) Project management and finance: Ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one’s own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
l) Life-long learning: Ability to recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs):

The programme specific outcomes are:

m) Join a technical workforce as successful professionals in a wide range of automobile engineering and related domains.
n) Pursue advanced degrees in engineering, business, or other professional fields.
o) Continuously advance themselves by expanding their technical and professional skills through formal means as well as through informal self-study.

Abbreviations used in describing the category in all the courses are as follows:

BSC:	Basic Science Course
BSLC:	Basic Science Laboratory Course
ESC:	Engineering Science Course
ESLC:	Engineering Science Laboratory Course
HSMC:	Humanities, Social Science & Management Course
PCC:	Professional Core Course
PCLC:	Professional Core Laboratory Course
PEC:	Professional Elective Course
OEC:	Open Elective Course
PROJ:	Project
IEC:	Industry Elective Course

COURSE STRUCTURE FOR B. TECH IN MECHANICAL (AUTOMOBILE) ENGINEERING

SCHEME-I
SEMESTER - I

Theory							
Sl. No	Course	Course Title	L	T	P	Total	Credit
1.	MA 1003	Mathematics – I	3	1	0	4	4
2.	PH 1007	Physics	3	1	0	4	4
3.	EE 1003	Basic Electrical Engineering	3	0	0	3	3
4.	ME 1003	Engineering Mechanics	3	0	0	3	3
Total of Theory						14	14
Practical							
1.	PH 1097	Physics Lab	0	0	3	3	1.5
2.	EE 1093	Basic Electrical Engineering Lab	0	0	2	2	1
Sessional							
1.	ME 1083	Basic Manufacturing Systems	0	1	2	3	2
2.	CH 1081	Environmental Science	0	0	2	2	1
Total of Practical & Sessional						10	5.5
Semester Total						24	19.5

SCHEME-I
SEMESTER - II

Theory							
Sl. No	Course	Course Title	L	T	P	Total	Credit
1.	MA 1004	Mathematics – II	3	1	0	4	4
2.	CH 1007	Chemistry	3	0	0	3	3
3.	HS 1005	Professional Communication	2	0	0	2	2
4.	LS 1001	Biology	2	0	0	2	2
Total of Theory						11	11
Practical							
1.	CS 1093	Computer Programming	0	2	4	6	4
2.	CH 1097	Chemistry Lab	0	0	3	3	1.5
Sessional							
1.	HS 1085	Language Lab	0	0	2	2	1
2.	CE 1083	Engg. Graphics	0	1	2	3	2
Total of Practical & Sessional						14	8.5
Semester Total						25	19.5
	EAA- 1	Extra Academic Activity					P/NP

SEMESTER – III

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	MA 2005	Mathematics-III (Civil & Mechanical)	3	1	0	4	4
2	ME 2031	Engineering Thermodynamics	3	1	0	4	4
3	ME 2027	Materials Science and Engineering	3	0	0	3	3
4	ME 2029	Mechanics of Solids	3	1	0	4	4
5	ME 2021	Fluid Mechanics & Hydraulic Machines	3	1	0	4	4
6	EC 2025	Principle of Electronics Engineering	3	0	0	3	3
Total of Theory						22	22
Practical							
1	EC 2095	Electronics Engineering Lab	0	0	2	2	1
2	ME 2091	Material Testing Lab	0	0	2	2	1
3	ME 2097	Fluid Mechanics and Hydraulic Machines Lab	0	0	2	2	1
Sessional							
1	ME 2083	Machine Drawing and Computer Aided Design	0	0	2	2	1
Total of Practical & Sessional						8	4
Semester Total						30	26

SEMESTER – IV

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	ME 2010	Basic Manufacturing Processes	3	0	0	3	3
2	ME 2013	Kinematics and Dynamics of Machines	3	1	0	4	4
3	ME 2022	Internal Combustion Engines and Gas Turbines	3	0	0	3	3
4	AE 2002	Automotives, Suspension and Transmission System	3	0	0	3	3
5	AE 2004	Automotive Mechatronics	3	0	0	3	3
6		HS Elective-I	3	0	0	3	3
Total of Theory						19	19
Practical							
1	ME 2093	Machine Kinematics and Dynamics Lab	0	0	2	2	1
2	AE 2092	Automotive Electrical and Electronics Lab	0	0	2	2	1
Sessional							
1	ME 2085	Manufacturing Practices	0	1	2	3	2
2	HS 2081	Business Communication	0	0	2	2	1
Total of Practical & Sessional						9	5
Semester Total						28	24

SEMESTER- V

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	ME 3021	Heat Transfer	3	1	0	4	4
2	ME 3023	Design of Machine Elements-I	3	0	0	3	3
3	ME 3019	Manufacturing Processes and Automation	3	1	0	4	4
4		Department Elective-I	3	0	0	3	3
5		Department Elective-II	3	0	0	3	3
6		Department Elective-III	3	0	0	3	3
Total of Theory						20	20
Practical							
1	ME 3095	Heat Transfer Lab	0	0	2	2	1
2	ME 3093	Computational Techniques Lab	0	0	2	2	1
Sessional							
1	ME 3081	Machine Design	0	0	2	2	1
Total of Practical & Sessional						06	03
Semester Total						26	23

SEMESTER - VI

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	AE 3002	Vehicle Maintenance	3	0	0	3	3
2	AE 3003	Electrical and Hybrid Vehicle Technology	3	0	0	3	3
3	AE 3004	Design of Automotive Components	3	1	0	4	4
4		Department Elective-IV	3	0	0	3	3
5		Department Elective-V	3	0	0	3	3
6		Open Elective -I / (MI-1)	3	0	0	3	3
Total of Theory						19	19
Practical							
1	AE 3092	IC Engine and Vehicle Maintenance Lab	0	0	2	2	1
2	ME 3096	Mechanical Engineering Lab	0	0	2	2	1
Sessional							
1	AE 3082	Minor Project	0	0	4	4	2
2	ME 3086	Computer Aided Design and Analysis	0	0	2	2	1
Total of Practical & Sessional						10	05
Semester Total						29	24

SEMESTER- VII

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	HS 4001	Professional Practice, Law & Ethics	2	0	0	2	2
2		Open Elective-II / (MI-2)	3	0	0	3	3
(3)		(MI-3)	(3)	(0)	(0)	(3)	(3)
(4)		(MI-4)	(3)	(0)	(0)	(3)	(3)
(5)		(HO-1)	(3)	(0)	(0)	(3)	(3)
Total of Theory						5	5
Sessional							
1	AE 4081	Project-I/Internship					3
2	AE 4083	Practical Training	-	-	-	-	2
(3)		(Project – Minor / Lab)	(0)	(0)	(4)	(4)	(2)
Semester Total							10

SEMESTER - VIII

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1		HS Elective-II	3	0	0	3	3
(2)		(MI-5)	(3)	(0)	(0)	(3)	(3)
(3)		(MI-6)	(3)	(0)	(0)	(3)	(3)
(4)		(HO-2)	(3)	(0)	(0)	(3)	(3)
(5)		(HO-3)	(3)	(0)	(0)	(3)	(3)
Total of Theory						3	3
Sessional							
1	AE 4082	Project-II / Internship					10
Semester Total							13

MI – Minor HO – Honors

LIST OF HS ELECTIVES

HS Elective – I

Sl. No	Course	Course Title	Credit
1.	HS 2002	Engineering Economics	3
2.	HS 2008	Economic Environment of India	3
3.	HS 2010	Financial Institutions, Markets and Regulations	3
4.	HS 2012	Development Economics	3

HS Elective – II

1.	HS 3006	Entrepreneurship	3
2.	HS 3008	Management Concepts & Practices	3
3.	HS 3002	Organizational Behaviour	3
4.	HS 3004	Human Resource Management	3

LIST OF DEPARTMENT ELECTIVES

Dept. Elective-I

1.	ME 3071	Renewable Energy Technology	3
2.	ME 3073	Mechanics of Composite Materials	3
3.	ME 3025	Optimization Techniques	3
4.	ME 3065	Combustion Engineering	3
5.	AE 3011	Fuels and Emission	3
6.	ME 2024	Industrial Engineering and Operations Research	3

Dept. Elective-II

1.	ME 3014	Refrigeration and Air Conditioning	3
2.	ME 3024	Mechanical Vibration and Noise Engineering	3
3.	ME 3051	Finite Element Analysis	3
4.	AE 3021	Tractors and Farm Equipments	3
5.	AE 3022	Two and Three Wheelers	3
6.	AE 3023	Off Road Vehicles	3

Dept. Elective-III

1.	ME 3056	Tribology	3
2.	AE 3031	Simulation of IC Engine	3
3.	AE 3033	Thermal Systems in Automotive	3
4.	AE 3034	Vehicle Dynamics	3
5.	AE 3037	Automotive Aerodynamics	3
6.	AE 3039	Battery Technology	3

Dept. Elective-IV

1.	ME 3028	Supply Chain Management	3
2.	ME 3069	Total Quality Management	3
3.	ME 3030	Product Life Cycle Management	3
4.	AE 3042	Automotive Safety and Lighting	3
5.	AE 3044	Theory And Design of Jigs And Fixtures	3

Dept. Elective-V

1.	ME 3059	Computational Fluid Dynamics	3
2.	AE 3052	Intelligent Vehicle Technology	3
3.	AE 3054	Design of Racing Car	3
4.	AE 3056	Fundamentals of Tyre Technology	3
5.	AE 3058	Assembly Line Automation	3
6.	AE 3060	Vehicle Life Cycle Management	3

HONORS COURSES OFFERED BY MECHANICAL (AUTOMOBILE) ENGINEERING

Sl. No	Course	Course Title	Prerequisite/s
1	AE 4001	Automotive Quality Management	Nil
2	AE 4002	Auxiliary systems in Automotives	Internal Combustion Engines and Gas Turbines(ME2022)
3	AE 4003	Turbochargers and Superchargers	Fluid Mechanics & Hydraulic Machines(ME2021)

LIST OF OPEN ELECTIVES OFFERED BY SCHOOL OF MECHANICAL ENGINEERING

Sl. No	Course	Course Title	Prerequisite/s
1	ME 3031	Finite Element Method for Engineers	Mathematics-I (MA1003)
2	ME 3032	Introduction to Fluid Mechanics and Heat Transfer	Mathematics –I (MA1003)
3	ME 3033	Renewable Energy Sources	Nil
4	ME 3034	Applied Thermodynamics	Mathematics –I (MA1003), Engineering Thermodynamics (ME2031)
5	ME 3035	Biomechanics	Nil
6	ME 3036	Strength of Materials	Engineering. Mechanics (ME1003)
7	ME 3037	Quality Engineering and Management	Nil
8	ME 3038	Kinematics and Dynamics of Machinery	Mathematics-I (MA1003), Engineering Mechanics (ME1003)
9	ME 3039	Mechatronic Systems	Principles of Electronics Engineering (EC2025)
10	ME 3040	Engineering Materials	Chemistry (CH1007)
11	ME 3042	Computer Controlled Manufacturing Systems	Nil
12	ME 3044	Robotics	Nil
13	ME 3046	Introduction to Composite Materials	Nil
14	ME 3048	Fundamentals of Computational Fluid Dynamics	Physics (PH1007), Chemistry (CH1007)
15	ME 3050	Automobile Technology	Nil

MINOR IN MECHANICAL ENGINEERING

Sl. No	Course	Course Title	Prerequisite/s
1	ME 2013	Kinematics and Dynamics of Machines	Nil
2	ME 2024	Industrial Engineering and Operations Research	Nil
3	ME 3043	Power Plant Engineering	Nil
4	ME 3062	Thermodynamics and Hydraulic Devices	Nil
5	ME 3041	Mechanical System Design	Nil
6	ME 4070	Manufacturing Processes	Nil
7	ME 2085	Manufacturing Practices	Nil
8	ME 4092	Thermo fluids Lab	Nil
9		Project(Minor)	Nil

MINOR IN MANUFACTURING ENGINEERING

Sl. No	Course	Course Title	Prerequisite/s
1	ME 2007	Materials Science and Engineering	Nil
2	ME 2026	Engineering Metrology	Nil
3	ME 2024	Industrial Engineering and Operations Research	Nil
4	ME 3055	Additive Manufacturing	Nil
5	ME 4070	Manufacturing Processes	Nil
6	ME 4072	Industrial Automation and Robotics	Nil
7	ME 2085	Manufacturing Practices	Nil
8	ME 2099	Metrology and Instrumentation Lab	Nil
9		Project(Minor)	Nil

MINOR IN INDUSTRIAL ENGINEERING AND MANAGEMENT

Sl. No	Course	Course Title	Prerequisite/s
1	ME 3028	Supply Chain Management	Nil
2	ME 3053	Project Management	Nil
3	ME 4061	Operations Research	Nil
4	ME 4074	Quality Engineering	Nil
5	ME 4076	Production, Planning and Control	Nil
6	ME 4078	Work System Design	Nil
7	ME 4092	Work System Design Lab.	Nil
8	ME 4094	Operations Research Lab.	Nil
9		Project(Minor)	Nil

COURSES OF FIRST YEAR

MA 1003 Mathematics-I

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description:

The laws of nature are expressed as differential equations. The construction of mathematical models to address real-world problems has been one of the most important aspects of each of the branches of science. This course is designed to familiarize the prospective engineers with techniques in ordinary differential equations, multivariate calculus and solution for ODEs numerically. This course also focuses on Linear algebra that covers system of linear equations and properties of matrices. The objective of the course is to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced levels of mathematics and applications that they would find useful in their disciplines.

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

CO1: model and formulate differential equation of Physical problems
CO2: apply different methods to solve 1st and 2nd order ODEs
CO3: apply numerical methods to solve ODEs
CO4: study differential calculus in engineering problems
CO5: use the essential tool of matrices and linear algebra
CO6: analyze Eigenvalue problems

Topics:

- Ordinary Differential Equations.
- Linear differential equations of 2^{nd} order.
- Differential calculus and Numerical methods to solve ODEs
- Vector space and system linear of equations
- Matrix-eigenvalue Problems

Textbook(s):

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, (online) 10^{th} Edition.
2. Differential Calculus, Shanti Narayan and P. K. Mittal, S. Chand, reprint 2009.

Reference Book(s):

1. Higher Engineering Mathematics, Grewal B.S., Khanna Publishers, 36th edition.
2. Introduction to engineering Mathematics, Dass H.K., S.Chand & Co Ltd, 11^{th} edition.
3. Higher Engineering Mathematics, Ramana B.V., TMH, 2007.
4. A course on ordinary & Partial Differential Equation, Sinha Roy and S Padhy, Kalyani Publication, 3rd edition.

PH 1007 Physics

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description:

This course includes the fundamentals of different types of oscillations and its applications; mathematical expression of waves and its physical interpretation; the concept of interference, diffraction and their applications; the principle, construction and working of different Lasers. The course also gives a flavour of Quantum mechanics, which is the founding stone to the state of the art in modern techniques and paves the way towards the world of nano devices. It covers the formulation of Maxwell's electromagnetic equations, and verification of different properties of electromagnetic waves. Mechanical and magnetic properties of different materials and their applications are also covered in this course.
Course Outcomes: At the end of the course, the students will be able to:

CO1: utilize the concept of waves and intensity modulation in day to day life through various applications
CO2: apply the mechanism of LASER technology in different fields
CO3: formulate and solve engineering problems of electricity and magnetism using Maxwell's electromagnetic equations
CO4: apply the principles of quantum mechanics to related problems
CO5: apply the knowledge of magnetic materials in related applications
CO6: analyze the macroscopic behavior of solids and utilize them in future applications

Topics:

- Oscillation and wave
- Interference and diffraction
- LASER
- Quantum mechanics
- Electromagnetism
- Properties of matter (mechanical)
- Magnetism

Textbook (s):

1. Engineering Physics, B. K. Pandey and S. Chaturvedi, Cengage Publication, New Delhi

Reference Book(s):

1. Introduction to Electrodynamics, D J Griffiths, Pearson Education
2. Quantum Mechanics, L. I. Schiff, Tata McGraw-Hill Publications
3. Optics, A K Ghatak, Tata McGraw-Hill Publications
4. Concepts of Modern Physics, A. Beiser, Tata McGraw-Hill Publications
5. Engineering Physics, R K Gaur and S. L. Gupta, Dhanpat Rai Publications, New Delhi.

ME 1003 Engineering Mechanics

Credit: 2
Category: ESC
Prerequisite(s): Nil

Course Description:

The course on Engineering Mechanics is a specialized need-based extension of applied physics which is aimed at developing an understanding of the principle of statics and dynamics. The course focuses on learning methodical and logical idealization and subsequent implementation of corresponding procedures for analysis of rigid body, frame and machine under the action of force system which is highly essential for effective design. The course intends to develop the ability of drawing and analyzing the free body diagram of a system when at rest or motion using scalar/vector techniques. Further, the course serves as a prerequisite to fundamental machine design courses such as mechanics of solids and design of machine elements.

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

CO1: draw complete and correct free-body diagrams and write the appropriate equilibrium equations from the free-body diagram
CO2: use scalar analytical techniques for analyzing forces and moments in mechanical systems
CO3: analyzing forces in statically determinate structures such as trusses, frames and problems related to friction
CO4: determine the centroid and second moment of area
CO5: apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple and practical problems
CO6: solve real-life problems by using mathematics, physical laws and theorems

Topics:

- Concurrent Forces in a Plane
- Friction
- Parallel Forces in a Plane
- Moment of Inertia
- Force analysis of Plane Trusses
- Principle of Virtual Work
- Kinematics of Rectilinear Motion
- Kinematics of Curvilinear Motion
- Rotation of a rigid body

Textbook(s):

1. Engineering Mechanics (Revised 5th edition), TMH by S. Timoshenko, D.H. Young, J.V Rao and S. Pati.

Reference Book (s):

1. Engineering Mechanics (Statics and Dynamics) - Bear and Johnson, TMH
2. Engineering Mechanics (Statics and Dynamics) by I.H. Shames, Prentice Hall
3. Engineering Mechanics –S.S. Bhavikatti, New Age International
4. Engineering Mechanics (Statics and Dynamics)-S. Rajasekaran & G Sankarasubramanian, Vikas Publishing House.

PH 1097 Physics Laboratory

Credit: 1.5
Category: BSLC
Prerequisite(s): Nil

Course Description:

This lab course covers different measurement techniques of various parameters using the instruments i.e. interferometer, spectrometer, spherometer, Screw gauge, vernier calliper, microspope, and telescope. It includes the application of photoelectric effect and photovoltaic effect in photo cell and solar cell respectively. Evaluation of the mechanical strength of materials by calculating elastic constants such as Young's modulus, rigidity modulus and Poisson's ratio are also included. This course provides hands on training for the usage of electrical, optical and mechanical systems for various measurements with precision and analysis of the experimental data by graphical interpretation and error calculation.

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

CO1: calculate appropriate structural members using the fundamental concepts of the elastic behavior of materials
CO2: use the principles of interference and diffraction to find out the wavelength of an unknown monochromatic source of light
CO3: apply the concept of photoelectric emission to calculate the Planck's constant and analyze some aspects of electron-photon interaction through characteristic curves
CO4: explore the efficiency in terms of power output of a green energy source i.e. solar cell
CO5: calculate the acceleration due to gravity 'g' by using the concept of a compound pendulum

Topics:

- Estimation of elastic constants such as Young's modulus, rigidity modulus and Poisson's ratio
- Determination of wavelength of unknown source using Newton's rings and Michelson's interferometer
- Precision length measurement up to the order of 6 A° (distance between sodium D-lines) using Michelson interferometer
- Determination of grating element using a diffraction grating
- Study of photo cell and solar cell by analyzing their characteristic curves
- Determination of acceleration due to gravity using a bar pendulum

EE 1093 Basic Electrical Engineering Laboratory

Credit: 1
Category: ESLC
Prerequisite(s): Nil

Course Description:

Basic Electrical Engineering lab comprises of various equipments and loads i.e voltmeters,ammeters, wattmeters, single phase and three phase transformer, induction motors etc. It is a specialized practical oriented course which intends to develop and understand various principles like Ohm's law and Kirchoff's law. The course focused on learning methodical and logical idealization of various theorems which is highly essential for solving a network. The course intends to make the students familiar with various parts of DC machines and AC machines. The course intends to develop the ability of problem solving by analyzing RL and RLC series circuits. This lab helps the students to understand the principle of operation of a single phase transformer with its no load calculation.

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

CO1: recall the safety practices in the laboratory and the associated work areas
CO2: comprehend the skills for working in a team with common objective
CO3: apply different theorems to find the parameters in DC and AC circuit
CO4: analyse the different parts of DC and AC machines to describe operational features thereof
CO5: apprise the experimental results in systematic manner
CO6: discuss about determination of resistance in incandescent lamp and power factor in fluorescent lamp

Topics:

- measurement of resistance of tungsten filament lamp
- measurement of inductance of a choke coil
- study and use of megger
- study of different parts of dc machine and three phase induction motor
- layout of power system analysis
- determination of voltage ratio of a single phase transformer
- measurement of no load current and core loss of a single phase transformer
- verification of KCL and KVL
- verification of voltage and current ratio of star and delta connection
- study & determine the power factor of the RLC series circuit
- study, connection & determine the power factor of fluorescent tube
- verification of the superposition theorem
- transient analysis of series RL and RC circuit using matlab-simulink with dc excitation

Textbook(s):

1. Basic Electrical Engineering by D.C. Kulshreshtha, Tata Mcgraw publication, 1st Edition 2011.
2. Basic Electrical Engineering, T.K. Nagasarkar and M.S. Sukhija, Oxford University press, 2nd Edition 2011.

Reference Book(s):

1. Basics Electrical Engineering Sanjeev Sharma, I.K. International, New Delhi.(Third Reprint 2010).

ME 1083 Basic Manufacturing Systems

Credit: 2
Category: ESLC
Prerequisite(s): Nil

Course Description:

This laboratory practice is designed to impart students the basic knowledge on manufacturing or developing a given object irrespective of their branch of engineering. While furnishing the given object, students will familiar with various mechanical operations and the respective tools or machines. This course involves four different sections namely Fitting, Welding, Turning and Sheet metal which covers both conventional and advanced tools to provide students the updated manufacturing experience. Students are also advised with various safety precautions to be followed during a specific manufacturing practice. At the end, students will also gain knowledge on different advanced machines such as CNC and 3D printing.

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

CO1: practice different operations related to fitting shop
CO2: use different welding tools to prepare a given type of joint
CO3: demonstrate various turning operations including taper turning and knurling using a conventional lathe machine
CO4: design a tray and prepare it using sheet metal equipment involving soldering
CO5: appraise different operations using a CNC machine
CO6: interpret different advanced machines such as 3D printing/additive manufacturing

Topics:

- Turning operations
- Sheet metal operations
- Fitting
- Welding

CH 1081 Environmental Science

Credit: 1
Category: BSLC
Prerequisite(s): Nil

Course Description:

The course is designed to make the students aware of different environmental components and their composition. It will make the students understand different pollutants, their sources and management. It will also help students to apply the principles of Green Chemistry and implement them in synthesis of advanced materials required for engineering applications. It also outlines the basic steps for developing the EIA statements

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

CO1: understand the different components and composition of the environment
CO2: rationalize the different pollutants, their sources, effects and controlling measures
CO3: quantify water quality parameters
CO4: apply the systematic environmental impact assessment (EIA) requirements before setup of any project
CO5: understand and implement the principles of solid waste management
CO6: conceptualize the principles of green chemistry and implement them in synthesis of advanced material, so as to reduce the pollution

Topics:

- Overview on environment
- Environmental pollution: air pollution, water pollution
- Pollution management

Textbook(s):

1. Environmental Chemistry, A. K. De, New Age International Publishers.

Reference Book(s):

1. Environmental Chemistry- S. Chakroborty, D. Dave, S.S. Katewa, Cengage Publishers
2. Environment Science and Engineering, Aloka Debi. Second Edition ;Universities Press
3. Text Book of Environment studies for under graduate courses, Erach Bharucha : 2nd Edition, Universities Press
4. Fundamentals of Environment and Ecology, D. De, D. De; 2013, S. Chand Group
5. Engineering Chemistry, Jain and Jain, Dhanpat Rai Publishing Company

MA 1004 Mathematics-II

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description:

The course is to familiarize the students with series solutions of ODEs, Laplace Transforms, Fourier series, vector calculus, and numerical integration. For the ODEs with variable coefficients, the situation is more complicated to get their solutions in elementary functions. Legendre and Bessel's equations are important ODEs of this kind and their solutions, the Legendre polynomials and Bessel functions play an important role in engineering applications. Laplace transforms can be used as a mathematical toolbox for engineers to solve linear ODEs and related initial value problems. The Fourier series and vector calculus play a very important role in many engineering areas such as solid mechanics, aerodynamics, fluid flow, heat flow, quantum physics. The applied mathematician, engineer, physicist, or scientist must become familiar with the essentials of numerics and its ideas, such as interpolation and numerical integration.

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

CO1: understand application of Power series and solution of ODEs
CO2: use Power series solutions to Legendre and Bessel's equations
CO3: comprehend Laplace transform and IVPs
CO4: study periodic and non-periodic functions and their Fourier series expansion
CO5: develop vector differential and integral calculus and the applications of Green's theorem, Gauss Divergence Theorem & Stokes Theorem
CO6: apply numerical techniques in interpolation and evaluation of the definite integral

Topics:

- Series Solution of Differential Equations
- Laplace Transforms
- Fourier Series
- Vector Differential and Integral Calculus
- Interpolation and Numerical Integration

Textbook(s):

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10^{th} Edition.

Reference Book(s):

1. Higher Engineering Mathematics, Grewal B.S., Khanna Publishers, 36th edition.
2. Introduction to engineering Mathematics, Dass H.K., S.Chand& Co Ltd, 11^{th}edition.
3. Higher Engineering Mathematics, Ramana B.V., TMH, 2007.
4. A course on ordinary & partial differential Equation, Sinha Roy and S Padhy, Kalyani Publication, 3rd edition.

CH 1007 Chemistry

Credit: 3
Category: BSC
Prerequisite(s): Nil

Course Description:

The course is designed to enrich the students with basic concepts in Chemistry to strengthen their fundamentals which will support them for pursuing education and research in engineering. It will help them to develop the idea on feasibility and mechanism of different chemical processes, conceptualize alternative sources of energy, give an exposure for handling instrumental techniques to explore structure of organic molecules and an idea of different methods for synthesis of advanced materials.

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

CO1: rationalize bulk properties and processes using thermodynamic consideration and apply the knowledge to decide the feasibility of a given process
CO2: analyze the kinetics of simple and multistep reactions as well as theories of reaction rates
CO3: evaluate some properties such as pH, solubility product etc. by using electrochemical cell and understand the working of modern batteries
CO4: able to understand the mechanism of corrosion and its different controlling measures
CO5: distinguish the different electromagnetic radiations used for exciting different molecular energy levels in various spectroscopic techniques to evaluate the structure of molecules
CO6: get an exposure to different methods used for synthesis of nanostructured materials

Topics:

- Chemical Equilibrium and Thermodynamics
- Chemical Kinetics
- Electrochemistry
- Spectroscopy
- Chemistry of Nano Materials

Textbook(s):

1. Engineering Chemistry: Fundamentals and Applications- Shikha Agarwal, Cambridge University Press, 2016

Reference Book(s):

1. Textbook of Engineering Chemistry: Sashi Chawala, Dhanpat Rai and Co, 2016
2. Principles of Physical Chemistry- B.R. Puri, L.R Sharma, M.S. Pathania; 42nd Edition, Vishal Publishing Co.
3. Spectrometric Identification of Organic compaunds,7th Edition -Robert M. Silverstein, Fransis , Webster, Dravid j. Kiemle; Jhon Wiley& Sons, INC.
4. Nanostructures &Nanomaterials: Synthesis, Properties and Applications- G. Cao and Y. Wang, World Scientific Pvt. Ltd.; 2nd Edition

HS 1005 Professional Communication

Credit: 2
Category: HSMC
Prerequisite(s): Nil

Course Description:

Professional Communication is more emphasized on enhancing the four LSRW skills like Listening, Speaking, Reading and Writing in order to improve students' professional communication. It is basically designed to enhance speaking skills through pronunciation, stress and tone. This course is prepared to improve reading skills through reading, comprehending and retaining information.This course is basically expected to provide the learner an approach to communicate using all the four skills

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

CO1: understand the communication process and practical implementations in the workplace
CO2: apply verbal and non-verbal modes of communication effectively in practical situations
CO3: apply effective conflict management strategies
CO4: use English grammar correctly and unambiguously in technical writing
CO5: bridge the gap between native language and target language i.e. English
CO6: retain a logical flow while drafting reports and other technical pieces of writing

Topics:

- Communication: Process and Methods of Communication
- Basics of Grammar: Time & Tense, Subject-Verb Agreement, Analogy, Active & Passive Voice, Error Detection in Sentences
- Writing Skills: Paragraph Writing-Techniques & Skills, Use of Punctuation, Business Letter-Enquiry, Claim/ Complaint, Order
- Basic Sounds of English: Hearing & Listening, Introduction to Basic Sounds of IPA, Problem Sounds & MTI

Textbook(s):

1. Technical Communication Principles & Practices. Meenakshi Raman and Sangeeta Sharma OUP. Second Edition-2011

Reference Book(s):

1. A Communicative English Grammar. Geoffrey Leech and Jan Svartvik. Third Edition. Routledge Publication.New York.2013.
2. Effective Technical Communication. MAshraf Rizvi TMH 2005
3. The Oxford Grammar (English) Sidney Greenbaum, Oxford University Press India. 1st Edition. 2005
4. Verbal Ability and Reading Comprehension for the CAT. Arun Sharma and Meenakshi Upadhyay, TMH,New Delhi,2007
5. Better English Pronunciation, Cambridge University Press, J D O'Connor, 2nd Edition (Paper Back) 2013

LS 1001 Biology

Credit: 2
Category: BSC
Prerequisite(s): Nil

Course Description:

Biology is important to everyday life because it allows humans to better understand their bodies, their resources and the potential threats existing in the environment. The engineering undergraduates need to be suitably exposed to the biological mechanisms of living organisms from the perspective of engineers. In addition, the course is expected to encourage engineering students to think about solving biological problems with engineering tools.

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

CO1: comprehend the typical characteristics which distinguish life forms and analyze life process at cellular level
CO2: apply concepts on structure and function of simple biomolecules in life processes
CO3: comprehend different biological process involved in life and to analyze their effect
CO4: understand different biological phenomenon and then relate it with engineering application domains
CO5: comprehend different physiological functions and then relate it to computer based techniques
CO6: understand biology and its relevance to engineering and technology

Topics:

- The Cellular organization of a living Organism
- The molecular and biochemical basis of an organism
- Enzymes, photosynthesis, metabolism and bioenergetics
- Molecular machines, biosensor and bioremediation
- Nervous system, immune system and cell signaling

Textbook(s):

1. Biology for Engineers. S. Thyagarajan, N. Selvamurugan, M.P Rajesh, R.A Nazeer, Richard W. Thilagarajan, S. Bharathi, M.K. Jaganathan. McGraw Hill Education (India) Ed., 2012

Reference Book(s):

1. Biology (Indian Edition), P.H. Raven and G.B. Johnson. McGraw Hill Education (India) Private Limited.
2. Concepts of Biology, Eldon D. Enger, Feederick C, Ross and David B. Bailey. TMH Publications.
3. Biology. Neil A. Campbell and Jane B. Recee, Pearson Education.
4. Biology Concepts and Application, Cecie Starr, Thomson Books.

CS 1093 Computer Programming Laboratory

Credit: 4
Category: ESLC
Prerequisite(s): Nil

Course Description:

The course aims to provide exposure to problem-solving through programming. It aims to train the student to the basic concepts of the C-programming language. This course involves lab component which is designed to give the student hands-on experience with the concepts.

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

CO1: have fundamental knowledge on basics of computers hardware and number systems with concept on basics commands in Linux
CO2: write, compile and debug programs in C language
CO3: design programs involving decision structures, loops, and functions
CO4: understand the dynamics of memory by the use of pointers
CO5: use different data structures and create/update basic data files

Topics:

- Basic linux commands
- Operators and Expressions
- Branching statements (if-else, switch).
- Control statements (looping - for, while, do-while).
- Arrays
- Character Arrays (strings).
- Functions.
- Pointers and Dynamic Memory Allocation.
- Structures and Unions
- File Handling

CH 1097 Chemistry Laboratory

Credit: 1.5
Category: BSLC
Prerequisite(s): Nil

Course Description:

The Chemistry laboratory course is designed to develop basic concepts of quantitative analysis by using volumetric as well as instrumental methods. It includes classical titrations to estimate hardness, alkalinity, dissolved oxygen, ferrous ion content, chloride content in water/solution samples. It also gives hands on training to use advanced titration techniques such as potentiometric, pH metric and conductometric titrations which can be used with turbid and colored solutions in incredibly low concentrations. The course also gives an exposure to extensive use of UV-Vis spectroscopy for estimation of different ions in solution phase.

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

CO1: understand the significance of quantitative chemical analysis
CO2: prepare solutions of different concentrations and do their standardization
CO3: get an exposure to different instrumental techniques such as Conductometry, pH-metry, Potentiometry and Colorimetry
CO4: evaluate the rate constant of pseudo first order reactions
CO5: analyse basic water quality parameters like hardness, dissolved oxygen, alkalinity, ferrous iron contents
CO6: rationalize chemical handling and chemical safety in an advanced modern laboratory

Topics:

- Hardness of water sample
- Alkalinity of water
- Estimation of Fe^{2+} iron
- Dissolved Oxygen
- Potentiometric Titration
- Kinetics of Ester Hydrolysis
- Chloride Estimation
- pH metric Titration
- Conductometric Titration
- Concentration of $KMnO_4$ by Visible spectroscopy

HS 1085 Language Laboratory

Credit: 1
Category: HSMC
Prerequisite(s): Nil

Course Description:

Language Lab is more practical oriented which is designed with an objective to make the learner practice the skills which he/she has learnt in the theory I.e Listening, Speaking, Reading and Writing in order to improve their communication skills. It is basically designed to engage the students to learn to perform group activity or an individual activity. This course is prepared to improve the listening reading, speaking and writing skills . It is expected to orient the students with vocabulary, analogy, sentence completion and sentence correction.

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

CO1: use English grammar correctly and unambiguously in technical writing
CO2: apply verbal and non-verbal modes of communication effectively in practical situations
CO3: have a basic understanding of the communication process and to know the practical implementations in the workplace
CO4: retain a logical flow while drafting reports and other technical pieces of writing
CO5: develop competence in reading and comprehension
CO6: be familiar with English pronunciation and use neutral accent successfully

Topics:

- Reading & Comprehension
- Skit/ Role-Play Practice
- Listening Comprehension
- Time & Tense
- Business Letter
- Business Report
- Subject-Verb Agreement
- Visual Elements in Writing:
- Gadget-Supported Textual Formatting
- Attendance + Lab Record Checking
- Viva Voce

CE 1083 Engineering Graphics

Credit: 2
Category: ESLC
Prerequisite(s): Nil

Course Description:

The course of Engineering Graphics comprises of basics of drafting, projection of points & lines, line inclined to both the planes, projection of planes, Computer Aided Drafting, projection of solids and development of surfaces.

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

CO1: use common drafting tools properly
CO2: select, construct and interpret appropriate drawing scale as per the situation
CO3: draw orthographic projections of points, lines and planes
CO4: draw orthographic projection of solids like cylinders, cones, prisms and pyramids including sections
CO5: develop the sections of solids for practical situations
CO6: communicate ideas effectively using Computer Aided Drafting

Topics:

- Introduction to Engineering graphics
- Lettering
- Projection of points & lines
- Line inclined to both the planes
- Projection of planes
- Introduction to Computer Aided Drafting
- Projection of solids
- Section of solids
- Development of surface

Textbook(s):

1. Engineering Drawing + AutoCAD by K. Venugopal, New Age Publishers, 1st edition, 2011

Reference Book(s):

2. Engineering Drawing with an Introduction to AutoCAD by S. N. Lal, Cengage India Private Limited, 1st edition, 2017

COURSES OF THE PROGRAMME

AE 2002 Automotive, Suspension and Transmission System

Credit: 3
Category: PCC
Prerequisite(s): Kinematics and Dynamics of Machines (ME 2013)

Course Description:

This course would encompass a comprehensive study the classification of automobiles according to various parameters such as; types of frames, types of chassis, numbers of road wheels, types of energy sources used, utility etc. Design of transmission system components such as; clutch, gearbox, differential is also included. Types of front axle,constructions details and Materials is also covered. Front wheel geometry viz. Castor, Camber, King Pin inclination, Toe-in. Conditions for true rolling motion of wheels during steering is introduced. Ackerman and Davis steering system andconstructional details of steering linkages,different types of steering gear boxes, Steering linkages and layouts are taught with live demo. Differential along with advantages and disadvantages of rigid axle and independent suspension system, working of various independent suspension systems and various types of springs used in suspension are included. Theory of braking,mechanical, hydraulic,pneumatic brakes, Servo brake, power assisted brakes are also taught to make a student understand the safety aspect in regular driving.

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

CO1: state the basic structure of different automobile
CO2: describe most suitable Drive train, Steering System, Brakes and Suspension System for new automobile
CO3: sketch and analyze of gear ratios in transmission system
CO4: analyze and analysis of springs and brakes used in different automobiles
CO5: formulate and calculate the correctSteering geometry
CO6: interpret the Repair Brakes and Suspension systems

Topics:

- Vehicle chassis and frame
- Transmission system; Clutch, gearbox, Torque converter, Differential, Overdrive
- Electrical drive
- Rear axle and rear axle drive line
- Suspension system
- Braking system

Textbook(s):

1. Automobile Engineering Vol-I, Kripal Singh, Standard Publisher Distributor, 2017.

Reference Book(s):

1. A Text book of Automobile Engineering, Volume-II. P.S. Gill, S.K. Kataria & Sons, First Edition, 2012
2. Basic automobile Engineering, Nakra C. P., Dhanpat Rai Publication Co. Ltd 7th edition, 2005
3. Automobile Engineering, A. De, Galgotia Publication Pvt. Ltd. 2004.

AE 2004 Automotive Mechatronics

Credit: 3
Category: PCC
Prerequisite(s): Principle of Electronics Engineering (EC 2025)

Course Description:

This course is focused on the wide application of electronics in various automotive subsystems to the students of Automobile Engineering who has basic knowledge of electronics engineering. This course emphasizes on microprocessor 8085, sensors and actuators. The significance of the pin diagram and coding required to program a microprocessor can be appreciated. In view of changing emission norms the fuel injection system in IC engine vehicle plays an important role and students will learn about electronic injection control. Students will also learn about electronic chassis control, anti lock braking system etc.

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

CO1: state the functions of microcomputer 8085
CO2: describe the appropriate electronic components to be used in an automobile
CO3: illustrate schematic of different sensors and actuators for various automotive systems
CO4: examine the efficacy of electronic engine management systems
CO5: formulate the electronic chassis control and safety mechanism
CO6: select among the algorithm of microprocessor programming for various applications

Topics:
- Microcomputer 8085
- Analog to digital converters and Digital to analog converters,
- Sensors and actuators
- Solenoids, stepper motors and relays.
- Electronic engine management system
- Electronic vehicle management system
- Display Devices
- Onboard diagnostics
- GPS navigation

Textbook(s):
1. Understanding Automotive Electronics, William B. Riddens, Butterworth Heinemann, Woburn, 5th edition 1998.

Reference Book(s):
1. Embedded System – Architecture, Programming, Design, Rajkamal, Tata McGraw Hill, 2003.
2. Instrumentation Devices and Systems, Raman, C.S., Sharma, G.R., Mani, V.S.V., Tata McGraw Hill, New Delhi, 1983.
3. Understanding Automotive Electronics, Bechhold, SAE- 1998.
4. Automotive Electricity and Electronics, Al Santini, Cengage, 2nd Edition 2011

AE 2092 Automotive Electrical and Electronics Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Nil

Course Description:

This laboratory is intended to describe the fundamental concepts and the electronics to the students. Focus is on to recognize the important electrical systems in a vehicle starting from wiring, switches, relay and fuses. It provides knowledge to evaluate battery characteristics such as; open circuit voltage, instantaneous current etc. In order to enhance the knowledge for automotive electronics troubleshooting, check list preparation is also included. Checking of the alternator, measurement of worn-out starter motor, light adjustment, are also kept in the course. Modern automobile is attached with various sensors and the students need to recognize them. Fault diagnosis and service of safety system is also demonstrated.

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

CO1: state the basics of Energy Conversion in Automobile
CO2: describe the best Troubleshooting for various automotive accessories.
CO3: sketch various electronic components find how they can be effectively used to improve the performance of a vehicle.
CO4: examine how these methodology are used in Industries by solving some real time problems.
CO5: formulate an electronic control problem.
CO6: select among the ICs for various applications

Topics:

- Wiring diagram
- Battery testing
- Alternator testing
- Starter motor
- Spark plug testing
- Rectifier circuit

AE 3002 Vehicle Maintenance

Credit: 3
Category: PCC
Prerequisite(s): Automotive, Suspension and Transmission System (AE 2002)

Course Description:

This course is intended to describe the process of automobile servicing to the students of Automobile Engineering who has sufficient knowledge of conventional automotive accessories. This course emphasizes on periodic maintenance and preventive maintenance for new automobile. The significance of the compulsory tools and special tools required to service a vehicle can be presented. In view of the best practices of industry record keeping plays an important role and students will have ample knowledge of it. Students will update their technical skill by tracking all the latest techniques introduced to the new models of vehicle. Students will also be introduced to troubleshooting critical problems.

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

CO1: state the necessity of record keeping in vehicle maintenance
CO2: describe the best practices in vehicle maintenance or servicing
CO3: select the compulsory and special tools of automobile workshop
CO4: examine the procedure of scheduling for repairing or overhauling work
CO5: formulate the plan to execute multiple work simultaneously in the automobile workshop
CO6: select after inspection and diagnosis the shortest path of troubleshooting a common failure

Topics:

- Preventive and Breakdown maintenance
- Maintenance records and Schedules
- Repair and Overhauling of engine
- Lubrication system, Fuel system and Body
- Repair and Overhauling of Chassis, Drive Line components
- Repair and Servicing of Electrical System
- Repair and Servicing of Cooling System
- Motor Insurance

Textbook(s):

1. Automobile Mechanical and Electrical Systems: Automotive Technology: Vehicle Maintenance and Repair, Denton T., Butterworth-Heinemann, 2011

Reference Book(s):

1. Motor vehicle engine servicing, Judge A.N., 3rd Edition, Pitman Paperback, London, 1969.
2. Motor Vehicle Mechanic's Textbook, Sully F.K., Butterworth-Heinemann; 5th edition, 2014
3. Vehicle Transport Management, Bhandarkar S.L., Dhanpat Rai &Co. New Delhi 2016

AE 3003 Electrical and Hybrid Vehicle Technology

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

This Course is structured to expose the students of automobile engineering to then world of electric and hybrid vehicles which are safe, reliable and environment friendly. Starting with Battery pack design the course covers selected component system specially designed for this purpose like DC-DC converters, Traction control etc. Students will have sufficient scope to learn the different series and parallel hybrid systems and the new generation fuel cell vehicles.

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

CO1: state electric vehicle technology and hybrid vehicles
CO2: discuss the basics of hybrid and electric drive trains
CO3: illustrate the standard hybrid system
CO4: compare the various vehicle power sources in hybrid vehicle technology
CO5: design drive train system and energy storage system of electric and hybrid vehicle
CO6: evaluate a low cost and energy efficient concept car following international regulations

Topics:

- Vehicle Battery Charge Capacity
- Battery Pack Design
- Power Electronic Converters-DC/DC Converters
- Electric Traction and Drive System Efficiency
- Parallel Hybrid
- Series Hybrid
- Introduction to Hybrid Vehicle Design
- Propulsion Motor
- Fuel Cell Heavy DutyVehicles

Textbook(s):

1. Electric and Hybrid vehicles Design Fundamentals,Iqbal Husain, CRC Press, second edition 2013

Reference Book(s):

1. Modern Electric, Hybrid Electric, and Fuel Cell Vehicles, Ehsani, CRC Press 2019
2. Hand book of Automotive Power Electronics and Motor Drives, Ali Emadi, CRC Press 2005
3. Introduction to Hybrid Vehicle System Modelling and Control, Wei Liu, Wiley 2015

AE 3004 Design of Automotive Components

Credit: 4
Category: PCC
Prerequisite(s): Design of Machine Elements (ME 3023)

Course Description:

This course is taught to the graduate students of automobile engineering. Design of components is a core competency expected of the graduates. Advanced level machine component design is taught in this course when the students have already known about mechanics of solids and kinematics of machine. IC engine components like piston, connecting rod are demonstrated and the students are exposed to the concept of factor of safety. Students fine tune their skill by designing components like valve spring and cam.

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

CO1: state and apply the design principle to study basic automotive components
CO2: discuss and determine geometrical dimensions of a component subjected to complex stress system
CO3: illustrate the new component design using factor of safety
CO4: design the component subjected to static and variable loads
CO5: propose the life of component subjected to complex loading
CO6: evaluate the assembly of complex machine parts

Topics:

- Stress concentration and Endurance limit
- Fracture and Fatigue based design
- Transmission shafts and stresses in shafts
- Combined torsion and bending loads
- Piston Design
- Connecting rodDesign
- Development of short and long crank arms
- Design of valve spring and valves

Textbook(s):

1. Design of Machine Elements, V.B. Bhandari,Tata McGraw Hill, 3rd Edition.
2. Design Data Hand Book, S. Md. Jallaludeen, Anuradha Pub.

Reference Book(s):

1. Machine Design, P.C. Sharma, K. Agarwal, S K Kataria and Sons, 2010.
2. Machines Design Data Book, P.S.G. College of Technology, Coimbatore.
3. Mechanical Engineering Design, Shigley J E, Mischiee C. R.; Tata McGraw Hill
4. Maleev and Hartman's Machine Design, CBS; 5th edition, 2011.

AE 3011 Fuels and Emission

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course is designed to teach the emission norms and clean air policy to the students of Automobile Engineering who has sufficient knowledge of internal combustion engine. This course emphasizes on conventional and non-conventional fuel for automobile. The significance of the control variables and techniques required to reduce emission. In view of the latest emission norms the measuring techniques of visible and invisible pollutant measurement is challenging and students will learn it with practical demonstration. Students will update their knowledge by tracking all the latest developments introduced to the new modes of power generation in vehicle.

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

CO1: state the need of different types of Alternative fuels in Automobiles
CO2: compare about the performance of Alternative Fuels used in Automobiles
CO3: illustrate the mechanism of pollutant formation in engines
CO4: examine the efficacy of policy to curb pollution in India
CO5: formulate different standards of automobile emission measurement
CO6: select a suitable exhaust treatment and control technique to curb harmful emission

Topics:

- Policy on pollution control
- Alternate Fuels
- Emission Standards
- Test Procedure & Instrumentation for Emission Measurement
- Control Techniques for SI and CI Engine:
- Exhaust gas recirculation
- Air injector PCV system
- Catalytic converters

Textbook(s):

1. Automotive Engineering Fuels and Emissions (Classroom & Shop Manual), Hollembeak B., Delmar CENGAGE Learning, 2004

Reference Book(s):

1. Engine Emissions, B.P. Pundir, Narosa Publishing House, 2007.
2. Internal Combustion Engines, V. Ganesan, Tata McGraw Hill, 2004.
3. Automobile Engineering, K.K. Ramalingam, Scitech Publications Pvt. Ltd., 2005

AE 3021 Tractor and Farm Equipment

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course is designed to teach about the basic structure of tractors and farm equipment the students of automobile engineering. Special arrangement of Cooling and lubrication system as well as the wheel structure for rough terrain driving will be interesting to the young graduates. Hydraulic and pneumatic system and their maintenance requires special skill for the technicians dealing in this agri-technology sector. Power management is taught practical demonstration. Students exploits various opportunities in trailer design and modifications beneficial to the farmers.

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

CO1: relate different component and part of tractor and power tiller and Farm Equipments.
CO2: identify the best Farm Equipment for land preparation.
CO3: illustrate the standard troubleshooting of tractor and power tiller.
CO4: examine proper engine and power train for tractor
CO5: construct proper attachment for lifting farm produce with minimum intervention
CO6: justify the PTO for different applications to suite Indian agriculture

Topics:

- General Design of Tractors
- Control of the Tractor and Fundamentals of Engine Operation
- Engine Frame Work and Valve Mechanism of Tractor
- Cooling system, Lubrication System and Fuel System of a Tractor
- Fuel tanks and filters; Fuel pumps
- Working attachment of tractors
- Power Take off
- Hydraulics and pneumatics, electro pneumatics
- Valves and actuators

Textbook(s):

1. Farm Tractor-Maintenance and Repair, S.C. Jain and C.R. Rai, McGraw-Hill Education.

Reference Book(s):

1. Tractor and Automobiles, Rodichev and G. Rodicheva, Mir Publishers, 1987.
2. Design of Automotive engines for tractor, Kolchin. A., and V. Demidov, Mir Publishers, 1972.

AE 3022 Two and Three Wheelers

Credit: 3
Category: PEC
Prerequisite(s): Kinematics and Dynamics of Machines (ME 2013), Internal Combustion Engines and Gas Turbines (ME 2022)

Course Description:

This course would encompass a comprehensive study of two stroke and four stroke SI engine and merits and demerits with respect to two and three wheelers. Types of scavenging processes, merits and demerits, scavenging efficiency, Scavenging pumps, Rotary valve engine are also important in this context.Chassis frame, its types, Single, multiple plates and centrifugal clutches are covered here. Gear box and gear controls, Front and rear suspension systems, Shock absorbers, Panel meters and controls on handle bar are discussed with demonstration. Disc brakes, front and rear brake links layouts, Spoked wheel, Cast wheel are also introduced. Stability of two wheelers on straight and curved path or the Chassis dynamometer analysis are most interesting topics here.

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

CO1: select best components of two and three wheeled vehicles given application.
CO2: design and develop a two wheeler or a three wheeler
CO3: test and, trouble shooting and diagnostics of two-wheeler and three-wheeler
CO4: evaluate performance of different models of two-wheeler and three-wheeler existing in India
CO5: select the drive train of electric scooter and e-rickshaws
CO6: design new vehicles as per requirement.

Topics:
- Internal combustion Engine basics
- Chassis and Sub-Systems
- Drum Brake and Disc Brake
- Wheels for two wheelers
- Two wheeler dynamics
- Two and three wheeler case studies
- ABS for Two wheelers

Textbook(s):
1. Two and Three Wheeler Technology, D.U. Panchal, PHI Learning 2015.

Reference Book(s:
1. Two Wheelers, RamlingamK. K., SCITECH, 2018
2. Automobile Engineering vol. I & II, Gupta, Satya Prakashan, 1st edition Reprint 2006.

AE 3023 Off-Road Vehicles

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

The subject is an elective course designed to give introductory knowledge about different types of off-road vehicles meant for various industrial applications. The course includes the construction, operation and maintenance of vehicles used in construction, road making and other allied industries. The vehicles focused in the course are excavator, shovel, dumper, dozer, grader and draglines etc. The important components of the vehicles such heavy duty diesel engines, torque converters, braking system, are also included. The course is also emphasizing on the periodic and overall maintenance and troubleshooting of these equipment.

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

CO1: name off road vehicles for different constructional and land preparation activities
CO2: compare various types of off road vehicles and their application
CO3: illustrate prime components' operating principle
CO4: test the efficacy of hydraulic systems used in off road vehicles
CO5: assemble and trouble shooting of off road vehicles
CO6: select proper maintenance schedule and mechanism of off road vehicles

Topics:

- Off road vehicle basics
- Engine and drive arrangement
- Transport Equipment structure
- Hydraulics and pneumatics
- Road making and maintenance Machines
- Working of other off road equipment
- Maintenance of off raod vehicles

Textbook(s):

1. Latest Development of Heavy Earth Moving Machinery, De, A., Annapurna Publishers, Dhanbad 1995

Reference Book(s):

1. Road Making Machinery, Abrosimov K., Bromberg and Katayev F., Mir Publishers, Moscow 1971.
2. Moving the Earth, Nichols, Herber L (Jr.), Galgotia Publishing House, New Delhi, 1962.
3. Digging of soils by earthmover with Powered Parts, Rudnev, V.K., Oxonian Press, 1985

AE 3031 Simulation of IC Engine

Credit: 3
Category: PEC
Prerequisite(s): IC Engine and Gas Turbines (ME 2022)

Course Description:

This course would cover a comprehensive study of the fundamental of combustion thermodynamics and chemical reaction that occurs during combustion inside the engine.Differentiation between actual and ideal thermodynamic cycles applied to IC Engine, liquid fuel injection and evaporation principles are very interesting. The effect of throttle operation and supercharging on engine performance, flame propagation can affect the simulation in SI engine as well as heat transfer process simulation.The valve timing and injection timing effect and simulation of unbalanced system for in engines is interesting.Diesel and petrol engine emission simulation is helpful in optimizing its control.

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

CO1: state the combustion phenomena and Combustion thermodynamics
CO2: discuss the actual thermodynamic cycle, air flow, liquid fuel evaporation and mixing
CO3: illustrate the flame propagation, heat transfer process, friction loss calculation
CO4: analyse mathematical model for engine simulation
CO5: formulate and simulate diesel and petrol engine performances
CO6: select the best modification in engine from simulated result analysis

Topics:

- Engine combustion fundamentals
- Air flow, fuel atomization and mixing
- Flame propagation
- Heat transfer
- Computer preparation from governing equations
- Simulation of Unbalanced Forces on two and four stroke engines
- Simulation and result study

Textbook(s):

1. Computer Simulation of spark ignition engine process, Ganesan. V., Universities Press (I) Ltd, Hyderbad, 1996.

Reference Book(s):

1. Modelling of Internal Combustion Engines Processes, Ramoss. A. L., McGraw Hill Publishing Co., 1992
2. Computer Simulation of Compression Ignition Engines, Ganesan. V., Orient Longman, 2000.

AE 3033 Thermal Systems In Automotive

Credit: 3
Category: PEC
Prerequisite(s): Heat Transfer (ME 3021)

Course Description:

This course is intended to describe engine cooling system, compressor and pumps to the students of Automobile Engineering who has sufficient knowledge of heat and mass transfer. This course emphasizes on cooling system in engine space as well as in cabin space. The significance of the heating ventilation and air conditioning system required for passenger comfort can be thoroughly understood. In view of the human comfort of air conditioning plays an important role and students will learn it with practical demonstration. Students will update their learning ability by knowing the design of heat exchangers for automotive which can be extrapolated to the power plants as well.

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

CO1: list the important thermal systems and its functions
CO2: describe the concepts to design heat exchangers
CO3: illustrate the various types of compressors
CO4: categorize the applications of different fluid systems
CO5: formulate and solve cooling load calculations and to select different types of fans.
CO6: justify one standard thermal system in computer and validate the result

Topics:

- System, boundary and surroundings
- Heat transfer and fluid flow in Heat engines
- Automotive Air Conditioning
- Air Compressors
- Centrifugal and axial compressors
- Fluid Transport
- Heat Exchangers
- Heat transfer rate, cost and pumping power
- Basic thermal design theory for reciprocators

Textbook(s):

1. Thermal Engineering, RajputR.K., Laxmi Publications, 8th Edition, New Delhi, 2010
2. Design and Optimization of Thermal Systems, Jaluria Y., CRC Press; 2nd edition, 2007

Reference Book(s):

1. Fundamentals of Engineering Heat and Mass Transfer, New Age Science Ltd., New Delhi, 2009
2. Heat and Mass Transfer, Yunus A. Cengel, Afshin J. Ghajar, Tata McGraw Hill, New Delhi, 2013

AE 3034 Vehicle Dynamics

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course is very important to the students of automobile engineering as it strengthens the design skill set. There are many interesting topics. The students will learn modelling and simulation and will develop expertize to utilize Hozler method for close coupled systems and branched systems. Gough's tyre characteristics plays a very important role in stability of the vehicle and the students will also know directional stability of the vehicle. Calculation of Tractive effort and reactions for different drives is also taught to students to give a holistic idea on vehicle dynamics and control.

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

CO1: state about the mechanical vibrating system
CO2: describe the suspension and tyre related vibrations
CO3: construct model for vibrations from vehicle
CO4: select suitable tyres and suspension for a vehicle
CO5: formulate the stability and handling characteristics of vehicle at different operating conditions
CO6: estimate the roll centre and pitch centre

Topics:

- Fundamental of vibration
- Modelling and Simulation
- Multi degrees of freedom systems,
- Vibration absorber
- Hozler method for close coupled systems and branched systems.
- Vehicle suspension in fore and apt directions.
- Gough's tyre characteristics
- Directional stability of vehicles
- Calculation of Tractive effort and reactions for different drives

Textbook(s):

1. Vehicle handling Dynamics Theory and Application, Masato Abe, Elsevier, 2015

Reference Book(s):

1. Vehicle Dynamics Theory and Application, Theory and Application, Reza N. Jazar, Springer.
2. Automotive Chassis, Heldt. P.M., Chilton Co., New York, 1982.
3. Vehicle Dynamics, Ellis. J.R., Business Books Ltd., London, 1991.
4. Steering, Suspension and Tyres, Giles. J.G. Steering, Iliffe Books Ltd, London, 1998.

AE 3037 Automotive Aerodynamics

Credit: 3
Category: PEC
Prerequisite(s): Fluid Mechanics and Hydraulic Machines (ME 2021)

Course Description:

This course would cover a comprehensive study of the importance of vehicle body, safety aspect in vehicle body design, different types of body according to shape and utility.Vehicle aerodynamics, types of drag and lift/down force, Various Forces and moments influencing drag, Effects of forces and moments are also included.Selected body optimization techniques for minimum drag considering thebasic fluid mechanics laws, various governing equations for drag force simulation are explained here. Experimental investigation procedure for drag calculation viz, wind tunnel technology, Flow visualization techniques and the wind tunnel balance is explained with demonstration. Effect of body shapes and its modification to reduce vehicle aerodynamics drag makes the way for body styling.

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

CO1: state the fundamentals of various automotive body construction details
CO2: describe the specific body styling of bus and passenger car
CO3: illustrate the forces and moments acting on car and bus under ideal flow conditions
CO4: inspect the wind tunnel testing and visualize flow field
CO5: design of a car body and determine aerodynamic interaction effects between different components attached on top of it
CO6: select the optimized cab of a commercial vehicle

Topics:

- Evolution of vehicle body
- Types of vehicle body according to utility
- Basic fluid mechanics laws, various governing equations
- Aerodynamics drag and lift fundamentals
- Simulation for determination of drag and lift
- Experimentation to determine drag and lift through scale model using wind tunnel

Textbook(s):

1. Aerodynamics of road vehicles, Wolf-Heinrich Hucho, 4th edition, 2000.
2. Modifying the Aerodynamics of Your Road Car: Step-by-step instructions to improve the aerodynamics of road cars, Julian Edgar, Richard H. Barnard, Veloce Publishing, 2019

Reference Book(s):

1. Vehicle Body layout and analysis, Mechanical Engineering Publication Ltd.,1984
2. Vehicle Aerodynamics: Wind Tunnels, CFD, Aeroacoustics, and Ground Transportation Systems Society of Automotive Engineers, U.S., 1996.
3. Low Speed Aerodynamics, PHI Learning Private Limited, 2017.

AE 3039 Battery Technology

Credit: 3
Category: PEC
Prerequisite(s): Chemistry (CH 1007)

Course Description:

This course is intended to describe the evolution of voltaic cell and various batteries to the students of Automobile Engineering who has sufficient knowledge of engineering chemistry. This course emphasizes on construction, reaction and applications for new batteries. The significance of the safety and reliability required to select a battery can be appreciated. In view of changing battery management systems the electronic circuit of BMS plays an important role and students will have ample knowledge of it. Students will also familiarize with various type of fuel cells and the recent research in membrane, electrode etc.

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

CO1: state the need to evolve energy storage system as a substitute to conventional IC engine
CO2: describe the process involved in the inter conversion of electrical energy and chemical energy
CO3: sketch the structure and schematic of battery and fuel cell
CO4: examine the process of battery state estimation
CO5: formulate and design a battery pack for an automobile
CO6: select among different type of fuel cell and battery for next generation automotive

Topics:

- Energy Storage Systems and Devices
- Lead acid battery
- Li-ion Battery Technology and Challenges
- Battery Management System
- Cell Balancing
- Battery State Estimation:
- Battery Health Estimation
- Fundamentals of Fuel Cells

Textbook(s):

1. Battery Technology for Electric Vehicles: Public science and private innovation, Albert N. Link, Alan C. O'Connor, Troy J. Scott, Routledge; 1st edition, 2015

Reference Book(s):

1. Lithium-Ion Batteries: Science and TechnologiesMasaki Yoshio, Ralph J. Brodd, Akiya Kozawa, Springer, 2009
2. https://batteryuniversity.com/learn/

AE 3042 Automotive Safety and Lighting

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course which deals with safety systems and the lighting system used in automotive is very much apt in imparting the knowledge on latest technological advancement of selected automotive system like advanced driver assistance system. In the present society the anxiety on road may increase the stress of the driver which increases the road accident throughout the world. Hence the graduate students must be aware how to appreciate and affect the changes in automotive system so that the chance of accident is minimized and in case of accident the injury remains minimum. Injury criteria is changing with time and affects the body styling and material therefore the students must learn the ergonomic design and illumination calculation so that they can be part of the development team working on Optimization of vehicle structures for crash worthiness.

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

CO1: state the best safety attachments and ergonomics
CO2: describe an automobile for the safety and comfort
CO3: illustrate the safety standards
CO4: analyze the basics of lighting, reflection and refraction
CO5: formulate an electronic system to improve a car to make it an intelligent vehicle
CO6: select most suitable automotive lighting systems

Topics:

- Active and passive safety
- Driver assistance systems in automobiles
- Optimization of vehicle structures for crash worthiness
- Photographic analysis of impact tests
- Ergonomics in Automotive safety
- Injury criteria and relation with crash
- Survival space requirements
- Warning devices, indicators, hinges, latches, wipers, horns etc.
- Illuminant calculations
- Regulations, test requirements and testing procedure.
- Adaptive front lighting system

Textbook(s):

1. Low speed Automobile Accidents, Alan J. Watts, Dale R. Atkinson, Corey J. Hennessy, Lawyers & Judges Pub Co; 3rd edition, 1996

Reference Book(s):

1. An Introduction to Modern Vehicle Design, Jullian Happian-Smith SAE, 2002
2. Crashworthiness of Vehicles, Johnson, W. and Mamalis, A.G., MEP, London, 1995
3. Lamps and Lighting, Edward A., Hodder & Stoughton, London, 1993.

AE 3044 Theory and Design Of Jigs and Fixtures

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This is a course designed to focus on the manufacturing of automobile components their assembly and disassembly. Preliminary analysis and planning of Jigs and fixture parts and their materials need to be thoroughly understood by the graduate students of automobile engineering. State of the art requires the skill set in handling any component with care. The students will know how to do Loading, Entering, locating and clamping in the factory. Industry expertise also require a fine knowledge of three construction principles, Built-up type, casting and weldment.

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

CO1: state the most suitable jigs and fixture for automotive application
CO2: describe and prepare Jigs and fixtures for given components
CO3: illustratethe proper clamping and support system
CO4: categorize different method of loading and unloading
CO5: assemble effective cutter guidance system
CO6: evaluate the best among different jigs and fixtures

Topics:

- Principles of Jigs and Fixtures design
- Planning of Jigs and fixture parts and their materials
- Degrees of freedom-3-2-1 location principle
- Radial location and diamond pin location
- Loading, Entering, locating and clamping
- Chip problems, relief and projection, shields and seals
- Press fit bushes
- Three construction principles, Built-up type, casting and weldment
- Optimizing various types of jigs
- Internal and external broaching fixtures

Textbook(s):

1. Jigs and fixtures, Joshi. P.H. Tata McGraw-Hill, 1988

References Book(s):

1. Jigs and Fixtures, Design Manual Industrial Henriksen, Erik. K., Press Inc., Madison Avenue, New York, 1983.
2. Tool design Donaldson G.H., Lecain, Gould. V.V., , TMH Edition, 1990
3. Fundamentals of Tool design ASTME, Prentice Hall, 1989.

AE 3052 Intelligent Vehicle Technology

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

Automobile engineering students learn about the handling of large fleet and traffic on highway by intervention of information technology here. It's important to adapt to the new technology in the transport sector to save time and fuel which have direct impact on environment and human life. Students learn about Data acquisition system, Global position system with the present day demand in amalgamation of Big data analysis and artificial intelligence. So the students with knowledge of this subject can appreciate any Processing System and Control System in broader sense.

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

CO1: name the intelligent vision system used in automobiles
CO2: explain the architecture of intelligent transportation system
CO3: illustrate the adaptive control technique for an autonomous vehicle
CO4: analyze the scope of intelligent vehicle in Smart city development in India
CO5: design for reliability of Sensor Based Manoeuvre
CO6: select anadvanced autonomous vehicle system

Topics:

- Vision Based Driver Assistance System
- Pedestrian Recognition
- Intelligent Transportation System
- Communication Systems and Services
- Global Positioning system.
- Automatic Control of Highway Traffic
- DARPA Challenge
- Prototype vehicle Hardware
- Data acquisition System
- Processing System and Control System

Textbook(s):

1. Intelligent Vehicle Technologies, Ljubo Vlacic, Michel Parent and Fumio Harashima, Butterworth-Heinemann publications, Oxford, 2001

Reference Book(s):

1. Autonomous Vehicles Intelligent Transport Systems And Smart Technologies, Nicu Bizon, Lucian D. Ascalescu and Naser Mahdavit Abatabaei, Nova Publishers, 2014
2. Intelligent Vehicle Technology and Trends, Richard Bishop, Artech House Publishers, 2005

AE 3054 Design of Racing Car

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course is focused only on the special requirement in developing a racing car as a product. Automobile engineering graduates are aware of the various racing events and take part in those events to exploit the opportunities in design modification which may later be imitated in a light commercial vehicle light motor car. Aerodynamic Force and Moment calculation is an important aspect to make a racing car to achieve high speed and its control under dynamic condition. Students learn about Transient Manoeuvrings with practical demonstration.

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

CO1: state the racing vehicle characteristics
CO2: identify the aerodynamic requirements in racing vehicles
CO3: illustrate the concepts of chassis behaviour of racing vehicles
CO4: analyze the suspension characteristics of racing vehicles
CO5: formulate problems faced in drives and braking systems in motorsports
CO6: estimate a G-G curve for a sports car developed indigenously

Topics:

- Racing Objective
- Longitudinal acceleration and lateral acceleration
- Circular Skid Pad Testing
- Aerodynamic Force and Moment
- Chassis Track Width and Chassis Ride Spring Rate
- Roll Stiffness and Roll Stiffness Distribution
- Instant Axis Concept
- Transient Manoeuvrings
- Bump Damping and Rebound Damping
- ABS In Racing; Carbon-Carbon discs

Textbook(s):

1. Advanced Race Car Chassis Technology HP1562: Winning Chassis Design and Setup for Circle Track and Road Race Cars, Bob Bolles, HP Books; Revised edition, 2010

Reference Book(s):

1. Race car vehicle dynamics, William F. Milliken and Douglas L. Milliken, 11th edition, SAE, 1995.
2. Formula 1Technology, Peter Wright, SAE International; 1st edition 2001.

AE 3056 Fundamentals of Tyre Technology

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

Tyre technology is a course designed to the most sought after component viz. tyre of automotive.Tyre is the connection between the road and the vehicle subjected to various forces. Vehicle stability in acceleration and braking is dependent on tyre and the tyre may affect the fuel economy of the vehicle. Construction of tyre which involves basic principle of mechanics of solids also requires the attention in composite material. Inspection of tyre requires highly technical skill and hence taught along with laboratory demonstration.

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

CO1: state various methods of tyre manufacturing
CO2: describe the forces and moments acting on tyres
CO3: illustrate wear possibilities, their causes and measurements
CO4: test the safety of tyres and its failure analysis
CO5: organize the tyre testing standards
CO6: select the best tyre with respect to load, service life

Topics:

- Belted Bias and Radial Bias Tyre
- Indoor Test and Outdoor Test
- Tyre dynamics
- Road Wear and Force Distribution
- Sound Generation Mechanisms
- Tyre Structural Failures;
- Shearography and Ultrasound test

Textbook(s):

1. Systematic Review of Tyre Technology, Yasuhiro Ishikawa, National Museum of Nature and Science Vol.16, 2011
2. US Department of Transportation., The Pneumatic Tire, February 2006

Reference Book(s):

1. Tire and Vehicle Dynamics, Hans B. Pacejka, 3rd Edition, 2002
2. Vehicle Dynamics: Theory and Application, Reza N. Jazar, Springer 2008

AE 3058 Assembly Line Automation

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course is framed to teach the students of automobile engineering about the modern automated industry 4.0. It is important for the automobile professionals to have prior knowledge of PLC programming and dynamic path planning to run a modern industry. Students learn about Pneumatic components, Fluid power actuators, direct and inverse kinematic differential motion and Jacobians. The transition for from industry 3.0 to industry 4.0 is well explained to the students with practical examples.

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

CO1: name the applications of PLC applicable to automobile assembly line
CO2: describe the PLC programs to solve industrial control problems
CO3: illustrate the processes to be best done by robotics application to reduce cost and increase productivity
CO4: categorize and apply pneumatic and hydraulic circuit using computer for automated factory
CO5: propose the best pneumatic actuator for a given application
CO6: evaluate a hydraulic link based on load requirements

Topics:

- Fundamental of Manufacturing and automation
- Automation strategies
- Overview and architecture of automated industry
- PLC programming
- Pneumatic components
- Fluid power actuators
- Direct and inverse kinematic differential motion and Jacobians.
- Dynamics path planning, trajectory planning and control
- Off line programming and simulation
- Hierarchy of computers in manufacturing,
- Overview and architecture of Industry 4.0

Textbook(s):

1. Industrial Automation and Robotics, A. K. Gupta and S. K. Arora, Laxmi Publications, New Delhi
2. Computer-Based Industrial Control, Krishna Kant, Prentice Hall of India Ltd, 1997.

Reference Book(s):

1. Oil Hydraulics, Majumdar S.R., Tata McGraw Hill, 2000.
2. Fluid power with application, Anthony Esposito. Pearson education, 2000.
3. Fundamentals of Industrial Instrumentation and Process Control, William C. Dunn, Tata McGraw Hill, 2009.

AE 3060 Vehicle Life Cycle Management

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course enables the students to understand the womb to grave concept for any automobile component vis-à-vis the modern industry practices. It's important to implement stringent practices to protect the environment as an automobile in general has a lot of potential to damage the environment. Graduates of automobile engineering going through this course is thoroughly aware of ISO 14001 certification of automobile industry and cost effective policy implementation to cope up with a challenging automotive market.

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

CO1: state the basic components and functionality of a PDM system
CO2: compare between the PDM and PLM
CO3: illustrate a PDM system to support and control a product realization process
CO4: categorize, configure, and adjust a PDM system to effectively support, follow up and control the project
CO5: propose an environment friendly scrap management policy
CO6: evaluate the best waste management technique in recycling old vehicle

Topics:

- Total life cycle management
- Life Cycle Costing method
- Vehicle End Life
- Design for end of old vehicle management
- Environment and health
- Harmonization of Environmental Goals
- Total quality environment (TQE)
- Environmental management system (EMS)
- ISO 14001
- Environmental policy implementation

Textbook(s):

1. Automotive Scrap Recycling: Processes, Prices and Prospects, James. W Sawyer, Routledge, 2015

Reference Book(s):

1. Sustainable Management of Automobile Waste, Forbid George Teke, VDM Verlag, 2010
2. Automobile Life Cycle Tools and Recycling Technologies, Society of Automotive Engineers, 1993

AE 3082 Minor Project

Credit: 2
Category: PROJ

Course Description:

Students are required to undertake a minor project either as an individual or in a group in consultation with the project guide which may be completed in one semester. The project work is aligned with the discipline of the student and its allied areas. It is preferably related to certain research objective or advanced technical domain. Students will demonstrate higher level learning outcomes and cognitive skills in the implementation of the project.

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

CO1: perform a background study on certain technical aspect and formulate a project objective
CO2: outline a pathway for the implementation of the project within the time line
CO3: apply fundamental engineering concepts, advanced technical know-how, use modern engineering tools, perform experiments and critically analyze the data
CO4: provide engineering solutions, design system components or processes with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
CO5: function effectively as an individual, and as a member or leader in a team under multidisciplinary settings following ethical practices
CO6: communicate effectively with a range of audiences and prepare technical reports

AE 3092 IC Engine and Vehicle Maintenance Laboratory

Credit: 1
Category: PLC
Prerequisite(s): Internal Combustion Engines and Gas Turbines (ME 2022)

Course Description:

This laboratory is intended to describe the fundamental concepts and the function of each and every components of both petrol and diesel engine, It provides knowledge to evaluate engine characteristics such as; thermal efficiency, bsfc etc. of petrol and diesel engine. In order to enhance the knowledge for vehicle maintenance, record preparation, check list preparation for various trouble shooting are also included. Checking of the cylinder bore, measurement of worn-out cylinder bore of an IC engine, perform the grinding, lapping, valve setting and valve leakage in the given valve, wheel geometry correction methodology are also kept in the course. Fault diagnosis and service of transmission system, Fault diagnosis and service of braking system carried out in laboratory.

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

CO1: state the function of each and every components of both petrol and diesel engine
CO2: describe engine characteristics such as; thermal efficiency, bsfc of two and four stroke petrol and diesel engine
CO3: illustrate and study the different statements / records required for the repair and maintenance works
CO4: examine the cylinder bore, measure worn-out cylinder bore and perform the grinding, lapping, valve setting and valve leakage in the given valve
CO5: formulate the major and minor tune-up of gasoline and diesel engines and wheel geometry correction
CO6: interpretfault diagnosis and service of transmission system and fault diagnosis service of braking system

Topics:

- Valve timing and Port timing diagram
- Petrol Engine performance
- Diesel Engine performance
- Engine dismantle
- Gearbox dismantle
- Lubrication and cooling
- Wheel balance and wheel alignment
- Brakes' service
- OBD scanner
- Emission testing

AE 4001 Automotive Quality Management

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

This course gives the automobile engineering students an exposure to quality engineering as practiced internationally. System certification is the process followed everywhere and this course teaches the standards ISO 9000 and ISO TS16949. 5s concept, Kizen technique and six sigma changed the scenario of manufacturing quality product all over the world and automotive components carry the quality mark to be relevant in the market. Students fine tune their skill using statistical process control so that they can be industry ready with proper knowledge of quality standards.

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

CO1: state the quality engineering and quality management
CO2: describe the best quality assessment for given Automobile Industry
CO3: illustrate the quality concepts in different time frame and different countries
CO4: analyzethe different Quality Management techniques, system and standards
CO5: formulate the problems related to Application of management tools and techniques for process improvement
CO6: justify the TS16949 quality system practices

Topics:

- Fundamentals of quality and services
- ISO 9000 clauses and its interpretations
- ISO TS16949 clauses and interpretation
- Modern Management Tools and Techniques
- 5s concepts
- Kaizen techniques
- Six sigma methodologies
- Taguchi loss function and POKE-YOKE Techniques
- Advanced Product Quality Planning (APQP)
- Statistical process control
- Introduction to Hypothesis Testing

Textbook(s):

1. Automotive quality system Handbook, David Hoyle, Butterworth Heinemann Ltd., Second edition, Oxford, 2000

Reference Book(s):

1. Introduction to statistical control, Montgomery Douglus C., John Wiley and Sons, New Delhi, 2007
2. Managing for total quality-From Deming to Taguchi and SPC, Logo Thetis N., Prentice Hall of India (P)Ltd., New Delhi, 1997

AE 4002 Auxiliary Systems in Automotive

Credit: 3
Category: PEC
Prerequisite(s): Automotive Mechatronics (AE 2004)

Course Description:

Modern vehicle have thousands of components and the modern amenities are needed for safety and reliability of an automobile. This course is to brief the students about selected advance devices which makes the vehicle adapted to latest technology including the infotainment system. Graduates of automobile engineering are confident in dealing with the new vehicle system only if they are fully aware of the electronics used in controlling various parameters and here its taught with practical demonstration.

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

CO1: state the role of artificial intelligence in modern automobiles
CO2: describe the auxiliary systems of chassis
CO3: illustrate the vehicle motion control and stabilization system
CO4: categorize the Driver assistance, security and warning System
CO5: assemble the Safety and comfort system used in automobiles
CO6: justifythe recent changes in Motor vehicle act regarding safety

Topics:

- Vehicle Motion Control and Stabilization System
- Adaptive Cruise Control System
- Electronic Transmission Control System
- Anti-lock Braking System
- Traction Control System
- Electronic Stability Program
- Electronic Brake Force Distribution System
- Information, security and warning system of automotive
- Electronic monitoring and enforcement of road safety

Textbook(s):

1. Modern Automotive Technology, James E Duffy, Goodheart-Wilcox Publisher; 9th Edition, 2015
2. Motor vehicle (amendment) bill 2017, Save life foundation, www.savelifefoundation.org

Reference Book(s):

1. A Text book of Automobile Engineering, Volume-II. P.S. Gill, S.K. Kataria & Sons, First Edition, 2012
2. Understanding Automotive Electronics, Bechhold, SAE, 1998.
3. The Motor Vehicle, T. K. Garrett, SAE USA, 13th edition 2009.

AE 4003 Turbochargers and Supercharger

Credit: 3
Category: PEC
Prerequisite(s): Fluid Mechanics & Hydraulic Machines (ME 2021)

Course Description:

This course emphasizes on the improving the power output of engine due to fast combustion by introducing turbocharger or supercharger. This course dissects the basic principle of fluid mechanics and hydraulic machines vis-à-vis a practical application. The significance of utilizing the high grade energy available at exhaust can be appreciated. Incoming turbulent air plays an important role in combustion and the students will have ample knowledge of it. Students will update their technical skill by designing a hydraulic machine like a turbocharger. Principle learnt can be extrapolated in understanding any other hydraulic machine used in industry or power plant.

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

CO1: state the basics of Supercharging and compressor working in an automobile
CO2: describe the fluid flow maps of supercharging systems
CO3: demonstrate the Modern design features of exhaust turbocharger features
CO4: analyze a turbocharger working thermodynamically
CO5: design a turbine blade using the principle of momentum conservation
CO6: evaluate the improved efficiency of turbocharged engine

Topics:

- Fundamentals of compressor matching
- Relationship between air consumption and power.
- Turbo-cooling process
- Rotor design process
- Flow Maps of Supercharging Systems
- Thermodynamics of Turbo-charging
- Exhaust manifold arrangements for various firing sequences of engines. Altitude de-rating.
- Cooling flow measurement techniques.
- Exhaust gas recirculation

Textbook(s):

1. Engine Systems by Supercharging of Internal Combustion Engines,Zinner K A., Auxillary Springer, 1978.

Reference Book(s):

1. Turbocharging the Internal Combustion Engines,Watson N., Janota M S., Springer 1982
2. Charging the Internal Combustion Engine,Hiereth H., Prenninger P., Springer 2010

AE 4081 Project-I

Credit: 3
Category: PROJ

Course Description:

Students are required to undertake a final year major project either as an individual or in a group in consultation with the project guide which may be completed in one year. The project should be related to certain research objective or advanced technical domain. The work encompasses two semesters and to be carried out in two phases (Project-I and Project-II). In Project-I, students are expected to complete detailed literature review, identify their objective and start working on the same; perform experiments, carry out analyses and report their findings to their supervisors and the panel.

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

CO1: conduct a detailed research survey or background study and summarize the theory and findings
CO2: formulate a research question or a general objective of the project
CO3: propose and outline the solution to the research question or a pathway for the implementation of the project with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
CO4: conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions
CO5: function effectively as an individual, and as a member or leader in a team under multidisciplinary settings following ethical practices
CO6: communicate effectively with a range of audiences and prepare technical reports

AE 4082 Project-II

Credit: 10
Category: PROJ

Course Description:

Project-II is a continuation of Project-I, the second phase of final year major project. Students should complete all related experiments, develop a final solution, product or system and validate the applicability of the same under real time scenario with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors. They produce a detailed technical report on their work as well as individual contribution reports. Throughout the implementation of the major final year project, students should demonstrate all cognitive skills and attainment of all program outcomes and student outcomes.

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

CO1: readily apply fundamental concepts in their area of study for executing the projects
CO2: demonstrate skill in using modern technical tools, apply advanced technical knowledge, integrate information from different sources, perform complex experiments and critically analyze the findings to draw conclusions
CO3: provide engineering solutions to predefined research question or project objective; design system components or processes with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors
CO4: function effectively as an individual, and as a member or leader in a team under multidisciplinary settings following ethical practices
CO5: communicate effectively with a range of audiences and prepare detailed technical reports
CO6: demonstrate knowledge and understanding of the management principles in executing their project as a member or leader of the team, and willingness to engage in life-long learning

COURSES OF OTHER PROGRAMMES

EC 2025 Principle of Electronics Engineering

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

The course objective is to make students of Engineering to understand the efficacy of Electronic principles which are pervasive in engineering applications. Students will be able to understand the essence and applications of electronic components used in different electronic circuit. They will understand the working of diode and transistor and their characteristics, benefits of feedback in amplifier, oscillators, design of simple circuits like amplifiers (inverting and non- inverting), adders, integrator and differentiator using OPAMPS, a digital logic and apply it to solve real life problems.

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

CO1: understand the properties of semiconductors and current conduction mechanisms
CO2: comprehend the working of P-N junction diodes; identify different diode circuits and analyse them
CO3: understand the working of BJT, different modes and configuration, identify and analyse their biasing circuits, understanding the working of CE amplifier and its properties
CO4: analyze the working of op-amp using either inverting or non -inverting configurations, timing circuit, regulated power supply ICs and their applications
CO5: comprehend the concept of feedback in electronic circuits, types of feedback, their applications
CO6: comprehend the working of different logic gates, combinational and sequential circuits, develop a brief idea about microprocessor and microcontrollers

Topics:

- Semiconductors
- Junction Diodes
- Bipolar Junction Transistor (BJT)
- Feedback Concept
- Operational Amplifiers (OPAMP) and 555 timer
- Digital Electronics

Textbook(s):

1. Electronics- Fundamentals & Applications- D. Chattopadhyay and P.C Rakshit- 11th Edition (New Age International)
2. Electronic Devices and Circuits- D. A. Bell- 5th Edition (Oxford)

Reference Book (s):

1. Electronic Devices & Circuits- R. L. Boylestad- 10th Edition(Pearson)
2. Digital Principles and Applications- A. Malvino and Leach-7th Edition(TMH)

EC 2095 Electronics Engineering Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Nil

Course Description:

The course objective is to give students the practical knowledge of designing and analysing various electronic circuits such as Rectifiers, Diodes and Transistor characteristics, applications of operational amplifiers, digital electronics circuits and 555 timer as Multivibrator so that they will be able to understand the practical aspects of Principles of Electronics Engineering theory.

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

CO1: identify the different active and passive components & apply different measuring devices and instruments for measurement and testing of the various active and passive components
CO2: analyze the different types of waveforms and calculate their amplitude & frequency
CO3: design and analyze simple circuits using elementary electronic components e.g. different sources, resistors, capacitors and non-linear elements such as diodes & transistors and analyze its working operation & characteristics
CO4: learn how operational amplifiers are modelled and analyzed, and to design Op-Amp circuits to perform operations such as summing, integration and differentiation on electronic signals
CO5: analyse the working operation and verify the truth table of different logic gates and flip-flops
CO6: design and analyse 555 timer as A stable Multivibrator and the study the performance characteristic of Monostable Multivibrator using 555 timer

Topics:

- Familiarization with electronic components
- Familiarization with electronic equipment (CRO & Function Generator).
- Study the V-I characteristics of P-N Junction diode and Zener diode
- Full wave rectifier with and without filter
- Clippers and clampers
- CE NPN Transistor characteristics
- Inverting and non-inverting op-amp(LM741)
- Differentiator and integrator amplifier using op-amp(LM741)
- Logic gates and flip flops (Study of truth table)
- Monostable and astable multi vibrator using 555 Timer

EE 2009 Electrical Machines and Power Electronics

Credit: 3
Category: PEC
Prerequisite(s): Basic Electrical Engineering (EE 1003)

Course Description:

Principle of operation, Types of DC Machines, Losses and Efficiency, Characteristics of different DC Machines,Speed control of DC Motor, construction and operation of Three-phase induction motor,Torque-Slip characteristics,Construction, Principle of Operation of single phase and three phase transformer, different tests, Regulation, Losses and Efficiency,Three Phase Transformer Connections, Power Semiconductor Devices, Thyristor Characteristics.

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

CO1: remember the Construction, principle and efficiency of different DC machines
CO2: understand the Speed control and characteristics of DC machines
CO3: evaluate the performance characteristics, different methods of starting and speed control of three phase induction motors
CO4: apply phasor diagram to find the voltage regulation of a Synchronous generators
CO5: remember the construction, principle, losses, efficiency and Phasor diagram of transformers
CO6: remember the working principles of various power electronic semiconducting devices

Topics:

- DC Generator
- DC Motor
- Three Phase Induction Motor
- Synchronous Generator
- Single Phase Transformer
- Three Phase Transformer
- Power Electronics Devices

Textbook(s):

1. Electrical Machinery by P. S Bimbhra, 7th Edition, Khanna Publishers, 2008.
2. Power Electronics, by P S Bhimbra, Khanna Publishers, 5th Edition, 2011.

Reference Book(s):

1. Electrical Machines by Ashfaq Hussain, Dhanpat Rai, Delhi, 2nd Edition, 2008.
2. Electrical Machines, by P. K. Mukharjee and S. Chakravorti, Danpat rai Publication,2nd Edition, 18th reprint 2013.
3. Electrical Machines, by P. Purkait and I. Bandyopadhyay, Oxford University Press. 1st Edition, 2017.

HS 2002 Engineering Economics

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Engineering Economics is a specialized need-based extension of applied Economics which is aimed at developing an understanding of the principles governing Economy's vital parameters like market, finance, Production,consumption and distribution.. The course focuses on learning methodical and rational conceptualization and developing the knowledge for effectively implementing these market principles in actual organizational activities and forums. The course intends to develop the ability of taking decisions related to project selection and implementation, optimization of market vitals like sales, revenue, profit, cost etc. It serves as the base of learning all Economics related elective papers offered in higher semesters as well as preparation for any competitive exams like civil services, MAT etc.

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

CO1: apply economic theory for optimisation of the economic variables of demand, supply,sales,profit, cost and revenue
CO2: apply the budgeting principles in making economic decisions during project appraisals
CO3: develop awareness towards all the economic issues related to the financial market, Budget, Money, Credit and Fiscal Policies etc.
CO4: relate and apply theoretical concepts in Economics with contemporary/modern business practices
CO5: understand the vitals of the financial market, know the source and methods of raising capital for an organization
CO6: understand the depreciation of asset principles and efficient inventory/resource management

Topics:

- An Introduction to Economics and Engineering Economics
- Basic Concepts of Economics: Market equilibrium and Consumers and Producer's equilibrium
- Elasticity and Demand Forecasting
- Optimization of Profit and cost
- Break Even Analysis
- Evaluation of Projects: Economic Appraisal Techniques
- Depreciation calculation and Inventory management
- Vitals of Money and capital market

Textbook(s):

1. Managerial Economics: Principles and Worldwide Applications. Dominick Salvatore,Siddartha K.Rastogi,8th Edition,Pub.Oxford University Press.ISBN: 9780199467068.
2. Engineering Economics –James L.Riggs, DavidD.Bedworth and Sabah U.Randhawa,4th Edition, McGraw Hill Education(India) Private Limited, New Delhi,2016.

Reference Book(s):

1. Principles of economics, Deviga Vengedasalam and Karunagaran Madhavan, Oxford University Press, New York,3rd Edition,2013.

2. Managerial Economics-Principles and Worldwide Applications-Dominick Salvatore, Adapted by Ravikesh Srivastava,7thEdition, Oxford University Press,2012.
3. Micro ECON-A South-Asian Perspective-by William A. McEachern and Simrit Kaur, Cengage Learning, 2013.
4. Engineering Economy-Zahid A. Khan, Arshad Noor Siddiquee, BrajeshKumar, Pearson Publication, 2012.
5. Engineering Economics – R.Panneerselvam, Pub: PHI Learning Private Limited, New Delhi, 9thEdition, 2008.

HS 2008 Economic Environment of India

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The Course on Economic Environment of India is designed to cater encompassing discernment of Indian Economy to the students. The course precisely highlights the role of different sectors in Indian economy and also touches upon the normative aspect of striking balance among different sectors. It covers the status of public economics in Indian context. Besides, it ensures the students to have knowledge on the role of foreign sector.

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

CO1: develop the analytical understanding of the economic situation of the country
CO2: develop the skill to interpret the economic indicators during steady growth path and economic crisis
CO3: acknowledge the role of different policy making bodies in India related to economic affairs
CO4: develop the ability to analyze the occupational structure of the country and sectoral contribution to growth
CO5: examine the extent and role played by foreign sector in the form of exchange rate, FDI etc in the domestic economy
CO6: develop a critical understanding of the fiscal position of the country

Topics:

- Economic Crises and Way out: Economic Crisis of early 1990s-Macro Economic Reforms since 1991
- Primary Sector and Secondary Sector: Agriculture during the Reform Period; New Industrial Policy
- Tertiary Sector and Foreign Sector: Service sector as the engine of growth in India; Trade reforms
- Public Finance: Fiscal reforms in India post 1991; Centre-State Fiscal relationship

Textbook(s):

1. Dutt and Sundaram.Indian Economy. latest edition.

Reference Book(s):

1. Uma Kapila (2019), Indian Economy since Independence, New Delhi, Academic Foundation.
2. Balakrishnan, P. (2010): 'Economic Growth in India: History and Prospect'. Oxford
3. University Press, New Delhi.
4. Bhagwati Jagdish and Arvind Panagariya(2012): ' India's Tryst with Destiny'. Collins Business, Noida, India.
5. Jean Dereze and Amartya Sen (1996): 'Indian Development: Selected Regional
6. Perspectives'. Oxford University Press, New Delhi.
7. Ajijava Raychaudhuri and Prabir De (2012), International Trade in Services in India, New Delhi, Oxford University Press.

HS 2010 Financial Institutions, Markets and Regulations

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Financial Institutions, Markets and Regulations is a specialized need-based extension of Financial Economics. This course is designed to present the fundamental concepts and theories in financial market and promote the application to the workplace and professional practice. It introduces current financial concepts and tools towards money management in organizations participating in the local and global economies. The course covers the current best practices in financial analysis and planning through the application of financial concepts in a nutshell. These include financial vitals relate to money and capital markets, time value of money, cost of capital, risks and return, long-term financial budgeting. Inaddition, the course also introduces topics on lease financing, hybrid securities and derivatives, trust funds, mergers and acquisitions and related issues in current financial sector.

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

CO1: have comprehensive understanding of the nature and functions of the several types of financial institutions operating in the market
CO2: develop critical skills in applying the principles of finance and financial inter-mediation to the real world situations
CO3: effectively interact with the financial markets they need to approach for their future economic endeavors and/or in their place of employment
CO4: make economic decisions and analysis of issues related to security market transactions and policies
CO5: develop the understanding of the structure and functions of Indian financial institutions, instruments and policies
CO6: take decisions regarding saving, investments, portfolio contents and diversification to maximize their return and reduce associated risks

Topics:

- Financial systems: Significance of banks and all other Financial institutions
- Financial Innovations
- Overview of Structure of Financial Debts and Equity markets
- Functions of Financial Intermediaries
- Monetary authority: Reserve Bank of India: Its role, structure and functioning
- Subprime crisis
- Derivative markets
- Capital market authority: structure and functions
- Regulation of Capital market, Role of SEBI

Textbook(s):

1. Madura, Jeff (2008), Financial Markets and Institutions, 8th edition, Thomson Publications.

Reference Book(s):

1. Fabozzi, Frank, Modigliani, Franco, Jones, Frank (Feb 2009), Foundations of Financial Markets.
2. Eakins, Stanley G. (2005), Financial Markets and Institutions (5th Edition), Addison Wesley.
3. Howells, Peter, Bain, Keith (2007), Financial Markets and Institutions, 5th Edition.

4. Barth, James R., Caprio, Gerard, and Levine, Ross (2008), Bank Regulations are Changing: For Better or Worse?, Association for Comparative Economic Studies.
5. Goldstein, Morris (2006), Financial Regulation after the Subprime and Credit Crisis, Washington: Peterson institute.

HS 2012 Development Economics

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Development Economics is a specialized need-based extension of Economics dealing with issues related to economic growth and development. It provides an in depth discussion of the different economic description of development and underdevelopment. It will put a deep insight into the most challenging economic issues of poverty, inequality and underdevelopment faced by the humanity. It will deal with the various existing, modern and developing strategies and policies to tackle these issues and foster the economy onto the path of development. The students will be able to assess the pros and cons of a proposed development intervention and its likely impact on the target population.

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

CO1: develop the understanding of issues related to economic growth and economic development
CO2: relate and apply the major growth theories in their related academic projects
CO3: develop the familiarity with major economic issues faced by the country like poverty, inequality, underdevelopment etc.
CO4: analyse and compare the development paths adopted across countries of the globe
CO5: analyse the empirical evidence on the pattern of growth and development
CO6: develop critical understanding of the existing, adopted and needed policies and strategies for sustainable growth and development

Topics:

- Concepts and difference between growth and development.
- Measures of growth and development
- Models of growth and development
- Poverty and Inequality : Perceptions, estimation and measures of improvement
- Impact of poverty and inequality on growth and development
- Cross country perspectives of development

Textbook(s):

1. Todaro, M. P. & Smith, S. C. (2015), Economic Development, Pearson (12^{th} Edition).
2. Thirlwall A. P. Growth and Development (6 th and 7 th edition)

Reference Book(s):

1. Debraj Ray : Development Economics
2. Meier and Rauch,: Leading Issues in Economic Development, OUP, Latest Edition
3. Kaushik Basu :Analytical Development Economics , OUP
4. Human Development Reports, various years
5. Bagchi A. K. The Political Economy of Underdevelopment, Cambridge University Press 1982.

HS 2081 Business Communication

Credit: 1
Category: HSMC
Prerequisite(s): Nil

Course Description:

This course is designed to give students a comprehensive view of communication, its scope and importance in business. This is an interactive course with a view to enhance language and soft skills with the aid of live demonstration within the framework of the syllabus. It is a foundation building measure to enable the students to excel in the corporate world and in day to day life.

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

CO1: develop competence in reading and comprehension, develop skimming skills for extracting the main idea(s) from the text, and scanning for keywords
CO2: enrich the fluency of the students with Collocations and Phrasal Verbs
CO3: use Email effectively and efficiently as per the organization hierarchy. To retain a logical flow while drafting emails, make aware students about the importance of succinct written expression in modern Business Communication
CO4: write standard and effective Cover Letters and Resume
CO5: bridge the gap between native language and target language i.e. English, make students communicative competent and develop their fluency in public speaking
CO6: prepare effective Power Point Slides. Maintain and arrange proper data structure in presentations. To learn skills of making effective presentation (verbal and non-verbal aspects)

Topics:

- Reading Comprehension – Activity based on BEC Training – Matching, Multiple Choice Questions, Open Close, Giving Appropriate Headings
- Collocation – Activity based on Word-Stock, Phrasal Verbs & Vocabulary Building
- E-mail – Activities based on Writing Appropriate Salutation, Paragraphs & Conclusion
- Resume Writing
- Thematic Discussions
- Speaking in Pairs – Everyday Activities & Detailed Introduction
- Activity based on PowerPoint Presentation

HS 3006 Entrepreneurship

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course has been designed for the students in order to provide basic knowledge of an entrepreneur and opportunities for new entrepreneurship. To provide idea about various financial sources available for small and medium enterprise by different financial institutions. To provide knowledge how to manage working capital of an organization in an efficient manner. To have an idea about motivational tools for increasing the productivity of employees in an enterprise.

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

CO1: know the contribution of an entrepreneur in growth and development of socioeconomic condition of our country
CO2: understand the role of SSI units in growth and development of socioeconomic condition of our country
CO3: learn market survey, sales promotions and management of working capital through costing and book keeping
CO4: know different decision making technique and benefit of personal management system.
CO5: learn motivational methods of an enterprise
CO6: learn how to prepare a project report and knowledge about different tax system of an enterprise

Topics:

- Introduction to entrepreneurship
- SSI Units
- Market survey and research
- Marketing mix
- Financial management
- Working capital management
- Personnel management
- Motivation

Textbook(s):

1. Entrepreneurial Development, S.S.Khanka, S.Chand

Reference Book(s):

1. Industrial Organisation and Engg. Economics, Sharma & Banga, Khanna Publication
2. Entrepreneurship New Venture Creation, David H. Holt, Prentice Hall, PHI

HS 3008 Management Concepts And Practices

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course curriculum is designed for student in order to provide fundamental knowledge in management area. The students will be able to know about general management concepts and various specialization in management area like marketing, finance, production and strategy management. The marketing management portion of the course will benefit the students to develop their career in marketing line, as most of the organisations give priority for marketing skills. Finance and production management will help the students in their respective domain and serve as a guide in their corporate career. The strategy management portion of this course will serve as a guide for the students to contribute in strategy formulation of the organization and how to achieve that strategy within a stipulated time period.

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

CO1: perform the critical management functions effectively and develop ideas about implementing principles and theories of management in organizations efficiently
CO2: develop various marketing skills in order to be successful in corporate world
CO3: utilize different financial techniques for better management and control of organisational financial resources
CO4: take strategic decision for day to day operation through proper working capital management.
CO5: have competency in production planning as well as control measures will become easy in their professional career
CO6: do strategy formulation of the organization and how to achieve that strategy within a stipulated time period

Topics:

- Introduction to management
- Marketing mix
- Market research
- Financial management
- Working capital management
- Production planning and control
- Inventory management
- Strategy management

Textbook(s)

1. Modern Business Organisation and Management. Sherlekar & Sherlekar, Himalaya Publishing House.
2. Business Organisation and Management. M. C. Shukla, S. Chand

Reference Book(s)

1. Principles & Practices of Management. L. M Prasad
2. A framework for marketing management, Philip Kotler
3. Financial Management. I. M Panday
4. Production and Operation Management, Everett E. Adam Jr. Ronald J. Ebert

HS 3002 Organisational Behaviour

Credit : 3
Category : HSMC
Prerequisite(s): Nil

Course Description:

The course has been designed for the students to provide an understanding about the behaviour of individuals, groups and the system in the organization. The course will help the students how to develop personality and leadership style for achievement of individual and organizational objective. To know about the benefit of motivation for increasing individual and organizational productivity. To Provide knowledge to work in groups and develop techniques for group decision making for organizational development.

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

CO1: know about organization, organizational behaviour its nature, scope and significance
CO2: develop their personality as per industry requirement
CO3: apply motivational techniques to make the employees work with confidence and satisfaction
CO4: develop different leadership style to adjust themselves in different organizational situations
CO5: improve the knowledge of group behaviour and techniques of group decision making
CO6: apply the concepts for managing changes in organization as well as the development of an organization's human resources

Topics:

- Introduction to Organisation and organisational behaviour
- Personality
- Motivation
- Leadership
- Group dynamics
- Organisational change
- Organisational development

Textbook(s) :

1. Organisational behaviour. Stephen P. Robbins, Timothy A. Judg, S. Sanghi, Pearson
2. Organizational Behaviour and Work, F. M. Wilson, Oxford University Press.

Reference Book(s):

1. Organizational Behaviour, Dipak Kumar Bhattacharya, Oxford University Press
2. ORGB, Organizational Behaviour, Nelson, Quick, Khandelwal, Cengage
3. Organisational Behaviour. Dr. S. S Khanka, S. Chand
4. Managing Organisational Behaviour, Moorhead & Griffin, Cengage Learning.

HS 3004 Human Resource Management

Credit: 3
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course has been designed in order to provide knowledge and idea about human resource management and how to become a professional human resource manager. It will help the students to follow different HR processes like recruitment, training, performance appraisal effectively in organizational level. The students will able to learn how to manage industrial dispute and develop industrial relation in corporate sector. The course will enable the students to understand the workers participation in management concept through employee discipline and the process of effective bargaining system in the organisation.

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

CO1: develop personal and professional qualities of a manager in order to manage human resource of an organization effectively
CO2: meet the human resource requirement of the organization for achieving its objective effectively
CO3: follow different HR processes like recruitment, selection, training, performance appraisal effectively in organizational level
CO4: inculcate the sense of inter personal relation required in professional front in handling employer-employee relation effectively for achievement of organizational objectives
CO5: achieve strategic objectives of the organizations, by optimizing the potentiality of the human resource through workers participation in management
CO6: know the technique of managing and being managed by the organisation

Topics:

- Human resource management
- Human resource planning
- Recruitment
- Selection
- Training
- Performance appraisal
- Industrial relation
- Industrila dispute
- Collective bargaining
- Workers participation in management

Textbook(s):

1. Human Resource Management, P. Jyoti & D. N. Venkatesh, Oxford Publication, 2016
2. Human Resource Management, B. Varkkey & G. Dessler, Pearson, 2017

Reference Book(s):

1. Human Resource Management. K. Aswathappa, Mc Graw Hill Education, 2013.
2. Human Resource Management. S. S. Khanka, S. Chand, 2019
3. Human Resource Management. P. Subba Rao, Himalaya Publishing House, 2018.

HS 4001 Professional Practice, Law and Ethics

Credit: 2
Category: HSMC
Prerequisite(s): Nil

Course Description:

The course on Professional Practice, Law and Ethics is designed to cater comprehensive insight of law and ethics to the students for practicing in their professional life. The course incisively highlights the role of morals and ethics in leading a sustainable profession. Besides, by containing different relevant laws like laws of contracts, intellectual property law and information technology law, the course provides foundation in law to the students which will help them a lot to face the real life situations with ease.

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

CO1: select appropriate engineering decisions in consideration of professional ethics in realization of more critical impact of engineering compared to general experiments
CO2: evaluate and prescribe risk reducing measures
CO3: comprehend the dynamics in engineers' roles and responsibilities with emerging issues in global scene
CO4: know the various compliance requirements and the regulatory bodies to protect environment
CO5: have a fair idea to protect their engineering inventions from unauthorized exploitation under intellectual property rights system and laws relating to information communication technologies
CO6: understand, analyze and prevent misuse of IT related transactions

Topics:

- Morals and ethics in engineering
- Engineering as social experimentation
- Engineer's responsibility for safety
- Global issues
- Law of contracts and law of torts
- Environmental laws
- Intellectual property law
- Information technology law

Textbook(s):

1. R. Subramaniam, Professional Ethics, Oxford University Press, 2013
2. Indian Contracts Act 1872
3. Patents Act 1970 (Unit-3)
4. Designs Act 2000 (Unit-3)
5. Information Technology Act 2000 (Unit-4)

Reference Book(s):

1. Mike Martin and Ronald Schinzinger, "Ethics in Engineering", McGraw Hill New York, 2005.
2. Charles E Harris, Michael S Pritchard and Michael J Rabins, "Engineering Ethics Concepts and Cases", Thomson Learning, 2000

HS 4003 Legal Issues and Requirements in Engineering

Credit: 1
Categories: HSMC
Prerequisite: Nil

Course description:

It depicts on law of contracts and law of torts, Consumer Protection Act 1986, Environmental Protection Act 1986, Environmental Impact Assessment 2006, standards for emission, discharge of environmental pollutants from various industries, Intellectual Property Law, Protecting engineering invention, the U.S Utility model approach and need for Utility model in India, Protecting Software and other engineering technologies in cyberspace, maintaining data security and technological privacy in Cyberspace, e-contracts, electronic and digital signatures.

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

CO1: understand the various legal requirements in terms of contracts
CO2: interpret the product liability which an engineer is required to take care while processing his engineering innovations
CO3: illustrate the various compliance requirements and the regulatory bodies to protect the environment
CO4: demonstrate to protect their engineering inventions from unauthorised exploitation under intellectual property rights system and laws relating to information communication technologies
CO5: identify Legal Issues in a given case
CO6: analyse and prevent misuse of IT related transactions

Topics:

- Law of contracts and law of torts
- Environmental Laws
- Intellectual Property Law
- Information Technology Law

Textbook(s):

1. Gurdeep Singh “Environmental Laws” Eastern Book Company,2nd Edition 2016.
2. V K Ahuja “Law Relating To Intellectual Property Rights”Lexis Nexis, 3rd Edition. July 2017.
3. Pavan Duggal “Cyber Law”-Indian Perspective”. 2nd Edition 2016.
4. Avtar Singh” Law of Contracts” Eastern Book Company,12th Edition, Reprinted 2020.
5. Dr. R K Bangia “Law of Torts”. Allahabad Law Agency; 24th 2019 edition (2019).

Reference Book(s):

1. Rosencranz “Enviromental Law and policy in india”.Oxford University Press, 2001.
2. Howard b rockman “Intellectual Property Law for engineers and scinentists”.ISBN: 978-0-471-69740-4, Wiley-IEEE Press, June 2004.
3. Mireille Hidebrant “ smart technologies and the end of law”. ISBN: 978 1 78643 022 9.

MA 2005 Mathematics-III

Credit: 4
Category: BSC
Prerequisite(s): Nil

Course Description:

Students are taught Partial differential equations based on the propagation of heat, wave etc. Numerical analysis is included to get approximate solutions to those problems for which analytical solution is difficult to obtain. Students are given fundamental Probability and Statistical knowledge to use statistical analysis of data.

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

CO1: solve problems on Partial Differential Equation by separable method
CO2: analyze two dimensional wave and heat equations problems with boundary conditions and solve
CO3: determine roots of algebraic/transcendental equations through Newton and Lagrange method and obtain interpolating Polynomials
CO4: evaluate differentiation and integration and solve ODE and PDE through numerical technique
CO5: use the concepts of regression and co-relation and curve fitting by least square method
CO6: work out problems related to probability distribution and hypothesis testing

Topics:

- Partial Differential Equation
- Numerical Analysis
- Probability
- Statistics

Textbook(s):

1. Grewal B. S., Higher Engineering Mathematics, Khanna Publishers, 44th edition

Reference Book(s):

1. Advanced Engineering Mathematics by Erwin Kreyszig, Wiley, INC, 10th Edition.
2. Engineering Mathematics by S. Pal and S. C. Bhunia, Oxford University Press.

ME 2010 Basic Manufacturing Processes

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

This course will provide the student with an introduction to the basic manufacturing processes used in industry such as foundry processes, metal working processes, powder metallurgy and various welding processes. Knowledge of the course will help the students to relate the design requirements of a part to the possible manufacturing processes. Successful completion of the course will also provide the student with the benefits, limitations, and applications of different manufacturing processes for product manufacturing. The overall aim is to establish the technical knowledge for selection and planning of manufacturing processes and systems.

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

CO1: understand and select the appropriate casting processes for manufacturing industrial products
CO2: apply the suitable rolling process and sheet metal for different material and product
CO3: understand the forging process for various components and its application
CO4: understand the fundamental processes of extrusion and drawing
CO5: apply powder metallurgy process to produce powder of various materials and to manufacture new composite material
CO6: analyze the principle of various welding processes and identify the best welding technique for joining of various components and to produce defect free products

Topics:

- Foundry Process
- Metal working process
- Sheet Metal Working
- Powder Metallurgy Process
- Fabrication Processes

Textbook(s):

1. Manufacturing Technology (Part I), P.N. Rao, Tata Mc-Graw Hill, Publication. Co.Ltd.
2. Manufacturing Processes, J. P. Kaushish, PHI (2nd Edition)

Reference Book (s):

1. Manufacturing Technology: Materials, Processes and Equipment: Helmi A. Youssef, Hassan A. El. Hofy and M.H. Ahmed, CRC Press, 2015
2. Principle of Manufacturing Materials and Processes: J.S. Cambell, TMH
3. Welding & Welding Technology - R. Little, TMH, 43rd reprint, 2014
4. Manufacturing Science: A. Ghosh & A.K. Mallick, EW.

ME 2013 Kinematics and Dynamics of Machines

Credit: 4
Category: PCC
Prerequisite(s): Engineering Mechanics (ME 1003)

Course Description:

This course would consist of the basic concepts of mechanisms, its velocity and acceleration analysis. It also consists of fundamental concepts of mechanical power transmission such as belts, ropes, chains and gear drives along with the analysis of different cam profiles. The latter half of the course describes dynamic force analysis of engine parts, turning Moment diagrams, flywheels, gyroscopic effect, working of different governors, Primary and Secondary balance of single and multi-cylinder engines and fundamental concepts of free, forced and damped vibration.

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

CO1: understand the basic kinematics of mechanisms, working principles of power transmission drives and cams profiles for different follower motion
CO2: understand the dynamic analysis of mechanisms, balancing along with the working principle and applications of governors, gyroscopes and flywheels
CO3: evaluate static and dynamic forces in reciprocating and rotating devices
CO4: analyze gyroscopic effects in case of plane discs, automobiles, ships and air crafts
CO5: Identify the number of degrees-of-freedom (mobility), types of links and joints within mechanisms. To assimilate the concept of synthesis and analysis of the most commonly used mechanisms
CO6: design flexible and rigid mechanical components to transmit power and to design and prescribe necessary components/systems to reduce effects of variations in the time-varying forces

Topics:
- Simple Mechanisms
- Velocity Analysis
- Acceleration Analysis
- Belt and Rope and Chain Drive
- Gear and Gear Trains
- Cams
- Force analysis
- Gyroscope
- Governors
- Balancing
- Vibration

Textbook(s):
1. Theory of Machines, S. S Rattan, TMH, 4th Edition

Reference Book(s):
1. Theory of Machines, J. Shigley, TMH
2. Machines and Mechanisms: Applied Kinematics Analysis, David H Myszka, PHI
3. Kinematics of Machinery through Hyper Works, J.S. Rao, Springer, 1st Edition
4. Theory of Machines, Sadhu Singh, Pearson
5. Theory of Mechanism and Machines, Sharma & Purohit, PHI
6. Theory of Machines and Mechanisms, John Joseph Uicker, Gordon R. Pennock, Joselph E.Shigley, Oxford Univ Pr (Sd), 2010

ME 2021 Fluid Mechanics and Hydraulic Machines

Credit: 4
Category: PCC
Prerequisite (s): Mathematics-I (MA1003), Mathematics-II (MA1004), Physics (PH 1007)

Course Description:

This course offers an extensive analysis of the basic laws of the fluid mechanics such as Newton's law of viscosity, Hydrostatics law, Pascal's law of pressure etc. The concept of stability of bodies in fully and partially submerged condition is discussed. Application of dimensional and model analysis is studied in order to predict the prototype. The concept of boundary layer theory widens the knowledge on the viscous effect of fluid adjacent to solid surface. It includes the impact of jet on stationary and moving vanes in order to understand the performance of hydraulic machines.

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

CO1: recall the properties of fluids, mechanism of viscosity, concept of continuum and classification of fluids based on Newton's Law
CO2: explain the effects of fluid pressure at a point, pressure measuring devices such as manometers etc.
CO3: apply the knowledge of buoyancy to determine the stability of submerged and floating bodies, computing the metacentric height and oscillation of a floating body
CO4: select different methods to predict the prototypes performance with the help of dimensional and model analysis
CO5: design the submerged bodies applying fundamental laws of fluid mechanics and boundary layer theory
CO6: evaluate the performance of various hydraulic devices such as turbine and pump

Topics:

- Properties of fluids
- Pressure and its measurement
- Hydrostatic forces on surfaces
- Buoyancy and floatation
- Kinematics of fluid flow
- Dynamics of inviscid flows
- Dimensional and model analysis
- Dynamics of viscous flow
- Boundary layer theory
- Fluid flow around submerged bodies
- Hydraulic Turbines
- Centrifugal pump
- Reciprocating pump

Textbook(s):

1. Fluid Mechanics and Hydraulic Machines, Sukumar Pati, McGraw Hill Education (India) Pvt. Ltd, New Delhi
2. Hydraulics and Fluid Mechanics Including Hydraulics Machines, P.N. Modi, Standard Publishers Distributors

Reference Book(s):

1. Fluid Mechanics, Y. Cengel and J. Cimbala, McGraw Hill Education (India) Pvt. Ltd, New Delhi
2. Fluid Mechanics, Frank M. White, McGraw-Hill Series in Mechanical Engineering.

3. A Text Book of Fluid Mechanics, R. K. Rajput, S. Chand Ltd.

ME 2022 Internal Combustion Engines and Gas Turbines

Credit: 3
Category: PCC
Prerequisite(s): Engineering Thermodynamics (ME 2031)

Course Description:

This course would encompass a comprehensive study and working principle of conventional spark-ignition (gasoline), compression-ignition (diesel), two stroke & four stroke engines. Moreover, the complete description of carburetor, fuel injectors, supercharging, engine emission, cooling lubrication, and ignition system. Knowledge of the course will help the students to make the performance analysis of internal combustion engines (SI and CI engines) and justify the applicability. In the later part, this course presents the analysis of Gas turbine and gas turbine cycles for aircraft propulsion. At the end of this course, the students will be able to perform research problems related to IC engines and fuels.

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

CO1: underline the classification of heat engines and cycles of operation of IC Engines for different application
CO2: discuss the effect of various operating variables on engine performance
CO3: demonstrate the fuel metering and fuel supply systems for different types of engines
CO4: analyze the normal and abnormal combustion phenomena in SI and CI engines
CO5: formulate the performance Analysis of IC Engine and justify the suitability
CO6: estimate the performance of Gas Turbine

Topics:
- Introduction to IC engines
- Fuels
- Carburetion and Fuel injection
- Test and Performance of SI and CI engines
- Engine Emission, Cooling Lubrication and ignition systems
- Gas Turbines and Aircraft Propulsion

Textbook(s):
1. IC Engines, V Ganeshan, TMH, 4th edition
2. Gas Turbines, V Ganeshan, TMH, 3rd edition

Reference Book(s):
1. IC Engines, Mathur and Sharma, Dhanpat Rai & Sons
2. IC Engines, S.P. Sen, Khanna Publishers
3. IC Engines, Gill and Smith, OXFORD & IBH
4. An introduction to energy Conversion (Vol. II), Kadambi & Prasad, Wiley Eastern.
5. Gas Turbine Theory, Cohen, Rogers and Saravanamutto, Pearson Education

ME 2024 Industrial Engineering and Operations Management

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

Industrial engineering section represents achieving maximum results with minimum efforts with increasing the efficiency of factors of production. The Operations research section aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints in different area such as production planning & control, inventory control, quality control, and supply chain management. This course is well equipped with different operations research tools such as liner programming, operations scheduling and project management. Analyze any real life system with limited constraints and depict it in a model form.

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

CO1: apply mathematics, science, and engineering
CO2: design, develop, implement and improve integrated systems that include people, materials, information, and equipment
CO3: formulate and solve linear programming problems
CO4: recognize types of transportation and assignment problems and apply solution techniques.
CO5: identify various CPM and PERT method
CO6: apply the various types of operation research methods

Topics:

- Production Systems
- Production Planning and Control
- Demand Forecasting
- Inventory Planning and Control
- Operations Scheduling
- Quality Control
- Project Management
- Linier Programming

Textbook(s):

1. Production and Operation Management, R. Paneerselvam, Prentice Hall of India, 3^{Rr} edition
2. Operation Research by Hira and Gupta, S. Chand

Reference Book (s):

1.Operations Management: Processes and Supply Chains, Larry P. Ritzman, Manoj K. Malhotra, Lee J. Krajewski, PHI, 10th, 2012.
2. Modern Production/Operations Management, Sarin Buffa, Wiley India Pvt Ltd, 8th,2011.
3. Industrial Engineering and Production management, Telsang Mertand, S.Chand, 2002.
4. Operation Research by S D Sharma

ME 2026 Engineering Metrology

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

This course is designed to let the students understand the concept of metrology, the various aspects and factors of metrology. It also highlights the concept of inspection and the errors like systematic and random errors. The course also describes the various types of fits and tolerances in machine parts. Different measuring tools and comparators are cored in this course. Measurements like, force, torque, strain, pressure, temperature, surface roughness, etc. are being measured using various instruments. Modern measuring techniques such as Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Atomic Force Microscopy (AFM), X-ray Diffraction Systems (XRD) are also covered in this course.

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

CO1: understand the different measurement techniques
CO2: understand the fundamental knowledge of various Metrology techniques
CO3: evaluate the tolerance and types of fits in various machine components
CO4: apply suitable metrological methods for measuring various entities
CO5: analyze the results from the various metrological methods
CO6: design the procedures for getting the final results

Topics:

- Metrology
- Standards of measurement
- Limits, Fits and Tolerances
- Simple measurement tools
- Screw Thread Measurement
- Surface Roughness
- Comparators
- Measurement of Force, Torque and Strain
- Measurement of Temperature and Pressure
- Modern Measurement Techniques

Textbook(s):

1. Engineering Metrology, R. K. Jain, Khanna Publication
2. Mechanical Measurements, T.G. Beckwith and M. Lewis Buck, Oxford & IBH Publishing

Reference Book(s):

1. Mechanical Measurements, R. S. Sirohi, H. C. Radha Krishna, New Age International, 1991
2. A course in Mechanical Measurements and Instrumentation, A.K. Sawhney, Puneet Sawhney, Dhanpat Rai & Co

ME 2027 Material Science and Engineering

Credit: 3
Category: PCC
Prerequisite(s): Physics (PH 1007), Chemistry (CH 1007)

Course Description:

This course would encompass a comprehensive study of different types of materials, their crystal structures and their mechanical, thermal, optical and magnetic properties. Moreover students will be able to study the phase diagram of materials, heat treatments methods and corrosion performance and learn to elucidate their phases, processing and properties for commonly used materials like steel and cast iron. With this knowledge students will be able to apply to solve common economic, environmental and societal issues in material science and engineering with correlation to different specializations. Overall students will be able to correlate the structure of different materials with their concerned processing and properties and select the right material and design considerations for their simulations and experimental research activities.

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

CO1: comprehend the material requirement for an engineering application
CO2: understand the structure of different materials and their mechanical, electrical, thermal and optical properties
CO3: understand material selection criteria using the phase diagram with emphasis on interpretation of the iron-carbon phase diagram
CO4: comprehend the heat treatment principles to change the mechanical properties of steel
CO5: analyze the various corrosion prevention methods and apply them to our day to day lives
CO6: correlate material structure to its processing and properties and apply to various engineering applications

Topics:
- Introduction to Engineering Materials
- Structure of Materials
- Phase diagram and phase transformations in metals and alloys
- Advances in metallic, non-metallic and advanced materials
- Economic, environmental and societal issues in material science and engineering
- Material selection and design considerations

Textbook(s):
1. Callister's Material Science and Engineering, Adopted by R. Balasubramanium, 2nd edition, Wiley India Pvt Ltd.

Reference Book(s):
1. Material Science and Engineering, V. Ragvan, Prentice Hall of India, 4th Edition.
2. Engineering Metallurgy: Applied Physical Metallurgy, R. A. Higgins, 6th Edition
3. MIT Open coursewares https://ocw.mit.edu/courses/materials-science-and-engineering/
4. NPTEL course: https://nptel.ac.in/courses/113/102/113102080/

ME 2029 Mechanics of Solids

Credit: 4
Category: PCC
Prerequisite (s): Engineering Mechanics (ME 1003)

Course Description:

This course illustrates the concepts of stress and strain, deformation of solids, elastic constants, compound stresses and strains, shear force and bending moment diagrams, slope and deflection of beams, bending stress and shear stress in beams, stresses in the cylinder and spherical shells, torsion in solid and hollow circular shafts, strain energy under various loading conditions, theories of failure, columns and springs. The knowledge of this course will help the learners to analyse and design the various structural and engineering components.

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

CO1: understand the concept of stress, strain and deformation of solids under axial and complex loading conditions
CO2: describe and sketch the profiles for shear force, bending moment, slope and deflection of simple structural members under different load states
CO3: interpret the bending stress and shear stress in beams, and stresses in the cylinder and spherical shells
CO4: analyze the torsional stress in solid and hollow circular shafts and strain energy under various loading conditions
CO5: select the appropriate theory of failure for various engineering components considering components material characteristics
CO6: design and Analyze the eccentrically loaded columns and helical springs

Topics:

- Stress, strain and elastic constants
- Stress under axial load
- Compound stress and strain
- Shear force and bending moment diagrams
- Stress under bending and torsion
- Slope and deflection
- Strain energy
- Theories of failure
- Stresses in cylindrical and spherical shells
- Columns
- Stress in some other significant elements

Textbook(s):

1. Strength of Materials, G. H. Ryder, MACMILLAN
2. Strength of Materials, S. S. Rattan, TMH

Reference Book(s):

1. Mechanics of Materials, R. C. Hibler, PEARSON
2. Strength of Materials, R.K. Rajput, S.Chand
3. Strength of Materials, R. S. Khurmi, S. Chand
4. A Text Book of Strength of Materials, R. K. Bansal, Laxmi Publications Pvt Ltd

ME 2031 Engineering Thermodynamics

Credit: 4
Category: PCC
Prerequisite(s): Mathematics-I (MA1003)

Course Description:

This course would lead to understanding of fundamental thermodynamic laws and consequently, their applications in analyzing various energy interactions that we come across in day-to-day life. Further, the knowledge on this course will help the students to disseminate the various forms of energy and their interactions involved in designing any thermal system. Additionally, this course includes the knowledge of designing thermal power plants by covering the characteristics of pure substances and the estimation of maximum available energy in a system. At the end, this course highlights mathematical definitions of various mechanical devices such as compressors, turbines, nozzles, boilers and condensers.

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

CO1: recall different terminology related to thermal engineering
CO2: recognize the need of learning thermodynamics
CO3: appreciate the 1st law of thermodynamics and apply that to flow processes
CO4: appraise the 2nd law of thermodynamics in applications related to heat engine, heat pump and refrigerators
CO5: read and comprehend steam table and Mollier chart in solving complex thermal problems
CO6: Compute availability

Topics:

- Thermodynamic systems and properties
- First law of thermodynamics and its application to flow processes
- Second law of thermodynamics and entropy
- Pure substances
- Exergy estimation
- Thermal devices

Textbook(s):

1. Thermodynamics, An Engineering Approach, Yunus A Cengel and Michael A. Boles, Mc Graw Hill Education, 7th Edition, 2011 (reprint 2013)

Reference Book(s):

1. Fundamentals of Classical Thermodynamics, Gordon J. Van Wylen , Richard E. Sonntag, Claus Borgnakke, John Wiley, Fifth Edition
2. Engineering thermodynamics, P. K. Nag, McGraw Hill Education, Fifth Edition
3. Engineering Thermodynamics, Gordon Rogers and Yon Mayhew, Pearson Education Ltd
4. Engineering Thermodynamics, Krieth, CRC Press
5. Engineering Thermodynamics, Jones and Dugan, PHI Learning Pvt. Ltd.
6. Engineering Thermodynamics, D. P. Mishra, CENGAGE.

ME 2083 Machine Drawing and Computer Aided Design

Credit: 1
Category: PCLC
Prerequisite(s): Nil

Course Description:

The aim of this sessional course is to develop two-dimensional and three dimensional drawing ability of machine components among students. The course starts with imparting basic concepts of machine drawing and CAD. Basic tools of the CAD software (prently Solidworks) is introduced to the students followed by making simple three dimensional machine components like pulleys, nuts, cotter joints, piston, etc. After that, assembly drawings of components like nut-bolt, tail stock, cotter and knuckle joint, screw jack, machine vice, piston assembly are taught. Extraction of orthographic views and sectional views from part and assembly drawings are also part the course.

Course Outcomes: At the end of this sessional course, the students will be able to

CO1: understand and learn the basic tools of CAD software
CO2: draw two dimensional three dimensional part drawings of machine components
CO3: Learn to assemble different part models to develop assembly
CO4: Draw assembly of different machine components such as nut-bolt, tail stock, cotter and knuckle joint, screw jack, machine vice, piston assembly, etc.
CO5: find sectional views, orthographic views from 3-D models using modeling softwares
CO6: design part and assembly of new proposed machine components

Topics:

- Introduction of 2-D tools of CAD software
- Introduction of 3-dimensional tools in CAD software
- Drawing 3-D models of basic machine components
- Assembly tools of CAD software
- Assembly Drawing of basic machine components
- Orthographic views of solid model/assembly
- Sectional views of a solid model/assembly
- Parametric tools to draw any 3-D model

ME 2085 Manufacturing Practices

Credit: 2
Category: PCLC
Prerequisite(s): Nil

Course Description:

This course would encompass a comprehensive study and experimentation on foundry, welding, shaper machine and milling machine. Knowledge of the course will help the students to cast aluminium to any shape through sand casting technique, to join similar or dissimilar metals using gas welding, TIG welding and MIG welding, to machine flat surfaces using shaper machine, and to prepare a spur gears through indexing in universal milling machine. At the end of the course the students will be able to solve casting, welding, shaping and milling related industrial problems through extensive and systematic research.

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

CO1: create aluminium castings of desired shape using sand casting method
CO2: apply the principles of gas welding to create welded joints between similar or dissimilar metals
CO3: apply the principles of TIG welding and MIG welding to create welded joints between similar or dissimilar metals
CO4: understand the mechanisms of shaper machine and create flat surfaces of desired dimension
CO5: understand the principles of milling operation and indexing
CO6: create spur gears of different shapes and dimensions through indexing using universal milling machine

Topics:

- Foundry
- Welding
- Shaping
- Milling

Textbook(s):

1. Manufacturing Technology (Part I), P.N. Rao, Tata Mc-Graw Hill, Publication. Co.Ltd.
2. Manufacturing Processes, J. P. Kaushish, PHI Learning Pvt. Ltd.

Reference Book(s):

1. Manufacturing Technology: Materials, Processes and Equipment: Helmi A. Youssef, Hassan A. El. Hofy and M.H. Ahmed, CRC Press.
2. Principle of Manufacturing Materials and Processes: J.S. Cambell, TMH
3. Welding & Welding Technology - R. Little, TMH.
4. Manufacturing Science: A. Ghosh & A.K. Mallick, EWP
5. Advanced Machining Processes, V. K. Jain, Allied Publishers Pvt. Ltd.
6. A Text Book of production Engineering, P C Sharma, S. Chand Publications.

ME 2091 Material Testing Laboratory

Credit: 2
Category: PCLC
Prerequisite(s): Nil

Course Description:

This laboratory would comprise of various equipment and experiments to provide the exposure to basic mechanical characterization techniques and microstructure analysis. This laboratory helps the students to understand the mechanical behavior of various materials, effect of microstructural parameters (grain size, boundary fraction, Phase fraction, second phase particle etc.) on their deformation behavior, quality, and performance. The laboratory is equipped with different destructive testing equipment such as Universal testing machine, Impact testing machine, hardness tester and torsion testing machine along with sample preparation setup and optical microscope. A series of experiments are chosen for undergraduate students to demonstrate the basic principles in the area of mechanics of materials, structural analysis and strength of material. The laboratory also provides support to different research activities carried out by both internal as well as external research scholars (B.Tech, M.Tech and PhD) in terms of finding various mechanical properties (impact strength, tensile strength, compressive strength, shear strength, flexural strength, hardness, etc.) of material as well as microstructural quantification.

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

CO1: understand the fundamentals of mechanical properties of various ferrous and nonferrous metals
CO2: understand the different types of mechanical properties of material and their characterization techniques which are used in various fields of engineering
CO3: understand the mechanical properties of various metals from different thermo-mechanical processing, performance and testing aspects
CO4: develop and change the mechanical properties of steel and its alloys for different structural and automobile applications
CO5: understand the fundamentals of microstructure, microstructural characterization of material by using optical microscope
CO6: analyze the various microstructural parameters: grain size, grain boundaries, inclusions, precipitates phases) and their effect on mechanical properties of material

Topics:

- Determination of the impact strength of mild steel by Izod test method
- Determination the impact strength of mild steel by Charpy test method
- Determination the tensile strength of a mild steel specimen using UTM
- Determination the compression strength of a mild steel specimen using UTM
- Determination the flexural strength of a mild steel specimen by three point bending test using UTM
- Determination the hardness of the given specimen by Rockwell hardness tester
- Determination the hardness of the given specimen by Vickers hardness tester
- Determination the torsional shear stress, maximum torque of mild steel by Torsion testing equipment
- Metallographically sample (mild steel) preparation and observation of microstructure using an Optical microscope

ME 2093 Machine Kinematics and Dynamics Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Kinematics and Dynamics of Machine (ME 2013)

Course Description:

This laboratory provides the basic and advance knowledge of various kinematics and dynamics machines and their parts like the coefficient of friction calculation setup, screw jack apparatus, flywheel setup, cam and follower analysis, the principle of Hartnell governor, gyroscopic couple calculation setup, damped or undamped with free or forced vibration calculation apparatus. Furthermore, these machines' practical applications in the industry will be discussed briefly during laboratory hours. After completing all the experiments, the students can implement this laboratory's outcome in their project work.

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

CO1: analyze the velocities and accelerations of mechanisms and IC engine parts
CO2: illustrate Hook's joint, Davis and Ackerman Steering gears. Compound pendulum, Bifilar and Trifler suspension
CO3: assess the effect of friction on mechanisms and the kinematics of cam and followers
CO4: elaborate the gyroscopic couple and its effect to two wheelers, four wheelers, ships, air-crafts etc.
CO5: discuss the static and dynamic balancing of high speed rotary and reciprocating machine parts like gear, cam, belt and chain drives
CO6: analyse both the free and forced vibrations of machines and structures

Topics:

- Determination of the coefficient of friction between different sliding surfaces
- Determination of the Mechanical Advantage (M.A), Velocity Ratio (V.R), Efficiency of a Simple Screw jack, and also verify the Law of machine
- Determination of the moment of inertia of the flywheel
- Study of Hartnell Governor and plot the curve between speed and sleeve displacement
- Study of cam and follower apparatus and draw the curve between follower displacement and angle of a cam rotation for a cam follower pair, and also observe the jump phenomenon
- Comparison between applied couple and theoretical gyroscopic couple
- Study of the longitudinal vibration of helical springs connected in series and parallel
- Study of undamped torsional vibration of two rotor-system, and Determination of the natural frequency
- Study of damped torsional vibration, and Determination of the damping coefficient
- Determination of forced vibration of an equivalent spring, mass and damper system, and plot the curve between amplitude and frequency
- Determination of the undamped free vibration of an equivalent spring, mass and damper system, and Determination of time period
- Study of various types of gears like spur, helical, straight bevel, rack and pinion, and worm gear

ME 2097 Fluid Mechanics and Hydraulic Machines Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Fluid Mechanics and Hydraulic Machines (ME 2021)

Course Description:

In this laboratory, the students are introduced to concepts of fluid mechanics and hydraulic machines. This helps the students to understand different means of pressure and flow measurements of fluid. Different devices used for this purpose are: pitot tube, venture meter, orifice meter, rotameter etc. Most common hydraulic machines like turbine and pumps are studied to understand principle of conversion of hydraulic energy to mechanical energy and vice versa. Important principles of fluid properties and effect of their variation in different hydraulic machines help the students to apply these concepts in industry to maximize the performance of such machines.

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

CO1: recall the principle of Bernoulli's in conservation of head in fluid flow
CO2: explain and use venture meter for flow measurement
CO3: illustrate the flow measurement with the help of orifice meter
CO4: analyze the effect of shape on metacentric height of any floating body
CO5: design Pelton wheel for a specific requirement after using characteristic curves
CO6: evaluate performance of centrifugal pump

Topics:

- Demonstration of the Bernoulli's principle in conservation of head in fluid flow
- Measurement of fluid flow rate through pipes with the help of ventury meter
- Calculation of the fluid flow through pipe with the help of orifice meter
- Evaluation of the metacentric height of any floating body
- Drawing the characteristic curves for Pelton wheel
- Drawing the characteristic curves for Francis Turbine
- Plotting the characteristic curves for reciprocating pump
- Plotting the characteristic curves for centrifugal pump

ME 3014 Refrigeration and Air Conditioning

Credit: 3
Category: PCC
Prerequisite(s): Fluid mechanics and Hydraulic Machines (ME 2021), Engineering Thermodynamics (ME 2031), Heat Transfer (ME 3021)

Course Description:

The course is about analyzing different Vapor Compression, Vapor Absorption and Air Refrigeration cycles. It also includes, the suitable refrigerants used in these cycles for better performance with due consideration to environmental impact. The psychometric calculations, load calculation and requirements of air-conditioning for different applications are included. Summer, winter and year round comfort air-conditioning processes and systems are discussed. The performance parameters like COP, tonnage, capacities of evaporator, condenser and heat exchangers and compressor power are estimated. According to the requirements, component selections for refrigeration and air-conditioning systems are appropriately studied.

Course Outcomes: At the end of the course, the student will be able to:

CO1: recall different thermodynamic cycles and moist air properties applicable in refrigeration and air-conditioning
CO2: explain the advantages and disadvantages of various cycles, processes and refrigerants
CO3: apply the fundamentals to calculate the different performance parameters like COP, compressor work, cooling or heating capacity, cooling or heating load, moisture removal rate etc.
CO4: select different components and refrigerants in refrigeration and air conditioning systems as per the requirements such as tonnage of the system, desired temperature, heat load and environmental and economic considerations etc.
CO5: design the system like vapor compression, vapor absorption, air refrigeration systems, summer, winter and all round air conditioning systems by taking into account different components and its interface
CO6: evaluate the different systems in refrigeration and air-conditioning in terms of COP, capacity and weight ratio, cost and impact on environment etc.

Topics:
- Introduction to refrigeration
- Refrigerants
- Air refrigeration system
- Vapour compression system and Multi-Pressure systems
- Vapour absorption systems
- Psychometrics
- Requirements of comfort air-conditioning
- Air conditioning system
- Refrigerant compressor

Textbook(s):
1. Refrigeration and Air Conditioning, C. P. Arora, McGraw Hill Education, 3rd Edition,
2. Refrigeration and Air Conditioning, R. S. Khurmi, and J. K. Gupta, S. Chand Ltd, 2013

Reference Book(s):
1. Refrigeration and Air Conditioning, R. C. Arora, PHI Learning Pvt. Ltd., 2013.
2. A course in Refrigeration and Air Conditioning, S.C. Arora and S. Domkundwar, Dhanpat Rai & Co (P) Ltd, 2013.
3. Refrigeration and Air Conditioning, Manohar Prasad, New Age International, 2003.

4. Refrigeration and air conditioning - Stocker and Jones.

ME 3019 Manufacturing Processes and Automation

Credit: 4
Category: PCC
Prerequisite(s): Basic Manufacturing Processes (ME 2010)

Course Description:

This course will provide the knowledge of different traditional machine tools, operations, cutting tools and applications. It will also enlighten the students on the various advanced non-traditional manufacturing processes as well as automated machine tools such as NC, CNC and DNC. This course will also give the fundamental knowledge to design the control systems for various applications. With the knowledge of this course, the students are able to identify the suitable traditional or non-traditional machining process to produce a component along with optimized process plan.

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

CO1: understand the constructional and functional details of machine tools and its related accessories
CO2: understand the industrial applications of the conventional machining processes
CO3: understand the advanced machining processes to machine difficult to machine materials with complicated and miniaturized product manufacturing
CO4: understand the designing principles of Jigs and fixtures for different machining operations
CO5: design the sequence of operations leading to optimized time and cost
CO6: understand the industrial automation with computer controlled machines and industrial robots

Topics:
- Traditional machine tools and processes
- Non-Conventional machining processes
- Design of jogs and fixtures
- Designing a process plan
- Industrial automation and fundamentals of robotics
- Designing of transfer function for control system

Textbook(s):
1. Manufacturing Processes, J. P. Kaushish, PHI Learning Pvt. Ltd.; 2nd Edition (2010)
2. Automation, Productions systems, and computer Integrated manufacturing, Mikell P. Groover, PHI Learning Pvt. Ltd-New Delhi (3rd edition)

Reference Book(s):
1. Advanced Machining Processes, V. K. Jain, Allied Publishers Pvt. Ltd.; 1st edition (2007)
2. A Text Book of production Engineering, P C Sharma, S. Chand Publications, 2010
3. Modern Machining Process, P.C. Pandey, H.S. Shan, TMH,3rd Edition
4. Introduction to Micromachining, V.K. Jain, Narosa Publishing house, 2010

ME 3021 Heat Transfer

Credit: 4
Category: PCC
Prerequisite(s): Mathematics-III (MA 2005), Engineering Thermodynamics (ME 2031), Fluid Mechanics & Hydraulic Machines (ME 2021)

Course Description:

The course aims to introduce the basic concepts and methods of heat transfer with practical applications. It provides an exposure to develop mathematical models for various industrial problems. It further elaborates the heat transfer with fluid motion with description of boundary layer and various experimental correlations. It includes radiation heat transfer with basic laws of radiation. Boiling and condensation heat transfer is discussed to understand the phase change heat transfer systems. Heat exchanger calculations to analyze the performance are explained.

Course Outcomes: At the end of the course, the student will be able to

CO1: describe the fundamentals of heat transfer processes in engineering problems
CO2: explain the different modes of heat transfer and it applications
CO3: apply analytical methods, numerical tools to develop mathematical models for different heat transfer applications
CO4: analyze the different mechanism of heat transfer with various experimental and theoretical correlations
CO5: design the thermal resistance network and heat transfer devices based on principles of different types heat transfer processes
CO6: evaluate the performance of various heat transfer application problems with the calculation of different parameters like efficiency, heat transfer coefficient etc.

Topics:
- Modes of heat transfer
- Conduction (Steady and Transient)
- Fin
- Lumped Capacitances
- Convective Heat Transfer (Forced and Natural)
- Radiation Heat Transfer
- Heat Transfer in Boiling and Condensation
- Heat Exchangers

Textbook(s):
1. Engineering Heat and Mass Transfer, M M Rathore, Laxmi Publications Pvt. Ltd, 3rd edition.
2. Heat and Mass Transfer, Y A Cengel and A J Ghajar, McGraw-Hill Publication, 4th edition.

Reference Book(s):
1. Principles of Heat Transfer, Frank Kreith, Raj M. Manglik, M.S. Bohn, Cengage Learning, 7th edition
2. Heat and Mass Transfer, R.K. Rajput, S. Chand & Company, 5th edition.
3. Fundamental of Heat and Mass Transfer, Frank P. Incropera, David P. Dewitt, Willey 1996, 4th edition.
4. Heat Transfer, J. P. Holman and S. Bhattacharya, McGraw Hill Education, 10th Edition.
5. Introduction to Heat Transfer, S. K. Som, PHI Learning Private Ltd, 2013.

ME 3023 Design of Machine Elements-I

Credit: 3
Category: PCC
Prerequisite(s): Engineering Mechanics (ME 1003), Materials Science & Engineering (ME 2027) and Mechanics of Solids (ME 2029)

Course Description:

This course focuses on various aspects of machine elements, manufacturing considerations and materials used. It enables to determine strength, stiffness and stability of a mechanical component by involving various analytical methodologies. It also deals with design of joints such as riveted, welded, cotter, knuckle, design of various types of threaded fasteners, design of machine parts used for power transmission such as shafts with keys and keyways, couplings, springs, and lever. At the end of the course, the student will be able to design a mechanical component with proper specifications, least manufacturing cost and high efficiency in operation.

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

CO1: identify basic requirements for machine elements, machines and manufacturing considerations in design
CO2: determine geometrical dimensions of a component subjected to complex stress system
CO3: apply technical skills and imagination to construct a proper design configuration
CO4: develop a link between fundamental concepts with realistic component design
CO5: design various temporary and permanent joints, fasteners
CO6: analyze and synthesize different power transmission elements and springs

Topics:
- Basic requirement for machine elements and machines
- Manufacturing considerations in design
- Design of fastening elements
- Design of transmission elements
- Design of springs
- Design of levers & brackets

Textbook(s):
1. Design of Machine Elements - V. B. Bhandari (TMH), 3rd Ed.
2. Design Data Hand Book, S. Md. Jallaludeen (Anuradha Pub.)

Reference Book(s):
1. Machine Design - Sharma/Agarwal (Katson publishing House)
2. Machines Design Data Book - P.S.G. College of Technology, Coimbatore.
3. Mechanical Engineering Design - Shigley J E, Mischiee C. R.; TMH
4. Mechanical Design of Machines, Maleev/Hartman (CBS)
5. Machine Design - Gupta J. K. and Khurmi R. S. (S. Chand Pub.)

ME 3024 Mechanical Vibration and Noise Engineering

Credit: 3
Category: PEC
Prerequisite(s): Kinematics and Dynamics of Machine (ME 2013)

Course Description:

This subject provides the brief study of various two and multi-degree freedoms of vibratory systems, torsional vibration of the rotor, geared system and branched system, wave equations for vibration of string, bar, and beams, sound and noise engineering with acoustics analysis. Furthermore, for calculating the vibratory systems' frequencies, the different differential equation methods like Newton's second, Energy method, Lagrange's method, etc., will be studied in this curricula. The last module of the course discusses the major sources of the noise and sound on the road and industries and their controlling methods.

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

CO1: elaborate the importance of vibration study in engineering
CO2: design the governing differential equation of a vibration system and its solution
CO3: develop models of dynamic system with varying degrees of freedom (SDOF, MDOF)
CO4: determine the natural frequency of certain physical systems and understand the advantage of providing damping in mechanical systems
CO5: discuss the concept of noise, its measurement and its adverse effects on human
CO6: select and explain the best noise control technique

Topics:
- Two degree of freedom systems of a vibratory system
- Multi-degree of freedom system of a vibratory system
- Torsional vibration of gear and rotor systems
- Vibration of continuous system like string, bar, and beam
- Introduction to acoustics
- Introduction of sound and noise engineering

Textbook(s):
1. Mechanical Vibrations and Noise Engineering, Ashok G. Ambekar, PHI

Reference Book(s):
1. Theory of Vibration and Application, William T. Thomson, CBS
2. Mechanical Vibrations, V. P. Singh, Dhanpat Rai & Co.(P) LTD
3. Textbook of Mechanical Vibrations, Rao.V. Dukkipati, PHI
4. Noise and vibration control, L. Beranek, McGraw-Hill

ME 3025 Optimization Techniques

Credit: 3
Category: PEC
Prerequisite(s): Operations Research (ME 4041)

Course Description:

This course would encompass a comprehensive study of importance of optimization in industrial process management. Knowledge of the course will help the students to apply basic concepts of mathematics to formulate an optimization problem. At the end of the course the students will be able to analyze and appreciate variety of performance measures for various optimization problems through extensive and systematic research.

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

CO1: understand importance of optimization of industrial process management
CO2: apply basic concepts of mathematics to formulate an optimization problem and solve it by simulation
CO3: analyze and appreciate variety of performance measures for various problems like game theory
CO4: define and Use Optimization Terminology and some multi-criteria decision making (AHP and ANP)
CO5: apply unconstrained & constrained search methods for optimization theory for continuous problems, including the necessary and sufficient optimality condition
CO6: apply constrained optimization theory for continuous problems, including the Karush-Kuhn-Tucker conditions and algorithms such as: quadratic & separable programming

Topics:

- Introduction to optimization
- Linear programming problem
- Concept of Dualities
- Sensitivities Analysis, IPP, NLPP
- Statistics & design of experiments
- Neural Networks, Fuzzy logic and Genetic algorithm

Textbook(s):

1. Engineering Optimization: Theory and Practice, S. S. Rao, New Age International (P) Ltd, 3rd Edition.
2. Soft Computing by D.K. Pratihar, Narosa Publications
3. Design & Analysis of Experiments, M.C. Montgomery, John Wiley & Sons, 2006
4. Quality & Robust Engineering, M.S. Phadke, Prentice Hall; 1 edition (May 22, 1989)
5. Taguchi Techniques in Quality Engineering, Phillip J. Ross, McGraw-Hill Professional; 2 editions (August 1, 1995)
6. Engineering Optimization, Ravindran and Phillips, McGraw Hill.

ME 3028 Supply Chain Management

Credit: 3
Category: PCC
Prerequisite(s): Nil

Course Description:

This course would encompass the flow of goods and services and includes all processes that transform raw materials into final products. It involves the active streamlining of a business's supply-side activities to maximize customer value and gain a competitive advantage in the market place. With effective SCM implementation inventory, production, distribution, sales and vendor inventory are all tightly controlled. SCM means managing costs at every step and delivering goods to consumers as quickly as possible. It assumes that every product that is for sale exists because of the various participants in the supply chain. At the end of the course the students will be able to solve Supplier selection and Supply chain related industrial problems through extensive and systematic research.

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

CO1: understand the important role of supply chain management in today's business environment
CO2: understand the risk associated with various supply chain practices
CO3: evaluate the implications of globalization and/or outsourcing components of the distribution network
CO4: analyze the interdependence between financial, non-financial and operational metrics used in pricing
CO5: apply problem solving and decision making frameworks that propose defensible solutions for supply chain
CO6: design a coordinated and collaborative processes and activities among the business partners

Topics:

- Understanding the supply chain, decision phases in supply chain
- Designing the distribution network
- Transportation in the supply chain
- Pricing and revenue management in the SC

Textbook(s):

1. Supply Chain Management: Strategy, Planning, and Operation, Chopra Sunil and Meindl Peter, PHI,
2. Designing and Managing the Supply Chain, David Semchi-Levi,Philip Kaminsy, TMH,

Reference Book(s):

1. Supply Chain Management: Text and Cases, Janat Saha, Pearson Education,
2. Logistics and Supply Chain Management, Martin Christoper, Pearson Education,

ME 3030 Product Life Cycle Management

Credit: 3
Category: PEC
Prerequisite(s): Nil

Course Description:

Product life cycle management (PLM) is the way the product's entire life cycle is handled from its conception, through its design and development, to its operation and disposal/retirement. Furthermore, PLM enables the manufacturing firms to describe, manage, and communicate the information about their products with their customers, suppliers, and the resources within the enterprise.
The core of PLM is to build and manage all the data and the technologies used to access the information and expertise centrally. PLM is a discipline that emerged from tools such as CAD, CAM, CAE, and PDM, but can be viewed as the integration of these tools with methods, peoples, and the processes through all stages of a product's life. The course aims to strike a balance between theory and practice by focusing on concurrent engineering practices right from the conceptual stages of product development. The students will be exposed to the use of technology to create concept drawings and designs and with the complete integration of engineering workflows.

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

CO1: identify and analyse the product design and development processes in the manufacturing industry and define the components and their functions of product design and development processes and their relationships from concept to the customer over the whole product lifecycle
CO2: aanalyse, evaluate, and apply the methodologies for product design, development, and management and undertake a methodical approach to the management of product development to satisfy customer needs
CO3: enable generation of an innovative idea for product design in a systematic approach and apply the check the quality of the new design by using product design tools
CO4: understand the stages of product life cycle management and the components of the Product life cycle environment to integrate the various stages of PLM into engineering product ranges and portfolios that will eventuate into commercial success
CO5: integrate life cycle management strategies and knowledge to develop new and/or formulate appropriate engineering design solutions in an engineering environment
CO6: develop the methodology to evaluate the life cycle

Topics:

- Fundamentals of Product Development
- Generic Product Development Process
- Product design tools and technology
- Product Life Cycle Management
- Product life cycle environment
- Components of Product Life Cycle Management

Textbook(s):

1. Product design and development, Ulrich Karl T and Eppinger Steven D., McGraw Hill Pub. Company, 1995.
2. Product Design, Kevin Otto, Kristin Wood, Indian Reprint 2004, Pearson Education, ISBN 9788177588217
3. Product Life Cycle Management, Antti Saaksvuori, AnselmiImmonen, Springer,1st Edition (Nov.5,2003).

Reference Book(s):

1. Product Design and Manufacture, Chitale A. K. and Gupta R. C, Prentice-Hall of India, New Delhi
2. Engineering of creativity: introduction to TRIZ methodology of inventive Problem Solving, Semyon D. Savransky, CRC Press.
3. Systematic innovation: an introduction to TRIZ; (theory of inventive Problem Solving), John Terninko, AllaZusman, CRC Press.
4. Emotional Design, Donald A. Norman, Perseus Books Group New York, 2004
5. Product Life Cycle Management - Driving the Next Generation of Lean Thinking, Grieves Michael, McGraw-Hill, 2006.

ME 3051 Finite Element Analysis

Credit: 3
Category: PEC
Prerequisite(s): Mathematics - I (MA 1003), Mechanics of Solids (ME 2029)

Course Description:

This course introduces the basic concepts of finite element methods, its brief story, and need of studying finite element methods. It is to teach in a cohesive way the fundamentals of the finite element method for the analysis of solid, structural, and heat transfer problems. The course will emphasize the solution of real-life problems using the finite element method underscoring the importance of the choice of the proper mathematical model, discretization techniques and element selection criteria. Applications include finite element analyses (selection of elements (1D or 2D), formulation of stiffness matrices, and shape functions), modelling of problems (1D or 2D), and interpretation of numerical results.

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

CO1: obtain an understanding of the fundamental theory of the Finite Element Analysis (FEA)
CO2: generate the governing finite element equations for systems governed by partial differential equations
CO3: formulate and solve various complicated beam problems using Galerkin‘s Technique
CO4: understand the use of the basic finite elements to solve the bar and truss problems
CO5: understand the application and use of the one-dimensional and two-dimensional problems
CO6: solve complicated engineering problems using FEM software

Topics:

- Introduction to Finite Element Method
- Direct Formulation
- Finite Element Formulation
- One-dimensional finite element analysis
- Two-dimensional finite element analysis
- FEA Software and its Applications

Textbook(s):

1. Textbook of Finite Element Analysis, P. Seshu, PHI.

Reference Book(s):

1. Finite Element Analysis, S. S. Bhavikatti, New Age International Publishers.
2. Fundamentals of Finite Element Analysis, D.V. Hutton, McGraw Hill.

ME 3056 Tribology

Credit: 3
Category: PEC
Prerequisite(s): Kinematics and Dynamics of Machines (ME 2013)

Course Description:

The Course, an off-shoot of Mechanical Engineering, has been designed to impart the pragmatic knowledge in context to the science of interacting surfaces and to offer a deeper insight in regard to the application as well as principles of friction, wear and lubrication. The domain of tribology happens to be interdisciplinary in nature and so accommodates the ingredients of plural disciplines like mechanical engineering, chemistry, material science, etc. Under the applicative scope of tribology, students are expected to get cognitive exposure pertaining to various tribological aspects of machine elements and a wide range of composite materials. The knowledge of tribology can be deployed meaningfully in checking the wasteful dispersal of energy on account of some uncalled for friction, and thereby contributes towards maintaining a green environment.

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

CO1: realize the importance of proper choice of tribological elements
CO2: design a tribological system for optimal performance
CO3: enhance students' awareness of tribological issues in the design of machine components, such as rolling element bearings, journal bearings, thrust bearings, seals, and braking systems
CO4: demonstrate basic understanding of friction, lubrication, wear processes and Sommerfeld number
CO5: select tribological elements based on design considerations
CO6: apply the knowledge of wear and lubricants for different applications

Topics:

- Introduction to tribology
- Hydrostatic lubrication
- Hydrodynamic theory of lubrication
- Friction and power losses in journal bearings
- Air lubricated bearing
- Types of bearing oil pads
- Bearing materials

Textbook(s):

1. Fundamentals of Tribology, Basu, Sen Gupta and Ahuja, PHI

Reference Book(s):

1. Engineering Tribology: G. W. Stachowiak, A. W Batchelor
2. Tribilogy, Friction and Wear of Engineering Materials: I.M. Hutchings, Elsevier Limited.
3. Introduction to Tribology of Bearing: B.C. Majumdar, S.Chand.
4. Theory and Practice of lubrication of Engineers: D.D. Fuller, John Wiley Sons 1998.

ME 3059 Computational Fluid Dynamics

Credit: 3
Category: PEC
Prerequisite(s): Fluid Mechanics and Hydraulic Machines (ME 2021), Heat Transfer (ME 3021)

Course Description:

The focus of this course is to develop the fundamentals of computational fluid dynamics and its implementations to the practical applications. The course describes the finite difference, finite volume and finite element methods in details. The mathematical formulation of mass, momentum and energy are discussed with initial and boundary conditions. Furthermore, discretization of governing equations is demonstrated and solution methods for linear algebraic equations are explained with examples. The course also describes implicit and explicit methods, stability, consistency, convergence, etc. Finally, solution algorithm for Navier-Stokes equations using SIMPLE, SIMPLEC and SIMPLER methods are explained.

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

CO1: underline the Finite difference, finite volume and finite element methods
CO2: describe the discretization procedure for steady and unsteady conduction equations using finite difference methods
CO3: apply Gauss elimination method, Gauss-Seidel iteration method, Jacobi iteration method, SOR, tri-diagonal matrix (TDMA) for solving linear algebraic equations
CO4: differentiate implicit and explicit methods, stability, consistency and convergence
CO5: propose a stable and accurate algorithm for convection diffusion equation with suitable scheme
CO6: assess the SIMPLE, SIMPLEC and SIMPLER algorithm in finite difference and finite volume framework

Topics:
- Introduction
- Mathematical formulation of physical phenomena
- Different methods for solving linear algebraic equations
- Introduction to finite difference approximation, accuracy and errors
- Discretization methods
- Finite volume formulation
- Flow field calculation

Textbook(s):
1. Computational Fluid Dynamics, John D Anderson, McGraw Hill.
2. An Introduction to Computational Fluid Dynamics: The Finite Volume Method, H, Versteeg, Malalasekhara, Prentice Hall.

Reference Book(s):
1. Computer Simulation of Flow and Heat Transfer, P. S. Ghoshdastidar, Tata McGraw Hill Publishing Company.
2. Computational Fluid Flow and Heat Transfer, Murlidhar and Sundarrajan, Narosa Publishers.
3. Numerical Heat Transfer and Fluid Flow, S. V. Patankar, Hemisphere Publishing.

ME 3065 Combustion Engineering

Credit: 3
Category: PEC
Prerequisite(s): Engineering Thermodynamics (ME 2031)

Course Description:

This course would encompass a comprehensive study of various energy sources, combustion applications, classification of combustion process according to mixing, species velocity, flame visibility etc. Application of thermodynamics on combustion, stoichiometry, absolute enthalpy and enthalpy of formation, enthalpy of combustion and heating values, adiabatic flame temperatures are also included in order to establish the fundamentals knowledge. Elementary reaction rates, unimolecular, bimolecular and termolecular reactions, collision theory; reaction rate and its functional dependence, Arrhenius equation are also discussed. Practical applications and fundamentals of laminar premixed and diffusion flames through conservation (mass, species & energy) equations & mass-fraction distribution flame velocity are explained to understand the physical and chemical behavior of combustion. Droplet evaporation basics and pollution emission during combustion such as; soot, NOx and SOx are further explored.

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

CO1: recall the basics of combustion and thermo chemistry relations
CO2: explain the fundamentals of chemical kinetics
CO3: illustrate the mechanism and explain technicality of laminar premixed flame
CO4: analyze the needs and the technical detail of laminar diffusion flame
CO5: formulate the physical process through mathematical relation of droplet evaporation
CO6: assess the causes of pollution and its minimization

Topics:

- Combustion and Thermo chemistry
- Chemical Kinetics
- Laminar premixed flame
- Laminar diffusion flame
- Droplet evaporation & combustion
- Pollutant emissions

Textbook(s):

1. Introduction to Combustion: Concepts and Applications, Stephen R Turns, McGraw Hill, 2000

Reference Book(s):

1. Combustion: Fundamentals and Application, Amitava Datta, Alpha Science International Ltd, 2017
2. Combustion Engineering, K. Kuo, New Age Pvt. Ltd.

ME 3069 Total Quality Management

Credit: 3
Category: PEC
Prerequisite(s): NA

Course Description:

This course would encompass the improvement of quality and performance in all functions, departments, and processes across the company to provide quality services which exceed customer expectations. The ability to provide quality services allow for higher prices to be charged. TQM can be summarized as a management system for a customer-focused organization that involves all employees in continual improvement. It uses strategy, data, and effective communications to integrate the quality discipline into the culture and activities of the organization. Many of these concepts are present in modern quality management systems, the successor to TQM. Here are the 8 principles of total quality management: At the end of the course the students will be able to solve industrial problems through extensive and systematic research.

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

CO1: understand the paradigm shift i.e. Quality journey to TQM philosophy
CO2: understand the top most Quality awards for International recognition and Customer satisfaction
CO3: evaluate Techniques for improving Quality in Organization and supplier end for overall improvement
CO4: analyze Leadership concepts, Employee motivation, TOP management
CO5: apply learning and research skills to be a part of World Class Quality and Excellence
CO6: design and Develop the Processes with SPC, Process capability analysis for competitive edge

Topics:

- Total Quality Management and its evolution. TQM and TPM.
- Quality awards and certification
- Statistical Methods for Quality Control
- Planning
- Quality Auditing

Textbook(s):

1. Quality Management: concepts and Tasks, V. Narayana and N.S Sreenivasan, New Age International, 1996
2. Total Quality Management for Engineers, M Zeiri, Wood Head Publishers

Reference Book(s):

1. Total Quality Management, Dale H Besterfield, Pearson Education, 2003
2. The Management and Control of Quality, James R Evans and William M Lidsay
3. Total Quality Management, L Suganthi, PHI, 2004

ME 3071 Renewable Energy Technology

Credit: 3
Category: PEC
Prerequisite(s): Mathematics-I (MA1003), Physics (PH 1007), Basic Electrical Engineering (EE 1003)

Course Description:

This course will provide a detailed understanding of the key renewable energy generation technologies and the factors which influence their exploitation**.** It provides the foundations necessary to understand the principles of solar, wind, biomass, geothermal and marine energy technologies. It describes the efficient distribution of renewable energy; their integration into usage into zero carbon built infrastructure. Finally, the economic and climate issues affecting the choice of renewable is explored.

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

CO1: list the potential, needs, the properties, advantages, disadvantages and the impact on the environment of the alternative and renewable energy sources
CO2: describe the technologies available for the conversion of renewable energy sources to the useful energy
CO3: apply the basic principles for determining the size of various equipment used in renewable energy technology
CO4: analyze the performance of various equipment used in renewable energy technology
CO5: design various components of flat plate collector, bio-gas plant, wind turbine
CO6: select the suitable material, component and technology required for efficient operation of different plants employed in renewable energy technology

Topics:

- Need for renewable energy sources and their merits and demerits
- Measurement of Solar Radiation, Solar Thermal Process, solar collector, Energy Storage, applications
- Biomass energy sources, physical processing, thermo-chemical processing, biochemical processing, vegetable oils and bio-diesel
- Energy and power in the wind, types of wind turbines, aerodynamics of wind turbines, power generation by a turbine, offshore wind energy
- Nature of tidal sources, physics of tidal energy, power generation from barrages
- Physical principles of wave energy, wave energy sources, wave energy technology, wave energy integrated systems
- Physics of geothermal resources, technologies for exploiting high enthalpy stream fields, technologies for direct use of geothermal energy, harnessing geothermal resources

Textbook(s):

1. Renewable Energy-Power for a Sustainable future, Godfrey Boyle, Oxford University Press, 3rd Edition, 2012.
2. S. P. Sukhatme, Solar Energy Principle of Thermal Collection and Storage', Tata McGraw Hill, 1990.

Reference Book(s):

1. V.S. Mangal, Solar Engineering', Tata McGraw Hill, 1992.
2. N. K. Bansal, Renewable Energy Source and Conversion Technology', Tata McGraw Hill, 1989.
3. G. L. Johnson, 'Wind Energy Systems', Prentice Hall Inc, New Jersey.

4. N K Bansal, Non-Conventional Energy Resources, Vikas Publishing House Pvt. Ltd., 2014.
5. G. D. Rai, Non-Conventional Energy Sources, Khanna Publishers, Fourth Edition.

ME 3073 Mechanics of Composite Materials

Credit: 3
Category: PCC
Prerequisite(s): Mechanics of Solids (ME 2029)

Course Description:

This course focuses on the comprehensive study of characteristics and application of composite material, strength of unidirectional and orthotropic lamina, mechanical and stress-strain behavior of anisotropic material, and application of plate theory to understand stress variation in laminates. Knowledge of the course will help the students to analyze the stress-strain behavior of laminate composites using classical lamination theory. At the end of the course the students will be able to cope up with industrial challenges related to analysis and application of laminated composites through extensive research.

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

CO1: understand the characteristics and application of a composite material and different manufacturing methods of laminated fiber-reinforced composite materials
CO2: understand the strength of a unidirectional lamina, strength and failure criteria of an orthotropic lamina
CO3: evaluate the macromechanical behavior of a lamina, stress-strain relation for anisotropic material
CO4: determine various elastic constants
CO5: apply the classical lamination theory for understanding the stress-strain variation in laminate
CO6: familiarize with composite test procedures and design new composites

Topics:

- Introduction of composite materials
- Elastic behavior of unidirectional lamina
- Macro-mechanical behavior of a lamina
- Micro-mechanical behavior of a lamina
- Analysis of laminated composites
- Test Methods for measuring properties of composites

Textbook(s):

1. Mechanics of Composite Materials, R. M. Jones, Taylor and Francis

Reference Book(s):

1. Composite Materials, K. K. Chawla, SPRINGER-VERLAG.
2. Engineering Mechanics of Composite Materials, I. M. Daniel and Ori Ishai, Oxford University Press.

ME 3081 Machine Design

Credit: 1
Category: PCLC
Prerequisite(s): Mechanics of Solids (ME 2012)

Course Description:

This sessional is intended to make the students learn how to design and determine geometrical dimensions of a component subjected to complex stress system. While solving the various numerical the basic requirement for machine elements, machines and manufacturing considerations in design can be understood easily. The practical significance is that a machine element subjected to point or distributed load, moment or a combination of both can be designed or selected for the available set of components for the industrial requirements with the imparted knowledge.

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

CO1: apply engineering analysis principles and methods to design different machine components, systems, or processes
CO2: solve competently and confidently basic and advanced design-related problems
CO3: design different types of temporary (like threaded, knuckle, cotter etc.) and permanent joints (riveted, welded etc.) and understand the basic design procedure
CO4: learn different methods of designing the temporary (like a threaded, knuckle, cotter etc.) and permanent joints (riveted, welded etc.)
CO5: select the most appropriate method out of available ones to design different Type of couplings, keys, and shafts
CO6: apply computer-based techniques in the analysis, design and selection of machine components

Topics:

- Design of Riveted joints.
- Design of circumferential and longitudinal joints in boiler.
- Design of welded joints.
- Design of bolted joints
- Design of cotter joints.
- Design of knuckle joints.
- Design of shafts.
- Design of keys.
- Design of couplings.
- Design of helical springs.

ME 3086 Computer Aided Design Analysis

Credit: 1
Category: PCLC
Prerequisite(s): Design of Machine Elements-I (ME 3023), Mechanics of Solids (ME 2029), Materials Science and Engineering (ME 2027)

Course Description:

This sessional emphasizes the design of the different components and structures under variable loading system. The practical significance of this sessional is to get ideas on material consideration, calculation of geometrical dimensions of machine components for various conditions. This helps to gain practical knowledge while designing the I.C engine components, Gear drive for the mechanical power system, sliding contact and rolling bearings. Using Solidworks, ANSYS software, modelling and analysis of the various elements under various load conditions can be learnt.

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

CO1: understand the design requirements for different machine components and manufacturing considerations associated with this
CO2: apply fatigue failure criteria in the design and analysis of machine component subjected to various loading condition
CO3: familiarize themselves with the design of I.C engine components and make themselves aware of the tribological issues in the design of machine components
CO4: identify, formulate and solve engineering problems by designing appropriate gear drives for the mechanical power system
CO5: implement and design the domain knowledge in actual systems
CO6: analyze and apply the domain knowledge in practical problems using engineering tools such as Solidworks and ANSYS

Topics:

- Design against variable loading conditions
- Design of I.C Engine Components such as I.C engine cylinder, piston, connecting rod, crankshaft, valve and valve mechanism
- Design of different types of gear such as spur gear, Helical gear, Bevel gear
- Design of Sliding and Rolling contact bearings
- Evaluation of fatigue life in machine components using ANSYS
- Demonstration of temperature and stress/strain distribution in I.C Engine components using ANSYS

ME 3092 Internal Combustion Engine & Refrigeration Air Conditioning Laboratory

Credit: 2
Category: PCLC
Prerequisite(s): Internal Combustion Engine & Gas Turbine (ME 3003) and Refrigeration Air Conditioning (ME 3014)

Course Description:

This course studies the fundamentals regarding the operation of internal combustion engines which includes the performance like all types of efficiencies, fuel requirements, and environmental impact. It also includes the estimation of engine power, efficiency and emission characteristics. The laboratory also gives a practical insight to various HVAC systems which includes the application of refrigeration, air conditioning, waste heat recovery and evaporative cooling. It also includes the estimation of C.O.P. and capacity. Cut section model of all types of compressors, Air conditioners and condensers are used to give thorough knowledge of their parts, working and maintenance.

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

CO1: recall the working principles of various processes related to IC Engines, Air-Conditioning and Refrigeration
CO2: recognize the different components related to IC Engines, Refrigeration and air conditioning
CO3: interpret the effects of various important parameters such load, speed and fuel consumption in case of IC Engine and super heating, under cooling, DBT, WBT etc. in case of HVAC systems on system performance
CO4: analyze the experimental result / heat balance sheet for better performance and improved accuracy
CO5: design open ended experiment
CO6: justify the source of difference between experimental and theoretical results

Topics:

- To determine the Valve Timing Diagram of 4-stroke petrol and diesel engine
- To determine the overall performance characteristics of a Single Cylinder Four Stroke Diesel Engine
- To determine the overall performance characteristics of a Single Cylinder Four Stroke Petrol Engine
- To determine the overall performance characteristics of a Single Cylinder Two Stroke Petrol Engine
- Study and trial of vapour compression refrigeration System
- Study and trial on air conditioning test rig
- Study and trial on auto-air conditioning unit
- Study and determination of the COP, cooling and heating capacity of air to air heat pump
- Investigate of the COP of vapour absorption refrigeration system
- Trial on ICE plant unit
- Performance evaluation of evaporative cooling setup
- Investigation of two stage cascade refrigeration system

ME 3093 Computational Technique Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Mathematics-III (MA 2005)

Course Description:

This course would encompass a comprehensive study of solving the numerical methods using the computational techniques. This course will help the students to develop a practical approach to mathematical problem solving using computational techniques and to develop the ability to convert commonly used numerical tools and techniques into computer s. At the end of the course, the students will be able to understand the nuances of the numerical techniques and computer applications of the same through extensive and systematic research.

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

CO1: recall the different numerical methods
CO2: explain the procedure of solving the numerical methods following various computational techniques
CO3: apply the program developed using the numerical methods and execute by using MATLAB/SCILAB software
CO4: analyze the computational results with the existing analytical results
CO5: propose the suitable numerical method for solving an equation
CO6: compare the results obtained for the program developed using the numerical methods with the results obtained using existing commercial software and justify

Topics:

- Recapitulation of numerical methods and introduction to the basics of MATLAB
- Solution of algebraic and transcendental equations using bi-section method
- Solution of algebraic and transcendental Equations using Regula-Falsi method
- Performing matrix inversion and solving eigen-value problems using Gauss-Jordan Method
- Interpolation using Newton's forward / backward interpolation formula
- Numerical solution of ordinary differential equations using Picard's Method and Euler's Method
- Numerical solution of partial differential equations: Solution to Laplace equation
- Solving a system of linear equations: Computing the deflection of cantilever beam/plate/truss subjected to mechanical loading
- Solving an eigen-value problem: Determining the natural frequencies and mode shapes of a beam/plate structure
- Introduction to ANSYS, introduction to pre-processing, solution and post-processing stages

Textbook(s):

1. Ralston and P. Rabinowitz, A First Course in Numerical Analysis, McGraw Hill
2. S. C. Chapra, Applied Numerical Methods with MATLAB for Engineers and Scientists, Indian Edition, McGraw Hill, 2012

Reference Book(s):

1. V. Rajaraman, Computer Oriented Numerical Methods , PHI, 2002
2. David Houcque, Introduction to Matlab for engineering students, Northwestern University

ME 3095 Heat Transfer Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Heat Transfer (M E3021)

Course Description:

This laboratory is intended to describe the fundamental concepts to students in the area of heat transfer and its applications. This provides knowledge about different modes of heat transfer, like conduction, convection and radiation. The practical significance of various parameters those are involved in different modes of heat transfer can be recognized. The knowledge of heat transfer can be applied for different applications in an effective manner. The students can be trained practically to utilize this knowledge in industry.

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

CO1: evaluate the thermal conductivity of given metal bars of different material and a solid disc
CO2: experiment the conduction heat transfer through fluids and assess their thermal conductivity
CO3: calculate the heat transfer coefficient for a pin fin
CO4: compare the heat transfer from flat, finned and pinned surfaces in forced convection and natural convection
CO5: estimate the overall heat transfer coefficient and efficiency of parallel and counter flow heat exchangers
CO6: test the emissivity of different surfaces and examine the Stefan Boltzmann Constant

Topics:

- Linear heat conduction experiment
- Radial heat conduction experiment
- Extended surface heat transfer
- Thermal conductivity of liquid
- Concentric tube heat exchanger
- Investigations of heat transfer in natural convection
- Investigations of heat transfer in forced convection
- Determination of Stefan-Boltzmann constant
- Determination of emissivity

ME 3096 Mechanical Engineering Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Advanced Manufacturing Processes Laboratory (ME 3097)

Course Description:

This mechanical engineering laboratory is intended to describe the indispensable concepts to students in the area for the development of practical knowledge with fundamental understanding of Lab view software, Measurement and Instrumentation, advance reliability center, Computer Integrated Manufacturing, and Robotics. Moreover, the practical significance of multifarious advanced concept of Mechanical Engg. analysis can be recognized. The knowledge of the CIM and robotics system can be furthermore enhanced for better implementation in the practical field. The students can be practically trained to exploit this knowledge in the industry.

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

CO1: develop a VI for numeric, boolean controls and indicators, temperature of a body using thermistor, acceleration of a body using accelerometer using Lab view software
CO2: experiment on condition monitoring equipments, bearing mounting and dismounting process.
CO3. experiment on pick and place an object using 6 axis aristo robot
CO4. experiment on automatic storage and retrieval system
CO5. measure the average arithmetic surface roughness using Surfest SV 2100 M4 machine and the 3D object in CMM
CO6. measure the cylindricity/ovality of cylindrical/ spherical object

Topics:

- Development on a VI numeric, boolean controls and indicators using Lab view software.
- Creation of a VI that converts degree centigrade to degree Fahrenheit built with sub VI using Lab view software.
- Development on a VI for measure the temperature of a body using thermistor.
- Development of a VI for acceleration of a body using accelerometer.
- Experiment on condition monitoring equipments.
- Experiment on bearing mounting and dismounting process.
- Experiment on pick and place an object using 6 axis aristo robot
- Experiment of automatic storage and retrieval system.
- Measurement of the average arithmetic surface roughness using Surfest SV 2100 M4 machine.
- Measurement of cylindricity/ovality of cylindrical/ spherical object.
- Measurement of the 3D object in CMM.

Cover Desiging by : KIIT Publication Cell

KIIT Deemed to be University

At / P.O.:-KIIT, Bhubaneswar-751024, Odisha, India

Ph: + 91 2725113, 2741998, Fax: +91 2740326, E.mail: kiit@kiit.ac.in, Website:www.kiit.ac.in