ACADEMIC CURRICULA 2018 - 2022

BACHELOR'S DEGREE PROGRAMME
B. Tech in
Aerospace 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
AEROSPACE 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 AEROSPACE ENGINEERING

Programme Educational Objectives (PEOs):

The B. Tech programme in Aerospace Engineering aims to prepare the graduates with the following objectives:

1. Graduates shall be able to provide solutions to aerospace 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 aerospace engineering and related domains.
n) Pursue advanced degrees in aerospace 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 AEROSPACE 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 2015	Manufacturing Technology	3	0	0	3	3
3	AS 2003	Introductory Aerodynamics	3	0	0	3	3
4	AS 2005	Aerospace Structures-I	3	1	0	4	4
5	AS 2007	Aerospace Thermodynamics	3	0	0	3	3
6	AS 2010	Aerospace Materials Technology	3	0	0	3	3
Total of Theory						20	20
Practical							
1	AS 2091	Aerospace Thermodynamics Lab	0	0	2	2	1
2	AS 2092	Aerospace Structures Lab-I	0	0	2	2	1
Sessional							
1	ME 2083	Machine Drawing and Computer Aided Design	0	0	2	2	1
2	ME 2085	Manufacturing Practices	0	1	2	3	2
Total of Practical & Sessional						9	5
Semester Total						29	25

SEMESTER- IV

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	AS 2002	Automatic Control Theory	3	0	0	3	3
2	AS 2012	Aerospace Structures-II	3	1	0	4	4
3	AS 2014	Aircraft Systems & Instrumentation	3	0	0	3	3
4	AS 2016	Aerodynamics - I	3	1	0	4	4
5	AS 2018	Propulsion - I	3	1	0	4	4
6		HS Elective-I	3	0	0	3	3
Total of Theory						21	21
Practical							
1	ME 2091	Material Testing Lab	0	0	2	2	1
2	AS 2094	Aerodynamics Lab - I	0	0	2	2	1
3	AS 2096	Aerospace Structures Lab-II	0	0	2	2	1
Sessional							
1	HS 2081	Business Communication	0	0	2	2	1
Total of Practical & Sessional						8	4
Semester Total						29	25

SEMESTER- V

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	AS 3005	Aerodynamics – II	3	1	0	4	4
2	AS 3007	Propulsion – II	3	1	0	4	4
3	AS 3015	Aircraft Performance	3	0	0	3	3
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	AS 3093	Aerodynamics Lab - II	0	0	2	2	1
2	AS 3095	Propulsion Lab	0	0	2	2	1
3	AS 3096	Aerospace Measurement Lab	0	0	2	2	1
Sessional							
1	AS 3081	Aircraft Systems	0	0	2	2	1
Total of Practical & Sessional						8	4
Semester Total						28	24

SEMESTER- VI

Sl. No	Course	Course Title	L	T	P	Total	Credit
Theory							
1	AS 3010	Aircraft Stability and Control	3	0	0	3	3
2	AS 3012	Space Mechanics	3	0	0	3	3
3	AS 3014	Avionics	3	0	0	3	3
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						18	18
Practical							
1	AS 3094	Avionics Lab	0	0	2	2	1
Sessional							
1	AS 3082	Minor Project	0	0	4	4	2
2	AS 3084	FEM &CFD Analysis	0	1	2	3	2
3	AS 3086	Aeroengine and Airframe	0	0	2	2	1
Total of Practical & Sessional						11	6
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	AS 4081	Project-I / Internship					3
2	AS 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	AS 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.	AS 3032	Theory of Aero-elasticity	3
2.	AS 3038	Aviation Fuels & Combustion	3
3.	ME 3071	Renewable Energy Technology	3
4.	ME 3073	Mechanics of Composite Materials	3
5.	ME 3025	Optimization Techniques	3

Dept. Elective-II

1.	AS 3031	Computational Aerodynamics	3
2.	ME 3024	Mechanical Vibration and Noise Engineering	3
3.	ME 3028	Supply Chain Management	3
4.	ME 3043	Power Plant Engineering	3
5.	ME 3047	Production and Operations Management	3

Dept. Elective-III

1.	AS 3035	Satellites& Space System Design	3
2.	AS 3037	Airframe Repair & Maintenance	3
3.	ME 3022	Principles of Turbo-machines	3
4.	ME 3051	Finite Element Analysis	3
5.	ME 3059	Computational Fluid Dynamics	3

Dept. Elective-IV

1.	AS 3040	Rockets & Missiles	3
2.	AS 3046	Rotor Dynamics & Tribology	3
3.	ME 3067	Cryogenics	3
4.	ME 3065	Combustion Engineering	3
5.	ME 3069	Total Quality Management	3

Dept. Elective-V

1.	AS 3048	Helicopter Aerodynamics	3
2.	AS 3050	Airport & Airlines Management	3
3.	AS 3056	Introduction to UAV Technology	3
4.	ME 3030	Product Life Cycle Management	3
5.	ME 3052	Nano Technology	3

HONORS COURSES OFFERED BY AEROSPACE ENGINEERING

Sl. No	Course	Course Title	Prerequisite/s
1	AS 4001	Composite Materials and Structures	Aerospace Materials Technology (AS 2010), Aerospace Structures-I (AS 2005)
2	AS 4002	Advanced Aerospace Structure	Aerospace Structures-I (AS 2005), Aerospace Structures-II (AS 2012)
3	AS 4003	Theory of Plates and Shells	Engineering Mechanics (ME 1003), Aerospace Structures-I (AS 2005), Aerospace Structures-II (AS 2012)
4	AS 4004	Boundary Layer Theory	Introductory Aerodynamics (AS 2003)
5	AS 4005	Turbulence in Fluid Flows	Introductory Aerodynamics (AS 2003)
6	AS 4006	Viscous Fluid Flow	Introductory Aerodynamics (AS 2003)
7	AS 4007	Hypersonic Air Breathing Propulsion	Propulsion - I (AS 2018), Propulsion – II (AS 3007)
8	AS 4008	Radiative Heat Transfer	Aerospace Thermodynamics (AS 2007)
9	AS 4009	High Temperature Gas Dynamics	Aerospace Thermodynamics (AS 2007), Aerodynamics - II (AS 3005)

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

AS 2002 Automatic Control Theory

Credit: 3
Category: PCC
Prerequisite(s): Mathematics-II (MA 1004)

Course Description:

This course would encompass a comprehensive study of control theory and their various applications in mechanical, thermal and electrical systems. It that includes open and closed loop feedback control system, representation of control systems, reduction methods of block diagrams, Signal Flow Graph (SFG), Mason's Gain Formula, Transient response of systems to different inputs viz. Step, impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuittools. Knowledge of the course will help the students to apply all these concept and methodology in different aero-systems especially flight control system, attitude control system, hydraulic/ pneumatic control system etc of aviation field by considering various design aspects aircraft. At the end of the course the students will be able to solve mechanical related industrial problems through extensive and systematic research.

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

CO1: explain and evaluate the transfer functions for automatic control systems; open-loop and closed-loop systems
CO2: analyze the various time domain and frequency domain tools for analysis and design of linear control systems
CO3: evaluate the response of different system and analyze the steady state error of unit feedback control system
CO4: understand the stability analysis of systems with reference to characteristic equation
CO5: apply the methods to analyze the stability of systems from transfer function forms
CO6: assess the methods to analyze the sampled-data control systems

Topics:

- Introduction To Automatic Control Systems- simple pneumatic, hydraulic and thermal systems, series and parallel systems, analogies, mechanical and electrical components
- Closed loop control versus open loop control, Feedback control systems, Block diagram representation of control systems, reduction of block diagrams, Signal Flow Graph (SFG), Mason's Gain Formula
- Transient And Steady-State Response Analysis- Laplace transformation, Response of systems to different inputs viz. Step, impulse, pulse, parabolic and sinusoidal inputs, Time response of first and second order systems, steady state errors and error constants of unity feedback circuit
- Stability Analysis- Stability definitions, characteristic equation, location of roots in the s-plane for stability, Routh-Hurwitz criteria of stability, Root locus and Bode techniques, concept and construction, frequency response
- Sampled data control systems - functional elements-sampling process – z-transforms-properties - inverse z- transforms- response between samples modified z-transforms - ZOH and First order Hold process- mapping between s and z planes - pulse transfer functions - step response

Textbook(s):

1. Katsuhiko Ogata., “Modern Control Engineering”, 4th edition, Prentice Hall of India Private Ltd, NewDelhi, 2004.
2. Nagrath, I J and Gopal, .M., “Control Systems Engineering”, 4th edition, New Age International Pvt. Ltd., New Delhi, 2006.

Reference Book(s):

1. Benjamin, C Kuo., “Automatic Control System”, 7th edition, Prentice Hall of India Private Ltd, New Delhi, 1993.
2. Richard, C. Dorf and Robert H. Bishop., “Modern Control System Engineering”, Addison Wesley, 1999.

AS 2003 Introductory Aerodynamics

Credit: 3
Category: PCC
Prerequisite(s): Physics (PH 1007), Mathematics-I (MA 1003)

Course Description:

This course would cover a comprehensive study of fluid properties and its properties, manometers, hydrostatic thrusts on submerged surfaces, buoyancy, classification of fluid flow, continuity equation, differential equation of continuity, Mathematical definitions of irrotational and rotational motion, potential function and stream function flow net, Bernoulli's equation and its applications. Flow in pipes and ducts, power transmission, flow through nozzles, dimensional analysis, Rayleigh's method and Buckingham theorem, similarity laws and model studies. Knowledge of the course will help the students to solve the problems relative to the fluid flows.

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

CO1: explain fluid properties and determine hydrostatic pressure using manometric data
CO2: demonstrate stability of floating bodies and types of flow and visualize different motion
CO3: understand the practical applications of Bernoulli's equation
CO4: apply Bernoulli's equation in moving fluids to find flow rate
CO5: solve hydraulic pipe flow problems and hence calculate hydraulic and energy grade lines
CO6: apply Rayleigh's method and Buckingham theorem for dimensional analysis and model study

Topics:

- Fundamentals of fluid mechanics, fluid properties
- Fluid statics, Manometers, Buoyancy
- Kinematics of fluid flow, Classification of fluid flow, Conservation of mass and momentum
- Dynamics of flow, Bernoulli's equation and its application
- Flow in pipes and ducts, Flow through nozzles
- Dimensional and model analysis

Textbook(s):

1. A Text Book of Fluid Mechanics and Hydraulic Machines, R. K. Bansal . Laxmi Publications(p) Ltd. 2010, 9th Edition.

Reference Book (s):

1. Introduction to Fluid Mechanics and Fluid Machines, S. K. Som, G. Biswas & S. Chakraborty, McGraw Hill Education (India) Pvt. Ltd, New Delhi, 3rd Edition, 2014.
2. A Text Book of Fluid Mechanics, R. K. Rajput, S. Chand Limited, 2008.
3. Hydraulics and Fluid Mechanics Including Hydraulics Machines, P.N. Modi, Standard Publishers Distributors, 19th Edition, 2013.
4. Fluid Mechanics, A. K. Mohanty, PHI Learning Pvt. Ltd., 2001.
5. Engineering Fluid Mechanics, K. L. Kumar, S. Chand Limited, 2008.
6. Fluid Mechanics, Y. Cengel and J. Cimbala, McGraw Hill Education (India) Pvt. Ltd, New Delhi, 2nd Edition, 2010.

AS 2005 Aerospace Structures-I

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

Course Description:

This course would encompass a comprehensive study of stress analysis of various structural members found in various structural components and functions especially used in aircraft structures. Knowledge of the course will help the students to identify various types of structural members based on dimensions, various types of supports and loading conditions. The students will be able to calculate normal stresses and strains, principal stresses and strains, draw shear force and bending moment diagrams of beams and frames, torsion and calculate deformations of structural members using various methods. This course will enable to students to identify various failure conditions and can perform failure analysis of aircraft structures. At the end of the course the students will be able to solve various structural stress analysis problems involved in design and stress analysis of aircraft structures related to industrial problems through extensive and systematic research.

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

CO1: analyze structural elements in aircraft
CO2: solve three moment equation and moment distribution
CO3: make simplified analysis of a/c structures & apply energy methods
CO4: understand and solve the column problems
CO5: apply failure theories for various loading conditions
CO6: understand the working principles of thin and thick cylinders

Topics:

- Introduction to Aircraft Structures
- Stresses and Strains
- Shear Force and Bending Moment
- Slope and Deflection
- Strain Energy
- Torsion
- Theories of Failure
- Columns and Cylinders

Textbook(s):

1. Donaldson, B.K., "Analysis of Aircraft Structures - An Introduction", McGraw-Hill, 1993.

Reference Book(s):

1. Timoshenko, S., "Strength of Materials", Vol. I and II, Princeton D. Von Nostrand Co, 1990.

AS 2007 Aerospace Thermodynamics

Credit: 3
Category: PCC
Prerequisite(s): Mathematics-I (MA 1003), Physics (PH 1007)

Course Description:

This course is designed to amplify the understanding of fundamental thermodynamic laws and consequently, their applications in analyzing various energy interactions for both cyclic and acyclic processes. 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 of aerospace engineering. Additionally, this course includes the knowledge of designing thermal power plants by covering the characteristics of pure substances and the performance analysis of various power cycles. Also, this course highlights the mechanism of various modes of heat transfer and the design principle of heat exchanger.

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

CO1: comprehend terminology related to thermal engineering and recognize the need of learning thermodynamics
CO2: apply the fundamentals of 1^{st} law of thermodynamics in cyclic and acyclic processes
CO3: appraise the 2^{nd} law of thermodynamics in applications related to heat engine, heat pump and refrigerators
CO4: read and comprehend steam table and Mollier chart in solving complex thermal power plant problems
CO5: understand the applicability of thermodynamics in gas and steam power cycles
CO6: interpret the mechanism of conduction, convection and radiation, and the principle of heat exchanger

Topics:

- Thermodynamic systems and properties
- First law of thermodynamics and its application to flow processes
- Second law of thermodynamics and entropy
- Pure substances
- Gas power cycles
- Heat transfer and heat exchanger

Textbook(s):

1. Engineering Thermodynamics, Second Edition, P. Chattopadhyay, Oxford University Press.

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

AS 2010 Aerospace Materials Technology

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

Course Description:

This course includes a comprehensive study of different types of materials, their crystal structures and their mechanical, thermal, optical and magnetic properties, in context to the aerospace industry. Students will be able to interpret the phase diagram of various material systems, elucidate their appropriate heat treatments methods and test their performance using common destructive and non-destructive testing techniques. 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 ferrous and non-ferrous materials with their concerned processing and properties and select the right material for their research activities.

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

CO1: recognize appropriate material for particular aerospace application
CO2: develop and change the chemical, physical and mechanical properties of ferrous and non-ferrous alloys for aero structural applications
CO3: select different non-ferrous materials for different industrial and day to day life application
CO4: change the mechanical properties of steel with or without change in chemical compositions
CO5: use the technique to prevent corrosion of different ferrous and non-ferrous alloys
CO6: understand the selection criteria of materials for designing various aircraft, missile and satellite components

Topics:

- Classification of Engineering Materials
- Structure of Materials
- Phase Diagrams
- Engineering Materials In Aerospace
- Materials Testing
- Materials Selection and Design Considerations

Textbook(s):

1. Materials Science and Engineering, Willium D. Callister, Jr. John Wiley & Sons publications Or Callister's Materials Science and Engineering Adapted By R. Balasubramaniam, Wiley India, Edition -2010.

Reference Book(s):

1. Material Science and Engineering, V. Raghavan, Prentice Hall of India, 4th Edition.
2. Engineering Metallurgy Applied Physical Metallurgy, R. A. Higgins, 6th Edition.

AS 2012 Aerospace Structures-II

Credit: 4
Category: PCC
Prerequisite(s): Aerospace Structures-1 (AS 2005)

Course Description:

This course would encompass a comprehensive study of stress analysis of unsymmetrical structural members found in various structural components and their functions especially used in aircraft structures. Knowledge of the course will help the students to identify indeterminate structures and to analyze those structures using various methods, un-symmetric bending and torsional analysis, sshear flow in open, closed sections, plate bending. This course will enable to students to identify various joints and their failure analysis used in aircraft structures. At the end of the course the students will be able to analyze indeterminate and un-symmetric structures under bending and torsion related to aerospace problems through extensive and systematic research.

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

CO1: understand maximum bending stress in unsymmetrical sections
CO2: analyze the flexural shear stress
CO3: determine torsional shear stress
CO4: calculate panel buckling allowable load
CO5: distinguish between flange and web load
CO6: determine the failure methods in joints and fittings

Topics:

- Indeterminate Structures
- Unsymmetrical Bending
- Shear Flow In Thin Walled Sections
- Bending of Thin Plates
- Joints and Fittings

Textbook(s):

1. Lakshmi Narasaiah, G., "Aircraft Structures", BS Publications, Hyderabad, 2010.

Reference Book(s):

1. Peery, D.J., and Azar, J.J., "Aircraft Structures", 2nd edition, McGraw-Hill, N.Y., 1993.
2. Megson, T.M.G., "Aircraft Structures for Engineering Students", Edward Arnold, 1995.
3. Rivello, R.M., "Theory and Analysis of Flight Structures", McGraw-Hill, 1993
4. Bruhn. E.H. "Analysis and Design of Flight Vehicles Structures", Tri - state off set company, USA, 1973.

AS 2014 Aircraft Systems & Instrumentation

Credit: 3
Category: PCC
Prerequisite(s): Aerospace Thermodynamics (AS 2007)

Course Description:

The course covers aircraft systems and subsystems which are important for reliable and safe operation of transport aircraft. Beginning with a review on the historical development of aircraft and aircraft systems, the course presents a comprehensive view on the design and functionality of several systems and system components as well as their interaction. It also includes various engine systems and subsystems, their functional aspects and troubleshooting. This course will introduce the student to aircraft instrumentation, communication radios, navigation equipment, and position/warning systems. The students will understand how to inspect, check, troubleshoot, and service aircraft flight instrumentations systems both mechanical and electronic.

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

CO1: know about Location, visibility and probing of Instrument, Panels, Basic Instrument elements and Mechanism
CO2: know about basic electrical system, communication and navigating system in aircraft
CO3: state the ICAO instrumentation requirements and describe instrumentation elements, mechanisms, error sources and temperature compensation
CO4: demonstrate an aircraft control system, engine control systems (such as fuel control, ignition control, engine indications etc.) fuel systems and its components for both civil and military aircraft
CO5: demonstrate the electrical systems (both A.C & D.C) utilizing as an auxiliary power sources in aircraft
CO6: understand the working principles of navigation system

Topics:

- Airplane Control Systems
- Aircraft Systems
- Air-Conditioning and Pressurizing System
- Engine Systems
- Aircraft Instruments
- Flight Instruments
- Communication and Navigations Systems

Textbook(s):

1. Treager, S., “Gas Turbine Technology”, McGraw-Hill, 1997.

Reference Book (s):

1. McKinley, J.L., and Bent, R.D., “Aircraft Maintenance & Repair”, McGraw-Hill, 1993.
2. “General Hand Books of Airframe and Powerplant Mechanics”, U.S. Dept. of Transportation, Federal Aviation Administration, The English Book Store, New Delhi1995.
3. Mekinley, J.L. and Bent, R.D., “Aircraft Power Plants”, McGraw-Hill, 1993.
4. Pallet, E.H.J., “Aircraft Instruments & Principles”, Pitman & Co., 1993.

AS 2016 Aerodynamics - I

Credit: 4
Category: PCC
Prerequisite(s): Introductory Aerodynamics (AS 2003), Mathematics-I (MA 1003), Mathematics-II MA 1004)

Course Description:

This course would encompass a comprehensive study of fundamentals of elementary flows in aerodynamics with detailed analysis of aerofoil theory, wing theory, propeller theory and boundary layer theory. Knowledge of the course will help the students to apply fluid mechanics concepts in calculating forces and moments acting on aerofoil and wings under ideal flow conditions and establishing aerofoil and wing characteristics with analysis of aerodynamic interaction effects between different components of aircraft.

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

CO1: apply fluid mechanics concepts
CO2: understand the fundamentals of lift generation
CO3: calculate forces and moments acting on aerofoil and wings under ideal flow conditions
CO4: determine the aerofoil and wing characteristics
CO5: design of a propeller and determine aerodynamic interaction effects between different components of aircraft
CO6: analyze the real time viscous flow and Boundary Layer behaviour

Topics:

- Introductory Topics for Aerodynamic
- Aerofoil Theory
- Theory of Propellers
- Wing Theory
- Flow Past Non-Lifting Bodies and Interference Effects
- Viscous Flow

Textbook(s):

1. Fundamentals of Aerodynamics, John D. Anderson (Jr.) Fifth Edition, McGraw Hill Series.

Reference Book(s):

1. Aerodynamics for Engineering Students, sixth Edition, Houghton, E.L., P. W. Carpenter, Steven H. Collicott, Daniel T. Valentine Elseveir Publishers Ltd.
2. Aerodynamics, Clancy, L.J., Indian Edition 2006, Sterling Book House Mumbai.
3. Aerodynamics for Engineers, fourth Edition, Bertin J J., Pearson Education 2002.
4. Milne Thomson, L.H., "Theoretical aerodynamics", Macmillan, 1985.

AS 2018 Propulsion- I

Credit: 4
Category: PCC
Prerequisite(s): Aerospace Thermodynamics (AS 2007)

Course Description:

This course provides an introduction to the design and performance of air-breathing engines and the physical parameters used to characterize propulsion system performance. It covers the mechanics and thermodynamics aspects of propulsion starting from the fundamental principles and how to apply those principles in engine design. This course helps to design various parts of a propulsion system including compressor, turbine, combustion chamber etc. Furthermore, also helps to model the fluid flow in a jet engine.

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

CO1: summarize the working principle, thermodynamic cycles and performance characteristics of gas turbine engines
CO2: illustrate the internal flow and external characteristics near the inlets, starting problems and different modes of operation in supersonic inlets
CO3: demonstrate the types and working principles of axial compressors, its velocity diagrams, blade design and performance characteristics of compressors
CO4: know the types of combustion chambers, the flame stabilization and combustion techniques
CO5: illustrate flow through nozzle, losses in nozzle, variable area nozzle and thrust vectoring
CO6: understand the efficiency calculations for over-expanded and under-expanded nozzles

Topics:

- Overview of propulsion application
- Review and mechanics of thermodynamic fluid flow
- Fundamentals of Gas turbine Engine, Thrust equation
- Performance characteristics
- Subsonic and supersonic inlets
- Axial and centrifugal compressor
- Combustion chamber, Turbines
- Nozzle

Textbook(s):

1. Hill, P.G. & Peterson, C.R. “Mechanics & Thermodynamics of Propulsion” Addison – Wesley Longman INC, 1999

Reference Book(s):

1. Cohen, H. Rogers, G.F.C. and Saravanamuttoo, H.I.H. “Gas Turbine Theory”, Longman, 1989.
2. Oates, G.C., “Aero thermodynamics of Aircraft Engine Components”, AIAA Education Series, New York, 1985.
3. “Rolls Royce Jet Engine” – Third Edition – 1983.
4. Mathur, M.L. and Sharma, R.P., “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers & Distributors, Delhi, 1999.

AS 2091 Aerospace Thermodynamics Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Aerospace Thermodynamics (AS 2007), Physics (PH 1007)

Course Description:

This laboratory is intended to impart the knowledge of laws of thermodynamics and to give hands on training to estimate the performance of thermodynamics system. Student can do a comparative studies of experimental and theoretical results. The experience of doing various experiments will help the students to solve the real problems related to heat transfer phenomena, refrigeration and air-conditioning and IC engines.

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

CO1: determine of thermal conductivity of a composite slab
CO2: find out thermal conductivity of the material in a soliddiscusing the radial heat conduction equipment
CO3: calculate of heat transfer coefficient for extended surface
CO4: determine of thermal conductivity of castor oil using Gas and Liquid thermal conductivity experiment Unit
CO5: study the two and four stroke Petrol and Diesel Engine
CO6: determine Coefficient of performance of a refrigeration test rig

Topics:

- Determination of thermal conductivity of a composite slab
- Determination of thermal conductivity of the material in a solid disc using the radial heat conduction equipment
- Determination of heat transfer coefficient for extended surface
- Determination of thermal conductivity of castor oil using Gas and Liquid thermal conductivity Experiment Unit
- Study of two and four stroke Petrol and Diesel Engine
- Test for Two and Four stroke single cylinder Petrol Engine Coupled to Rope Brake Dynamo-meter Test Rig
- Study the Vapour compression test rig and determine the theoretical and actual of Coefficient of performance in batch mode with and without load
- Study of Air Conditioning System and their Components

AS 2092 Aerospace Structures Laboratory - I

Credit: 1
Category: PCLC
Prerequisite(s): Engineering Mechanics (ME 1003)

Course Description:

This laboratory is intended to carryout experiments to understand the fundamental concepts of stresses and strains of structural members used in aircraft. Students also the verify the experimental results with theoretical calculations. The practical significance of various experiments will help them to carryout stress analysis of aerospace structures. 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: determine the stress and strain in a structure subjected to a combined loading using a strain Rosette
CO2: calculate the shear forces and bending moments, deflection of simple supported beam, cantilever beam and fixed beams
CO3: verify Maxwell's reciprocal theorem, for a simply supported beam
CO4: to know the forces in each member and determine the deflection of a pin jointed truss
CO5: to evaluate the stresses in a thin and thick cylinder and compare the results analytically
CO6: to calculate impact strength of steel specimen by Izod impact test

AS 2094 Aerodynamics Laboratory – I

Credit: 1
Category: PCLC
Prerequisite(s): Introductory Aerodynamics (AS 2003)

Course Description:

This laboratory is intended to carryout experiments to understand the fundamental concepts of fluid flow using a low speed wind tunnel. Flow visualization will be carried out using smoke tunnel, tufts and water tunnel over different geometries like circular cylinder, sphere, square and triangular cylinder, symmetric and unsymmetric airfoils. The practical significance of various experiments will help them to carryout calculation of coefficient of forces and aerodynamic forces. 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: explain different components and their functionalities in a wind tunnel
CO2: perform calibration of a wind tunnel
CO3: analyze fluid flow patterns based on flow visualization using smoke tunnel, water tunnel and tufts
CO4: estimate optimized shape of different geometries for better aerodynamic effects
CO5: carry out flow visualization of symmetrical and unsymmetrical aerofoils
CO6: understand the practical significance of wind tunnel and its use in design and development work

AS 2096 Aerospace Structures Laboratory – II

Credit: 1
Category: PCLC
Prerequisite(s): Engineering Mechanics (ME 1003)

Course Description:

This laboratory is intended to carryout experiments to understand the fundamental concepts of stresses and strains of in-determinate structural members used in aircraft. Students can also verify the experimental results with theoretical calculations. The practical significance of various experiments will help them to carryout stress analysis of aerospace structures. 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: determine the deflection of a continuous beam and draw shear force and bending moment diagrams
CO2: determine the deflection of a cantilever beam under un-symmetric loading condition
CO3: find out Euler's buckling load for columns under different end conditions
CO4: study the photo elastic model by using circular disc under diametrical compression
CO5: evaluate the stress in Wagner beam
CO6: carry out the creep test of steel material

AS 3005 Aerodynamics – II

Credit: 4
Category: PCC
Prerequisite(s): Aerodynamics I (AS 2016)

Course Description:

This course would encompass a comprehensive study of fundamentals of energy, momentum and continuity equations in compressible flow. Steady compressible theory will be discussed. Parameters affecting the normal and oblique shock waves will be discussed explicitly. Fundamentals of transonic flow over finite wings will be discussed. Wind tunnel components and their functionalities will be discussed.

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

CO1: explain the energy, momentum and continuity equations
CO2: know the various parameters affecting the normal and oblique shock waves
CO3: understand the various theories regarding the steady compressible flow
CO4: describe the various parameters of airfoil in high speed flow
CO5: know the various methods for creating supersonic flow in wind tunnels
CO6: analyze transonic flow over the wing

Topics:

- One Dimensional Compressible Flow
- Normal, Oblique Shocks
- Expansion Waves, Rayleigh and Fanno Flow
- Differential Equations of Motion for Steady Compressible Flow
- Transonic Flow Over Wing
- Wind Tunnels

Textbook(s):

1. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.

Reference Book(s):

1. Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronold Press, 1982.
2. Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.
3. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.
4. Anderson Jr., D., - "Modern compressible flows", McGraw-Hill Book Co., New York 1999.

AS 3007 Propulsion-II

Credit: 4
Category: PCC
Prerequisite(s): Propulsion-I (AS 2018)

Course Description:

Main objective of this course is to impart knowledge on fundamentals of non air-breathing and hypersonic propulsion methods. This course covers the fundamentals of rocket propulsion and discusses advanced concepts in space propulsion ranging from chemical to electrical engines. This course helps students to make familiar with various propulsion technologies associated with space launch vehicles, missiles and space probes. Besides this, performance of rocket engine and heat transfer aspects of various components are to be covered briefly.

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

CO1: differentiate the types of rocket, missiles and its basic configuration
CO2: demonstrate about liquid propellant rockets and the various types of propellants used with their burning rates
CO3: explain the operating principle of ramjet, combustion and its performance
CO4: illustrate the solid rocket operating principles and components of solid rocket motor
CO5: differentiate electric, ion and nuclear rockets
CO6: understand the basics of solar sails and its operating principle

Topics:

- Ramjet Propulsion
- Fundamentals of Rocket Propulsion
- Chemical Rockets
- Advanced Propulsion Techniques
- Scramjet propulsion
- Performance of aerospace vehicles

Textbook(s):

1. Rathakrishnan, E., "Gas Dynamics", Prentice Hall of India, 2003.

Reference Book(s):

1. Shapiro, A.H., "Dynamics and Thermodynamics of Compressible Fluid Flow", Ronold Press, 1982.
2. Zucrow, M.J. and Anderson, J.D., "Elements of gas dynamics", McGraw-Hill Book Co., New York, 1989.
3. Mc Cornick. W., "Aerodynamics, Aeronautics and Flight Mechanics", John Wiley, New York, 1979.
4. Anderson Jr., D., - "Modern compressible flows", McGraw-Hill Book Co., New York 1999.

AS 3010 Aircraft Stability and Control

Credit: 3
Category: PCC
Prerequisite(s): Aerodynamics-I (AS 2016), Aerodynamics-II (AS 3005)

Course Description:

An understanding of flight stability and control is very important in aircraft designs. This course includes static stability, aircraft equations of motion, dynamic stability, flying or handling qualities and application of control theory to the synthesis of automatic flight control systems. The aim of this course is to present an integrated treatment of the basic elements of aircraft stability, flight control, and autopilot design.

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

CO1: illustrate degrees of stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing. (stick fixed)
CO2: illustrate degrees of stability, stability criteria, effect of fuselage and CG location, stick forces, aerodynamic balancing. (stick free condition)
CO3: interpret about lateral control, rolling and yawing moments, static directional stability, rudder and aileron control requirements and rudder lock
CO4: summarize dynamic longitudinal stability, stability derivatives, modes and stability criterion, lateral and directional dynamic stability
CO5: explain the rotor function in vertical flight, rotor mechanism
CO6: understand the stability and control mechanisms in vertical and forward flights

Topics:

- Static longitudinal stability and control (Stick-free and Stick-fixed)
- Lateral and directional stability
- Dynamic stability
- Helicopter flight dynamics

Textbook(s):

1. Perkins, C.D., and Hage, R.E., "Airplane Performance stability and Control", John Wiley & Son, Inc, New York, 1988.
2. J.Seddon, "Basic Helicopter Aerodynamics", AIAA Series, 1990.

Reference Book(s):

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998.

AS 3012 Space Mechanics

Credit: 3
Category: PCC
Prerequisite(s): Engineering Mechanics (ME 1003)

Course Description:

This course would encompass a comprehensive study of mechanics related to space. Knowledge of the course will help the students to develop satellite orbits relation between position and time, satellite orbit transfer and interplanetary trajectories and various phases in missile launching. At the end of the course the students will be able to identify, understand and solve various problems related to space mechanics through extensive and systematic research.

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

CO1: understand solar time solar system and associated basic terms
CO2: analyse satellite orbits relation between position and time
CO3: solve satellite orbit transfer mechanics, special perturbations
CO4: understand about the various phases in missile launching
CO5: find out spacecraft trajectories between planets
CO6: understand the effects of influence coefficients on missile trajectories

Topics:

- Basic Concepts on Space Mechanics
- N-body problems
- Satellite injection and satellite orbit perturbations
- Ballistic Missile Trajectories
- Interplanetary Trajectories

Textbook(s):

1. Cornelisse, J.W., " Rocket propulsion and space dynamics ", W.H. Freeman & co,1984.

Reference Book(s):

1. Sutton, G. P., "Rocket Propulsion Elements", John Wiley, 1993
2. Van de Kamp, P., "Elements of Astromechanics", Pitman, 1979 \
3. Parker, E. R., "Materials for Missile and Spacecraft", McGraw-Hill Book Co. Inc., 1982

AS 3014 Avionics

Credit: 3
Category: PCC
Prerequisite(s): Aircraft Systems & Instrumentation (AS 2014)

Course Description:

This course would encompass a comprehensive study of different avionics system fitted in various civil as well as military aircraft and their function as per their operation, familiarizing with different avionics data buses architecture and their comparative study, understand the trends in control and display technology used in different commercial modern aircraft. Moreover, the principle of digital system has been introduced to enhance and up bring the knowledge on applicability of Microprocessor in aviational operation. At the end of the course, the students will be able to handle avionics components/ aggregates effectively in aircraft system.

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

CO1: understand the concept of avionics in aviation field and analyze the role of avionics on different aircraft system design and technologies adopted
CO2: evaluate different aspect of digital computers, microprocessors and memories and their usability in aviation application
CO3: analyze the different types of avionics system architecture data bus like MIL STD 1553-B ARINC 429 and ARINC 629
CO4: judge and interpret various control and display technologies like CRT, LED, LCD, EL and plasma panel fitted in aircraft
CO5: analyze and examine the different type of avionics system like communication system, flight control system and Navigation system and develop the knowledge on electronic warfare (EW)
CO6: understand the phenomena of utility, reliability and maintainability of avionics system

Topics:

- Importance and role of Avionics, Basic principles of Avionics – Typical avionics sub system in civil/ military aircraft and space vehicles, integrated avionics and weapon systems- design, technologies
- Principles of digital systems- Digital computers, Architecture of microprocessors 8085, different types of memories
- Digital Avionics Architecture- Avionics system architecture-Data buses MIL-STD 1553-B, ARINC 429, and ARINC 629
- Control and display technologies CRT, LED, LCD, EL and plasma panel - Touch screen - Direct voice input (DVI) - Civil cockpit and military cockpit MFDS, HUD, MFK, HOTAS.
- Different avionics systems- Communication Systems - Navigation systems - Flight control systems - Radar electronic warfare
- Utility systems Reliability and maintainability– Certification

Textbook(s):

1. Malcrno A.P. and Leach, D.P., "Digital Principles and Application", Tata McGraw-Hill, 1990.
2. Gaonkar, R.S., "Microprocessors Architecture - Programming and Application", Wiley and Sons Ltd., New Delhi, 1990.
3. Thomas K Eismin “Aircraft electrical and electronic, GLENCOLE aviation technology series Macmillan/McGraw Hill, 6th edition.

Reference Book(s):

1. Spitzer, C.R. „Digital Avionics Systems“, Prentice Hall, Englewood Cliffs, N.J., U.S.A., 1987.

2. Cary R .Spitzer, The Avionics Handbook, Crc Press, 2000.
3. Collinson R.P.G. „Introduction to Avionics", Chapman and Hall, 1996.
4. Middleton, D.H. „Avionics Systems", Longman Scientific and Technical, Longman Group UK Ltd, England, 1989.
5. Jim Curren, Trend in Advanced Avionics, IOWA State University, 1992.

AS 3015 Aircraft Performance

Credit: 3
Category: PCC
Prerequisite(s): Aerodynamics-I (AS 2016), Propulsion-I (AS 2018)

Course Description:

Main objective of this course is to study the performance and design characteristics of conventional aircraft using atmospheric properties, and the concepts of fundamental forces (lift, drag, thrust and weight). This course helps to impart the knowledge about the concepts of Flight performance and the various parameters which affect the performance of an airplane during steady level and maneuvering flights. Also, analysis of level flight performance, rates of climb, service and absolute ceilings, range, take-off and landing, and turn performance.

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

CO1: illustrate the airplane as a dynamic system, equilibrium conditions
CO2: differentiate the types of drag and drag polar
CO3: estimate the variation of thrust, power, SFC with velocity and altitude
CO4: assess the performance in level flight, minimum drag and power required, climbing, gliding and turning flight, V-n diagram and load factor
CO5: interpret the principles and mechanics behind the helicopter flight
CO6: understand the ground effect on the performance of helicopter aerodynamics

Topics:

- Aircraft properties, aircraft as a rigid body and dynamics body
- Standard Atmosphere
- Basic Aerodynamics, wing geometry
- Drag Estimation
- Cruising flight performance
- Maneuvering flight performance
- Helicopter rotor aerodynamics and performance

Textbook(s):

1. Perkins, C.D., and Hage, R.E., "Airplane Performance Stability and Control", John Wiley & soInc., New York, 1988.
2. Leishman, J.G., "Principle of Helicopter Aerodynamics", Cambridge Aerospace.

Reference Book(s):

1. Etkin, B., "Dynamics of Flight Stability and Control", Edn. 2, John Wiley, New York, 1982.
2. Babister, A.W., "Aircraft Dynamic Stability and Response", Pergamon Press, Oxford, 1980.
3. Dommasch, D.O., Shelby, S.S., and Connolly, T.F., "Aeroplane Aero dynamics", Third Edition, Issac Pitman, London, 1981.
4. Nelson, R.C. "Flight Stability and Automatic Control", McGraw-Hill Book Co., 1998

AS 3031 Computational Aerodynamics

Credit: 3
Category: PEC
Prerequisite(s): Aerodynamics-I (AS 2016), Aerodynamics-II (AS 3005)

Course Description:

This course would encompass a comprehensive study of fundamentals of discretization theory for solving heat and fluid flow problems numerically. The 2D panel method will be implemented on lifting and non-lifting geometries. Design procedures will e discussed for compressile flow computations. Converging nozzles, CD nozzles and diffusers will be discussed. Numerical solvers will e developed from first principle for 2D incompressible and compressible flows.

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

CO1: execute subsonic potential flow computations
CO2: explain the basics of discretization process for numerical calculations
CO3: implement 2D panel methods on lifting and non-lifting bodies
CO4: design components which require compressible flow computations
CO5: design Converging nozzles, C&D nozzles and diffusers using Euler equations
CO6: develop numerical solvers from scratch for 2D compressible flow computations

Topics:

- Basic Aspects of Computational Aerodynamics
- Governing Equations and Physical Boundary Conditions
- Derivation of continuity, momentum and energy equations
- Mathematical Behavior of Partial Differential Equations and Their Impact on Computational Aerodynamics
- Basic Aspects of Discretization
- Finite Volume Methods
- Grid Types and Characteristics
- CFD Techniques

Textbook(s):

1. Computational Fluid Dynamics- The Basics with Applications, Anderson, J.D., Jr.,McGraw-Hill Inc., 1995.
2. Computational Fluid Mechanics and Heat Transfer, Second Edition, Anderson, D.A., Tannehill, J.C., Pletcher, R.H., Taylor and Francis, 1997.

Reference Book(s):

1. Numerical Computation of Internal and External Flows-Fundamentals of Computational Fluid Dynamics, Second Edition, Hirsch, C., Elsevier, 2007.
2. An Introduction to Computational Fluid Dynamics-The Finite Volume Method, Second Edition, Versteeg, H.K. and Malalasekera, W., Pearson Education Ltd, 2010.
3. Computational Fluid Dynamics-A Practical Approach, Tu, J., Yeoh, G.H., Liu, C., Butterworth- Heinemann, 2008.

AS 3032 Theory of Aeroelasticity

Credit: 3
Category: PEC
Prerequisite(s): Mathematics-II (MA 1004), Aerodynamics-I (AS 2016)

Course Description:

This course would encompass a comprehensive study of dynamic analysis of aerospace structures under aerodynamic load. Knowledge of the course will help the students to identify static and dynamic problems, free and forced vibration analysis of single and multiple degrees of freedom systems. At the end of the course the students will be able to solve aeroelasticity stress analysis, multiple degrees of freedom flutter analysis. Student can solve aeroelasticity problems using Matlab related to industrial problems through extensive and systematic research.

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

CO1: understand the phenomenon of aero elasticity
CO2: solve problem related to single degrees of freedom
CO3: solve problems using the theorems of multiple degrees of freedom
CO4: solve problems by analyzing the systems which undergo static aero elasticity problems
CO5: solve problems in aero elasticity using MATLAB
CO6: use MATLAB for solving systems having multi-degrees of freedom

Topics:

- Introduction to Aeroelasticity
- Single Degree of Freedom
- Multiple Degrees of Freedom
- Static Aero-elasticity
- Application of Matlab for solving aero elastic problem

Textbook(s):

1. Y.C. Fung, "An Introduction to the Theory of Aero elasticity (2002) ", John Wiley & Sons.

Reference Book(s):

1. Bisplinghoff R.L., Ashley H and Hoffman R.L., ―Aeroelasticity‖ – Addision Wesley Publication, New York, 1983.

AS 3035 Satellite and Space System Design (SSSD)

Credit: 3
Category: PEC
Prerequisite(s): Propulsion-II (AS 3007), Space Mechanics (AS 3012).

Course Description:

This course would encompass a comprehensive study of subsystem design in engineering spacecraft. The course presents characteristic subsystems such as power, structure, communication and control and analyzes the engineering trades necessary to integrate subsystems successfully into a satellite and spacecraft system. Discussions of spacecraft operating environment, product assurance and small satellite engineering and its application help students to understand the functional requirements and key design parameters for small satellite systems.

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

CO1: explain the Payloads and missions, system view of spacecraft propulsion system, launch vehicles, and spacecraft mechanisms
CO2: ndiscuss about Preoperational spacecraft environment, operational spacecraft environments, Environmental effects on design, the sun, the earth, and spacecraft effects, spacecraft structure and thermal control
CO3: explain about the various Attitude controls, Electrical power systems, Telecommunications, telemetry command, data handling and process
CO4: evaluate the various Failures, Reliability, material and process, safety, configuration control, build and verification, system engineering, case studies
CO5: explain satellite design philosophy, satellite system design, COTS components in the space environment. Micro satellites, mini satellites and nano satellites, in orbit operation, satellite application for meteorology, navigation, communication, geo observation, and space environment study
CO6: know about the satellite application for meteorology, navigation, communication, geo-observation and space environmental studies

Topics:

- SPACE SYSTEM DESIGN- Payloads and missions, system view of spacecraft propulsion system, launch vehicles, spacecraft mechanisms
- SPCAECRAFT ENVIRONMENT AND ITS EFFECTS ON DESIGN- Preoperational spacecraft environment, operational spacecraft environments, Environmental effects on design, the sun, the earth, and spacecraft effects, spacecraft structure, thermal control
- SPACECRAFT SYSTEMS- Attitude control, Electrical power systems, Telecommunications, telemetry command, data handling and process
- PRODUCT ASSURANCE- Failures, Reliability, material and process, safety, configuration control, build and verification, system engineering, case studies
- SMALL SATELLITE ENGINEERING AND APPLICATIONS- Satellite design philosophy, satellite system design, COTS components in the space environment. Micro satellites, mini satellites and nano satellites, in orbit operation, satellite application for meteorology, navigation, communication, geo observation, and space environment study

Textbook(s):

1. P. Fortescue J. Stark, and G. Swinerd, "Spcaecraft systems engineering", John Wiley and sons, 2002

AS 3037 Airframe Repair & Maintenance

Credit: 3
Category: PEC
Prerequisite(s): Manufacturing Technology (ME 2015), Aircraft Systems & Instrumentation (AS 2014)

Course Description:

Courses in aircraft repair and maintenance programs provide students with the necessary knowledge and experience to work in a variety of aviation maintenance and inspection roles. Some of the topics courses will cover include Structural assembly, Blueprint reading, Procedures and regulations (safety, weather-related), Repairing, modifying and upgrading, Mechanics and electrical components. The students will understand the Airframe components and the tools used to maintain the components. Defect investigation, methods to carry out investigation and the detailed maintenance and practice procedures.

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

CO1: familiarize with welding technology and sheet metal repair works
CO2: have the detailed information on the use of plastic and composite materials in Aircraft
CO3: know the Hydraulic and Pneumatic systems in Aircraft
CO4: know the Safety Practices during repair
CO5: understand the inspection and maintenance of auxiliary systems
CO6: explore the trouble shooting processes

Topics:

- Welding in Aircraft Structural Components
- Plastics and Composites in Aircraft
- Aircraft Jacking, Assembly and Rigging
- Review of Hydraulic and Pneumatic System
- Safety Practices

Textbook(s):

1. Kroes, Watkins, Delp., “Aircraft Maintenance and Repair”, McGraw Hill, New York, 1992.
2. Brimm, D. J., Bogges R. E., “Aircraft Maintenance”, Pitman Publishing corp., New York, 1940.

Reference Book(s):

1. Larry Reithmeir., “Aircraft Repair Manual”, Palamar Books, Marquette, 1992.

AS 3038 Aviation Fuels & Combustion

Credit: 3
Category: PEC
Prerequisite(s): Aerospace thermodynamics (AS 2007), Propulsion-I (AS 2018)

Course Description:

This course will provide with an overview of aviation jet fuel, focusing on the jet engine, its underlying principles and fuel requirements as well as the critical characteristics of jet fuel, including additives, Industry best practice adopted in the supply, handling and use of aviation fuel. This course will discuss fundamental combustion problems arising from gas turbine combustion or, more generally, from combustion in steady flowing, premixed systems. Briefly overview will be provided on defining a "good combustor" - operability, emissions, turn-down, and durability.

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

CO1: understand the concepts in combustion and make combustion calculations
CO2: know the flame temperature of commercial fuels burning in the combustion chambers of various engines
CO3: know the rate of chemical reactions and emission characteristics of hydrocarbon fuels used in power plants and transportation sector
CO4: know the thermodynamic and transport properties of fuels at elevated pressures and temperatures prevalent in the combustion chambers of actual engines
CO5: know the supersonic combustion
CO6: understand the reaction and mixing processes

Topics :

- Fundamental Concepts in Combustion
- Chemical Kinetics and Flames
- Combustion in Gas Turbine Engines
- Combustion in Rockets
- Supersonic Combustion

Textbook(s):

1. Sharma, S.P., and Chandra Mohan, “Fuels and Combustion”, Tata McGraw Hill Publishing Co., Ltd., New Delhi 1987.
2. Loh, W.H.T., Jet Rocket, “Nuclear, Ion and Electric Propulsion Theory and Design”, Springer Verlag, New York 1982.

Reference Book(s):

1. Beer, J.M. and Chigier, N.A., Combustion Aerodynamics, Applied Science Publishers Ltd., London, 1981.
2. Chowdhury, R., Applied Engineering Thermodynamics, Khanna Publishers, New Delhi, 1986.
3. Sutton, G.P., and Biblarz, 0., Rocket Propulsion Elements, 7th Edition John Wiley and Sons, Inc., New York, 2001.
4. Mathur, M., and Sharma, R.P., Gas Turbines and Jet and Rocket Propulsion, Standard Publishers,New Delhi, 1988.
5. Turns, S.R., An Introduction to Combustion Concepts and Applications,2nd Edition. McGraw Hill International Editions, New Delhi, 2000.

AS 3040 Rockets and Missiles

Credit: 3
Category: PEC
Prerequisite(s): Space Mechanics (AS 3012), Propulsion-II (AS 3007)

Course Description:

This course would encompass an explicit study of forces and moments acting on a rocket. Computing and analyzing the forces and moments acting on a rocket. Governing equations for flight and separation phases. Studying combustion and propulsion systems in a rocket. Carrying out the performance and assessment of rockets. Material selection procedure for rockets and missiles will be discussed.

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

CO1: compute and analyze the various forces and moments acting on a rocket
CO2: formulate the equations of motions for flight and separation phases
CO3: explain the combustion and propulsion systems in rocket
CO4: select suitable materials for the rockets and missiles
CO5: execute the design, performance and testing aspects
CO6: carryout the performance evaluation and assessment techniques of rockets

Topics:

- Rocket Dynamics
- Solid Propulsion and Pyrotechnics
- Solid propellant rockets
- Liquid Propulsion and Control Systems
- Liquid propellant rockets
- Multi-Staging of Rocket and Separation Dynamics
- Design, Materials and Testing of Rockets

Textbook(s):

1. Ramamurthi.K. Rocket Propulsion. Macmillan Publishers India first edition. 2010.
2. Sutton.G.P. and Biblarz.O. Rocket Propulsion Elements.7th edition.Wiley India Pvt Ltd.2010.
3. Cornelisse, J.W, Schoyer H F R, and Wakker K F, "Rocket Propulsion and Space Dynamic", Pitman Publishing Co., 1979.

Reference Book(s):

1. Ronald Humble, Henry and Larson.Space Propulsion Analysis and Design. McGraw-Hill. 1995
2. George M. Siouris, Missile Guidance and Control Systems, Springer-Verlag New York, 2000.

AS 3046 Rotor Dynamics and Tribology

Credit: 3
Category: PEC
Prerequisite(s): Aerospace Structures-I (AS 2005), Aerospace Structures-II (AS 2012)

Course Description:

This course would encompass a comprehensive study of torsional vibration of rotating machinery, fundamentals of tribology and various bearing. Knowledge of the course will help the students to design and analyze rotating machine parts, solve related dynamic problems, find critical speed of rotors, knowledge on tribology, differentiate between the types of lubricants and understand behaviour of bearing. At the end of the course the students will be able to carry out rotor design and analysis, select appropriate bearing and lubricants applicable for industrial problems through extensive and systematic research.

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

CO1: derive the equations of motion of a rigid rotor in the absolute and rotating coordinate systems
CO2: explain the critical speed of revolution and the self-balancing effect
CO3: explain the external damping, and internal damping and their effects
CO4: differentiate between the types of lubricants and its respective application area
CO5: understand behavior of bearing in different lubrication regimes and able to develop mathematical model
CO6: select the type of bearing for any given required engineering use and determine the load carrying capacity and other related parameters

Topics:

- Introduction to Vibration and the Laval-Jeffcott Rotor Model
- Torsional Vibrations of Rotating Machinery
- Rigid Rotor Dynamics and Critical Speed
- Overview and Fundamentals of Tribology
- Hydrodynamic Bearings
- Antifriction Bearings

Textbook(s):

1. J. S. Rao, ―Rotor Dynamics‖, New Age International Publishers, New Delhi.
2. Fundamentals of Tribology –S.K. Basu, S.N. Sengupta, B.B. Ahuja –PHI Learning Pvt. Ltd., 2010.

Reference Book(s):

1. W J Chen and J E Gunter, ―Introduction to Dynamics of Rotor –Bearing Systems‖,Trafford Publishing Ltd.
2. Tribology in Industries –S.K. Shrivastava –S. Chand & Company Ltd., New Delhi, 2001.

AS 3048 Helicopter Aerodynamics

Credit: 3
Category: PEC
Prerequisite(s): Aerodynamics I (AS 2016), Aerodynamics II (AS 3005)

Course Description:

This course would highlight the components, characteristics and configurations of helicopters. Performances under forward flight, axial flight and hovering will be discussed. Aerodynamic design of helicopter rotor will be attempted. Power estimation in helicopter flights will be discussed.

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

CO1: explain the major helicopter components, characteristics and configurations
CO2: analyze the performance of a helicopter in forward flight, identifying conditions which limit the performance of the helicopter
CO3: determine the rotor performance under conditions in which a helicopter is in hovering and axial flight
CO4: understand application of aerodynamic theory to helicopter flight
CO5: carry out preliminary aerodynamic design of a helicopter rotor
CO6: calculate the power estimates

Topics:

- Elements of Helicopter Aerodynamics
- Ideal Rotor Theory
- Power Estimates
- Lift, Propulsion and Control of Vistol Aircraft
- Ground Effect Machines

Textbook(s):

1. Gessow, A., and Myers, G, C., "Aerodynamics of Helicopter", Macmillan & Co., N.Y. 1987.
2. McCormick, B, W., "Aerodynamics of V/STOL Flight", Academic Press, 1987.

Reference Book(s):

1. Johnson, W., "Helicopter Theory," Princeton University Press, 1980.
2. McCormick, B, W., "Aerodynamics, Aeronautics and Flight Mechanics"John Wiley, 1995.
3. Gupta, L., "Helicopter Engineering", Himalayan Books, 1996.

AS 3050 Airport & Airlines Management

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

Course Description:

This course deals with the study of airport business, airlines industry. By studying these courses, students have a better understanding of the departments at an airport and their importance. They are taught about the different sectors of the aviation industry and their responsibilities. Students also learn about the legal and commercial aspects of different processes to better understand their duties once they become a part of the airport management team. Airlines management course reviews the operation and management of a commercial airline company. Students explore issues such as aircraft selection, market analysis, pricing, human resources, financing and advertising. Other topics explored are routes, passenger trends and safety requirements.

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

CO1: understand the basic management aspect of airport and airlines system such as airports layout, air traffic control, landing procedure
CO2: know the scheduling, flight planning and other economic and commercial activities
CO3: know how government regulation and industry standards effect the cost of operating an airline
CO4: know the relationship between various airlines, and operational issues affecting airlines and passengers
CO5: understand the economic characteristics of airlines
CO6: understand the design and development in fleet planning process

Topics:

- Airports and Airport Systems
- Airport Operations Management
- Airport Administrative Management
- Introduction to Airline Planning
- Fleet Planning and Route Evaluation

Textbook(s):

1. Airport Planning and Management 6/E 0006 Edition by Young Seth, Mc GRAW Hills.
2. Airport Management by Ravindran P.C.K, Asian Law House.
3. Air Transportation A Management Perspective (Fifth Edition) by Alexander T.Wells and John G.Wensveen, Brooks Cole,2003.
4. Airline Management by Charles Banfe, Prentice-Hall, 1991.

Reference Book(s):

1. Airport Systems Planning, Design and Management by Rechard De Neufville Tata Mc Graw Hills.
2. Straight and LevelPractical Airline Economics by Stephen Holloway, Ashgate Publishing, 2003
3. Airline Marketing and Management by Stephen Shaw, Ashgate Publishing, 2004
4. An Introduction to Airline Economics (Sixth Edition), William O' Connor, Praeger Publishers,2000
5. Airline Management, by Peter P BelobabaMIT Open Courseware Lecture Notes, 2006.
6. Airline Operations and Scheduling by Massoud Bazargan, Ashgate Publishing, 2004.

AS 3056 Introduction to UAV Technology

Credit: 3
Category: PEC
Prerequisite(s): Aerodynamics I (AS 2016), Aerodynamics II (AS 3005), Propulsion I (AS 2018)

Course Description:

This course would highlight the role of UAVs in past, present and future society. Highlight and explain various components of UAVs. Describe the ASIS regulations applicable to UAV flight. The control systems in UAVs will be comprehended.

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

CO1: understand the basics of UAV technology
CO2: know the role of UAVs in past, present and future society
CO3: comprehend and explain various components of UAVs
CO4: know the basics of flight and flight control systems
CO5: understand and describe basic regulations applicable to UAV flight
CO6: know the ASIS regulations for UAVs

Topics:

- Overview and Background
- Unmanned Aerial System (UAS) Components
- Concepts of Flight
- Regulatory and Regulations

Textbook(s):

1. Austin, “Unmanned Aircraft Systems UAVs Design, Development and Deployment”, Wiley, 2010.

Reference Book(s):

1. Beard and Mclain, “Small Unmanned Aircrfat Theory and Practice”, Princeton University Press, 2012.

AS 3081 Aircraft Systems Sessional

Credit: 1
Category: PCLC
Prerequisite(s): Aircraft Systems & Instrumentation (AS 2014)

Course Description:

The course covers aircraft systems and subsystems which are important for reliable and safe operation of transport aircraft. Beginning with a review on the historical development of aircraft and aircraft systems, the course presents a comprehensive view on the design and functionality of several systems and system components as well as their interaction. It also includes various engine systems and subsystems, their functional aspects and troubleshooting.

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

CO1: know about Location, visibility and probing of Instrument, Panels, Basic Instrument elements and Mechanism
CO2: know about basic electrical system, communication and navigating system in aircraft
CO3: describe instrumentation elements, mechanisms, error sources and temperature compensation
CO4: demonstrate an aircraft control system, engine control systems (such as fuel control, ignition control, engine indications etc.) fuel systems and its components for both civil and military aircraft
CO5: demonstrate the electrical systems (both A.C & D.C) utilizing as an auxiliary power sources in aircraft
CO6: understand the working principles of navigation system

Topics:

- Aircraft landing gear system
- Aircraft braking system
- Aircraft air-conditioning system
- Engine fuel system
- Engine lubrication system
- De-icing system
- Jet nozzle control system
- Afterburner system
- Electrical system
- Cockpit instrumentation system

AS 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

AS 3084 FEM &CFD Analysis

Credit: 1
Category: PCLC
Prerequisite(s): Aerospace Structures-I (AS 2005), Aerospace Structures-II (AS 2012)

Course Description:

This course introduces the basic concepts of finite element methods and finite volume methods and their importance in solving structural problems along with fluid and heat transfer problems. The course aims at teaching in a cohesive way the fundamentals of the finite element method and finite volume methods for the analysis of solid, structural, and heat transfer problems. The course will emphasize the solution of real-life problems underscoring the importance of the choice of the proper mathematical model, discretization techniques and elements selection criteria. The course will introduce key concepts such as selection of elements (1D or 2D or 3D), 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) and Finite Volume Methods (FVM)
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 and CFD 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.

AS 3086 Aeroengine & Airframe Sessional

Credit: 1
Category: PCLC
Prerequisite(s): Aircraft Systems & Instrumentation (AS 2014)

Course Description:

This course provides the students with the necessary knowledge and experience to work in a variety of aviation maintenance and inspection roles. Some of the topics courses will cover include Structural assembly, Blueprint reading, Procedures and regulations (safety, weather-related), Repairing, modifying and upgrading, Mechanics and electrical components. The students will understand the Airframe components and the tools used to maintain the components. Defect investigation, methods to carry out investigation and the detailed maintenance and practice procedures.

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

CO1: familiarize in welding technology and sheet metal repair works
CO2: know the use of plastic and composite materials in Aircraft
CO3: know the Hydraulic and Pneumatic systems in Aircraft
CO4: know the Safety Practices
CO5: understand the inspection and maintenance of auxiliary systems
CO6: understand the trouble shooting processes

Topics:

- Identification of Jet Engine components
- Identification of Piston Engine components
- NDT Check For Aircraft Components
- Checking of Propeller Pitch Balancing
- Fixed Pitch Propeller Balancing
- Stripping Of Turbojet Engine
- Engine Starting Procedure

AS 3093 Aerodynamics Laboratory – II

Credit: 1
Category: PCLC
Prerequisite(s): Aerodynamics I (AS 2016)

Course Description:

This laboratory is intended to carryout experiments to understand the fundamental concepts of aerodynamics using a low speed wind tunnel. Coefficient of pressure over cylinder and airfoil surfaces will be performed for thorough understanding of aerodynamic theory. Estimation of aerodynamic forces and moments will be carried out for different geometries like circular cylinder, symmetric and unsymmetric airfoils. Development of boundary layer over flat surfaces will also be studied explicitly. 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: understand and visualize the flow over airfoils
CO2: estimate coefficient of pressure for flow over different geometries
CO3: determine aerodynamic forces acting over different geometries
CO4: evaluate aerodynamic moments acting over symmetric airfoils
CO5: visualize the flow over unsymmetrical airfoils
CO6: estimate boundary layer thickness over flat surfaces

AS 3094 Avionics Laboratory

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

Course Description:

This laboratory is intended to educate the students to learn about basic digital electronics circuits, programming with microprocessors, design and implementation of data buses in avionics with MIL-STD-1553B and remote terminal configuration and their importance in different applications in the field of Avionics. The knowledge of data transfer can be applied for different applications in an effective manner. The students can be trained practically to utilize this knowledge in aerospace industry.

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

CO1: evaluate addition and Subtraction of binary number
CO2: compare and differentiate the multiplexer and de-multiplexer, encoding and decoding circuits in digital electronics
CO3: evaluate addition and subtraction of 8-bit/16-bit data using microprocessor 8085
CO4: examine storing of 8-bit/16-bit data using microprocessor 8085
CO5: test for the data flow by ascending or descending order using Microprocessor 8085
CO6: develop interface programming with 4 digit 7 segment Display & Switches & LED‘s

AS 3095 Propulsion Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Aerospace Thermodynamics (AS 2007), Propulsion-I (AS 2018), Propulsion-II (AS 3007)

Course Description:

The objective of this laboratory is to impart the practical exposure of various phenomena which are related to jet engine propulsion system such as calorific value of fuel, pressure distribution in diffuser and nozzle etc. The students will be able to design compressor and turbine blades using cascade analysis of the blades. The experience of doing various experiments will help the students to solve the real problems related to propellant preparation, propeller performance etc.

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

CO1: determine the calorific value of the given solid or non-volatile liquid fuel using a bomb calorimeter
CO2: calculate of actual heat transfer co-efficient using Natural convective heat apparatus
CO3: examine the pressure distribution over the linear turbine cascade model
CO4: study the performance of the Diffuser, and show its wall pressure distribution along the diffuser axis
CO5: determine of actual heat transfer co-efficient using natural &forced convective heat transfer apparatus
CO6: calculate the thrust development of the propeller and find the helical tip speed of the propeller

Topics:

- Determination of velocity and flow characteristics of wall jet
- Determination of velocity and flow characteristics of free jet
- Determination of velocity and pressure distribution over the linear turbine cascade tunnel
- Determination of heat transfer co-efficient of aerofoil by using natural convection
- Determination of heat transfer co-efficient of aerofoil by using forced convection
- Study of ramjet combustion
- Study of fluid flow through nozzle and wall pressure measurement
- Study of fluid flow through diffuser and wall pressure measurement
- Determination of the calorific value of fuels by Bomb Calorimeter
- Study of propellant preparation
- Determination of performance characteristics of a propeller

AS 3096 Aerospace Measurement Laboratory

Credit: 1
Category: PCLC
Prerequisite(s): Aerospace Thermodynamics (AS 2007), Physics (PH 1007)

Course Description:

Main objective of this laboratory is to introduce students to basic measurement and data analysis techniques using LABVIEW. Students will become acquainted with various types of measurement systems and to set up and perform various experiments according to a given procedure. The practical exposure of data acquisition system, LABVIEW and NI instruments will help the students to solve the problems to calculate range, temperature and fluid flow rate etc.

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

CO1: measure the internal and external features using Vernier caliper, Micrometer, Height gauge, Sin bar, Snap gauge, Plug gauge, Screw pitch gauge, Slip gauge, Feeler gauge
CO2: know the basics of LABVIEW and NI Instruments
CO3: find the temperature of a body using Thermistors (LM-35) with myDAQ
CO4: estimate the range (in distance) using IR sensor with myRIO
CO5: measure the flow rate of the flowing fluid using flow-meter with myDAQ
CO6: determine the acceleration of a body using accelerometer with myRIO

Topics:

- Measure The Internal And External Features (Length, Width, Thickness, Linear And Angular Measurement) Of Given Component (Nut, Bolt, Washer) Using Vernier Caliper, Micrometer, Height Gauge, Sin Bar, Snap Gauge, Plug Gauge, Screw Pitch Gauge, Slip Gauge, Feeler Gauge
- Introduction Of Basics Of LABVIEW And NI Instruments
- Find The Temperature Of A Body Using Thermistors (LM-35) With Mydaq
- Measure The Flow Rate Of The Flowing Fluid Using Flow-Meter With Mydaq
- Find The Acceleration Of A Body Using Accelerometer With Myrio
- Find The Surface Temperature Of An Object Using IR Camera
- Find The Temperature Of A Body Using Thermocouple With Compactrio

AS 4001 Composite Materials and Structures

Credit: 3
Category: PEC
Prerequisite(s): Aerospace Materials Technology (AS 2010), AerospaceStructures-I (AS 2005)

Course Description:

This course would comprise of a comprehensive study of importance of composite material in various aerospace structural applications, structural mechanics and detailed stress analysis of laminates under various loading conditions, deformation behavior and failure criteria of composite material, mechanics of laminated composite beam &columns and mechanical characteristics of laminated composite plate. Knowledge of the course will help the students right from selecting the suitable composite materials to creating and testing of aerospace structures, choosing an appropriate combination, geometry, and arrangement of reinforcements in matrix material to enhance the properties of composites. Understanding the mechanics will help in control the performance and productivity of structures by detailed stress and failure analysis. At the end of the course the students will be able to involve in the research, design and development of composite materials to advance the technology and products related to aerospace structures.

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

CO1: familiarize with the fundamentals of structural mechanics
CO2: analyze the composite layer and laminates in anisotropic and orthotropic manner
CO3: figure out the failure criteria of composite materials
CO4: know the mechanical characteristics of composite beams and columns
CO5: determine allowable stresses for laminates consisting of unidirectional plies
CO6: understand the post-buckling behavior of symmetric plates under axial compression

Topics:

- Fundamentals of mechanics of solids
- Mechanics of a composite layer
- Mechanics of laminates
- Failure criteria and strength of laminates
- Laminated composite beams and columns
- Laminated composite plates

Textbook(s):

1. V.V. Vasiliev and E.V. Morzov, ―Advanced Mechanics of Composite Materials‖, 3rd edition, Elsevier, 2007.
2. R. F. Gibson, ―Principle of Composite Material Mechanics‖, 2nd edition, McGraw-Hill 1994

Reference Book(s):

1. R.M. Jones, Mechanics of Composite Material‖, 2nd edition, Taylor and Francis (1999)
2. I.M. Daniel and O. Ishai, Engineering Mechanics of Composite Materials‖, 2nd edition, Oxford University Press, 2005.
3. T.H. Hong and S.W. Tsai, Introduction to Composite Materials‖, Techonomic Pub. Co.1980.

AS 4002 Advanced Aerospace Structures

Credit: 3
Category: PEC
Prerequisite(s): Aerospace Structures-I (AS 2005), Aerospace Structures-II (AS 2012)

Course Description:

This course would encompass a comprehensive study of stress analysis of aerospace structures, especially wings and fuselage of an aircraft. Knowledge of the course will help the students to identify various type stress analysis to be carried out such as buckling analysis, fatigue analysis, stress concentration checks and dynamics. This course will enable to students to design composite material for the use of aerospace structural components. At the end of the course the students will be able to solve various structural stress analysis problems deals with statics and dynamics of aerospace structures related to industrial problems through extensive and systematic research.

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

CO1: get an idea of the basic function of the aircraft structural components
CO2: know the different types of load associated with aircraft
CO3: analyze the stresses in open and closed section beams of wings and fuselage
CO4: carry out fatigue and buckling analysis of various aircraft components
CO5: design the composite material for use in different airframe parts
CO6: learn the static and dynamic analysis of aircraft structural components

Topics:

- Bucking of Structural Members
- Stress Analysis in Wing and Fuselage
- Fatigue Analysis
- Stress Concentration
- Composite Material for Aircraft Structures
- Dynamic Analysis of Structures

Textbook(s):

1. T.H.G. Megson, ―Aircraft Structures for Engineering Students‖, 4th ed., Butterworth-Heinemann (2007).

Reference Book(s):

1. S.P Timoshenko and J.N. Goodier, Theory of Elasticity, 3rd ed., McGraw-Hill, 1970.
2. E.F. Bruhn,Analysis and Design of Flight Vehicle Structures‖, 2nd ed., Jacobs Publishing Inc., 1973.

AS 4003 Theory of Plates and Shells

Credit: 3
Category: PEC
Prerequisite(s): Engineering Mechanics (ME 1003), Aerospace Structures-I (AS 2005), Aerospace Structures-II (AS 2012)

Course Description:

This course would encompass a comprehensive study of various theories related to plates and shells. Knowledge of the course will help the students to solve deflections and stresses of plates and shells by classical methods, free vibration and stability analysis of plates. At the end of the course the students will be able to carry out stress analysis problems deals with statics and dynamics of plates and shells related to industrial problems through extensive and systematic research.

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

CO1: understand the fundamentals of plate theory
CO2: know the governing equations forstress analysis plates and shells
CO3: solve the numerical problems related to plates and shells using governing equations
CO4: understand the phenomenon of pure bending in plates
CO5: use approximate methods applied to problems
CO6: analyze the statics and dynamics of plates and shells

Topics:

- Classical Plate Theory
- Plates of Various Shades
- Pure Bending of Plates
- Eigen Value Analysis
- Approximate Methods
- Shells

Textbook(s):

1. S.P. Timoshenko, S. Winowsky and Kreger, ―Theory of Plates and Shells‖, McGraw-Hill Book Co., 1990.
2. T.K. Varadan and K. Bhaskar, ―Theory of Plates and Shells‖, Narosa Publishing House, 1999.

Reference Book(s):

1. W. Flugge, ―Stresses in Shells‖, Springer – Verlag, 1985.
2. S. P. Timoshenko and J.M. Gere, ―Theory of Elastic Stability‖, McGraw-Hill Book Co. 1986.

AS 4004 Boundary Layer Theory

Credit: 3
Category: PEC
Prerequisite(s): Introductory Aerodynamics (AS 2003)

Course Description:

This course would encompass a comprehensive study of boundary layer theory and different types of boundary layer thickness involved in the flow system. Laminar and turbulent boundary layer theory will be discussed explicitly. Boundary layer problems will be discussed with exact solutions. Different types of boundary layer controls will be discussed.

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

CO1: familiarize with the boundary layer concept in detail
CO2: estimate the boundary layer thicknesses
CO3: know the laminar boundary layer and its applications
CO4: solve boundary layer problems using exact solutions
CO5: understand the transition and turbulent boundary layer formation
CO6: know the types and methods of boundary layer control

Topics:

- Fundamentals of Boundary Layer Theory
- Boundary Layer Equations in Plane Flow
- General Properties and Exact Solutions of the Boundary Layer Equations for Plane Flows
- Transition
- Turbulent boundary layer Boundary Layer Controls

Textbook(s):

1. H. Schlichting and K. Gersten, “Boundary Layer Theory”, 8th ed., McGraw-Hill, 2001.

Reference Book(s):

1. G.K. Batchelor, “Introduction to Fluid Dynamics”, 2nd ed., Cambridge Univ. Press, 2000.
2. F. M. White, “Viscous Fluid Flow”, 3rd ed., McGraw-Hill, 2006.
3. T. Cebeci and A.M.O Smith, “Analysis of Turbulent Boundary Layers”, Academic Press, 1974.
4. T.B. Gatski and J.P. Bonnet, “Compressibility, Turbulence and High Speed Flow”, 2nd ed., Academic Press, 2013.

AS 4005 Turbulence in Fluid Flows

Credit: 3
Category: PEC
Prerequisite(s): Introductory Aerodynamics (AS 2003)

Course Description:

This course would encompass a comprehensive study of the fundamentals of turbulence in fluid flows. The phenomena of turbulent heat transfer and shear flow will be discussed. The fluctuations of dynamic temperature in a flow fluid will be discussed. Boundary-free shear flows and wall-bounded shear flows will be discussed. Transport phenomena in turbulence will be discussed.

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

CO1: explain the fundamentals of turbulence in fluid flows
CO2: comprehend the phenomena of turbulent heat transfer and turbulent shear flow
CO3: evaluate the dynamic temperature fluctuations in turbulent flow
CO4: explain the flow characteristics at the wake of a self-propelled body
CO5: evaluate the effects of pressure gradient on the flow in surface layers
CO6: comprehend the dispersion of contaminants in turbulent flows

Topics:

- Introduction
- Turbulent Transport of Momentum and Heat
- Dynamics of Turbulence
- Boundary-free Shear Flows
- Wall-bounded Shear Flows
- Turbulent Transport

Textbook(s):

1. H. Tennekes and J.L. Lumley, “A First Course in Turbulence”, The MIT Press, 1972.

Reference Book(s):

1. U. Frisch, “Turbulence”, Cambridge Univ. Press, 1996.
2. P.A. Davidson, “Turbulence An Introduction to Scientist and Engineers”, Oxford Univ. Press (2004).
3. S.B. Pope, “Turbulent Flows”, Cambridge Univ. Press, 2000.
4. J. Mathieu and J. Scott, “An Introduction to Turbulent Flow, Cambridge Univ. Press, 2000

AS 4006 Viscous Fluid Flow

Credit: 3
Category: PEC
Prerequisite(s): Introductory Aerodynamics (AS 2003)

Course Description:

This course would encompass a comprehensive study of the fundamentals of compressible flow and the governing equations involved in the process. The solution procedure for Newtonian viscous flow equations will be addressed. The similarity solutions for various types of flows with laminar boundary layer will be discussed. The stability of laminar flows and its effects will be discussed. The physical and mathematical description of turbulence and the similarity solution for compressible boundary layer flows will be discussed.

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

CO1: explain the fundamentals of compressible flow and the governing equations
CO2: evaluate the solutions of Newtonian viscous-flow equations
CO3: explain the similarity solutions for various types of flows with laminar boundary layers
CO4: analyze the effects of linear stability theory for laminar flows
CO5: comprehend the physical and mathematical description of turbulence
CO6: comprehend the similarity solutions for compressible boundary layer flows

Topics:

- Fundamental Equations of Compressible Flow
- Solutions of the Newtonian Viscous-flow Equations
- Laminar Boundary Layers
- Stability of Laminar Flows
- Incompressible Turbulent Mean Flow
- Compressible Boundary Layer Flow

Textbook(s):

1. F. M. White, “Viscous Fluid Flow”, McGraw-Hill, 1991.

Reference Book(s):

1. H. Schlichting and K. Gersten, “Boundary-Layer Theory”, Springer-Verlag, 2000.
2. F. S. Sherman, “Viscous Flow”, McGraw-Hill, 1990.

AS 4007 Hypersonic Air-breathing Propulsion

Credit: 3
Category: PEC
Prerequisite(s): Propulsion-I (AS 2018), Propulsion-II (AS 3007)

Course Description:

This course includes the analysis of hypersonic air-breathing propulsion concepts for high speed flights. This course deals with the design and performance of high speed air-breathing engines and the physical parameters used to characterize propulsion system performance. It covers the mechanics and thermodynamics aspects to design the various parts of a hypersonic engine.

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

CO1: interpret the fundamentals of hypersonic air-breathing propulsion techniques
CO2: illustrate the aerodynamics of combustor/inlet and combustor/nozzle interaction
CO3: analyze the performance of HAP inlets, isolators and nozzles
CO4: analyse the performance of HAP combustors and fuels
CO5: differentiate the basics of dual mode combustion and dual mode transition
CO6: demonstrate the characteristics of air-breathing hypersonic vehicles

Topics:

- Overview of hypersonic application
- Hypersonic flight and hypersonic flow
- Scramjet Aerodynamics
- Hypersonic inlets, isolates, nozzles
- Combustion chamber, fuels
- Dual mode combustion
- Combined cycle propulsion

Textbook(s):

1. H. W. Heiser and D.T. Pratt, “AIAA Education Series”. 5th Edition.

Reference Book(s):

1. Cohen, G.F.C Rogers and H.I.H. Saravanamuttoo, “Gas Turbine Theory”, Longman, 1989.
2. M.L. Mathur and R.P. Sharma, “Gas Turbine, Jet and Rocket Propulsion”, Standard Publishers and Distributors, Delhi, 1999.

AS 4008 Radiative Heat Transfer

Credit: 3
Category: PEC
Prerequisite(s): Aerospace Thermodynamics (AS 2007)

Course Description:

This course deals with the radiation heat transfer phenomena. This course helps to solve problems with radiative heat transfer, using heat transfer coefficients and the circuit analogy where appropriate. Students will learn to use blackbody distribution function and radiation properties (emissivity, transmissivity, and absorptivity) in solving problems in the course. Students will be able to analyse the problem by using shape factors and the gray body assumption.

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

CO1: outline the fundamentals of radiative heat transfer
CO2: illustrate the role of configuration factors for diffuse surfaces with uniform radiosity
CO3: interpret the analysis of enclosures with black and/or diffuse-gray surfaces
CO4: estimate net-radiation in enclosures with specular and diffuse reflecting surfaces
CO5: illustrate the numerical solution methods for radiation heat transfer
CO6: explain absorption and emission phenomena in participating media

Topics:

- Fundamentals of radiative heat transfer
- Blackbody thermal radiation
- Surface to surface exchange of diffusion radiation
- Configuration factors
- Radiation exchange in Diffuse-Gray surfaces
- Radiation exchange in non-diffuse non-Gray surfaces
- Radiation with conduction and convection
- Absorption and radiation in participating media
- Radiative properties of translucent liquid and solids

Textbook(s):

1. R. Siegel and J. Howell, “Thermal Radiation Heat Transfer”, Taylor and Francis, 2002

AS 4009 High Temperature Gas Dynamics

Credit: 3
Category: PEC
Prerequisite(s): Aerospace Thermodynamics (AS 2007), Aerodynamics-II (AS 3005)

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

CO1: interpret the fundamentals of high temperature gas dynamics
CO2: evaluate the thermodynamic properties in terms of partition function
CO3: analyse the basics of kinetic theory of gases
CO4: outline the governing equations for inviscid high-temperature equilibrium flow
CO5: outline the governing equations for inviscid high-temperature non-equilibrium flow
CO6: extend the applications of Navier–Stokes solutions to chemically reacting flows

Topics:

- Fundamentals of high temperature gas dynamics
- Statistical thermodynamics
- Basic of kinetic theory
- Inviscid high temperature Equilibrium and non - Equilibrium flows
- Viscous high temperature flows

Textbook(s):

1. J.D. Anderson, “Hypersonic and High-Temperature Gas Dynamics”, 2nd ed., AIAA, 2006.

Reference Book(s):

1. W.G. Vincenti and C.H. Kruger, “Introduction to Physical Gas Dynamics”, Krieger Pub, 1975.
2. J.F. Clarke and M. McChesney, “The Dynamics of Real Gases”, Butterworths, 1964.
3. R. Brun, “Introduction to Reactive Gas Dynamics”, Oxford Univ. Press, 2009

AS 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

AS 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

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,4thEdition, 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,7th Edition, 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
Category: HSMC
Prerequisite(s): 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 2015 Manufacturing Technology

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

Course Description:

This course will offer a detailed understanding of manufacturing processes used in industry such as casting, forming, welding and various conventional and non convention machining processes. This course also encompass a comprehensive study of geometry of cutting tools, types of cutting conditions, mechanisms of chip formation, mechanics of metal cutting, cutting tool materials, machinability studies. Successful completion of the course will also provide the student with the benefits, limitations, and applications of different conventional and non conventional machine tools and engineering materials for product manufacturing. Knowledge of the course will also help the students to identify right cutting tool and to choose optimal machining parameters to machine any given material considering various aspects of machinability criteria and machining economy. At the end of the course the students will be able to solve machining related industrial problems through extensive and systematic research.

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: identify the suitable forming processes and sheet metal working for different material and product
CO3: understand the different basic machining processes and machine tools
CO4: understand tool geometry, tool angles, mechanisms of chip formation and Evaluate Cutting forces for various machining conditions
CO5: analyze machinability, machining economy, selection of cutting tool material, evaluation of tool failure and tool life
CO6: apply the different non- traditional machining processes for up growing high strength materials with complicated and miniaturized product manufacturing

Topics:

- Casting
- Mechanical working of metals
- Machine tools
- Theory of metal cutting
- Gear manufacturing and surface finishing process

Textbook(s):

1. Production Technology, P.C. Sharma, Manufacturing Processes, 7th Edition, S. Chand Publisher.
2. Manufacturing Technology, P.N. Rao. Vol I and II, Tata McGraw Hill Publishing Co.

Reference Book(s):

1. Hajra Choudhary.S.K and Hajra Choudhary.A.K, ―Elements of Manufacturing Technology‖, Vol II, Media Publishers, Bombay,
2. Jain.R.K, ―Production Technology Manufacturing Processes, Technology and Automation‖,17th Edition, Khanna Publishers, 2011.
3. Kalpakjian, ―Manufacturing Engineering and Technology‖, 4th edition, Addison Wesley Congmen Pvt. Ltd., Singapore, 2009.
4. Chapman.W.A.J, ―Workshop Technology Vol. I and II‖, Arnold Publisher, New Delhi, 2001.

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 3022 Principles of Turbo-machines

Credit: 3
Category: PEC
Prerequisite(s): Fluid Mechanics and Hydraulic Machines (ME 2021), Engineering Thermodynamics (ME 2031)

Course Description:

This course provides an introduction to the basic concept including Basic laws and Governing Equations of turbo-machine. The course covers brief review of essential fluid Mechanics and hydraulic Machines basics and thermodynamics fundamentals. Concepts of blade theory including Aero-foil Section, Drag and Lift Coefficients, Blade Terminology and Cascade Nomenclature are introduced. Compressors and Fans are studied in depth. At the end, course covers different type of turbine and pump with their performance parameter and performance characteristic, respectively.

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

CO1: recall the review of turbo-machine
CO2: explain the classification turbo-machine and their working principle
CO3: interpret the difference between compressor and fan
CO4: analyze various features of a turbine
CO5: design turbine and Pump
CO6: evaluate of performance of turbine, pump and compressor

Topics:
- Introduction of Turbo-machine
- Centrifugal Compressors and Fans
- Axial Flow Compressors
- Radial Flow Turbine
- Axial Flow Turbine
- Axial Pump

Textbook(s):
1. Turbo Machines, A Valan Arusu, Vikash Publishing House Private Limited

Reference Book(s):
1. Turbines, Compressors and Fans, S.M. Yahya, Tata McGraw- Hill Education.
2. Principles of Turbo Machinery, Turton R.K., Springer Publication.
3. Fundamentals of Turbo Machinery, William W., John Wiley and Sons.
4. Gas Turbine Theory, Cohen and Roger, Pearson Education
5. Fluid Mechanics, Thermodynamics of Turbomachinery by S.L. Dixon

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 3043 Power Plant Engineering

Credit: 3
Category: PEC
Prerequisite(s): Engineering Thermodynamics (ME2031), Fluid Mechanics & Hydraulic Machines (ME 2021)

Course Description:

The course starts with description of various sources of energy to run a power plant. The suitability of the location for establishing the power plant is then described. To understand the concept of running the power plant, different thermodynamic cycles are discussed. Further, to enhance the performance, the different components such as turbines, condensers, nozzles, cooling tower are explained.

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

CO1: state the conditions necessary to establish a power plant
CO2: describe the thermodynamic cycles used in power generation
CO3: apply the basic principles to maximize the performance and minimizing the cost
CO4: analyse the performance of the power plants in terms of its efficiency
CO5: design the power plant for high performance with minimal cost
CO6: evaluate the energy demand for power in an effective way

Topics:

- Sources of energy and Utilization
- Analysis of steam cycles
- Generation of steam
- Flow of steam through nozzles
- Steam Turbine
- Steam condensers and cooling tower
- Introduction to Nuclear power plants

Textbook(s):

1. Power Plant Engineering, P. K. Nag Tata McGraw-Hill Education, 2002

Reference Book(s):

1. Power Plant Engineering, R. K. Rajput Laxmi Publications (P) Ltd., Fourth Edition.
2. Power Plant Engineering, M. K. Gupta, PHI Learning, 2012.
3. Power Plant Engineering, P.C. Sharma, S. K. Kataria & Sons, 2009.

ME 3047 Production and Operations Management

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

Course Description:

This course basically consists of two parts, one is production and the other one is management aspects of the industrial setup. In production domain this course covers the work study, aggregate planning, inventory control, etc. including overview and the solution of numerical problems. The other part consists of supply chain, project management and statistical quality control. In these area also detail description and numerical problems are done. Scheduling of man-machine along with the Johnson's rule is also included in the course. In order to have a better insight to the industrial setups, facility location and various plant layout are also included to this course.

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

CO1: understand (identify/write) the various components that make up the manufacturing planning and control system and the interaction among them
CO2: understand the concept and applicability for supply chain, inventory management, including those for quantity discounts, safety stocks, and order quantity and reorder point interactions
CO3: evaluate the algorithms that are appropriate for solving single-machine, two-machine, parallel-machines and flow shop scheduling problems
CO4: analyze the material requirement plans, manufacturing resource plans, and capacity requirement plans, lot sizing decisions, etc.
CO5: apply the best plant location using different tools and design the plant layout using different techniques
CO6: design the process capability using statistical control techniques, understand the attributes chart and importance of acceptance sampling

Topics:

- Overview of Operations Management
- Work Study and Aggregate Planning
- Project Management and Supply chain Management
- Facility Location and Layout, Scheduling
- Inventory Control and Quality Control

Textbook(s):

1. Production and Operations Management, R. Paneerselvam, Third Edition,2013

Reference Book(s):

1. Production and Operations Management, K. Aswathappa, K. Shridhara Bhat
2. Production and Operations management, S. N. Charry, TMH

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 3052 Nanotechnology

Credit: 3
Category: PEC
Prerequisite(s): Chemistry (CH 1007), Physics (PH 1007), Materials Science and Engineering (ME 2027)

Course Description:

This course would encompass a comprehensive study of nanoparticles, nanowires, nanoshells, nanotubes, quantum dots and self-assembled monolayers. Knowledge of the course will help the students to synthesize various nanomaterials through different techniques and to characterize them through different spectroscopy and microscopy techniques. At the end of the course the students will be able to apply the concept of nanotechnology in various engineering industries.

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

CO1: understand the concept of nanoparticles, nanowires, nano shells, nanotubes, quantum dots and self-assembled monolayers
CO2: create nanomaterials through different synthesis routes
CO3: evaluate physicochemical characteristics through different spectroscopy and thermal analysis methods
CO4: analyze the microstructure and elemental composition of nano materials through microscopic imaging and XRD techniques
CO5: apply the concept of nanotechnology in engineering industries
CO6: apply the concept of nanotechnology medical applications, food and agriculture, data storage, risk assessment, management and ethical aspects

Topics:

- Introduction to nano materials
- Synthesis of Nanomaterials
- Physicochemical Characterization of Nanomaterials
- Imaging Techniques for Nanotechnology
- Applications of Nanotechnology

Textbook(s):

1. Textbook of Nanoscience and Nanotechnology, T. Pradeep, McGraw Hill, 2012.

Reference Books:

1. Nanotechnology: Fundamentals and Applications, R, Booker and Boysen Earl (Eds), I K International Publishing House Pvt. Ltd, 2008.
2. Nanoscience and Nanotechnology: Fundamentals of Frontiers, Shubra Singh and M.S. Ramachandra Rao, Wiley, 2013.
3. Fundamentals of Nanoscience, S. L. Kakani and Subhra Kakani, New Age International, 2017.
4. Introduction to Nanoscience, S. M. Lindsay, Oxford University Press, 2009.
5. Nanostructure and nanomaterial, G. Cao, World scientific, 2011.

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 3067 Cryogenics

Credit: 3
Category: PEC
Prerequisite(s): Engineering Thermodynamics (ME 2031), Heat Transfer (ME 3021)

Course Description:

This course is about production, measurement and application of low temperature systems and devices. The course starts with material properties at low temperature and different thermodynamic cycles for gas liquefaction systems. Then the course discuss about gas purification and separation methods with detailed design of rectification column. Different refrigeration systems at cryogenic temperature are also discussed. The course ends with low temperature measurement systems and applications of cryogenics.

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

CO1: recognize historical developments in cryogenic systems
CO2: explain material behaviour at low temperature
CO3: demonstrate the applications of cryogenics
CO4: choose the measurement systems at low temperature
CO5: compare gas liquefaction and purification systems/methods
CO6: analyze system parameters and performance

Topics:

- Introduction to Cryogenics Systems
- Gas Liquefaction Systems
- Gas Separation and Purification Systems
- Cryogenic Refrigeration
- Measurement Systems for Low Temperatures
- Application of Cryogenics

Textbook(s):

1. Cryogenics Engineering, T M Flynn and Marcel Dekkar
2. Cryo-Cooler Fundamentals, G. Walker, Plenum Press New York

Reference Book(s):

1. Cryogenics Engineering, T M Flynn and Marcel Dekkar
2. Cryo-Cooler Fundamentals, G. Walker, Plenum Press New York

ME 3069 Total Quality Management

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

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 (MA 1003), 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.

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