Indrashil University

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A Life Sciences University

Sustained Excellence with Relevance

School of Engineering

Mechanical Engineering

Proposed Course Curriculum

w.e.f. Academic Year 2019-20

B.TECH. (All Branches) ENGINEERINGPROGRAMME (w.e.f. academic year 2019-20)

Semester : 1	**Minimum Semester Credit Required :21 Cumulative Semester Credit Required : 21**		
Course Code	**Subject Name**	**L-T-P**	**Credits**
CHE101	Engineering Chemistry	**3-0-2**	**4**
MATH 101	Engineering Mathematics-I	**3-1-0**	**4**
HS 101	Communication Skills – I	2-2-0	4
TA 101 / TA 102	Computer Programming / Engineering Graphics	**3-0-2/2-0-4**	**4/4**
HS 102	Soft Skills – I	2-0-0	0
ES 101 / ES 102	Engineering Mechanics / Electrical Technology	2-1-2/3-0-2	4/4
WS101	Engineering Workshop	0-0-2	1
	Total	**15-4-8/15-3-10**	**21/21**
Semester : 2	**Minimum Semester Credit Required :22 Cumulative Semester Credit Required : 43**		
Course Code	**Subject Name**	**L-T-P**	**Credits**
PHY 101	Engineering physics	**3-0-2**	**4**
MATH 102	Engineering Mathematics-II	**3-1-0**	**4**
HS 103	Communication Skills – II	2-2-0	4
TA 102 / TA 101	Engineering Graphics / Computer Programming	**2-0-4/3-0-2**	**4/4**
HS 104	Soft Skills – II	2-0-0	0
ES 102 / ES 101	Electrical Technology / Engineering Mechanics	3-0-2/2-1-2	4/4
ES 103	Environmental science	2-0-0	2
	Total	**17-3-8/17-4-6**	**22/22**

CURRICULUM FOR B.TECH. MECHANICAL ENGINEERING PROGRAMME

Semester : 3	**Minimum Semester Credit Required : 25 Cumulative Semester Credit Required : 68**		
Course Code	**Subject Name**	**L-T-P**	**Credits**
ME 301	Mechanics of Solids	3-1-0	4
ME 302	Materials Science and Metallurgy	3-0-2	4
ME 303	Engineering Thermodynamics	3-1-0	4
ME 304	Fluid Mechanics and Fluid Machinery	3-0-2	4
ME 305	Theory of Machine -I	2-1-2	4
MATH 301	Engineering Mathematics -III	3-1-0	4
ME 306	Engineering Innovation Project - I	0-0-2	1
HS 301	Soft skills III	2-0-0	0
	Total	**19-4-8**	**25**
Semester : 4	**Minimum Semester Credit Required : 22 Cumulative Semester Credit Required : 90**		
Course Code	**Subject Name**	**L-T-P**	**Credits**
ME 401	Measurement and Instrumentation	3-0-2	4
ME 402	Manufacturing Technology -I	3-0-2	4
ME 403	Theory of Machines II (Dynamics)	2-1-2	4
ME 404	Heat and Mass Transfer	3-0-2	4
ME 405	Machine Design –I	2-1-0	4
ME 406	Engineering Innovation Project - II	0-0-2	1
HS401	Soft skills IV	2-0-0	0
ME 407	Group related Activity	0-0-1	1
	Total	**15-3-11**	**22**

Semester : 5	Minimum Semester Credit Required : 26 Cumulative Semester Credit Required : 116		
Course Code	**Subject Name**	**L-T-P**	**Credits**
ME 501	Thermal Engineering I	3-0-2	4
ME 502	Machine Design II	3-1-0	4
ME 503	Manufacturing Technology II	3-0-2	4
ME 504	Operations Research	3-0-0	3
ME 5E1	Elective 1	3-0-0	3
ME 5E2	Elective 2	3-0-0	3
HS 501	Soft skills V	2-0-0	0
ME 505	Engineering Innovation Project - Part III	0-0-2	1
ME 506	Industrial Practice*	0-0-0	4
	Total	**20-1-6**	**26**
Semester : 6	**Minimum Semester Credit Required : 21 Cumulative Semester Credit Required : 137**		
Course Code	**Subject Name**	**L-T-P**	**Credits**
ME 601	Thermal Engineering II	3-0-2	4
ME 602	Control Engineering and System Integration	3-0-2	4
ME 603	Industrial Engineering	3-0-0	3
ME 6E1	Elective 3	3-0-0	3
ME 6E2	Elective 4	3-0-0	3
ME 6E3	Elective 5	3-0-0	3
HS 601	Soft skills 6	2-0-0	0
ME 604	Engineering Innovation Project - IV	0-0-2	1
	Total	**20-0-6**	**21**

Semester : 7	Minimum Semester Credit Required : 17 Cumulative Semester Credit Required : 154		
Course Code	**Subject Name**	**L-T-P**	**Credits**
ME 701	Gas Dynamics and Turbo-Machinery	3-1-0	4
ME 7E1	Elective 6	3-0-0	3
ME 7E2	Elective 7	3-0-0	3
ME 7E3	Foreign Language	2-0-0	2
ME 702	Comprehensive Viva	0-0-0	1
ME 703	Industrial Practice*	0-0-0	4
	Total	**11-1-0**	**17**
Semester : 8	**Minimum Semester Credit Required : 15 Cumulative Semester Credit Required : 169**		
Course Code	**Subject Name**	**L-T-P**	**Credits**
ME801	Project + 2 courses / Thesis / Industry Project /Internship	0-0-30	15
	Total	**0-0-30**	**15**

***Student will undergo for 6 to 8 weeks Industry Internship during summer vacation.**

Specialization

Design Engineering
Process Equipment Design
Process Piping and Power Piping
Rotating Machine Design
Thermal System Design
Tribology
Vibration and Noise Isolation
Acoustics
Product Design Development (PDD)

Advance Manufacturing
Computer-integrated manufacturing (CIM)
Welding Technology
Foundry Technology
Tool Design
Die Design, Forming and Punching
Advance machining process
Additive Manufacturing
Total Quality Management

Automobiles Engineering
Basic Automobile Engineering
Internal Combustion Engines
Automobile Materials

Mechatronics
Calculus & Linear Algebra
Multivariable Calculus and ODE
Introduction to Electrical Systems
Computer and Software Systems
Circuit Signal and Systems
Mechanical and Space Dynamics

Functional systems
Industrial Hydraulics and Pneumatics
Bulk Material Handling
Dredging Basic
Dynamics of Living bodies

Interdisciplinary Electives
Energy Audit
Mechatronics
Robotics
Control Engineering

Vehicle Dynamics
Vehicle Interaction with Terrain
Off-Road vehicle Engineering

Industrial Engineering
Planning Engineering
Value Engineering
Cost Accounting
Production Management
Quality Engineering

Soft Social Skill Courses:

1. English
2. Communication Skill
3. Ethics and Values
4. Economics for Engineers
5. Laws for Engineers
6. Entrepreneurship Development
7. Organizational Behaviour

Energy Systems
Thermo Chemical Process Design
Advance Air conditioning
Cryogenics
Advance Power Generation
Renewable Energy Resources
Greenhouse capture, storage and utilization
Alternative Energy
Experimental Techniques in Thermal & Fluid Sciences
Computational Fluid Dynamics (CFD)
Advance Heat Transfer

Automation and Robotics

Automatic Control Systems
Basic Robotics
Digital Electronics
Microcontroller and Microprocessor
Programmable Logic Controller
Sensors and Instrumentation

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Course Code:	**ME 301**
Course Title:	**Mechanics of Solids**
Credit Structure (L-T-P-C):	**3 - 1- 0 - 4**
Instructor in Charge:	

COURSE OBJECTIVES:

- Understand the basic concepts of stress, strain, deformation, and material behavior under different types of loading (axial, torsion, bending).
- Perform stress analysis and design of beams subjected to bending and shearing loads using several methods.
- Perform stress analysis of thin-walled members.
- Analyze the elastic stability of columns.
- Students will illustrate these capabilities through course homework, labs and exams.

COURSE OUTCOMES:

After studying this course, students will be able to:

- Understand simple, compound, thermal stresses and strains their relations and strain energy.
- Analyze structural members for stresses, strains and deformations.
- Analyze the structural members subjected to bending and shear loads.
- Analyze shafts subjected to twisting loads.
- Analyze the short columns for stability.

Syllabus:

Unit 1

Introduction of theory of elasticity: 10 Hour

Analysis of Stress and Strain, Stress equation of equilibrium, Compatibility equations, Stress-Strain Relations, Solution of elasticity equations-stress function approach. Elastic constants and relations between them

Cylinders:

Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations.

Unit 2

Stress in Beams: 10 Hour

Bending moment and shear force diagram for different types of beams at different loading conditions. Straight and asymmetrical bending, Shear center, bending of curved beams, Deflection of thick curved beams. Bending and shear stress distribution in rectangular, I and T section beams.

Unit 3

Theories of Failure: 10 Hours

Maximum Principal stress theory, Maximum shear stress theory for 2D cases. Torsion: Circular solid and hallow shafts, Torsional moment of resistance, Power transmission of straight and stepped shafts, Twist in shaft sections, Thin tubular sections, Thin walled sections.

Unit 4

Energy methods: 10 Hours

Strain energy due to axial, shear, bending, torsion and impact load.

Generalized forces and displacements, Reciprocal Theorem, Maxwell-Betti-Raleigh reciprocal theorem, Castigliano's theorem I and II and their applications. Principle of virtual work.

Unit 5

Column: 5 Hours

Buckling of slender columns, Euler bucking load for different end conditions.

Text Books:

- L. S. Srinath, Advanced Mechanics of Solids, Mcgraw Hill, 2009.

References:

- James M Gere, Mechanics of Materials, 6th Edition, Thomson, 2004.
- Allen F. Bower (2009), Applied Mechanics of Solids, CRC Press.

Open Source:

- NPTEL course on Solid Mechanics
- MIT open courseware on Mechanics and Materials

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Course Code:	**ME 302**
Course Title:	**Material Science and Metallurgy**
Credit Structure (L-T-P-C):	**3 - 0 – 2-4**
Instructor in Charge:	

COURSE OBJECTIVE:

- To review physics and chemistry in the context of materials science & engineering.
- To describe the different types of bonding in solids, and the physical ramifications of these differences.
- To describe and demonstrate diffraction, including interpretation of basic x-ray data.
- Give an introduction to metals, ceramics, polymers, and electronic materials in the context of a molecular level understanding of bonding.
- To give an introduction to the relation between processing, structure, and physical properties.
- To give the beginning student an appreciation of recent developments in materials science & engineering within the framework of this class.
- To give the beginning student an opportunity for teamwork in research.
- To give the beginning student practice in basic expository technical writing.

COURSE OUTCOME:

- Understand the basic concept of Material Science and Metallurgy.
- Know about the ferrous and non ferrous metals and alloys and their applications.
- Understand different non-destructive testing methods.
- Find the causes and prevention of metallic corrosion.
- Judge the Scope and limitations of different materials.

Syllabus:

Unit 1

Fundamentals: **5 Hours**

History of engineering materials, Engineering materials, Materials property charts.

Unit 2

Material Characterization: **5 Hours**

Crystal structure, Imperfections of solids, Mechanism of strengthening in metals, Hall-Petch effect, X-ray diffraction, SEM.

Unit 3

Behaviour and Property of material : **10 Hours**

Fracture: Ductile, brittle, fatigue. Griffith criterion, S-N curve, Creep. Phase diagram (binary), Iron-carbon system, Electrical, thermal, magnetic, optical properties of materials. Corrosion, oxidation, thermal stability, wear, abrasion, friction of materials. Mechanical, Thermal, Electrical and Magnetic property.

Unit 4

Heat Treatment of Metals: **9 Hours**

Introduction, importance of manufacturing processes, classifications of manufacturing processes. Structure of metals such as crystal structures, imperfection in crystal, equilibrium phase diagram, heat treatment.

Unit 5

Engineering Applications of materials: **8 Hours**

Economics, Environment and Stability, Characterization Polymers and their characterization Composites and their characterization

Unit 6

Metallurgical Aspects: 8 Hours

Polycrystalline, single crystal and Non crystalline Materials, Lattice Defects, Solid Solution, Phase Diagram and Transformation, Mechanical properties and Strengthening mechanism, Iron Carbon Diagram, TTT Diagram, hot working and cold working, elasticity and plasticity, solidification, heat treatment, Non Destructive Testing

Text Book:

- Narula GK, Narula KS, Gupta VK. Materials science, Tata McGraw-Hill Education; 2011.

Reference Books:

- Ashby MF, Jones DR. Engineering materials 1: an introduction to properties, applications and design. Elsevier; 2012.
- V. Raghavan, Material Science and Engineering, Prentice Hall, 1993
- Callister WD, Rethwisch DG. Materials science and engineering: an introduction. New York: John Wiley & Sons; 2007.

Open Source Contents

- NPTEL online course on Material Science and Engineering
- https://nptel.ac.in/courses/113106032/1

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Course Code:	**ME 303**
Course Title:	**Engineering Thermodynamics**
Credit Structure (L-T-P-C):	**3 – 1 – 0-4**
Instructor in Charge:	

COURSE OBJECTIVES:

- To present a comprehensive and rigorous treatment of classical thermodynamics while retaining an engineering perspective.
- To lay the groundwork for subsequent studies in such fields as fluid mechanics, heat transfer and to prepare the students to effectively use thermodynamics in the practice of engineering.
- To develop an intuitive understanding of thermodynamics by emphasizing the physics and physical arguments.
- To present a wealth of real world engineering examples to give students a feel for how thermodynamics is applied in engineering practice.

COURSE OUTCOMES:

- To be able to state the First Law and to define heat, work, thermal efficiency and the difference between various forms of energy. (quiz, self-assessment, PRS)
- To be able to identify and describe energy exchange processes (in terms of various forms of energy, heat and work) in aerospace systems. (quiz, homework, self-assessment, PRS)
- To be able to explain at a level understandable by a high school senior or non-technical person how various heat engines work (e.g. a refrigerator, an IC engine, a jet engine). (quiz, homework, self-assessment, PRS)
- To be able to apply the steady-flow energy equation or the First Law of Thermodynamics to a system of thermodynamic components (heaters, coolers, pumps, turbines, pistons, etc.) to estimate required balances of heat, work and energy flow. (homework, quiz, self-assessment, PRS)
- To be able to explain at a level understandable by a high school senior or non-technical person the concepts of path dependence/independence and reversibility/irreversibility of various thermodynamic processes, to represent these in terms of changes in thermodynamic state, and to cite examples of how these would impact the performance of aerospace power and propulsion systems. (homework, quiz, self-assessment, PRS)

- To be able to apply ideal cycle analysis to simple heat engine cycles to estimate thermal efficiency and work as a function of pressures and temperatures at various points in the cycle.

Syllabus:

Unit 1

Introduction: 6 Hours

Fundamental concepts: Definitions of system and surrounding, Thermodynamic properties, Absolute thermodynamic temperature scale, Temperature and Zeroth law, Thermodynamic State and Thermodynamic equilibrium, Thermodynamic concept of energy, Modes of work and heat transfer.

Unit 2

The First Law of Thermodynamics: 6 Hours

The first law related to cyclic and non-cyclic processes, Concept of internal energy of a system, Conservation of energy for simple compressible closed systems, Definitions of enthalpy and specific heats, Conservation of energy for an open system or control volume. Concept of flow work

Unit 3

The Second Law: 6 Hours

The directional constraints on natural processes, Claussius and Kelvin-plank statement, Concept of reversibility, Carnot's principle, Equivalence of Kelvin Plank statement The Clausius inequality, Entropy, Entropy balance for closed and open systems and entropy generation, Principle of entropy increase of universe, Availability and Second Law efficiency, Concept of heat pump, refrigeration and COP

Unit 4

Properties of Pure Substances: 6 Hours

p-v, p-T, T-s and h-s diagrams of a pure substance, Dryness fraction, uses of steam tables and Mollier diagram, Clausius-Clapeyron equation.

Unit 5

Properties of Gases and Gas Mixtures: 5 Hours

Equation of State, Ideal gas, Avogrado's law, Internal energy, enthalpy, specific heats and entropy change of ideal gas, Virial expansion, Law of corresponding states, Equation of state and properties of a mixture of ideal gases.

Unit 6

Thermodynamic Property Relations: 6 Hours

Maxwell’s Equations, Tds Equations, Difference in heat capacities, Ratio of heat capacities, Joule-Kelvin Effect.

Unit 7

Fuels and Combustion: 10 Hours

Carnot cycle, Simple Rankine cycle, Reheat and Regenerative cycles, Vapour Compression refrigeration cycle. Carnot cycle, Brayton Cycle, Otto cycle, Diesel Cycle and Stirling cycle.

Text Book

- Yunus A. Çengel; Michael A. Boles - Thermodynamics: an Engineering Approach, 9th Edition, Mc Graw Hill publication 2019.

Reference Books:

- Sonntag RE, Borgnakke C, Van Wylen GJ, Van Wyk S. Fundamentals of thermodynamics. New York: Wiley; 2013.
- Moran MJ, Shapiro HN, Boettner DD, Bailey MB. Fundamentals of engineering thermodynamics. John Wiley & Sons; 2010, Dec 7.
- P.K. Nag– Engineering Thermodynamics, 6th Edition, McGraw Hill Education
- Thermodynamics: an Engineering Approach, (2017).
- Kern DQ. Process heat transfer. Tata McGraw-Hill Education; 2016.
- Rao YV. An introduction to thermodynamics. Universities Press; 2004.

Open Source Contents

- NPTEL web or video Course Web-link: http://nptel.ac.in/courses/112105123/
- MIT open courseware:
- MOOC or Moodle courses : https://onlinecourses.nptel.ac.in/noc16_ae03

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Course Code:	**ME 304**
Course Title:	**Fluid Mechanics and Fluid Machinery**
Credit Structure (L-T-P-C):	**3 – 0 – 2 - 4**
Instructor in Charge:	

COURSE OBJECTIVES:

To impart knowledge on -

- Conservation of mass, momentum and energy in fluid flows.
- Internal flows and dimensional analysis
- To understand working of pumps and turbines.

COURSE OUTCOMES:

Ability to –

- Recognize the important fluid properties.
- Determine forces acting on immersed bodies.
- Solve fluid flow problems using Conservation principles.
- Determine rate of flow and calculate flow losses through pipes.
- Analyze the relationship between different physical quantities of fluid flow.
- Evaluate the performance of pumps and turbines.

Syllabus:

Unit 1

Introduction: **2 Hours**

Properties of fluids, concept of continuum, pressure and stress tensor

Unit 2

Fluid Statics: **3 Hours**

Pressure variation in a static fluid, force on submerged surfaces, stability of floating bodies

Unit 3

Kinematics: **3 Hours**

Lagrangian and Eulerian description, streamline, streakline and pathline, acceleration of a fluid element, stream function, rotation and angular deformation, irrotational flow, velocity potential

Unit 4

In viscid flow: **2 Hours**

Euler equation, Bernoulli equation and its applications.

Unit 5

Reynolds transport theorem: **3 Hours**

Conservation of mass, linear and angular momentum Stokes law of viscosity and Navier-Stokes equations

Unit 6

Dimensional analysis and similarity: **3 Hours**

Introduction to dimensional analysis, principle of similitude, Buckingham Pi theorem, applications

Unit 7

Internal and external flows: **8 Hours**

Pipe flow, head loss and friction factor, Moody diagram, minor and major losses, pipe networks, hydraulic diameter, Boundary layer approximation, momentum integral method, flow over a flat plate, flow separation

Unit 8

Turbulence: **4 Hours**

Reynolds experiment, Reynolds decomposition, time averaged Navier Stokes equation, eddy viscosity

Unit 9

Potential Flow: 3 Hours

Elementary plane flow solutions, Magnus effect

Unit 10

Fluid Machinery: 10 Hours

Impulse and Reaction turbine, Performance, Operation and control of hydraulic Pump and impulse and reaction Turbines, Classification, components of turbo machines, Velocity Triangle, Types of Pump; Reciprocating Pump and Compressor, Specific speed, Ns – Ds Diagram, Matching of machinery with prime movers and generators as per Torque – Speed characteristics.

Unit 11

Introduction to CFD simulation and compressible fluid flow **4 Hours**

Text Books

- Y A Cengel, J M Cimbala, Fluid Mechanics: Fundamentals and Applications, McGraw-Hill, USA, 2006.
- Bansal RK. A textbook of fluid mechanics and hydraulic machines. Laxmi Publications; 2004 Dec 31.

Reference Books

- S K Som, GBiswas, S Chakraborty – Introduction to Fluid Mechanics and Fluid Machines, 3rd Edition, Tata McGrawhill Pvt Ltd, 2008
- Robert J fox, Alan T Mcdonald and Philip J Pritchard, Fluid Mechanics, Wiley student editon, Wiley, 2004

Open Source Contents

- NPTEL course on Fluid Mechanics
- MIT open courseware on Fluid Mechanics, Fluid Dynamics

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Course Code:	**ME 305**
Course Title:	**Theory of Machines -I**
Credit Structure (L-T-P-C):	**2– 1– 2 - 4**
Instructor in Charge:	

COURSE OBJECTIVES:

Course has the following objectives:

- To understand the basic components and layout of linkages in the assembly of a system / machine.
- To understand the principles in analyzing the assembly with respect to the displacement, velocity, and acceleration at any point in a link of a mechanism.
- To understand the function gears and cams in mechanisms and machines.

COURSE OUTCOMES:

At the end of the course, student should be able to:

- Find the relation between input and output of simple mechanisms.
- Apply mobility criterion to determine degrees of freedom of a mechanism.
- Determine position, velocity and acceleration of a link in a linkage.
- Employ gears and gear trains in machine design.
- Estimate the effects of friction on motion transmission and machine components.
- Design a cam profile for the given motion characteristics of a follower.

Syllabus:

Unit 1

Introduction: 5 Hours

Introduction to mechanisms: kinematic pairs, kinematic diagrams, classification of kinematic chains, kinematic inversion, equivalent linkages

Unit 2

Planar Mechanism: 6 Hours

Kinematic analysis of planar mechanisms: mobility analysis and range of movement, number synthesis, Grashof criterion and inversions, displacement analysis, relative instantaneous center of rotation, Arnold-Kennedy theorem, velocity and acceleration analysis, Dimensional synthesis of planar mechanisms: three position synthesis for function generation, path generation and rigid body guidance, branch and order defects

Unit 3

Cams: 5 Hours

Synthesis of translating flat-face and roller follower cams, Profile generation and cam analysis

Unit 4

Gears: 5 Hours

Fundamental law of gearing, characteristics of involutive action, contact ratio, interference and undercutting, gear trains

Unit 5

Spatial kinematic chains and robot kinematics: 5 Hours

Kinematic analysis of spatial chains, Denavit-Hartenberg parameters, kinematics of robotic chains

Unit 6

Kinematic simulation: 4 Hours

Kinematic simulation of mechanisms using computerized velocity and acceleration diagram, Dynamic balancing, Prominent manufacturers and models of power transmission machinery

Text Books

- Ratan, S. S. "THEORY OF MACHINES, Seventh Reprint." 2014.

Reference Books:

- Ghosh A, Mallik AK. Theory of mechanisms and machines. Affiliated East-West Press Private Limited; 2002.
- Waldron KJ, Kinzel GL, Agrawal SK. Kinematics, dynamics, and design of machinery. John Wiley & Sons; 2016 Apr 25.

Open Source Contents

- NPTEL web or video Course Web-link
- MIT open courseware
- MOOC or Moodle courses
- Any other resources

Date:

Indrashil University

School of Engineering

Chemical and Biochemical Engineering

Third Semester, 2019-20

Course Syllabus

Course Code:	**MATH 301**
Course Title:	**Engineering Mathematics - III**
Credit Structure (L-T-P-C):	**3-1-0-4**
Instructor in Charge:	

Learning Course Outcome:

After learning the course the students should be able to:

- apply the basic methods to solve problems in ordinary differential equations;
- classify the partial differential equations and will be able to apply appropriate method to solve the equation;
- represent a function in the form of a Fourier series;
- apply Laplace and Fourier transform technique to solve ordinary and partial differential equation;
- explain the analyticity of a complex function;
- explain conformal mapping and different transformations in complex plane;
- evaluate complex integrations and analyze the singularities of a complex function;
- deal comfortably when encountering and solving the types of problems listed above.
- apply the techniques learnt in this subject to the solution of a comprehensive design problem.

Syllabus:

Unit-I **08 Hours**

Laplace Transform:

Definition of Laplace Transform, Basic properties of Laplace transform, Laplace Transform of derivatives and integrals, Convolution theorem, Inversion, Periodic functions, Solution of initial valued problems.

Unit-II **06 Hours**

Fourier Series:

Periodic functions, Fourier series representation of a function, half range series, sine and cosine series, Fourier integral formula, Parseval's identity.

Unit-III **16 Hours**

Differential equations: Autonomous differential equations, slope fields, phase lines, equilibrium solutions, stable and unstable equilibria, classification of singularities of an ODE, Power series solution for ODE, Bessel functions and Legendre polynomials;Formation of PDEs, Solution of first order Partial Differential equations, Lagrange's Method of solution and its geometrical interpretation, Nonlinear PDEs of first order, Charpit's method, Second order partial differential equations with constant and variable coefficients, classification and reduction of second order equation to canonical form, Method of separation of variables to solve heat equation, D'Alembert's solution of the wave equation.

Unit-IV **15 Hours**

Complex Analysis:

Definition of Analytic Function, Cauchy Riemann equations, Properties of analytic functions, Determination of harmonic conjugate, Milne-Thomson method, Conformal mappings: $\frac{1}{z}$, az, $az + b$, $z + \frac{1}{z}, z^2$ and bilinear transformation,Schwarz-Christoffel transformation, Line & Contour integration, Cauchy's integral theorem (without proof), Cauchy's integral formulae

and its applications, Taylor's and Laurent's expansions (statements only), Singularities, Poles and Residues, Cauchy's residue theorem

Tutorials

10-12 tutorials will be given to students based on the syllabus covered as above.

Text Books/References

1. Kreyszig, E., Advanced Engineering Mathematics, John Wiley & Sons
2. Jain, R.K. and Iyengar, S.R.K., Advanced Engineering Mathematics, Narosa Publishers
3. Boyce, W.E. and DiPrima, R.C., Elementary Differential Equations, 7th Ed., John Wiely& Sons
4. Varma and Morbidelli, Mathematical methods in chemical engineering , Oxford University Press
5. Grewal, B.S., Higher Engineering Mathematics, Khanna Publishers
6. Churchill, R. V. and Brown, J. W., Complex variables and application, McGraw-Hill

Open Source Contents (Provide if available)

1. https://nptel.ac.in/courses/111106111/
2. https://nptel.ac.in/syllabus/111103021/

Evaluation Scheme:

Continuous evaluation process comprising of components like attendance, tutorials, class tests, comprehensive examinations, etc.

Date:

Indrashil University
School of Engineering
Third Semester, 2019-20

Course Syllabus

Course Code :	**HS 301**
Course Title :	**Ethics and Values**
Credit Structure (L-T-P-C):	**2-0-0-0**
Instructor in Charge:	

Scope and Objective:

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

- Develop a familiarity with the mechanics of values and ethics.
- Exercise values, ethics in context of engineering profession, social and personal spectrum
- Apply values and ethics in personal, social, academic, global and professional life.

Learning Outcome of the Course:

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

- Correlate the concepts and mechanics of values and ethics in their life.
- Apply value and ethical inputs to solve social, global and civic issues.
- Apply such principles with reference to cultural values

Syllabus:

Unit-1 **06 Hours**

Introduction to Values: Definition and Concept, Types of Values, Values and its Application.

Unit-2 **06 Hours**

Elements and Principles of Values: Universal & Personal Values**,** Social, Civic & Democratic Values**,** Adaptation Models & Methods of Values.

Unit-3 **06 Hours**

Values and Contemporary Society: Levels of Value Crisis**,** Value Crisis Management, Cultural Values.

Unit-4 **05 Hours**

Ethics and Ethical Values: Definition and Concept**,** Acceptance and Application of Ethics**,** Ethical Issues and Dilemma**,** Universal Code of Ethics: Consequences of Violation

Unit-5 **07 Hours**

Applied Ethics: Professional Ethics**,** Organizational Ethics, Ethical Leadership**,** Ethics influenced by culture

Text books:

1. Values and Ethics in Business and Profession by Samita Manna, Suparna Chakraborti PHI Learning Pvt. Ltd., New Delhi.
2. Just a Job?: Communication, Ethics, and Professional life George Cheney Oxford University Press.
3. Professional Ethics and Human Values M. Govindarajan, S. Natarajan,V. S. Senthilkumar PHI Learning Pvt. Ltd.
4. Creating Values In Life: Personal, Moral, Spiritual,
5. Family and Social Values by Ashok Gulla Author House, Bloomington.

Reference Books:

E-Books:

1. Ethics for Everyone, Arthur Dorbin, 2009. (http://arthurdobrin.files.wordpress.com/2008/08/ethics-for-everyone.pdf)
2. Values and Ethics for 21st Century, BBVA. (https://www.bbvaopenmind.com/wp-content/uploads/2013/10/Values-and-Ethics-for-the-21st-Century_BBVA.pdf)

Evaluation Scheme:

Continuous evaluation process comprising of components like attendance, assignment, class tests, presentations, case studies, etc.

Since it is non-credit course, the students should be qualified/ non-Qualified depending upon their marks and grades obtained.

INDRASHIL UNIVERSITY

Course Name: Engineering Innovation Project

Course Code: ME306 **Course Credit: 01**

Instructor-in-charge: **L-T-P: 0-0-2**

Course Description:

The program requires each student to undertake a project with interdisciplinary group-size up to a maximum of 4 students. Each project group is supervised by up to a minimum of two faculty staffs. In Engineering Innovation Project (EIP), students will take CDIO initiative for their innovation. CDIO (Conceive-Design-Implement-Operate) is an innovative framework in the field of engineering that equips engineers with the knowledge in the state-of-the-art of technology. Conceive, design, implement and operate are the different components of research methodology for which the students have to perform during the incoming semesters III, IV, V and VI respectively. Total credit of this course is four with one credit in each semester. Followings are the steps that the groups of interdisciplinary students are required to follow to secure 4 credits.

1. **Conceive:** This is one of the basic components of CDIO initiative for project work. In this component, students have to conceive the idea of project through observations and literature reviews to define the problems to be solved. Conceive part of project work will be of one credit along with the duration of one semester (semester III).
2. **Design:** Whatever be the problems that were conceived in semester III will be continued to semester IV for designing/simulating/modeling of the defined objectives. This part of the project will also be of one credit for the duration of semester IV.
3. **Implement:** The implementation part will be done in V semester of the same credit 1. In this component, installation and testing will be required to be done for the designed project. The problems related to modeling and simulation can be implemented using different software.
4. **Operate:** In this component, output of solution of the well defined problems will be investigated or analyzed. Results so obtained after operating the installed system will be manipulated and validated with the previous research. This component has to be finished during semester VI and will be of 1 credit.

Course Objectives:

The Objectives of the course are:

- To introduce students to engineering projects.
- To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.
- To excite the imagination of aspiring engineers, innovators and technopreneurs.
- To make students understand why innovation is integral to commercial success.
- To evaluated Innovation strategies and tactics through perspective ideation.

Course Outcomes:

On successful completion of the course students will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation and solution.

- Design engineering solutions to complex problems utilizing a systems approach.
- Conduct an engineering project
- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Evaluation Scheme:

The assessment of Engineering Innovation Project consists of assessment by supervisor in the following areas:

- Technical Knowledge and Skills
- Project Report
- Oral Presentation
- Attendance and Participation
- Interview
- Demonstration

1. **Conceive**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of work plan	10%	One months after the commencement of semester III
2	Progress report/presentation-1	20%	Two months after the commencement of semester III
3	Progress report/presentation-2	20%	Three months after the commencement of semester III
4	Final Presentation/Viva	50%	End of semester III
Total		**100%**	

2. **Design**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of design/drawing	10%	One months after the commencement of semester IV
2	Progress report/presentation-1	20%	Two months after the commencement of semester IV
3	Progress report/presentation-2	20%	Three months after the commencement of semester IV
4	Final Presentation/Viva	50%	End of semester IV
Total		**100%**	

3. **Implement**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of installation	10%	One months after the commencement of semester V
2	Progress report/presentation-1	20%	Two months after the commencement of semester V
3	Progress report/presentation-2	20%	Three months after the commencement of semester V
4	Final Presentation/Viva	50%	End of semester V
Total		**100%**	

4. **Operate**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of result extraction	10%	One months after the commencement of semester V
2	Progress report/presentation-1	20%	Two months after the commencement of semester V
3	Progress report/presentation-2	20%	Three months after the commencement of semester V
4	Final Presentation/Viva	50%	End of semester V
Total		**100%**	

Reference Book: NA

Indrashil University

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A Life Sciences University

Sustained Excellence wit Relevance

Course Code:	**ME 401**
Course Title:	**Measurement and Instrumentation**
Credit Structure (L-T-P-C):	**3 – 0 – 2 - 4**
Instructor in Charge:	

COURSE OBJECTIVES:

To impart knowledge on -

- To acquaint the concepts of Measurements.
- To impart knowledge on various Metrological equipment available to measure the dimension of the components.
- To identify procedures for the measurement of the dimension of the components.
- The working of measuring instruments and errors associated with them
- Error analysis and uncertainty of measurements
- The measurement and data acquisition applicable to a thermal systems
- kinds of errors and uncertainty –
- types of fluid flow and flow measuring devices –
- temperature measuring devices and calibration methods –
- solar radiation measuring instruments and solar collectors –
- data acquisition and processing systems
- Advanced instrumentation, experimental methods and measurement techniques.
- Operation and specific functional characteristics of thermal instruments.
- Analytical calculations and their uncertainties which may arise in the various instruments and their measurement techniques.

COURSE OUTCOMES:

Ability to -

- Differentiate accuracy, precision, and some additional terminology.
- Employ measuring instruments for linear and angle measurement.
- Use effective methods of measuring straightness, flatness, screw threads and gear teeth
- Recommend suitable techniques to measure temperature and flow
- Demonstrate the use of advanced measurement techniques.
- Demonstrate handling of various metrological equipment to measure the dimension of the components
- Identify experimental data and predict correlation
- Interpret uncertainties in various measurements
- Apply measurement techniques of intensive and extensive properties
- Analyze specific functional characteristics of thermal instruments.
- Estimate the control system parameters using analog and digital controllers
- Formulate concepts to reduce errors in measurements
- describe the kinds of errors and uncertainty –
- analyze the types of fluid flow –

- explain the temperature measuring instruments –
- choose the solar collector for a particular application –
- make use of data acquisition and processing systems
- Analyze experimental data and predict correlation
- Quantify uncertainties and errors in various measurements
- Apply measurement techniques of intensive and extensive properties

Syllabus:

Unit 1

Fundamental of Measurement and Instrumentation: 6 Hour

Introduction, Need of Inspection, Objectives of Metrology, Precision and Accuracy, Errors in Measurement, General Care of Metrological Instrument, Data Communication.

Unit 2

Linear & Angular Measurement: 6 Hour

Vernier Instruments and their applications; Micrometers, Bore Gauge, Dial Indicator, Slip Gauge Angular Measurement; Bevel Protectors, Sine Principle and Sine Bars, Angle Gauges

Unit 3

Mechanical Measurement: 10 Hours

Measurement of Temperature: Basics Thermometer RTD, pyrometer Thermocouple, thermisters Pyrometer. Measurement of Flow: Basic flow meters Advanced flow meters, Anemometry. Measurement of Force: Dynamic force measurement Dynamometers -prone brake Dynamometers- electrical dynamometer. Measurement of vibration: Measurement of natural frequency, Concept of equation of motion, Modelling vibrations. Measurement of Strain: Defining strain and its measurement, Describe strain gauges, Installation of strain gauges. Basic concepts of measurement pressure, Velocity, Acceleration & Jerk.

Unit 4

Surface Measurement: 6 Hours

Measurements of Flatness and Screw Threads, Measurement of Surface Finish

Unit 5

Comparators 5 Hours

Unit 6

Interfacing of Instruments: 12 Hours

Analog and digital signal generated by instrument, Interpretation of signals, voltage and current signal, transmission of signal, Open loop and close loop control, Sensor and non contact type measurement, data logger and lab view

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Text Book:

1. Jain RK, Chiu DM, Hawe WR. A quantitative measure of fairness and discrimination. Eastern Research Laboratory, Digital Equipment Corporation, Hudson, MA. 1998.
2. Bewoor Anand K, KulkarniVinay A., "Metrology and Measurement", 1st Edition, Tata McGraw Hill, New Delhi, 2009

Reference Books:

1. Raghavendra and Krishnamurthy, “Engineering Metrology and Measurements (English)”. 1st Edition, OxfordUniv Press,2013
2. Thomas G. Beckwith, Roy D. Marangoni, John H. Lienhard V.,"Mechanical Measurements" 6th Edition. Pearson Education, 2006

3. Measurement and Instrumentation: Theory and Application (2011), by Alan S. Morris and Reza Langari
4. Measurement and Instrumentation Principles (1988), by Alan S. Morris
5. Measurement, Instrumentation, and Sensors Handbook: Two-Volume Set (1998)
6. Fundamentals of Instrumentation and Measurement (2006), by Dominique Placko
7. Measurement System by Doebelin - Tata McGraw-Hill Education

Open source:

- http://nptel.ac.in/courses/mechanical measurement system

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Course Code:	**ME 402**
Course Title:	**Manufacturing Technology-I**
Credit Structure (L-T-P-C):	**3 – 0 – 2 - 4**
Instructor in Charge:	

COURSE OBJECTIVES:

- To know how different machine tools work to manufacture a product.
- This course aims towards acquiring technical knowledge and skills involved in the processes.
- The course is practical orientated and requires that basic skills in handling of tools, machines and machine tools, testing equipments, etc. used in different manufacturing processes

COURSE OUTCOMES:

On completion of the course the student will be able to:

- List the different techniques and applications of basic manufacturing processes.
- Different machine tools, cutting tool materials, nomenclature & surface finish required.
- Explain the construction & specification of various machine tools.
- Understand machining processes pertaining to relative motions between tool & work piece.
- Apply mechanics of machining process to evaluate machining time and acquire knowledge.

Syllabus:

Unit 1

Metal Cutting: 10 Hours

Introduction, Chip formation & types and shear zone, Orthogonal and oblique cutting, Angles and its levels, relevance, Cutting-tool materials, Tool signature, thermal aspects, tool wear and tool life, Surface finish, Cutting fluids and cutting force calculations, Merchant circle diagram, failure, machinability, operating conditions.

Unit 2

Machine Tool Operations: 10 Hour

Types of motions in machining, Turning and Boring, Thread cutting, Drilling and allied processes, Shaping, Planing and Slotting, Milling & Grinding process, grinding wheel, Grinding operations and grinding machines, Honing, lapping, super finishing and polishing, Sawing and Broaching , Gear cutting & hobbing, Numerical, Design for turning and hole-making operations, Introduction, Functional surfaces, Location principles, Clamping devices, Jigs and fixtures.

Unit 3

Computer Controlled Machines: 7 Hour

Introduction, Numerical control Advantages & disadvantages, comparison, Introduction, Need and classification, Coordinate systems and classification, Direct numerical control and adaptive control systems, Robotics – structure, applications and Indian scenario, Machining Centres, Flexible Manufacturing Systems.

Unit 4

Non-Conventional Machining: 8 Hours

Electrical discharge machining and Electrochemical machining, Ultrasonic machining and Abrasive Water-Jet Machining, Electron Beam Machining and Laser beam machining, Ion beam machining and Explosive forming , Plasma –arc machining and process selection.

Unit 5

Metal Forming Processes: **10 Hours**

Introduction to bulk deformation processes, analysis, Rolling – terminology, mills and parameters, Thread rolling and Extrusion, Forging – classification and types, Wire drawing , Rod and tube drawing, Swaging and Tube making, Introduction, Punch & dies, operations, Operations – piercing & punching, blanking, notching, beading, Flanging, Operations – Hemming, seaming, perforating, slitting and lancing, Drawing, spinning and stretch forming, Embossing & coining, Sheet-metal die design, Production Control Activities in Manufacturing

Text Book :

1. P N Rao, "Manufacturing Technology – Vol. 2" ,3rd Edition, McGraw Hill Education, 2014.

Ref. Book:

1. P N Rao, "Manufacturing Technology – Vol. 1" ,3rd Edition, McGraw Hill Education, 2014.
2. Nagendra Parashar B.S., Mittal, R.K., "Elements of Manufacturing, Processes", PHI publications, 11th reprint 2012.

Open Source:

https://nptel.ac.in/courses/112107144

Indrashil University

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A Life Sciences University

Sustained Excellence wit Relevance

Course Code:	**ME 403**
Course Title:	**Theory of Machines II**
Credit Structure (L-T-P-C):	**2 – 1 – 2 - 4**
Instructor in Charge:	

COURSE OBJECTIVES:

To impart knowledge on

- Turning moment diagrams employed in flywheel and forces involved in reciprocating engines.
- Balancing procedures for rotating and reciprocating engines.
- Fundamentals of free and forced vibrations.

COURSE OUTCOMES:

Ability to

- Demonstrate an understanding of turning moment diagrams in various applications.
- Demonstrate skills to design flywheel for an IC engine and punching press with the consideration of geometrical and economical constraints.
- Perform static balancing of high speed rotary and reciprocating machines.
- Analyze free vibrations of machines, engines and structures.
- Analyze forced vibrations of machines, engines and structures.
- Calculate gyroscopic couple on various vehicles and apply concept of governors.

Syllabus:

Unit 1

Fundamentals: 4 Hours

Kinematics of particles: Coordinate systems and representation of motion, relative motion, constrained motion of connected particles

Unit 2

Motion Analysis: 10 Hour

Kinetics of particles: Inertial frame and Newton's second law for a particle, rectilinear and curvilinear motion, linear and angular momentum, impulse-momentum relation, conservation of momentum, work-energy relation, conservative force and potential energy, conservation of energy, impact, central force motion, relative motion, Kinetics of systems of particles: Generalized Newton's second law, impulse-momentum and work-energy relations, conservation laws, steady mass flow, variable mass flow

Unit 3

Plane dynamics of rigid bodies: 10 Hour

Plane kinematics in rotating frames, relative and absolute motion, equations of motion, translational and fixed-axis rotational motion, general plane motion, impulse-momentum relation, work-energy relation, conservation laws

Unit 4

Spatial kinematic chains and robot kinematics: 6 Hour

Three-dimensional dynamics: Kinematics in rotating frames, fixed-axis rotation, parallel-plane motion, rotation about a fixed point, angular momentum, kinetic energy, kinetics of parallel-plane motion, introduction to gyroscopic motion, Fundamental of mechanical vibration

Text Book

1. Meriam JL, Kraige LG. Engineering mechanics: dynamics. John Wiley & Sons; 2012 Mar 19.

Reference book:

1. Johnston ER, Beer F, Eisenberg E. Vector Mechanics for Engineers: Statics and Dynamics. McGraw-Hill; 2009.

Open Source Contents

- NPTEL web or video Course Web-link
- MIT open courseware
- MOOC or Moodle courses
- Any other resources

Indrashil University

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A Life Sciences University

Sustained Excellence wit Relevance

Course Code:	**ME 404**
Course Title:	**Heat and Mass Transfer**
Credit Structure (L-T-P-C):	**3 – 0 – 2- 4**
Instructor in Charge:	

COURSE OBJECTIVE:

To impart knowledge on:

- Conduction, convection and radiation heat transfer.
- Design of heat exchangers.
- Basic principles of mass transfer.

COURSE OUTCOME:

At the end of the course, student should be able to:

- Understand principles of heat conduction, convection, radiation and mass diffusion and apply to solve heat transfer problems
- Design heat exchanger systems for enhanced heat transfer performance
- Analyse and predict the flow patterns in two phase flow and heat transfer

Syllabus:

Unit 1

Introduction: 4 Hour

Definition of heat transfer, modes of heat transfer: conduction, convection and radiation, relevance of the field, energy balance, and concept of thermal resistance.

Unit 2

Conduction: 8 Hour

Basic concepts, thermal conductivity, Fourier's law, critical thickness of insulation, thermal diffusivity, heat diffusion equation, 1-D steady state conduction – Cartesian and radial systems, internal energy generation, extended surfaces, Fin efficiency, effectiveness and performance, 2-D steady state conduction, and transient heat conduction – lumped capacitance.

Unit 3

Convection: 8 Hour

Introduction - forced and free convection, Prandtl number, Boundary layer - hydrodynamic and thermal, laminar and turbulent, governing equations, solution procedures, relation between fluid friction and heat transfer, Entry length, Flow through a bank of cylinders, Natural convection from vertical and inclined plate.

Unit 4

Radiation: 8 Hour

Basic concepts, emission characteristics and laws of blackbody radiation, radiation incident on a surface. Solid angle and radiation intensity. Heat exchange by radiation between black surfaces. Shape factor. Radiant heat exchange in an enclosure having black surfaces. Radiant heat exchange in an enclosure having diffuse-gray surfaces.

Unit 5

Boiling and Condensation: 6 Hour

Introduction to boiling and condensation, pool boiling – modes and correlations, introduction to forced convective boiling, Film condensation, Drop wise condensation.

Unit 6

Heat Exchangers: 6 Hour

Co- and counter-flow, Fouling factor, Use of LMTD, Effectiveness-NTU method, Design considerations, Applications: heat pipe and shell and tube heat exchanger

Unit 7

Mass Transfer: **5 Hour**

Fundamentals of Mass Transfer by Packed / Tray Tower, Membrane – Evaporator, Desecrator

Text Book:

1. Cengel YA, Klein S, Beckman W. Heat transfer: a practical approach. New York: McGraw-Hill; 1998.

Reference Books:

1. Heat Transfer – A. Bejan, Wiley and Sons, New York, NY, 1993
2. A Textbook on Heat Transfer, 3rd Edition - S.P. Sukhatme, Orient Longman /Universities Press, Hyderabad, 1989.
3. Fundamentals of Heat and Mass Transfer, 5th Edition – F. P. Incropera & D. P. Dewitt, Wiley and Sons, New York, NY, 2001
4. Conduction and Radiation by J. Banerjee and Muralidhar

Open Source Contents

1. NPTEL Course Web-link: http://nptel.ac.in/courses/112101097/
2. MIT open courseware: https://ocw.mit.edu/courses/mechanical-engineering/2-051-introduction-to-heat-transfer-fall-2015/index.htm
3. MOOC or Moodle courses: https://onlinecourses.nptel.ac.in/noc18_ch08/preview

Indrashil University

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A Life Sciences University

Sustained Excellence wit Relevance

Course Code:	**ME 405**
Course Title:	**Machine Design –I**
Credit Structure (L-T-P-C):	**2-1-0-4**
Instructor in Charge:	

COURSE OBJECTIVES:

Course has the following objectives:

- To impart knowledge on applyingelementary design principles and basic design procedures for design of machine elements.
- Handling and interpreting design data for the design of mechanical elements.

COURSE OUTCOME:

At the end of the course, student should be able to:

- Analyze stresses acting on components and determine the size based on theories of failure.
- Design machine components for a given load condition using design data hand books.
- follow standards as per design data hand books and select standard components to improve interchangeability.

Syllabus:

Unit 1

Introduction: 10 Hour

General principles of machine design: Definition of design, phases of design, and review of engineering materials and their properties and manufacturing processes, material selections for design; use of codes and standards, selection of preferred sizes. Review of axial, bending, shear and torsion loading on machine components, combined loading, two- and three dimensional stresses, principal stresses, stress tensors, Mohr's circles.

Unit 2

Mechanical Design: 10 Hour

Design against static load – strength based failure theories (examples may include plane stress scenario); Design against fluctuating loads – fatigue failure theories; Design of elements – Fasteners, welded joints, gears, shaft, keys, couplings, helical coil and leaf springs, clutches and brakes, selection of rolling element bearings

Unit 3

Design considerations: 5 Hour

Manufacturing considerations in design; Design for Reuse and Recycle, Aesthetic design

Unit 4

Design Project: 5 Hour

Assembly Design Product

Text Books

1. Juvinall R.C, and Marshek K.M, “Fundamentals of Machine Component Design”, John Wiley & Sons, Third Edition, Wiley student edition, 2007.
2. V B Bhandari, *Design of Machine Elements*, 4th Ed., Tata Mcgraw Hill, 2016.

Reference Books:

1. Robert L. Norton “Machine Design- an integrated approach”, Pearson Education, 2nd edition.
2. Spotts M.F., Shoup T.E “Design and Machine Elements”, Pearson Education, 8th edition,2006.
3. Orthwein W, “Machine Component Design”, Jaico Publishing Co, 2003.

4. Hall, Holowenko, Laughlin (Schaum's Outline series), "Machine Design", adapted by S.K.Somani,
5. Tata McGraw Hill Publishing Company Ltd., Special Indian Edition, 2008.
6. H.G.Patil, S.C.Pilli, R.R.Malagi, M.S.Patil., "Elements of Machine Design", IK International,
7. First edition,2019.
8. T. Krishna Rao, Design of Machine Elements, Volume I, 2012, IK international publishing house, New Delhi.
9. G. M. Maithra and L.V.Prasad, "Hand book of Mechanical Design", Tata McGraw Hill,
10. 2nd edition, 2004.
11. Richard G. Budynas, and J. Keith Nisbett, **"**Shigley's Mechanical Engineering Design**",** McGraw- Hill Education, 10th Edition, 2015.
12. Budynas RG, Nisbett JK. Shigley's mechanical engineering design. New York: McGraw-Hill; 2008.

Open Source Contents

1. NPTEL online course on Design of Machine Elements
2. MIT opens courseware on Elements of Mechanical Design

Date:

Indrashil University

School of Engineering

Fourth Semester, 2019-20

Course Syllabus

Course Code:	**HS 401**
Course Title:	**Engineering Economics**
Credit Structure (L-T-P-C):	**2-0-0-0**
Instructor in Charge:	

Scope and Objective:

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

- To impart knowledge, with respect to concepts, principles and practical applications of Economics.
- To know the tactics of demand and supply of the market
- To understand the different market and its implications

Learning Outcome of the Course:

After learning the course the students should be able:

- To explain the relation between Science, Engineering, Technology and Economics.
- To deal with current marketing terminologies.
- To discuss the Indian economy in broad and sector specific perspective.

Syllabus:

Unit-1 **06 Hours**

Definition of Economics – various definitions, Nature of Economic problem, Production possibility curve Economic laws and their nature. Relation between Science, Engineering, Technology and Economics. Concepts and measurement of utility, Law of Diminishing Marginal Utility, Law of equi-marginal utility – its practical application and importance.

Unit-2 **07 Hours**

Meaning of Demand, Individual and Market demand schedule, Law of demand, shape of demand curve, Elasticity of demand, measurement of elasticity of demand, factors affecting elasticity of demand, practical importance & applications of the concept of elasticity of demand.

Meaning of production and factors of production; Law of variable proportions, Returns to scale, Internal and External economics and diseconomies of scale.

Unit-3 **07 Hours**

Various concepts of cost – Fixed cost, variable cost, average cost, marginal cost, money cost, real cost opportunity cost. Shape of average cost, marginal cost, total cost etc. in short run and long run.

Meaning of Market, Types of Market – Perfect Competition, Monopoly, Oligopoly, Monopolistic Competition (Main features of these markets)

Unit-4 **04 Hours**

Supply and Law of Supply, Role of Demand & Supply in Price Determination, effect of changes in demand and supply on prices.

Unit-4 **06 Hours**

Nature and characteristics of Indian economy (brief and elementary introduction), Privatization – meaning, merits and demerits. Globalisation of Indian economy – merits and demerits. Elementary Concepts of VAT, WTO, GATT & TRIPS agreement.

Text Books:

1. Principles of Economics: P.N. Chopra (Kalyani Publishers).
2. Modern Economic Theory – K.K. Dewett (S.Chand)

Reference Books:

1. A Text Book of Economic Theory Stonier and Hague (Longman's Landon)
2. Micro Economic Theory – M.L. Jhingan (S.Chand)

3. Micro Economic Theory – H.L. Ahuja (S.Chand)
4. Modern Micro Economics : S.K. Mishra (Pragati Publications)
5. Economic Theory – A.B.N. Kulkarni & A.B. Kalkundrikar (R.Chand & Co.)
6. Indian Economy: Rudar Dutt & K.P.M. Sundhram

Evaluation Scheme:

Continuous evaluation process comprising of components like attendance, assignment, class tests, presentations, case studies, etc.

Grades and Reports:

Since it is non-credit course, the students should be qualified/ non-Qualified depending upon their marks and grades.

INDRASHIL UNIVERSITY

Course Name: Engineering Innovation Project

Course Code: ME406 **Course Credit: 01**

Instructor-in-charge: **L-T-P: 0-0-2**

Course Description:

The program requires each student to undertake a project with interdisciplinary group-size up to a maximum of 4 students. Each project group is supervised by up to a minimum of two faculty staffs. In Engineering Innovation Project (EIP), students will take CDIO initiative for their innovation. CDIO (Conceive-Design-Implement-Operate) is an innovative framework in the field of engineering that equips engineers with the knowledge in the state-of-the-art of technology. Conceive, design, implement and operate are the different components of research methodology for which the students have to perform during the incoming semesters III, IV, V and VI respectively. Total credit of this course is four with one credit in each semester. Followings are the steps that the groups of interdisciplinary students are required to follow to secure 4 credits.

1. **Conceive:** This is one of the basic components of CDIO initiative for project work. In this component, students have to conceive the idea of project through observations and literature reviews to define the problems to be solved. Conceive part of project work will be of one credit along with the duration of one semester (semester III).
2. **Design:** Whatever be the problems that were conceived in semester III will be continued to semester IV for designing/simulating/modeling of the defined objectives. This part of the project will also be of one credit for the duration of semester IV.
3. **Implement:** The implementation part will be done in V semester of the same credit 1. In this component, installation and testing will be required to be done for the designed project. The problems related to modeling and simulation can be implemented using different software.
4. **Operate:** In this component, output of solution of the well defined problems will be investigated or analyzed. Results so obtained after operating the installed system will be manipulated and validated with the previous research. This component has to be finished during semester VI and will be of 1 credit.

Course Objectives:

The Objectives of the course are:

- To introduce students to engineering projects.
- To provide students an opportunity to exercise their creative and innovative qualities in a group project environment.
- To excite the imagination of aspiring engineers, innovators and technopreneurs.
- To make students understand why innovation is integral to commercial success.
- To evaluated Innovation strategies and tactics through perspective ideation.

Course Outcomes:

On successful completion of the course students will be able to:

- Demonstrate a sound technical knowledge of their selected project topic.
- Undertake problem identification, formulation and solution.
- Design engineering solutions to complex problems utilizing a systems approach.
- Conduct an engineering project

- Communicate with engineers and the community at large in written an oral forms.
- Demonstrate the knowledge, skills and attitudes of a professional engineer.

Evaluation Scheme:

The assessment of Engineering Innovation Project consists of assessment by supervisor in the following areas:

- Technical Knowledge and Skills
- Project Report
- Oral Presentation
- Attendance and Participation
- Interview
- Demonstration

1. **Conceive**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of work plan	10%	One months after the commencement of semester III
2	Progress report/presentation-1	20%	Two months after the commencement of semester III
3	Progress report/presentation-2	20%	Three months after the commencement of semester III
4	Final Presentation/Viva	50%	End of semester III
Total		**100%**	

2. **Design**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of design/drawing	10%	One months after the commencement of semester IV
2	Progress report/presentation-1	20%	Two months after the commencement of semester IV
3	Progress report/presentation-2	20%	Three months after the commencement of semester IV
4	Final Presentation/Viva	50%	End of semester IV
Total		**100%**	

3. **Implement**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of installation	10%	One months after the commencement of semester V
2	Progress report/presentation-1	20%	Two months after the commencement of semester V
3	Progress report/presentation-2	20%	Three months after the commencement of semester V
4	Final Presentation/Viva	50%	End of semester V
Total		**100%**	

4. **Operate**

S. No.	Evaluation Component	Weightage	Date and Time
1	Synopsis of result extraction	10%	One months after the commencement of semester V
2	Progress report/presentation-1	20%	Two months after the commencement of semester V
3	Progress report/presentation-2	20%	Three months after the commencement of semester V
4	Final Presentation/Viva	50%	End of semester V
Total		**100%**	

Reference Book: NA