THE ASSAM KAZIRANGA UNIVERSITY

SYLLABUS

FOR

BACHELOR OF TECHNOLOGY

(MECHANICAL ENGINEERING)

SCHOOL OF ENGINEERING AND TECHNOLOGY

2015

Bachelor of Technology in Mechanical Engineering 2015-2019

Code	Course	L	T	P	Credit
Semester- I					
ET1111	Mathematics-I	3	1	0	4
ET1130	Physics	3	1	0	4
ET1113	Chemistry	3	0	0	3
ET1114	English communication skills	2	0	0	2
ET1619	Engineering Mechanics	3	0	0	3
UN1121	Professional Ethics and Human Values	1	0	0	1
UN1122	Environmental Studies	2	0	0	2
ET1116	Chemistry Laboratory	0	0	3	2
ET1117	Communicative English Laboratory	0	0	3	2
ET1131	Physics Laboratory	0	0	3	2
ET1620/ ET1614	Engineering Graphics Laboratory/Workshop Practice	0	0	3	2
Total		**17**	**2**	**12**	**27**
Semester- II					
ET1118	Mathematics-II	3	1	0	4
ET1651	Basic Thermodynamics	3	0	0	3
ET1320	Introduction to Computing	3	1	0	4
ET1119	Business Communication	2	0	0	2
ET1411	Basic Electrical Engineering	3	0	0	3
ET1511	Basic Electronics	3	0	0	3
ET1321	Introduction to Computing Laboratory	0	0	3	2
ET1120	Business communicative Laboratory	0	0	3	2
ET1412	Basic Electrical Engineering Laboratory	0	0	3	2
ET1512	Basic Electronics Laboratory	0	0	3	2
ET1614/ ET1620	Workshop Practice/Engineering Graphics Laboratory	0	0	3	2
Total		**17**	**2**	**15**	**29**

Code	Course	L	T	P	Credit
Semester- III					
ET 1123	Mathematics-III	3	1	0	4
ET1625	Material Science	3	0	0	3
ET1417	Electrical Machines -I	3	1	0	4
ET1615	Strength of Materials	3	0	0	3
ET1652	Mechanics of Fluids	3	1	0	4
ET 1653	Engineering Thermodynamics	3	1	0	4
ET1618	Machine Drawing	0	0	3	2
ET1654	Mechanical Laboratory - I	0	0	3	2
ET 1418	Electrical Machines -I Laboratory	0	0	3	2
Total		**18**	**4**	**9**	**28**
Semester- IV					
ET1129	Mathematics-IV	3	1	0	4
ET1638	Manufacturing Technology-I	3	0	0	3
ET1655	Heat and Mass Transfer	3	1	0	4
ET1656	Fluid Machinery	3	1	0	4
ET1657	Kinematics of Machinery	3	1	0	4
ET1622	Computer Aided Drafting Laboratory	0	0	3	2
ET1631	Heat Transfer Laboratory	0	0	3	2
ET1658	Mechanical Laboratory - II	0	0	3	2
ET1664	Fluid Mechanics Laboratory	0	0	3	2
ET1133	Extra Academic Activity- I	0	0	2	1
Total		**15**	**4**	**14**	**28**

Code	Course	L	T	P	Credit
Semester- V					
ET 1126	Engineering Economics and principles of management	2	0	0	2
ET1621	Operations Research	3	1	0	4
ET1640	Manufacturing Technology II	3	0	0	3
ET1650	Machine design- I	3	1	0	4
ET1430	Control System Engineering	3	1	0	4
ET1659	Dynamics of Machinery	3	1	0	4
ET1633	Theory of Machines Laboratory	0	0	3	2
ET1660	Manufacturing Technology Laboratory	0	0	3	2
ET1134	Extra Academic Activity- II	0	0	2	1
Total		**17**	**4**	**8**	**26**
Semester- VI					
ET1634	Machine Design-II	3	1	0	4
ET1635	Refrigeration and Air Conditioning	3	1	0	4
ET1643	Computer Aided Design and Manufacturing	3	1	0	4
ET1644	Internal Combustion Engine	3	1	0	4
ET1646	Industrial Engineering	3	1	0	4
ET1629	Mechanical Measurement	3	0	0	3
ET1666	Seminar	0	0	2	1
ET1632	Metrology Laboratory	0	0	3	2
ET1645	Internal Combustion Engine Laboratory	0	0	3	2
ET1662	Mechanical Laboratory - III	0	0	3	2
ET1135	Extra Academic Activity- III	0	0	2	1
Total		**18**	**5**	**13**	**31**

Code	Course	L	T	P	Credit
Semester- VII					
ET1630	Production Management.	3	0	0	3
ET1637	Non-Conventional Energy Resources	3	0	0	3
ET16**	Elective-I	3	0	0	3
ET16**	Elective-II	3	0	0	3
ET1665	Industrial Training	0	0	0	1
ET1667	Minor Project	0	0	8	4
Total		**12**	**0**	**8**	**17**
Semester- VIII					
ET16**	Elective-III	3	0	0	3
ET16**	Elective-IV	3	0	0	3
ET1671	Major Project	0	0	16	8
Total		**6**	**0**	**16**	**14**

Elective I	**Power Plant Engineering(ET1677),Composite Materials (ET1627),Numerical Heat Transfer and Fluid flow (ET1628),Gas Turbine and Compressor (ET1668)**
Elective II	**Convective heat and Mass transfer (ET1641),Fluidized Bed System (ET1642), Wind Energy(ET1647) , Combustion (ET1649)**
Elective III	**Quality and Reliability Engineering (ET1663), Design of Heat Transfer equipment (ET1669), Material Handling System (ET1672),Solar Energy(ET 1639) Advanced Manufacturing Technology (ET1678)**
Elective IV	**Heating, Ventilation and Air-conditioning Design (ET1673),Mechatronics (ET 1674), Automobile Engineering (ET1675), Energy Conservation and Waste heat recovery system (ET1676)**

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ET1111: Mathematics- I (4) **Semester-I**

Rationale: Differential calculus leads to differential equation, which has wide application to this real world phenomenon. Integrals and derivatives became the basic tools of calculus, with numerous applications in science and engineering.

Catalog Description: This paper is designed to provide students the opportunity to learn successive differentiation, definite integral and its application, ordinary differential equation with application and differentiation based on several variables.

Pre-requisite: For this course one must know function, limit, continuity and differentiation.

Course Outline:

Unit-I: Differential Calculus (13 Lectures)
Successive differentiation, standard forms, Leibnitz's Theorem, Rolle's Theorem, Lagrange's Mean Value Theorem, Expansion of functions by Tailor's Series, Indeterminate forms, L. Hospital's Rule. Tangents and Normals, Asymptotes, Curvature.

Unit-II: Integral Calculus: (13 Lectures)
Properties of definite integrals, Reduction formulae, Areas and lengths of plane curves, Volumes and surface area of solid of revolution.

Unit-III: Differential Equation: (13 Lectures)
Differential Equation: Differential equations of first order and first degree, Separation of variables, exact equation, linear equation, Bernoulli's equation and application to Electrical circuits. Linear differential equation of second and higher order, Homogeneous equation with constant co-efficient, Euler-Cauchy equations, Solutions by variation of parameters, some applications.

Unit-IV: Partial Differentiation: (13 Lectures)
Functions of two or more variables, Partial derivatives, Euler's theorem on homogeneous functions. Differentiation of implicit and composite functions, Errors and approximations. Change of variables. Jacobians, Taylor's series of two variables. Maximum and minimum of functions of two variables, Lagrange's method of undetermined multipliers.

Text Book(s):

1. Santi Narayan and Mittal , Differential Calculus, Santi Narayan and Mittal, Chapters 14, 15; Publisher: S. Chand
2. E. Kreyszig ,Advanced Engineering Mathematics , John Willey & Sons Inc- 8th Edition-Chapter 1(1.1 to 1.6), Chapter 2(2.1 to 2.12), Chapter 4(4.1 to 4.3, 4.5, 4.6) Chapter 6(6.1 to 6.6), Chapter 7(7.1 to 7.5)

Reference Book(s):

1. B. V. Ramana ,Higher Engineering Mathematics , TMH
2. H. K. Dass ,Advanced Engineering Mathematics ,S. Chand
3. H. K. Dass ,Engineering Mathematics , S. Chand.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

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ET1130:Physics(4) **Semester - I**

Rationale: Physics is the most fundamental of all the sciences because it is the basis of the natural world that surrounds us from the ever expanding universe to the world of subatomic particles. Almost all the branches of engineering and technology have emerged from the core science of physics. A sound understanding of the basic concepts of physical phenomena is, therefore, an important requirement for the prospective engineers. Major concepts covered in this physics course include the study of motion, light, magnetism, relativity, and quantum theory. What separate physics from other science courses is its correlation to and need for mathematics. Students must learn to apply the concepts to problem solving.

Catalog Description: It is designed to provide an introduction to the scientific method and its application to the study of selected topics in physics. Classroom demonstration instructors make every effort to provide the students with a model of how science should be taught in the classroom.
A lecture / laboratory course designed to provide an introduction to the scientific method and its application to the study of selected topics in physics. Four hours of lectures and one 3 –hour lab per week

Pre-requisites: Knowledge of elementary school physics is assumed.

Course Outline:

Unit- I: General Physics (3 Lectures)
Angular momentum, Relation between torque and angular momentum; Relation between elastic constants, Energy of strained body, torsional balance, Bending of beam, Cantilever, Poisseulli's formula, Stoke's law, Bernoullis Equation

Unit- II: Oscillation And Waves(2 Lectures)
Oscillatory systems: Simple harmonic oscillation, damped harmonic oscillation, forced vibration, resonance, coupled oscillation. Waves as periodic variation quantity in space and time, wave equation, Reflection and transmission of waves at boundary of two media.

Unit-III: Electricity, Magnetism and Electromagnetism: (8Lectures)
Gauss's theorem and its applications, Poisson's and Laplaces equation, Lorentz force, BiotSavart law & ampere's law, their application, L-C-R circuit.; Magnetic and Dielectric materials, Magnetization, Classification of magnetic materials: Dia, Para and ferromagnetism, Anti-ferromagnetism and ferrimagnetism, Spinwave, Ferrite, Magnetic bubble, Ferroelectricity, Piezoelectricity, Luminescence, Hysteresis, Hall Effect, Electric displacement (D), Magnetic Induction (B), Amperes circuital law. Faraday's law of induction – inductance – energy in magnetic field – generalization of Ampere's law – Maxwell's equations, Electromagnetic wave equation.

Unit-IV: Wave Optics (8 Lectures)
Interference: Superposition of waves: Two beam superposition, Multiple-beam superposition, coherent and incoherent superposition. Two source interference pattern, Intensity distribution, Biprism, Determination of wavelength of light. Newton's rings: Determination of wavelength of light, refractive index of liquid. Diffraction: Huygen's principle, Fresnel and Fraunhofer diffraction,

zone plate, Fraunhofer diffraction due to a single slit, Plane transmission grating- diffraction spectra, determination of wave length of light. Polarization: Polarization of transverse waves, plane, circular and elliptically polarized light. Polarization by reflection, refraction and scattering. Double refraction; Nicol prism, Quarter – wave plate, half – wave plate construction and use. Production and

analysis of circular and elliptically polarized light, Optical rotation (Only concepts).

Unit-V: Basic Quantum Mechanics:(6Lectures)
Wave-particle duality, de-Broglie matter waves; phase and group velocities, Davission-Germer experiment; Heisenberg uncertainty principle and its applications; wave-function and its physical significance; Schrödinger wave-equation and its simple applications

Unit-VI: Solid State Physics and Superconductivity (12 Lectures)
The bonding of atoms, Crystalline, Polycrystalline and amorphous materials, Liquid crystal, Space lattice, Unit cell, Miller indices, crystal defect, lattice vibration and phonon, Origin of energy bands, classification of solids: Conductor, Insulator and semiconducting materials, Polymer material, Electrical conduction in polymers, crystal structure of semiconductors, Intrinsic and extrinsic semiconductors, N-type and P-type semiconductor; Conductivity, Einstein relationship, Generation and recombination in semiconductors; Diffraction of X-rays by crystal planes; Bragg's law and Bragg's spectrometer. Superconductors and their properties; Type-I and Type-II superconductors; Josephson effect, SQUID, Meissner effect; Temperature dependence of critical field, High temperature superconductors and their applications; Simple outlines of BCS theory, Ceramic material, solar cell material, Material for VSLI and Photoconductors.

Unit-VII: Laser and Optical Fiber (6 Lectures)
Spontaneous and stimulated emission of radiation; Basic concept of Laser; Einstein's coefficients; construction and working of Ruby and He-Ne Lasers; laser applications. Basic idea of optical fiber; types of optical fibers; acceptance angle and cone; Numerical aperture; propagation and communication in optical fibers; attenuation, dispersion and signal loss in optical fiber; applications of optical fibers, Acoustic and Optical phonon.

Unit-VIII: Introduction to Nano materials (4Lectures)
Historical view of Nanoscience and Nanotechnology, production and properties of nano particles, material used in nanotechnology, quantum confinement in semiconductor, Applications of nano materials in different fields.

Text Book(s):

1. RK. Gaur and S.L. Gupta ,Engineering Physics , Dhanpat Rai Publications
2. Neeraj Mehta ,Textbook of Engineering Physics part I & II, PHI publications

Reference Book(s):

1. University Physics by Hugh D. Young and Roger A. Freedman,Pearson Education

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the followings:

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

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ET1113: **Chemistry (3)** **Semester-I**

Rationale: Building a strong fundamental knowledge in chemistry is the key to crack new innovative ideas in the field of Engineering and Technology. Hence, this fundamental course will enhance the knowledge of students in the field of chemistry and applied science and enables students to understand the properties of different materials and to transform materials into new and useful substances.

Catalog Description: The objective of this course is to develop basic concepts of important topics: chemical kinetics and catalysis, electrochemistry and thermodynamic.Moreover, some important applied chemistry topics are also included, considering their importance in various branches of engineering.

Pre-requisites: Knowledge of fundamental principles of chemistry is essential.

Course Outline:

Phase Rule:(3 Lectures)
Phase diagram of one & two component systems, H_2O, S, Cd-Bi and Fe-C systems

Reaction Kinetics and Catalysis: (4 Lectures)
General discussion on different order reactions, derivation of second, third, parallel and consecutive reactions, order and molecularity of reactions, differential and integrated from of rate equations, determination of order of reactions, activation energy- concept and connected problems, kinetics study and mechanism of reactions, homogeneous andheterogeneous catalysis (a general idea).

Electrochemistry:(5 Lectures)
Electrolytic and galvanic cells,EMF series, Nernst equation for electrode potential, cell EMF, measurement ofcell EMFand its applications, Weston standard cell, hydrogen electrode, calomel electrode, glass electrode, reversible and irreversible cells, concentration cell, electrode (hydrogen gas electrode) and electrolyte concentration cell, concentration cell with and without transference, fuel cells, hybrid cells.
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Chemical Thermodynamics: (5 Lectures)
Thermo chemistry, thermo-chemical calculations based on Hess's law and Born-Haber cycle, second law of thermodynamics, entropy, the free energy concepts, applications free energy concepts to gases, Gibbs-Helmholtz equation, free energy change and criterion of spontaneity and equilibrium of chemical reactions, chemical equilibrium, Maxwell's relations.

Energy & Fuels:(6 Lectures)
Origin and types of coal, coal characterization methods, coal classification, fluidized bed combustion, gas hydrate, gaseous energy sources.

Origin of petroleum, classification of petroleum, brief introductions about exploration, transportation and refining processes of petroleum.

Basics of some Industrial Processes:(9 Lectures)

Definition, composition and types of Portland cement, blended cements, silicate based ceramic industries: basic raw materials.

Introduction and chemistry of some basic processes of: pulp and paper industry, dyes, detergents and soap industries, polymer and rubber industry, paints and pigment industries, fertilizer industries, lubricants and lubrications.

Materials in electronic industries.

Environmental Chemistry:(5 Lectures)

Basic chemistry of some common air pollutants and their reduction strategeis, water and soil pollutants, basics of acid rain, global warming and phootochemicaal smogs, criteria of water and air qualities.

Text book(s):

1. G.M. Barrow. Physical Chemistry, 5th edition, Tata McGraw Hill, New Delhi.
2. P.W. Atkins. Physical Chemistry, 6thedn., Oxford.
3. P.C. Jain, M. Jain. Engineering Chemistry, 15thedn., Dhanapat Publishing Company (P) Ltd., New Delhi.
4. S. Ramesh et al. Engineering Chemistry, Wiley India, 1stedn., 2011.
5. H.D.Gesser, Applied Chemistry: A Textbook for Engineers and Technologist, 1st edition, (Springer, 2008).
6. S.E.Manahan, Environmental Chemistry, 8thedn., (Lewis Publishers, London, 2004).

Reference book(s):

1. Puri, Sharma and Pathania. Principles of Physical Chemistry.
2. Bahl and Tuli. Physical Chemistry.
3. Thomas Engel, Philip Reid. Physical Chemistry, Pearson Education.
4. Robert A Alberty. Physical Chemistry.
5. Castellan. Physical Chemistry
6. G.T. Austin, Shreve's Chemical Process Industries, 5th edition, (Tata McGraw-Hill, 2012).

Journal:

E-Resources:

Grading System: The final grade shall be based on the following:

Internal Evaluation: 30%
End Semester Exam: 70%

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ET1114: English Communication Skills (2) **Semester: I**

Rationale: English Communication is a course tuned to help prospective engineers build and sharpen their language skills. It is designed to familiarize learners with the nuances of technical and non-technical language use and to boost their communicative competence.

Catalog Description: The course begins with an introduction to the importance of English and the value of Humanities for professional students. The next unit deals with context-specific forms and varieties of language. The third unit is devoted to pronunciation, stress and intonation. The final unit deals with functional grammar.

Pre-requisites: Intermediate level proficiency in English.

Course Outline:

Unit-I: The Elements of Communication: (3 Lectures)
The importance of communication through English at the present time; Varieties of English: Standard Indian, American, British, Caribbean, Australian, etc.; Interface between Science and Society.

Unit-II: Forms of Language: (2 Lectures)
Introduction to context-specific forms of language; Registers of language; Comparing and analysing variants of language: sample texts across disciplines viz. engineering, management, sociology, literature, non-fiction, law, etc.

Unit-III: The Sounds of English: (12 Lectures)
The sounds of English (vowels, diphthongs, consonants, consonant clusters); Problem sounds; Syllable division and word stress; Contrastive stress in sentences to highlight different words; Sentence rhythm; Intonation: falling, rising and falling-rising tunes

Unit-IV: Review of English Grammar: (9 Lectures)
Time, tense and aspect; Voice: active and passive; Determiners, articles and prepositions; Subject verb agreement/planarization; Static and dynamic verbs; Modality; Phrasal verbs

Text Book(s):

1. Seth, J., Sadanand, K., Jindal, D.V. A Practical Course in English Pronunciation. (PHI Publishing, 2010).
2. Muralikrishna, C., Mishra, S. Communication Skills for Engineers (Pearson, 2011).

Reference Book(s):

1. Penny, U.R. Grammar Practice Activities. **(**Cambridge University Press, 2008).
2. Kumar, S., Lata, P. Communication Skills. **(**Oxford University Press, 2012).
3. Das, B.K. An Introduction to Professional English and Soft Skills. (Cambridge University Press, 2009).
4. Murphy, Raymond. English Grammar in Use. **(**Cambridge University Press, 2004).
5. Prasad, P., The Functional Aspect of Communication Skills. **(**Katson Student Edition, 2012).

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the followings:

Internal Evaluation: 30%

End Semester Examination: 70%

Academic Council Approval:

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ET 1619: Engineering Mechanics (3) **Semester: I**

Rationale: The main aim and purpose behind the study of engineering mechanics is to evolve the ability among engineering students to predict the effects of force and motion while carrying out the design functions of engineering.

Catalog Description: The course covers the basic principles and theories of both statics and dynamics.

Pre-requisites: Basic knowledge of physics.

Course Outline:

Unit I: Review of Basic Force Systems(3 Lectures)
Dimensions and units of mechanics, idealization of mechanics, laws of mechanics, vector algebra review, moment of a force about a point and axis, the couple and couple moment, addition and subtraction of couples, moment of a couple about a line, translation of a force to a parallel position, resultant of a force system.

Unit II: Resolution of a force and composition of a force system(3 Lectures)
Parallelogram law of forces; triangle law of forces; polygon law of forces. Resultant and Equilibrant, Varignon's theorem of moments. Basic principles: Equivalent force system; Equations of equilibrium; Free body diagram;Reaction; Static indeterminacy.

Unit III:Friction (4 Lectures)
Coulomb dry friction laws, simple surface contact problems, friction angles, types of problems, wedges. Wheel friction and rolling resistance.
Virtual work and Energy method: Virtual Displacement; Principle of virtual work; Mechanical efficiency;

Unit-IV: Analysis of structures (5 Lectures)
Analysis of structures: Assumptions followed in the analysis of truss; Analysis of truss by method of joints and sections. Analysis of frames.

Unit V: Centroid and Moment of inertia (6 Lectures)
Centroid of plane figures - Locating centroid of basic regular figures from first principles including sector of a circle, parabola, locating centroid of built-up sections.Moment of inertia (Second moment of area)-Perpendicular and parallel axistheorems; radius of gyration; Mass moment of inertia.

Unit VI:Kinematics and kinetics of Particles (5 Lectures)
Rectilinear motion; Curvilinear motion;Force, mass and acceleration; Work and energy; Impulse and momentum;

Unit VII:Kinematics and Kinetics of Rigid Bodies (7 Lectures)

Relative velocity, Translation, Pure rotation and plane motion of rigid bodies, D'Alembert's principle, linear momentum, principle of conservation of momentum, Impact of solid bodies, work, energy, power, principle of conservation of energy

Text book(s):

1. I.H. Shames, Engineering Mechanics: Statics and Dynamics, 4th Ed., PHI, 2012
2. F. P. Beer and E. R. Johnston, Vector Mechanics for Engineers: Statics and Dynamics, Tata McGraw Hill, 2003.

Reference Book(s):

1. J. L. Meriam and L. G. Kraige, Engineering Mechanics, Vol I – Statics, Vol II – Dynamics, 5th Ed., John Wiley, 2002.
2. R. C. Hibbler, Engineering Mechanics, Vols. I and II, Pearson Press, 2002.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

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UN1121: **Professional Ethics and Human Values(1)** **Semester-I**

Rationale: This subject deals in creating awareness on engineering ethics and human values, and instilling moral and social values as well as loyalty to appreciate the rights of others.

Catalog Description: This course is designed to make the students familiar with the basic tenets of professionals and professionalism, ethics in engineering, engineers' responsibility for safety, and human values and attributes.

Pre-requisites: None

Course Outline:

Unit-I: Professionals and Professionalism(03lectures)
Roles of a Professional: Engineering as a Profession, Professional Risks and Accountability, Virtue, Ethics, Honesty and Moral Responsibility

Unit-II:Ethics in Engineering(03 hours)
Engineer's Moral Responsibility for Safety and Human Right, Engineering Ethics: Making Sense of Engineering Ethics, Issues in Engineering Ethics, and Ethical Obligations of Engineering Professionals, Models of Professional Roles and Application of Ethical Theories: Kohlberg's Theory, Gilligan's Theory, and theories about right action

Unit-III:Engineers' Responsibility for Safety(03 lectures)
Safety and Risk: Concept of Safety, Assessment of Risk: Risk–Benefit Analysis, Risk Costs and Management, and Principles of Risk Management, Engineers' Responsibility for Safety: Safety in Engineering Products, Mandatory Product Standards, Designing for Safety, and Providing for Safe Exit, Select Case Studies: Bhopal Gas Tragedy, Uphaar Cinema Tragedy, Chernobyl Disaster, etc.

Unit-IV: Human Values and Attributes(03 lectures)
Human Values: Classification of Values, Values and Ethics, and Universality of Values, Acquiring Values, Components of Attitudes, and Degeneration of Values, Values, Attitudes and Engineering Professionals

Text Book(s):

1. Subramanian, R. Professional Ethics. New Delhi: Oxford University Press, 2013.

Reference Book(s):

1. Fleddermann, Charles D., Engineering Ethics. New Jersey: Pearson Education/Prentice Hall, 2004 (Indian Reprint).

2. Harris, Charles E., Michael S Pritchard and Michael J Robins, Engineering Ethics: Concepts and Cases. Wordsworth/Thompson Learning, United States, 2000 (Indian Reprint).

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

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UN1122:Environmental Studies(2) **Semester-I**

Rationale: To create awareness on the various environmental pollution aspects and issues.

- To give a comprehensive insight into natural resources, ecosystem and biodiversity
- To educate the ways and means to protect the environment from various types of pollution.
- To impart some fundamental knowledge on human welfare measures.

Catalog Description: This subject covers the introductory concept of environmental studies such as Ecosystem, Biodiversity, Environmental Pollution, Human Population, etc.

Pre-requisites: Preliminary knowledge on environmental science

Course Outline:

Unit-I: Introduction to Environmental Studies and Natural Resources (6 lectures)
Definition, scope and importance, Need for public awareness**.** Forest resources: Use and over-exploitation, deforestation, case studies, Timber extraction, mining, dams and their effects on forests and tribal people. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer/pesticide problems, water logging, salinity, case studies. Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. case studies. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dam's-benefits and problems. Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.

Unit-II: Ecosystem and Biodiversity (7 lectures)
Concept of an ecosystem, Structure and function of an ecosystem, Producers, consumers and decomposers, Energy flow in the ecosystem, Ecological succession, Food chains, food webs and ecological pyramids, Introduction, types, characteristic features, structure and function of the (a) forest ecosystem (b) grassland ecosystem (c) desert ecosystem (d) aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries), Introduction to biodiversity – definition: genetic, species and ecosystem diversity, Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values, Biodiversity at global, national and local levels – India as a mega-diversity nation,Hot-spots of biodiversity, Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts,Conservation of biodiversity

Unit-III: Environmental Pollution (6 lectures)
Definition, Causes, effects and control measures of: (a) air pollution (b) water pollution (c) soil pollution (d) marine pollution (e) noise pollution (f) thermal pollution (g) nuclear hazards, Solid waste management: causes, effects and control measures of urban and industrial wastes**,** Role of an individual in prevention of pollution.

Unit-IV: Social Issues and the Environment (5 lectures)

From unsustainable to sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management, Resettlement and rehabilitation of people; its problems and concerns, case studies, Environmental ethics: issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear

accidents / holocaust, case studies, Wasteland reclamation, Consumerism and waste products.

Unit-V: Human Population and the Environment (2 lectures)

Population growth, variation among nations, Population explosion- family welfare program, Environment and human health

Text Book(s):

1. Gilbert M.Masters, "Introduction to Environmental Engineering and Science", PHI Learning education Pvt., Ltd., second edition, ISBN 81-297-0277-0, 2004.
2. Miller T.G. jr., "Environmental Science", Wadsworth publishing co.
3. Townsend C., Harper J and Michael Begon, "Essentials of Ecology", Blackwell science.
4. 4. Trivedi R.K. and P.K. Goel, "Introduction to air pollution", techno-science publications.

Reference Book(s):

1. Bharuchaerach, "The Biodiversity of India", Mapin publishing Pvt. Ltd., Ahmedabad India,
2. Trivedi R.K., "Handbook of Environmental Laws", Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro media.
3. Cunningham, W.P.Cooper, T.H.Gorhani, "Environmental Encyclopedia", Jaico Publ., House, Mumbai, 2001.
4. Wager K.D., "Environmental Management", W.B. Saunders Co., Philadelphia, USA, 1998.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1116: **Chemistry Laboratory (2)** **Semester-I**

Rationale: Laboratory work at postgraduate master's level course is essential to produce skilled technicians for industry and highly competent workers for research laboratories.

Catalog Description: This course has included different analytical methodologies, which will help students' analytical skill to undertake academic and industrial research work.

Pre-requisites: Basic experimental skills, basic concept of chemistry, safety rules in chemical laboratory.

Course Outline:

(At least ten (10) different experiments from the following list to be done)

1. Determination of amount of sodium hydroxide and sodium carbonate in a mixture.
2. Determination of total hardness of water by EDTA method.
3. Estimation of calcium in limestone.
4. Determination of percentage of available chlorine in a sample of bleaching powder.
5. Preparation of Phenolphthalein.
6. Preparation of Aspirin.
7. Preparation of buffer solution and determination of pH of a buffer solution.
8. Standardization of KMnO4 using sodium oxalate.
9. Determination of Ferrous iron in Mohr's salt by potassium permanganate.
10. Determination of partition coefficients of iodine between benzene and water.
11. Determination of rate constant of acid catalysed hydrolysis reaction.
12. Determination of concentration of a coloured substance by spectrophotometer.
13. Determination of dissolved Oxygen in a sample of water.
14. Determination of Viscosity of lubricating oil by Red wood viscometer.
15. Determination of Flash point of given oil by Pensky Marten's flash point approach.

Text Book(s):

1. GurdeepRaj, Advanced Practical Inorganic Chemistry, 23rd Edition, GOEL Publishing House, Meerut, 2011.
2. J.B. Yadav, Advanced Practical Physical Chemistry, 32th Edition, Krishna Prakashan, Meerut, 2014.
3. S. Barua, A Textbook of Practical Chemistry, 1st Edition (Reprint), Kalyani Publisher, Delhi, 2008.

Reference book(s):

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 40%
End Semester Exam: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1117: Communicative English Laboratory (2) **Semester: I**

Rationale: In today's competitive global world, English enhances one's career prospects by creating new and varied opportunities. Practicing English language skills in the language lab enhances students' proficiency in language. The course is designed to give students practice in all the modules taught in the theory class. The focus of the course is on language use by students in real life situations.

Catalog Description: The course is divided into four units. The first unit acquaints the learners with the sounds of English. The second unit focuses on the listening skills with a stress on ear-training, segmental sounds with the help of audio clips, music, movies, etc. The third unit deals with the speaking skills focussing on stress, rhythm and intonation. The final unit of the course focuses on grammar and its usage.

Pre-requisites: Intermediate level proficiency in English.

Course Outline:

Lab sessions will be devoted to practice activities based on all four units of theory:

Unit-I: The Sounds of English
(Students will be trained to find out the correct pronunciation of words with the help of a dictionary, to enable them to monitor and correct their own pronunciation)
Syllable division marking, Stress marking, Practicing Rhythm, and Practicing Intonation.

Unit-II: Listening
Listening with a focus on pronunciation (ear-training), segmental sounds, stress, weak forms, intonation, practiced with the help of audio clips, music, movies, etc. in English, Listening for meaning: overall idea and specific information, Follow-up activities based on listening: review and group discussion.
(Students should be exposed, if possible, to the following varieties of English during listening practice: Standard Indian, British, American, Caribbean, etc**.)**

Unit-III: Speaking
Reading aloud of dialogues, poems, excerpts from plays, speeches etc. for practice in pronunciation. (Focus on stress, rhythm and intonation); conversation practice and role-play.

Unit-IV: Grammar and Usage
(The focus will be on the elimination of common errors. LSRW activities (e.g. Writing of short paragraphs on assigned topics, orally presenting one's ideas and arguments etc.) can be used to identify these errors.

Text Book(s):

1. Seth, J., Sadanand, K., Jindal, D.V. A Practical Course in English Pronunciation. (PHI Publishing, 2010).
2. Muralikrishna, C., Mishra, S. Communication Skills for Engineers (Pearson, 2011).

Reference Book(s):

1. Penny, U.R. Grammar Practice Activities. **(**Cambridge University Press, 2008).
2. Kumar, S., Lata, P. Communication Skills. **(**Oxford University Press, 2012).
3. Das, B.K. An Introduction to Professional English and Soft Skills. (Cambridge University Press, 2009).
4. Murphy, Raymond.English Grammar in Use. **(**Cambridge University Press, 2004).
5. Prasad, P.,The Functional Aspect of Communication Skills. **(**Katson Student Edition, 2012).

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 40%

End Semester Examination: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET-1131:Physics Laboratory(2) **Semester: I**

Rationale: Real understanding of a physical phenomenon can be achieved by doing physics experiments. This module is intended to familiarize the students with some basic physics experiments which would be helpful in engineering applications.

Catalog Description: This practical course is divided into 10 experiments spreading over the 1st semester covering general physics, optics and electronics.

Pre-requisites: Knowledgeof measuring techniques and data analysis, basic electronic circuits.

Course Outline:

Exp No. 1: Determination of young's modulus of a wire by Searle's method.
Exp No. 2: Determination of surface tension of water by capillary rise method.
Exp No. 3: Determination of modulus of rigidity of the material of a wire by static method.
Exp No. 4: Determination of the value of acceleration due to gravity by Katter's reversible pendulum.
Exp No. 5: To find carrier concentration, mobility, Hall co-efficient etc. using Hall Effect.
Exp No. 6: Determination of grating element of a diffraction grating using monochromatic source of light.
Exp No. 7: Determination of wavelength of a semiconductor LASER using diffraction gratings.
Exp No. 8: Determination of plank's constant by using photo diode.
Exp No. 9: To study the forward and reverse characteristics of p-n junction diode using DPM.
Exp No. 10: To study the input and output characteristics of a junction transistor using DPM.

Text Book(s):

Reference Book(s):

1. Consult Laboratory manuals.

Journal(s):
E-Resource(s):

Grading System: The final grade shall be based on the followings :-

Internal Evaluation: 40%
End Semester Exam: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1620: **Engineering Graphics Laboratory (2)** **Semester: I/II**

Rationale: Engineering graphics is a type of technical drawing, used to clearly define and communicate all engineering design ideas. Engineering Graphics is regarded as the graphical language of communication for all engineers. It forms an integral part right from conceiving the design criteria of any product up to its final production stage. Engineering graphics has a well-defined set of standards based on which all technical drawings are produced.

Catalog Description: This course covers the basic principles and techniques of engineering graphics.

Pre-requisites: Basic geometrical constructions.

Course Outline:

Unit-I:
Introduction to engineering drawing, Convention and standards: ISO, Scales: Representative Fraction, Types of Scale, Conics and Engineering Curves.

Unit-II:
Projection: Introduction, Principle of Projection, Method of projection, Planes of projection, Four quadrant, First and Third angle projection, Reference line, symbols for methods of projection.

Unit-III: Orthographic projections: points, lines, planes and solids.

Unit-IV: Sections of solids.

Unit-V: Isometric projections.

Unit-VI: Development of surfaces.

Unit-VII: Intersection of solids.

Text book(s):

1. N. D. Bhatt, Engineering Drawing, Charotar Book Stall, 50th Ed, 2011.
2. Dhananjay A Jolhe ,Engineering Drawing,Tata Mc Graw Hill,3rd Ed,2009.

Reference Book(s):

1. M.B. Shah and BC Rana Engineering Drawing, Pearson, 2nd Ed, 2009
2. SP 46: 2003 Engineering Drawing Practice for school and colleges, Bureau of Indian Standards

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

-Internal Evaluation: 40%
-End Semester Exam: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1614: **Workshop Practice (2)** **Semester: I/II**

Rationale: The objective is to introduce the first year engineering students with the basic tools and techniques used in engineering.

Catalog Description: This module contains the fundamentals of machine, welding and fitting shops.

Pre-requisite:

Course Outline:

Introduction and practice of various fitting processes: Use of hand tools in fitting, preparing a male and female joint of M.S.

Introduction and practice of various Welding processes: Electric Arc welding Practice and Gas welding.

Joints such as a Lap joint, a T-joint or a Butt joint are to be prepared.

Introduction and practice of various Machining processes: Plain and Stepped cylindrical turning, grooving, knurling and Thread-cutting of a job in lathe.

Text Book(s):

1. Hajra choudhary ,Elements of Workshop Technology, Vol. I and II , Khanna Publishers

Reference(s):

1. WAJ Chapman ,Workshop Technology, Viva Books
2. Kannaiah & Narayana Workshop Manual, Scitech

Grading System: The final grade will be based on the following weight distribution:
-Internal assessment – 40 %
-Semester Practical exam-60 %

Academic Council Approval:

The Assam Kaziranga University
School of Engineering and Technology
Koraikhowa, Jorhat, Assam-785006

ET 1118:Mathematics- II (4) Semester-II

Rationale: This paper includes Vector Algebra (wide application in mechanics, geometry and calculus), Numerical Analysis (gives approximate solution of an mathematical problem), Statistics and Probability (provides models of probability distribution, engineering applications are in testing materials, control of production process, robotics, etc), Linear Algebra (consists of the theory and application of vectors and matrices, it forms a foundation of numeric methods).

Catalog Description: This paper is designed to provide students the opportunity to learn geometrical meaning of vector triple product, numerical methods to find differentiation, integration, solution to ordinary differential equation, provides models of probability distribution, linear equations and linear transformation and eigen value problem.

Pre-requisite: Matrices, determinant and elementary calculus.

Course Outline:

Unit-I: Vector Algebra (13 Lectures)

Scalar and vector triple products, Geometrical meaning of triple products. Volume of a tetrahedron, vector and scalar functions, Derivatives, Tangent and arc length of curve, Gradient, Divergence, Curl.

Unit-II: Numerical Analysis-I (13 Lectures)
Interpolation: Finite differences, Newton's forward and backward interpolation, Newton's and Lagrange's formulas for unequal intervals.
Numerical differentiation and integration: Numerical differentiation, Trapezoidal and Simpson's rules for numerical integration.
Solution of ordinary differential equations: Taylor's series, Runge-Kutta(4^{th} order). Solution of Transcendental and polynomial equations: Bisection, Regula-Falsi and Newton-Raphson methods.Solution of Simultaneous Linear equations.: Gauss-Jacobi and Gauss-Seidal iterative methods.

Unite-III: Statistics and Probability (13 Lectures)
Measure of central tendency (mean, median, mode), Measures of dispersions, variance.Theory of probability: addition law, multiplication law, conditional probability, independent events. Baye's Theorem, Theoretical discrete distribution- Binomial, Poisson distribution, Normal distribution. Sampling theory.

Unit-IV: Linear Algebra (13 Lectures)
Matrices: Symmetric and Skew-symmetric, Hermitian and Skew-Hermitian, Idempotent, Nilpotent, Involuntary, Orthogonal, Unitary matrices, Triangular and echelon form, Differentiation and integration of matrices; Inverse of a matrix.
Vector spaces: Linear independence, Basis and Dimension, Rank of a matrix, Solution of a system of non-homogeneous linear equations, solution of a system of homogeneous linear

equations, Consistency of a system of linear equations.Eigen values and Eigen vectors and their properties, Cayley-Hamilton's Theorem.

Text Book(s):

1. Advanced Engineering Mathematics by E. Kreyszig Publisher: John Willey & Sons Inc- 8th Edition;

Reference Book(s):

1. Higher Engineering Mathematics by B. V. Ramana, Publisher: TMH Mathematical Methods by Potter and Goldberg, Publisher: PHI
2. Advanced Engineering Mathematics by H. K. Dass Publisher: S. Chand.
3. An Introduction to Probability Theory and Mathematical Statistics by V.K.Rohatgi: Publisher: Wiley Eastern Ltd., New Delhi, 1988(3rd Print).

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
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Koraikhowa, Jorhat, Assam-785006

ET1651:Basic Thermodynamics(3) **Semester: II**

Rationale: To impart the basic concepts of thermodynamics

Catalog Description: Scope of Thermodynamics, Ideal gases and their P-V-T relations, Gas mixtures, Energy Transfer, First Law of Thermodynamics, Second Law of Thermodynamics.

Pre-requisite: Basic knowledge of temperature, heat and work

Course Outline:

Unit-I:Basic concepts and definition **(3 Lectures)**
Scope of Thermodynamics, Macroscopic and Microscopic approaches; Definition of Fixed mass (closed systems) and Control volume(open system), Properties (extensive and Intensive), State and its representation on a property diagram, Process and its representation, Cyclic process (or cycle) and its representation, Characteristics of properties (point and path function);Reversible and Irreversible processes; Thermal, mechanical and Chemical equilibrium, Thermodynamic equilibrium.

Unit-II: **(4 Lectures)**
Zeroth Law of Thermodynamics and temperature, Measurement of temperature and calibration of Thermometers, the ideal gas temperature scale, Measurement of pressure, Bourdon pressure gage and manometers, gage and absolute pressure.

Unit-III: **(2 Lectures)**
Ideal gases and their P-V-T relations, Gas mixtures.

Unit-IV: Energy Transfer **(8 Lectures)**
Work Transfer (definition and calculation), Different modes of work, Displacement Work for various process, Heat Transfer; Modes of heat transfer, specific heat and latent heat.

Unit-V: First Law of Thermodynamics **(13 Lectures)**

First law for a closed system undergoing a change of state (process), First law for a closed system undergoing a cycle, Energy- a property of the system, different forms of stored energy, Specific heat at constant volume, Introduction of enthalpy as a thermodynamic property; Specific heat constant pressure, Energy of an isolated system, PMM-1.
First Law for a open system (control volumes), Steady flow process, mass and energy balance in a simple steady flow process for a control volume, Application of steady flow energy equation to engineering systems - Nozzle, Diffuser, Compressor, Turbine, Throttling device, Heat Exchanger.
Limitation of first law of thermodynamics.

Unit-VI: Second Law of Thermodynamics **(7 Lectures)**
Brief concept of energy reservoir, Kelvin- Planck statements of Second Law, Introduction to heat engine, Clausius statements of Second Law, Refrigerator and heat pump, Equivalence of Kelvin-

Planck and statements of Second Law, Reversible cycle- Carnot cycle, Carnot theorem and its corollary, Absolute thermodynamic scale, Entropy concepts and the principle of entropy increase.

Text Book(s):

1. P.K.Nag, Engineering Thermodynamics,5E,Tata-McGraw Hill,2013
2. Y. A. Cengel, M. A. Boles, Thermodynamics : An Engineering Approach, 7E, Tata McGraw – Hill, 2011

Reference Book(s):

1. R. E. Sonntag, C. Borgnakke, Fundamentals Of Thermodynamics, 7E,Willey, 2008
2. Eastop and McConkey, Applied Thermodynamics,5E, Pearson, 2002

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

-Internal Evaluation: 30%
-End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1320:Introduction to Computing(4)Semester-II

Rationale: Computing Science is the scientific and practical approach to computation and its application. Computing science spans a range of topics from theoretical studies of algorithms and the limits of computation to the practical issues of implementing computing systems in hardware and software.

Catalog Description: This course covers the introductory concepts of computer science that fulfill the basic concepts.

Pre-requisites: Knowledge of basic mathematics and aptitude for problem solving.

Course Outline:

Unit-I: Basics of Computers (05 Lectures)
Computer Fundamentals: Bits and Bytes ,CPU,Block Diagram of a Computer System Memory, Input and Output Devices, I/O Devices ,Application Software and System Software's, Basic Number System - Decimal, Binary, Octal, Hexadecimal.

Unit-II: Introduction to Operating System (03 Lectures)
Functions of OS, Introduction to Microsoft Dos, DOSStructures, DOS Commands.

Unit-III: Language Preliminaries (02 Lectures)
Problem Analysis ,Need for Programmed Languages ,Introduction to Algorithms, Algorithmic Representations ,Pseudo Codes, Flow Charts And Decision Tables ,Structured Programming And Modular Programming,Symbols of Flow Charts.

Unit-IV: Characters, Commands and Operators (10 Lectures)
Character Set, Identifiers and Keywords ,Data Types, Variables, Declarations, Expressions, Statements and Symbolic Constants,#include, #define ,Operators and Expressions: Arithmetic, unary, assignment, logical, conditional, and bitwise operators, Storage Types: Automatic, External, Register and Static Variables, Control Statements: if-else, for, while, do-while, switch, break, continue, nested loops

Unit-V: Arrays (07 Lectures)
Defining and Processing ,Passing Arrays to a Function ,Multi-Dimensional Arrays ,String and String Handling Functions

Unit-VI: Functions (10 Lectures)
Defining and Accessing, PassingArguments, FunctionPrototypes, Recursion, Library functions Static functions.

Text Book(s):

1. V. Rajaram, "Fundamentals of Computers" PHI

2. ReemaTheraja, "Computer Fundamentals and Programming in C" Oxford Pub.
3. E. Balaguruswamy, "Programming in ANSI C"TMH Publications

Reference Book(s):

1. Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education
2. Ashok N. Kamthaneet. al., "Computer Programming and IT", Pearson Education, 2011

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University
School of Engineering and Technology
Koraikhowa, Jorhat, Assam- 785006

ET1119: Business Communication (2) Semester: II

Rationale: In placement-orientedprofessional courses like engineering, communicative competence and proficiency in English play a crucial role. The course Business Communication is designed to familiarize learners with the various kinds of language usage in a professional scenario. In a professional set-up, it is essential that individuals are able to articulate and conduct themselves effectively and appropriately. Hence, imparting training to students to enable them to become competent language users and well-groomed professionals is an indispensable part of an engineering program.

Catalog Description: The course is divided into three units. The first unit acquaints learners with the elements of business communication. The second unit focuses on the importance of developing reading and writing skills. The final unit of the course stresses on developing the soft skills of the learners and covers the importance of non-verbal communication.

Pre-requisites: Intermediate to advanced level proficiency in English.

Course Outline:

Unit-I: The Elements of Business Communication (13 Lectures)
Patterns of communication in the business world: upward, downward, horizontal, grapevine etc. ;internal and external channels of communication; formal and informal channels, introduction to cross-cultural communication, gender, racial, regional and other forms of bias in communication, common forms of oral and written communication in the business world: oral presentations, interviews and group discussions, memos, reports, minutes & proceedings, summaries and abstracts, e-mails, resume and cover letter/application.

Unit-II: Reading and Writing (12 Lectures)
The differences between speech and writing; the importance of developing reading skills, the sub-skills of reading [include texts dealing with technical concepts]**-** understanding the main idea and supporting details;reading between the lines: inferential reading;understanding the writer's point of view;making predictions, guessing the meanings of unfamiliar words, skimming and scanning, note-making; the importance of developing writing skills; the qualities of effective writing: coherence, cohesion, logical structuring and organization, clarity of language, stylistic variation etc.; the writing process: pre-writing, drafting, re-writing; introduction to process writing, fundamentals of academic writing.

Unit-III: Soft Skills Development (5 Lectures)
Introduction to and importance soft skills; Verbal and Non-verbal Communication/Body Language; Inter-relating soft skills and Communication skills

Text Book(s):

1. Muralikrishna,C., Mishra, S. Communication Skills for Engineers. (Pearson, 2011).

Reference Book(s):

1. Sinha, K. K .Business Communication. (Taxmann, 2012).
2. Bhatnagar, N. Communicative English for Engineers and Professionals. (Pearson, 2012).
3. Sharma, S., Mishra, B. Communication Skills for Engineers and Scientists. (PHI, 2009).
4. Konar, N. Communication Skills for Professionals. (PHI, 2011).

E- Resource(s):

Journal(s):

Grading System: The final grade will be based on the following weight distribution:-
Internal Evaluation: 30%
End Semester Examination: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1411: Basic Electrical Engineering (3) **Semester: II**

Rationale: Everyday liferevolves around the use of electrical devices and electricity. A sound knowledge of electrical principles, circuits and electrical technology would enable the student to grasp the working principle involved behind these devices making it easier for the student to operate them in a proper manner without any damage/risk to the device or the student.

Catalog Description: The course covers the basic concepts of Electrical circuits and provides an insight into the working of simple electrical machines.

Pre-requisite: Familiarity and ability to interpret certain concepts of Physics along with knowledge of certain Mathematical methods.

Course Outline:

Unit I: Fundamentals of Electrical Circuits (5 lectures)

Charge, Current, Electric Power and sign conventions, Circuit elements and their characteristics, Resistance and Ohm's Law, Inductive and Capacitive networks, Series and Parallel circuits, Star-delta and Delta-star transformations, Practical voltage and current sources.

Unit II: DC Circuit Analysis and Theorems (6 lectures)

Resistive Network Analysis, Kirchhoff's laws, Nodal analysis and Mesh analysis, Thevenin's theorem and Norton's theorem, Maximum power transfer theorem and Principle of Superposition.

Unit III: Fundamentals AC circuits (5 lectures)

Generation of AC voltages and currents and their equations, RMS and Average values of alternating quantities, AC through Series and Parallel Resistance, Inductance and Capacitance circuit.

Unit IV: Measuring Instruments (6 lectures)

Basic definitions, Working principle and construction of Permanent magnet moving coil (PMMC) instruments and Moving iron instruments, Advantages & Disadvantages, Applications, Single Phase Energy meter.

Unit V: Polyphase Circuit (4 lectures)

Advantages and disadvantages of polyphase circuit, Balanced Star and Delta circuit, Phase and line voltages and currents, Power equations, Measurement of power by two wattmeter method.

Unit VI: Principles of Electro mechanics **(4 lectures)**

Electricity and Magnetism, Magneto-Motive force (M.M.F), Faraday's laws of Electromagnetic Induction, Self and Mutual Inductance, Lenz's law, Magnetic materials, B-H Curve.

Unit VII: Introduction to Electrical Machines **(6 lectures)**

Electromechanical energy conversion, Principle of operation of DC machines (DC Generator & Motor), Principle of operation of AC machines (Alternator, Induction & Synchronous Motor), Principle of operation of Single-phase transformers, Applications.

Unit VIII: Electrical Wiring System **(3 lectures)**

Fuse and MCB, Earthing and its types, Different types of wiring.

Text Book(s):

1. A.Sudhakar and S.S.Palli,"Circuits and Networks: Analysis and Synthesis", (Tata McGrawHill).
2. B.L.Theraja and A.K.Theraja,"A Textbook of Electrical Technology vol. II", (S.Chand& Co.)

Reference Book(s):

1. V.K.Mehta and RohitMehta,"Basic Electrical Engineering", S. Chand & Co.
2. A.Chakrabarti," Basic Electrical Engineering", TMH.

Journal(s):

E-Resource(s):

Grading System: The final grade will be based on the following weight distribution: -

- Internal Evaluation (30%)
- End Semester Examination (70%)
-

Academic Council Approval:

The Assam Kaziranga University
School of Engineering and Technology
Koraikhowa, Jorhat, Assam-785006

ET1511: Basic Electronics (3) **Semester: II**

Rationale:

Fundamental circuitry knowledge of electronics and its use in control circuitry has become most essential to any technician. Hence, this preliminary course will enhance the knowledge of students in the field of electronics and will also assist students in maintenance and operation of machines they use. More emphasis on application of electronic devices in control circuit for the machine is envisaged.

Catalog Description:

This is a course in basic electronics covering the behaviour of resistance, inductance, and capacitance in direct current and alternating current circuits. Also covered are basic of semiconductor materials and devices.

Pre-requisite:

Knowledge of general principles of electricity & magnetism is assumed.
Course Outline:

Unit- I: Introduction to Electronics (4 Lectures)

Modern Trends in Electronics, Application of Electronics, Charge and Characteristics of charge.

Unit- II: Passive Circuit Elements (6 Lectures)

Resistance & Resistivity: Ohm's law,Grouping of Resistors, Classification of Resistors Light Dependent Resistance (LDR), Voltage & Current Divider circuit, Classification of Capacitors, Grouping of Capacitors, Inductance: Loss of energy during Grouping, Energy stored by an Inductor, Q-factor of Inductor

Unit- III: Circuit Control and Protective Devices (6 Lectures)

Switch and its classifications, Fuses, Relays, Electromagnetic Relays, Bread board and Printed Circuit Board.

Unit-IV: Semiconductors and Semiconductor Diodes (10 Lectures)

Types of Semiconductors, N-type and P-type Semiconductor, Effect of Temperature in a Semiconductor, Formation of P-N Junction, Biasing of P-N Junction Diodes, V-I Characteristics of a P-N Junction Diode, Effect of Temperature on Characteristics, Special Diodes: Zener Diode, Light Emitting Diode (LED) and their application, Rectifier Circuits and their parameters (half-wave, full-wave and bridge rectifiers), Filter Circuit, Ideal Power Supply, Power Supply IC.

Unit-V: Bipolar Junction Transistors (BJTs) (6 Lectures)

Introduction, NPN and PNP Transistors, Uses of BJT, BJT Circuit Configuration, Current Gain in different Configurations and their relation, Input Characteristics of BJT in CE and CB mode, Output Characteristics of BJT in CE and CB mode.

Unit-VI: The Operational Amplifier (Op-Amp) (5 Lectures)

The Ideal Op-Amp, Inverting and Non-inverting configurations, Difference Amplifier, CMRR, Application of Op-Amp (Instrumentation amplifier, Summing Amplifier, Integrator and Differentiator).

Unit-VII: Digital Electronic Principles (4 Lectures)

Introduction, Binary Number System, decimal-to-Binary conversion, Simple Binary Arithmetic, NOT, AND, OR, NAND NOR, Exclusive-OR and Exclusive-NOR gate.

Text Book(s):

1. Textbook of Applied Electronics, R.S. Sedha, S. Chand Publication, 2008
2. DigitalFundamentals (Eighth Edition),Thomas L. Floyd and R.P. Jain,PearsonEducation
3. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited

Reference Book(s):

1. Electronic Devices and Circuit Theory (Ninth Edition), Robert L. Bolysted and Louis Nashelsky, Pearson Education
2. Electronic Devices (Seventh Edition), Thomas L. Floyd, Pearson Education

Journal(s):

E-resource(s):

Grading System: The final grade will be based on the following weight distribution:

-Internal Evaluation (30 %)
-End Semester Examination (70 %)

Academic Council Approval:

School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1321: Introduction to Computing Laboratory (2) **Semester-II**

Rationale: Computing Science is the scientific and practical approach to computation and its application. Computing science spans a range of topics from theoretical studies of algorithms and the limits of computation to the practical issues of implementing computing systems in hardware and software.

Catalog Description: This course covers the introductory concepts of computer science that fulfill the basic concepts.

Pre-requisites: Knowledge of basic mathematics and aptitude for problem solving.

Laboratory Session: 3 hours per week to grasp the concepts learnt in theory class. Some of the sample experiments are listed below. (Atleast 8 Experiments to be conducted)

Experiment No. 01:
Introduction of Microsoft Word, Microsoft Excel, Microsoft PowerPoint and Microsoft Access.

Experiment No. 02:
Introduction to HTML

Experiment No. 03:
Implement the DOS Commands

Experiment No. 04:
Write a C program to find the sum and multiplication and division of two integers.

Experiment No. 05:
Write a C program to find the sum of individual digits of a positive integer

Experiment No. 06:
Write a C program to find both the larges and smallest number in a list of integers

Experiment No. 07:
Write a C program to find the factorial of a number

Experiment No. 08:
Write a C program to generate all the prime numbers between 1 and n, where n is a value supplied by the user

Experiment No. 09:
Write a C program to generate the Fibonacci series.

Experiment No. 10:
Write a C program to construct a pyramid of numbers

Text Book(s):

1. V. Rajaram, "Fundamentals of Computers" PHI
2. Reema Theraja, "Computer Fundamentals and Programming in C" Oxford Pub.
3. E. Balaguruswamy, **"**Programming in ANSI C**"**TMH Publications

Reference Book(s):

1. Ashok N. Kamthane, "Programming with ANSI and Turbo C", Pearson Education
2. Ashok N. Kamthaneet. al., "Computer Programming and IT", Pearson Education, 2011

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 40%
End Semester Exam: 60%

Academic Council Approval:

School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1120: **Business Communicative Laboratory (2)** **Semester: II**

Rationale: Inplacement-oriented professional courses like engineering, communicative competence and proficiency in English play a crucial role. The course-Business CommunicativeLaboratoryis designed to familiarize learners with the various kinds of language usage in a professional scenario. In a professional set-up, it is essential that individuals are able to articulate and conduct themselves effectively and appropriately. Hence, imparting training to students to enable them to become competent language users and well-groomed professionals is an indispensable part of an engineering program.

Catalog Description: The course is divided into five units. The first unit acquaints learners with the functions of English. The second unit focuses on telephonic communication which is an integral part of one's professional life.In the third and fourth units, the various sub skills of reading and writing are dealt with, viz., skimming, scanning, note-making and note-taking, multi-stage writing, etc. The final unit of the course focuses on developing the soft skills of the learners and covers aspects like team work, presentation skills, etiquette and dressing.

Pre-requisites: Intermediate to advanced level proficiency in English.

Course Outline:

Unit-I: Speaking in a professional environment:
Differences between oral communication in social and work-related situations;*functions of language:*greeting an acquaintance/ friend, introducing oneself, introducing a friend to another friend, breaking off a conversation politely, leave-taking; making requests, accepting / refusing a request ; expressing gratitude, responding to expressions of gratitude; apologizing, responding to an apology; asking for or offering help, responding to a request for help; asking for directions (e.g. how to reach a place) and giving direction, asking for and giving instructions (e.g. how to operate a device, etc.); asking for and granting/ refusing permission; prohibiting someone from doing something; suggesting, advising, persuading, dissuading, making a proposal; praising, complimenting, felicitating; expressing sympathy (e.g. condolence etc.); complaining, criticizing, reprimanding; negotiating.

Unit-II: Tele-conversation/Tele-conferencing skills:
Unit-III: Reading
Students will be given practice in reading and comprehending 6-8 simple passages of 100-300 words each, on topics of general as well as professional interest. The texts will be supported by suitable exercises designed to foster comprehension skills and vocabulary enrichment, together with study skills (note making) and reference skills (using a dictionary).

Practice will be provided in the important sub-skills of reading which are introduced in Unit-II of the theory component.

Unit-IV: Writing:
Writing short paragraphs on given topics or topics of one's choice spanning diverse disciplines and discourses;activities designed to practice the various forms of writing viz. resume, abstract, memos etc. as delineated in Unit- I of the theory syllabus.
[The principles of '*Process Writing*' should be used to teach writing skills: *pre-writing*-generating ideas, brain-storming, idea mapping, outlining; *writing*- generating a first draft; reviewing, redrafting, editing; *post-writing*-making a presentation; discussion and feedback, preparing the final draft]

Unit-V: Soft Skills Practice:
Activities designed to develop team spirit, leadership qualities and the ability to work in a group; group discussion, debate, group presentations, peer-evaluation and feedback.*[Task-based and project-based learning should be emphasized]*

Text Book(s):

1. Muralikrishna,C., Mishra, S. Communication Skills for Engineers. (Pearson, 2011).

Reference Book(s):

1. Sinha, K. K .Business Communication. (Taxmann, 2012).

2. Bhatnagar, N. Communicative English for Engineers and Professionals. (Pearson, 2012).

3. Sharma, S., Mishra, B. Communication Skills for Engineers and Scientists. (PHI, 2009).

4. Konar, N. Communication Skills for Professionals. (PHI, 2011).

Journal(s):

E-Resource(s):

Grading System: The final grade will be based on the following weight distribution:-

-Internal Evaluation: 40%
-End Semester Examination: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1412: Basic Electrical Engineering Laboratory (2)Semester-II

Rationale:Everyday liferevolves around the use of electrical devices and electricity. A sound practical knowledge of electrical circuits, meters and machines would enable the student to grasp the applications of electricity.

Catalog Description: The course covers the following experiments.

Pre-requisite: Familiarity and ability to interpret certain concepts of Physics along with knowledge of certain Mathematical methods.

Experiments:

1. V-I characteristics of Incandescent lamps.
2. Time-fusing characteristics of a Fuse.
3. Connection and Measurement of Power consumption of a Fluorescent Lamp.
4. Verification of Thevenin's theorem.
5. Verification of Norton's theorem.
6. Verification of Maximum power transfer theorem.
7. Verification of Principle of Superposition.
8. Calculation of current, voltage and power in series R-L-C circuit excited by single-phase AC supply and calculation of power factor.
9. Connection and Testing of a Single phase Energy meter.
10. Calculation of No-Load Losses of a Single phase Transformer.

Text Book(s): Laboratory Manual.

Reference Book(s):

1. B.L.Theraja and A.K.Theraja,"A Textbook of Electrical Technology vol. I", S.Chand& Co.

Journal(s) :

E-Resource(s):

Grading System: The final grade will be based on the following weight distribution:-

- Internal Evaluation (40%)
- End Semester Examination (60%)

AcademicCouncilApproval:

The Assam Kaziranga University
School of Engineering and Technology
Koraikhowa, Jorhat, Assam-785006

ET1512: Basic Electronics Laboratory (2) **Semester: II**

Rationale:

Fundamental circuitry knowledge of electronics and its use in control circuitry has become most essential to any technician. Hence, this preliminary course will enhance the knowledge of students in the field of electronics and will also assist students in maintenance and operation of machines they use. More emphasis on application of electronic devices in control circuit for the machine is envisaged.

Catalog Description:

This practical course in basic electronics will cover those experiments related to the basic electronics theory paper, mainly the characteristic curves of different semiconductor devices. Besides experiments related to basic gates and OPAMP are also incorporated in this course.

Pre-requisite: Knowledge of general principles of electricity & magnetism is assumed.

Experiments:

1. To draw the V-I characteristics of p-n junction diode in forward bias and to calculate static and dynamic resistances.

2. To draw the V-I characteristics of zener diode in reverse bias and to find out the break down voltage.

3. To design a half-wave rectifier circuit, record the waveform and to calculate its ripple factor without and with filter.

4. To design a full-wave center tapped rectifier circuit and to record the waveforms and measurement ripple factor.

5. To design a full-wave bridge rectifier circuit and to record the waveforms and measurement ripple factor.

6. To draw the Input and Output V-I characteristics of an n-p-n transistor in CB configuration.

7. To draw the Input and Output V-I characteristics of an n-p-n transistor in CE configuration.

8. To design an amplifier using Op-Amp 741 in inverting and non inverting mode and

to record the input-output waveforms.

9. To design an integrator and differentiator using Op-Amp 741 and to record the input-output waveforms.
10. To verify the truth tables of basic logic gates (AND , OR and NOT).
11. To verify the truth tables of universal logic gates (NAND and NOR).
12. To design Exclusive OR and to verify their Truth table.
13. To design Exclusive NOR and to verify their Truth table.

Textbook(s):

1. Textbook of Applied Electronics, R.S. Sedha, S. Chand Publication, 2008
2. Modern Digital Electronics by R.P.Jain, Tata McGraw-Hill Education
3. Electronic Instrumentation, H.S. Kalsi, Tata McGraw-Hill Publishing Company Limited

Reference Book(s):

1. Electronic Devices and Circuit Theory(Ninth Edition), Robert L. Bolysted and Louis Nashelsky, Pearson Education
2. Digital Fundamentals (Eighth Edition), Thomas L. Floyd and R.P. Jain, Pearson Education

Journal(s):

E-Resource(s):

Grading System: The final grade will be based on the following weight distribution:

-Laboratory sessional (40%)

- End semester practical examination (60%).

Approval by Academic Council:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1620: **Engineering Graphics Laboratory (2)** **Semester: I/II**

Rationale: Engineering graphics is a type of technical drawing, used to clearly define and communicate all engineering design ideas. Engineering Graphics is regarded as the graphical language of communication for all engineers. It forms an integral part right from conceiving the design criteria of any product up to its final production stage. Engineering graphics has a well-defined set of standards based on which all technical drawings are produced.

Catalog Description: This course covers the basic principles and techniques of engineering graphics.

Pre-requisites: Basic geometrical constructions.

Course Outline:

Unit-I:
Introduction to engineering drawing, Convention and standards: ISO, Scales: Representative Fraction, Types of Scale, Conics and Engineering Curves.

Unit-II:
Projection: Introduction, Principle of Projection, Method of projection, Planes of projection, Four quadrant, First and Third angle projection, Reference line, symbols for methods of projection.

Unit-III: Orthographic projections: points, lines, planes and solids.

Unit-IV:
Sections of solids.

Unit-V:
Isometric projections.

Unit-VI:
Development of surfaces.

Unit-VII:
Intersection of solids.

Text Book(s):

1. N. D. Bhatt, Engineering Drawing, Charotar Book Stall, 50th Ed, 2011.
2. Dhananjay A Jolhe ,Engineering Drawing,Tata Mc Graw Hill,3rd Ed,2009.

Reference Book(s):

1. M.B. Shah and BC Rana Engineering Drawing, Pearson, 2nd Ed, 2009
2. SP 46: 2003 Engineering Drawing Practice for school and colleges, Bureau of Indian Standards

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

-Internal Evaluation: 40%
-End Semester Exam: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1614: **Workshop Practice (2)** **Semester: I/II**

Rationale: The objective is to introduce the first year engineering students with the basic tools and techniques used in engineering.

Catalog Description: This module contains the fundamentals of machine, welding and fitting shops.

Pre-requisite:

Course Outline:

Introduction and practice of various fitting processes: Use of hand tools in fitting, preparing a male and female joint of M.S.

Introduction and practice of various Welding processes: Electric Arc welding Practice and Gas welding.

Joints such as a Lap joint, a T-joint or a Butt joint are to be prepared.

Introduction and practice of various Machining processes: Plain and Stepped cylindrical turning, grooving, knurling and Thread-cutting of a job in lathe.

Text Book(s):

1. Elements of Workshop Technology, Vol. I and II by Hajra choudhary, Khanna Publishers

Reference(s):

1. Workshop Technology by WAJ Chapman, Viva Books

2. Workshop Manual by Kannaiah / Narayana, Scitech

Grading System: The final grade will be based on the following weight distribution:
-Internal assessment – 40 %
-Semester Practical exam-60 %

Academic Council Approval:

The Assam Kaziranga University
School of Engineering and Technology
Koraikhowa, Jorhat, Assam-785006

ET 1123: Mathematics-III (4) **Semester-III**

Rationale: This paper includes Discrete Mathematics (deals with discrete objects,developed for students interested in computer science), Special functions (There is no general formal definition, but the list of mathematical functions contains functions which are commonly accepted as special), Laplace Transform & Fourier Analysis (Laplace transform is used for solving ordinary differential equation where as Fourier Analysis concerns periodic phenomena as they occur in engineering e.g., rotating parts of machines, alternating electric current, motion of planets, etc), Partial Differential Equations (models of various physical and geometrical problems arising when the unknown functions depend on two or more variables).

Catalog Description: This paper is designed to provide students the opportunity to learn some new functions, new techniques of solving ODE & PDE.

Pre-requisite: Matrices, determinant and calculus, ODE.

Course Outline:

Unit-I: Discrete Mathematics **(13Lectures)**
Basic concepts of set theory, cardinality – countable and uncountable sets, Cantor's theorem of power sets. Groups, Rings, Lattices as partially ordered set, properties of lattices, Homomorphism, Boolean algebra, Boolean functions. Basic concepts of Graph Theory - basic definitions of graphs, Paths. Introduction to Trees, Tree Traversal, Spanning Trees. Foundations of Logic.

Unit-II: Special Functions **(13Lectures)**
Series solution of differential equations, Power series method, Legendres equation and Lagenders polynomials, Bessels equation, Bessels function and its application

Unit-III: Laplace Transformation and Fourier Analysis **(13 Lectures)**
Laplace transformation of elementary functions, Inverse Laplace transforms Laplace transform of derivatives and integrals, Application to ordinary differential equations.
Fourier series, Fourier transform and Fourier Integral.

Unit-IV: Partial Differential Equation **(10 Lectures)**
First order linear equations. Four standard forms of non-linear equations, linear equations with constant coefficients. Solutions by separation of variables. Solutions of boundary-value problems.

Text Book(s):

1. Advanced Engineering Mathematics by E. Kreyszig Publisher: John Willey & Sons Inc- 8th Edition;

Reference Book(s):

1. Higher Engineering Mathematics by B. V. Ramana, Publisher: TMH Mathematical Methods by Potter and Goldberg, Publisher: PHI
2. Advanced Engineering Mathematics by H. K. Dass, Publisher: S. Chand.
3. *Discrete Mathematics* and Its Applications, 7th Edition, *Kenneth* H. *Rosen, Publisher:* McGraw-Hill.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the followings:-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1625: **Material Science(3)** **Semester: III**

Rationale: The purpose of this course is to develop better understanding of the basics about materials and their structure, different classes of materials, relation between structure and many engineering properties, their performance in different environments, economical and environmental aspects materials usage in daily life .

Catalog Description: This course includes the study of Structure of Materials, Elastic and Plastic Deformation, Phase Diagrams and Heat Treatment

Pre-requisites: None

Course Outline:

Unit-I: Structure of Materials **(5 Lectures)**
Crystalline structure of solid: Concept of unit cell and space lattice, Miller Indices, Crystal structure determination by X-ray diffraction, Crystal imperfections.

Unit-II: Solidification of Metals and Alloys **(4 Lectures)**
Mechanism of solidification, nucleus formation and crystal growth, Metal ingot structure-dendritic and columnar grains, grain boundaries, grain growth, effect of grain size on properties of metals, polytropic transformation.

Unit-III: Elastic and Plastic Deformation **(10 Lectures)**
Material properties like strength, hardness, toughness, ductility, brittleness etc. and their importance in manufacturing. Quantitative evaluation of these properties with destructive testing methods. Mechanism of plastic deformation, role of dislocations, slip and twinning.

Strain hardening, Seasons cracking, Baushinger effect, yield point phenomena and related effects, Cold working and Hot working processes, effect on properties like recovery, recrystallization, grain growth, grain size etc.

Unit-IV: Phase Diagrams **(8 Lectures)**
Phase and phase equilibrium: solidification of pure metals and alloys, Phase diagrams of monotectic, eutectic, eutectiod, peritectic and peritectoid & other systems. Allotropy of iron and Fe-C diagram.

Unit-V: Heat Treatment **(5 Lectures)**
Introduction, purpose of heat treatment, T-T-T curve and micro constituents in steel heat treatment processes like hardening, tempering, annealing, normalizing, Effects of heat treatment on properties of materials. Surface treatment processes.

Unit-VI: Engineering Materials **(6 Lectures)**
Classification, structure, general properties and applications of Cast Iron, Steel, brass, Bronze, bearing metals, light metal alloys, sintered carbide.

Introduction to plastics,composites and ceramics: Types and applications.

Text Book(s):

1. G.E. Dieter, Mechanical Metallurgy, 3rd Ed., McGraw Hill, 2013.
2. D. Swarup & M.N Saxena, Elements of Metallurgy, 13th Ed., Rastogi Publication, 13 Ed., 2005
3. V. Raghavan, Materials Science and Engineering, 5th Ed., PHI, 2009

Reference Book(s):

1. S.R. Askland and P.P. Phule, The Science And Engineering Of Materials, 5th Ed., Thomson Brooks/Cole, 2006.
2. J.F. Shackelford and M.K. Muralidhara, Introduction Of Materials Science for Engineers, Pearson, 6th Ed., 2010.
3. W. D. Callister, Material Science and Engineering And Introduction, 8th Ed., Wiley Publication, 2009

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1417: Electrical Machines-I(4)Semester: III

Rationale: The course covers a whole range of machines that include Static Machines (transformers), and Rotating Machines. The main aim is to introduce the basics, which are the cornerstones of Electrical Machines.

Catalog Description: The course contains 5 chapters – introduces DC generator, DC Motor, Transformer, and Induction Motor.

Pre-requisite: The fundamentals of electromagnetism and single and 3-phase circuits.

Course Outline:

Unit-I:Electromechanical Energy Conversion (6 lectures)

Principle, energy conversion devices, energy balance equation, energy in magnetic system, rotating electrical machines-DC and AC machines, basic construction of electrical machines, commonly used electrical machines.

Unit-II: DC Generators (12 lectures)

Working principle, construction, function of commutator and brushes, armature winding-general features, lap and wave winding, commutator pitch, pole pitch, coil pitch, full pitched coil; armature reaction and commutation, emf equation, voltage and power equation, types of DC generators-series, shunt, compound; losses in DC generators, , efficiency, DC generator characteristics, voltage build up of shunt generator, voltage regulation, parallel operation of DC generator, application of DC generators.

Unit-III: DC Motors (10 lectures)

Working principle, construction, back emf, voltage and power equation, torque equation, speed relation, types of DC motors, losses in a DC motor, efficiency, characteristics of DC motors, starting of DC motors – three-point and four-point starters and grading of starting resistance, speed control methods, testing- Swinburne's test, back to back test, retardation test, brake test; application of DC motors.

Unit-IV: Transformer (12 lectures)

Working principle, construction – shell type and core type, single phase and poly phase, emf equation and output equation, magnetic circuit, leakage flux and leakage reactance, phasor diagram, equivalent circuits, per unit values of resistance and reactance, open circuit and short circuit tests, back to back test, regulation, losses and efficiency, maximum efficiency, all-day efficiency, auto-transformer, 3-phase transformer, phase transformation and connections, parallel operation of transformer, application of transformer.

Unit-V: Three phase Induction Motors **(12 lectures)**

Working principle, constructional features – slip ring and squirrel cage motors. rotating magnetic field and operation of poly-phase induction motors, equivalent circuit and phasor diagram, torque and power, speed-torque curves – effects of rotor resistance, deep-bar and double cage rotors, performance calculation from circle diagram, method of speed control, Losses and efficiency, applications, induction generator and induction regulator, starting of induction motor.

Text Book(s):

1. P.S. Bhimra, "Electrical Machinery", Khanna Publishers.

Reference Book(s):

1. Langsdrof : 'Theory of Alternating Current Machines', Tata McGraw Hill

2. Kingsley, Fitzereld : Electric Machinery McGraw Hill

3. Guru, B.S. and Huseyin R. Hiziroglu, Electric Machinery and Transformers, Oxford University Press

4. Kothari D.P. and Nagrath, I.J., 'Electrical Machines', Tata McGraw Hill

5. Mehta V. K. and Mehta R., 'Principles of Electrical Machines', S Chand & Co.

Journal(s) :

E-Resources:

Grading System :

The final grade will be based on the following weight distribution:

- Internal Evaluation (30%)
- End Semester Examination (70%)

Academic Council Approval :

The Assam Kaziranga University,
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Koraikhowa, Jorhat, Assam-785006

ET1615 : Strength of Materials (3) **Semester: III**

Rationale: The subject Strength of Materials deals with the strength, stability and rigidity of various structural or machine members such as beams, columns, shafts, springs, cylinders, etc. An engineer always endeavors to design structural or machine members that are safe, durable and economical. To accomplish this, he has to evaluate the load-carrying capacity of the members so that they are able to withstand the various forces acting on them.

Catalog Description: This course covers the introductory concept of stresses and strains, and the strength of certain members such as beams, columns and struts, cylinders and spheres.

Pre-requisites: Engineering Mechanics, Engineering Mathematics and problem solving aptitude.

Course Outline:

Unit-I : Simple stress and strain **(5 Lectures)**
Basic of stress & strain, Generalized Hooke's law, Elastic constants and Relationship.

Unit-II : Generalized stress and strain **(8 Lectures)**
Stresses and strains on oblique planes under uniaxial and biaxial loading., Analysis of plane stress and plane strain, Mohr's circle of stress and strain.

Unit-III : Beams **(10 Lectures)**
Shear force and Bending moments for different types of beams, Simple bending theory, Bending stress analysis for symmetrical and unsymmetrical sections, Strain energy due to bending, Shear stress distribution in massive and thin walled cross section ,Shear centre, Strain energy due to shear,.

Unit-IV : Slope and deflection of beams **(8 Lectures)**
Relationship between curvature, deflection and slope, Method of Superposition, Macaulay's method, Moment-Area method, Conjugate Beam method.

Unit-V : Torsion **(4 Lectures)**
Torsional rigidity, Torsion of circular bars, Torsion in thin tubular section ,Strain energy due to Torsion.

Unit –VI : Column and struts **(4 Lectures)**
Elastic buckling concept, Euler's theory for crippling load, Empirical formulae for crippling load.

Text Book(s):

1. Ramamrutham,S.Strength Of Materials,DhanpatRai Publishing Company
2. Bansal, R.K. Strength Of Materials,Laxmi Publications Pvt Ltd.
3. Nag, D., Chanda, A. Strength Of Materials,Wiley-India.
4. Subramaniam, R.Strength Of Materials,Oxford University Press.

5. Singh, S.Strength Of Materials, Katson Book.

Reference Book(s):

1. Shames, I.H. Introduction to Solid Mechanics, Prentice Hall of India.
2. Rajput, R.K. Strength of Materials, DhanpatRai& Sons.
3. Singh, S.Strength of Materials, Khanna publications.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

- Internal Evaluation: 30%
- End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1652: **Mechanics of Fluids (4)** **Semester: III**

Rationale: The objective is to develop fundamental understanding of Fluid mechanics in an engineering perspective and to prepare the students to effectively use fluid mechanics in practice of engineering.

Catalog Description: It includes the Basic concepts and properties of fluids, Fluid Flow Measurements, Boundary Layer concept, Internal flow and Flow through open channels.

Pre-requisites:

Course Outline:

Unit-I: Introduction **(3 Lectures)**
Basic concepts and properties of fluids.

Unit-II: Fluid Statics **(6 Lectures)**
Hydrostatic pressure distribution; Application to manometry; Hydrostatic forces on submerged plane and curved surfaces; Buoyancy and stability.

Unit-III: Fluid Kinematics **(3 Lectures)**
Lagrangian and Eulerian description; Flow pattern and Fundamentals of flow visualization; Deformation of fluid element; Vorticity and Rotationality; Reynolds transport theorem.

Unit-IV: Fluid Flow Measurements **(4 Lectures)**
Venturimeter, orificemeter, pitot-tube, vertical orifice, V-Notch and rectangular notches.

Unit-V: Integral relations for a control volume **(6 Lectures)**
Conservation equations for mass, momentum and energy; Bernoulli equation.

Unit-VI: Differential relations of fluid flow **(6 Lectures)**
Conservation equations in differential form – stream function; Velocity potential

Unit-VII: Dimensional analysis and similitude **(4 Lectures)**
Buckingham Pi theorem; Modeling and similarity.

Unit-VIII: Boundary Layer concept **(5 Lectures)**
Introduction to boundary layer over flat plate, velocity profile.Introduction to laminar and turbulent flows

Unit-IX: Internal flow **(10 Lectures)**
Reyonold's number, critical Reynold's number, fully developed laminar flow between parallel plates-Plane Poiseille's flow, Coutte Flow, laminar flow through circular pipe-Hagen Poiseille's equation. Turbulent flow in pipes.Minor losses through pipes. Darey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL.

Unit-X: Introduction to Flow through open channels (4 Lectures)

Text Book(s):

1. F. M. White, Fluid Mechanics, McGraw Hill, 7th Ed, 2011
2. S.K.SOM &G.BISWAS,Introduction to Fluid mechanics and fluid machines,TMH, 3rd Ed, 2012
3. Dr. Lal Jagadish, Hydraulics and Fluid Mechanics, Metropolitan Book, 9th Ed., 2008

Reference Books(s):

1.B.S. Massey, Mechanics of Fluid, Nelson Thornes Ltd, 7th Ed.,2001
2. V.L. Streeter & E.B. Wylie ,Fluid Mechanics, McGraw Hill Book Company, 9th Ed, 2010
3.Yunus A Cengel, Fluid Mechanics (fundamentals and applications), McGraw Hill Book Company, 2nd Ed., 2010

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1653: **Engineering Thermodynamics (4)** **Semester: III**

Rationale: Thermodynamics is the science of energy transfer and its effect on physical properties of substance. It forms the basis for the study of a vast variety of devices such as refrigerators, air-conditioners, automotive engines, power plant etc., the use of which is involved in everyday life of almost every individual. The knowledge of this subject will help student to understand how thermodynamics is applied in engineering practice.

Catalog Description: It includes Properties of pure substances, Entropy, Vapour Power Cycles, Reciprocating Gas Compressor and Thermodynamic Relations

Pre-requisites: Basic Thermodynamics

Course Outline:

Unit-I: Properties of pure substances(10 Lectures)
Introduction to pure substance, phase change processes of pure substance in brief, p-v, p-t, t-s diagram for a pure substance, h-s diagram (Mollier diagram) for steam, Introduction to steam tables with respect to specific volume, pressure, temperature, enthalpy and entropy.

Unit-II: Entropy (7 Lectures)
Concept of entropy, Clausius' Theorem, property of Entropy, Clausius' inequality, entropy change in various processes, Entropy Principle and its application, Entropy generation in a closed system and open system, available and unavailable energy.

Unit-III: Vapour Power Cycles(12 Lectures)
Simple steam power cycle, Rankine Cycle, Actual Vapour Cycle, Reheat cycle, ideal Regenerative Cycles, Reheat-regenerative cycle, Characteristics of an ideal Working Fluid in Vapour Power Cycles, Binary Vapour Cycles.

Unit-IV: Reciprocating Gas Compressor(6 Lectures)
Classification of air compressors, Advantages and Disadvantages of Air compressors, Compression Processes, Working of Reciprocating Compression, Analysis of Single Stage Reciprocating Air Compressor, Analysis of Multi-Stage Compressors

Unit-V: Properties of Gases and Gas Mixture(8 Lectures)
Avogadro's law, Equations of State , ideal gas, Virial Expressions, Law of corresponding states, Properties of Mixtures of Gases, Internal Energy, enthalpy, specific heats and entropy of Gas mixtures.

Unit-VI: Thermodynamic Relations(6 Lectures)
Maxwell's Equations, TdS Equations, isothermal compressibility and volume expansity, relationship of heat capacities, Energy Equation, Joule-Kelvin Effect, Clausius-Clapeyron Equation, Evaluation of Thermodynamic Properties from an Equation of State.

Text Book(s):

1.P.K. Nag, Engineering Thermodynamics,5th Ed., TMH,2013
2. C P Arora, Thermodynamics, TMH Pub, 1st Ed., 2008

Reference Book(s):

1. G F C Rogers and Y R Mayhew, Engineering Thermodynamics Work and Heat Transfer, 4th Ed., Pearson 2003.
2. Y. A. Cengel and M. A. Boles, Thermodynamics, An Engineering Approach, 4th Ed., Tata McGraw Hill, 2003
3. T.D.Eastop and A. McConkey, Applied Thermodynamics for Engineering Technologists, Prentice Hall Press; 3rd edition

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
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Koraikhowa, Jorhat, Assam-785006

ET1618:**Machine Drawing (2)** **Semester: III**

Rationale: Engineers are required to read and interpret drawings. Therefore it is essential that they have competency in preparing drawings and sketches of various machine parts.

Pre-requisite: Engineering Graphics

Course Outline:

1. Interpenetration of simple solids

2. Orthographic views of machine parts from pictorial views.

3. Thread forms

4. Bolts, nuts and screws

5.Joints and couplings

6.Bearings

7.Assembly drawings

Text Book(s):

1. N.D.Bhatt, R.C. Patel, Machine drawing, Charotar Book Stall Tulshi Sadan, Station Road, Annad, India.
2. P.S. Gill ,Machine drawing ,S.K. Kataria & Sons Delhi.

Reference Book(s):

1. Basudeb Bhattacharyya, Machine drawing, Oxford University Press

Journal(s):
E-Resource(s):

Grading System: The final grade will be based on the following weight distribution-
-Internal assessment – 40 %
-Semester Practical exam-60 %

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1654: **Mechanical Laboratory I (2)** **Semester: III**

Rationale: To understand the basics of Strength of Material and Mechanics by doing experiments.

Catalog Description: Tensile, compression , bending, hardness , impact strength for Charpy and lzod Tests, fatigue strength, modulus of rigidity, mechanical advantage, velocity ratio and efficiency of a simple screw jack, equilibrium of coplanar forces and moment of inertia of fly wheel
Pre-requisites: Basic Knowledge of Strength of Material and Mechanics

Course Outline:

Part A

1. To determine tensile, compression and bending strength of materials by Universal Testing Machine.
2. To determine the hardness for various materials.
3. To determine the impact strength for Charpy and lzod Tests for various materials.
4. To find the fatigue strength of materials and to draw S-N diagram.
5. To determine the modulus of rigidity for specimens of various materials.

Part B

1. To find the mechanical advantage, velocity ratio and efficiency of a simple screw jack.
2. To determine of equilibrium of coplanar forces.
3. To determine of moment of inertia of fly wheel.

Text Book(s):

1. Egor P. Popov, Engineering Mechanics of Solids, Pearson Education, Limited, 1991
2. F.P. Beer, E.R. Johnston (Jr.) and J.T. DeWolf, Mechanics of Materials, Tata McGraw Hill, 2005
3. S. Timoshenko, D.H. Young, and J.V. Rao, Engineering Mechanics, TATA McGraw-Hill Book Company.

Reference Book(s):

1. Strength of material – Rider–ELBS
2. Introduction to Solid Mechanics – I.H.Shames–PHI

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-
Internal assessment – 40 %
Semester Practical exam-60 %
Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1418: Electrical Machines-I laboratory (2) **Semester III**

Rational: The course covers a whole range of machines that include Static Machines (transformers), and Rotating Machines. The main aim is to introduce the basics, which are the cornerstones of Electrical Machines.

Catalog Description: The course contains 5 chapters – introduces DC generator, DC Motor, Transformer, and Induction Motor.

Pre-requisites: The fundamentals of electromagnetism and single and 3-phase circuits.

Course Outline:

1. Study of the characteristics of a separately excited DC generator.
2. Study of the characteristics of a DC motor
3. Study of methods of speed control of DC motor
4. Study of the characteristics of a compound DC generator (short shunt).
5. Measurement of speed of DC series motor as a function of load torque.
6. Study of equivalent circuit of a single phase transformer.
7. Polarity test on a single phase transformer &studyof different connections of three phase transformer.
8. Study of equivalent circuit of three phase Induction motor by no load and blocked rotortest.
9. Study of performance of wound rotor Induction motorunder load.
10. Study of performance of three phase squirrel- cage Induction motor –determination of iron-loss, friction &windage loss.

Text book(s):
Laboratory experiments on Electrical machines, C.K.Chanda, A. Chakrabarty, DhanpatRai& Co.

Reference Book(s):
Laboratory Manual

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 40%
End Semester Exam: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1129:Mathematics- IV (4) **Semester: IV**

Rationale: This paper includes Co-ordinate Geometry (the study of geometry using a co-ordinate system and the principles of algebra and analysis), Complex Analysis (traditionally known as the theory of functions of a complex variables is the branch of mathematical analysis that investigates functions of complex numbers), Vector Integral Calculus (generalize the fundamental theorem of calculus to higher dimensions), Infinite Series (informally speaking, the sum of the terms of a sequence).

Catalog Description: This paper is designed to provide students the opportunity to learn geometry in three dimensions, functions of complex variables, fundamental theorem of calculus to higher dimension and some of the tests of infinite series

Pre-requisites: Co-ordinate Geometry of 2-dimension, complex numbers, vectors, series and sequence.

Course Outline:

Unit-I-Co-ordinate Geometry of three dimension (12 Hours): Cartesian Co-ordinates. D C's, Different forms of the eqn. of a plane, distance of a point from a plane, angle between two planes, parallel and perpendicular planes, intersection of two planes. Different forms of the equation of a straight line, condition for a line to lie on a plane, condition for two lines to be coplanar, and the equation of the common plane, shortest distance between two skew lines. Standard equation of a sphere, Tangent plane to a sphere, Equation of a cone with given vertex and guiding curve, equation of a cone with vertex at origin, Right circular cone, Standard equation of a cylinder, Right circular cylinder, Standard equation of ellipsoid, Paraboloid and Hyperboloid.

Unit -II-Complex Analysis (13 Hours): Functions of complex variables, elementary functions, analytic functions, Cauchy-Riemann eqns. Harmonic functions and their applications to two dimensional problems.

Complex integral, Cauchy's integral formula, Taylor's and Laurent's series, Poles and Singularities, Residue Theorem and applications.

Unit -III-Vector integral calculus (10 Hours): Line Integrals, Surface integrals, Volume integral, Green's Theorem, Stokes Theorem, Gauss's Divergence Theorem and some applications.

Unit-IV-Infinite Series (10 Hours): Convergence and divergence of infinite series, comparison test, ratio test, root test, Rabbe's test, Logarithmic test. Absolute convergence, uniform convergence, power series and radius of convergence.

Text books:

1. Advanced Engineering Mathematics by E. Kreyszig Publisher: John Willey & Sons Inc- 8th Edition;

Reference Books:

1. Higher Engineering Mathematics by B. V. Ramana, Publisher: TMH Mathematical Methods by Potter and Goldberg, Publisher: PHI.
2. Advanced Engineering Mathematics by H. K. Dass, Publisher: S. Chand.

Journal:

E-Resources:

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1638: **Manufacturing Technology -I (3)** **Semester: IV**

Rationale: To impart fundamental knowledge on theory of manufacturing processes.

Catalog Description: It includes foundry, welding and Forming processes.

Pre-requisites: Basic knowledge of Material Science.

Course Outline:

Unit-I: Introduction to Manufacturing Processes (2 Lectures)

Importance of manufacturing processes, classification, economic and technological definitions of manufacturing processes.

Unit-II: (10 Lectures)

Foundry Practice
Pattern making,Types, material, allowances, core – types, materials and its properties.

Mould Making and Casting: Types of sand moulding, moulding machines & moulding procedure, moulding sand – types, properties, composition and applications, design considerations - riser, gate etc., Casting defects.

Special Casting Processes: Investment casting, centrifugal casting, shell moulding, CO_2 moulding, slush casting, die casting.

Unit-III: Forming processes (15 Lectures)

Forging: Principle, types, tools and fixture of forging, forging dies, forging machines, forging design, drop forging die design, upset forging die design, forging practice and process capability, forging defects, Inspection and testing of forged parts.

Rolling: Principle, classification of rolled products, types of rolling, rolling mill train components, roll pass design for continuous mill

Extrusion: Principle, extrusion processes, process parameters, extrusion equipment, extrusion defects.

Drawing: Wire drawing, Rod and tube drawing-Principle, setup, types.

Press Working: Types of presses, selection of press, components of a simple press, press working operations – shear, bending, drawing etc., types of dies, die sets, considerations in die design.

Unit-IV: Welding **(10 Lectures)**

Principles of Welding, survey and allied processes Arc Welding: TIG and MIG processes and their parameter selection, atomic hydrogen welding, welding of cast iron, welding electrode – types, composition, specification.

Resistance Welding: Principle, equipment and processes. Thermit Welding, brazing & soldering,

Internal and external welding defects, Inspection & testing of weld, Introduction to advanced welding process.

Unit-V: Powder metallurgy **(2 Lectures)**
Introduction, production of metallic powder, processing methods, advantaged and limitations.

Text Book(s):

1. P.N.Rao, Manufacturing & Technology:Foundry Forming and Welding, 3rd Ed., Tata McGraw Hill. Volume -1,2008
2. Amitabha Ghosh & Mallik, Manufacturing Science, 2nd Ed., East West Press ,2010

Reference Books:

1. James Campbell ,Principle of Manufacturing Material And Processes, TMH, 1St Ed., 1984
2. Serope Kalpakjain & Steuen.R.Sechmid, Manufacturing Technology, Pearson Education Asia
3. Roy A Lindberg , Process and Materials of Manufacturing, Pearson Edu.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1655: **Heat and Mass Transfer (4)** **Semester: IV**

Rationale: Heat transfer and mass transfer are necessary processes in virtually all forms of energy generation and use; from coal fired to nuclear power stations, from automobile engines to rocket motors, from refrigerating cold stores to air conditioning space vehicles. A sound knowledge of this field is essential to all mechanical engineers.

Catalog Description: This unit develops the basic physics concepts and principles of heat transfer in its three different modes. The three modes are conduction, convection and radiation. Application of these principles to practical industrial applications is an important aspect of this unit.

Pre-requisites: Basic of Thermodynamics.

Course Outline:

1. **Introduction:**Various modes of heat transfer, Fourier's, Newton's and Stefan Boltzmann's Law, Combined modes of heat transfer, Thermal transfer, Thermal diffusivity, Overall heat transfer coefficient.**(3 Lectures)**

2. **Conduction:**The thermal conductivity of solids, Liquids and gases, Factors influencing conductivity measurement. The general differential equation of conduction, One dimensional steady state conduction, Linear heat flow through a plane and composite wall, Tube and sphere, Critical thickness of insulation, Effect of variable thermal conductivity, Conduction with heat generation in slab and cylinders, Spheres.**(7 Lectures)**

3. **Fins:**Conduction convection system, Extended surfaces rectangular, Triangular, Circumferential and pin fins, General conduction analysis, Fins of uniform and non-uniform cross sectional area. Heat dissipated by a fin. Effectiveness and efficiency of fins.
(5 Lectures)

4. **Transient/Unsteady State Heat Conduction:**System with negligible internal resistance, Lumped capacity method and its Validity. Unsteady state conduction through finite and semi- infinite slab without surface resistance, convection boundary conditions. Solution through Heisler`s chart.**(6 Lectures)**

5. **Forced Convection:**Physical Mechanism of Forced Convection, Dimensional analysis for forced convection, velocity and Thermal Boundary layer, Flow over plates, Flow across cylinders and spheres, Flow in tubes, Reynolds's analogy.**(4 Lectures)**

6. **Natural Convection:**Physical Mechanism of Natural Convection, Dimensional analysis of natural convection; Empirical relationship for natural convection.**(4 Lectures)**

7. **Boiling and condensation:**Condensation and boiling heat transfer – film and drop wise condensation – film boiling and pool boiling – boiling curve – empirical relations for heat

transfer with change of face. Boiling heat transfer, Pool boiling. **(3 Lectures)**

8. **Heat Exchangers:**Different types of heat exchangers; Determination of heat exchanger performance, Heat exchanger transfer units, Analysis restricted to parallel and counter flow heat exchanger (LMTD and NTU method)**(6 Lectures)**

9. **Thermal Radiation:**Introduction, absorption and reflection of radiant energy, Emission, Radiosity and irradiation, Black and non black bodies, Kirchhoff's law, intensity of radiation, Radiation exchange between black surface, Geometric Configuration factors. Grey body relation exchange between surface of unit configuration factors, Electrical analogy to simple problems. Non-luminous gas radiation. Errors in temperature measurement due to radiation.**(6 Lectures)**

10. **Introduction to Mass Transfer:**Mass and mole concentrations, molecular diffusion, eddy diffusion, Molecular diffusion from an evaporating fluid surface, Introduction to mass transfer in laminar and turbulent convection Combined heat and mass transfer, the wet and dry thermometer. **(6 Lectures)**

Text Book(s):

1. S.P. Sukhatme,Heat Transfer,4th Ed., Tata McGraw Hill,2008
2. J.P. Holman,Heat Transfer, 10th Ed.,Tata McGraw Hill,2011

Reference Book(s):

1. Yunus A. Cengel,Heat Transfer – A Practical Approach,2nd Ed., McGraw Hill,2002
2. P.S.Ghoshdastidar,Heat Transfer,2nd Ed.,Oxford University Press,2012
3. D.S. Kumar,Basics Heat & Mass Transfer,8th Ed.,S.K. Kataria & Sons,2010

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1656: **Fluid Machinery (4)** **Semester: IV**

Rationale: To provide fundamental understanding of working principle of Fluid Machineries.

Catalog Description: It includes Impact of jets, flow around submerged bodies, turbines and pumps

Pre-requisites: Basic of fluid mechanics.

Course Outline:

Unit-I: Impact of Free Jets **(4 Lectures)**
Impulse momentum principle, Force exerted by the jet on stationary flat and curved plate, Hinged plate, Moving plate and Moving curve vanes, Jet propulsion of ship.

Unit-II: Flow around submerge bodies **(6 Lectures)**
Force exerted by flowing fluid on a body, Drag and lift, stream lined and bluff body, Drag on sphere and cylinder, Circulation and lift on circular cylinder, Lift of an air foil.

Unit-III: Introduction to turbo machinery **(4 Lectures)**
Basic principles, Classification, Impulse & Reaction type, Fundamental equations, Euler's equation, Introduction to hydro-electric power plants, major components, Surge tanks etc.

Unit-IV: Impulse Turbine **(6 Lectures)**
Classification of turbine, Impulse turbine, Pelton wheel, Construction working, work done, Head efficiency and Design aspects, Governing of impulse turbine.

Unit-V: Reaction Turbine **(5 Lectures)**
Radial flow reaction turbine, Francis turbine: construction, working, work done, efficiency, design aspect, advantages & disadvantages over pelton wheel.

Unit-VI: Axial flow reaction turbine **(7 Lectures)**
Propeller and Kaplan turbine, Bulb or tubular turbine, Draft tube, Specific speed, Unit quantities, Cavitation, Degree of reaction, Performance characteristics, Surge tanks, Governing of reaction turbine.

Unit-VII: Centrifugal Pumps **(7 Lectures)**
Classification of Pumps, Centrifugal pump, Construction, working, Workdone, Heads, Efficiencies, Multistage centrifugal pump, Pump in series and parallel, Specific speed, Characteristic, Net positive suction head, Cavitation.

Unit-VII: Reciprocating Pumps **(6 Lectures)**
Classification, Component and working, Single acting and double acting, Discharge, work done and power required, Coefficient of discharge, Indicator diagram, air vessels.

Unit-VII: Fluid system **(5 Lectures)**

Hydraulic accumulator, Hydraulic intensifier, Hydraulic Press, Hydraulic crane, Hydraulic lift, Hydraulic Ram, Hydraulic coupling, Hydraulic torque converter, Air lift pump, Jet pump.

Text Book(s):

1. B.S Massey, Mechanics of Fluid, 4th Ed.,English Language Book Society,1979
2. Jagdish Lal, Hydraulic Machines, 6th Ed.,S.K. Kataria & Sons, 1975
3. S.K. Som & G. Biswas, Introduction to Fluid Mechanics and Fluid Machines,3rd Ed.,TMH,2011
4. Dr. R K Bansal, Fluid Mechanics and Hydraulic Machines,Reprint, Laxmi Publications, Ltd., 2005

Reference Book(s):

1. P.N Modi, S.M Seth, Hydraulics and Fluid Mechanics,20th, Standard Book House,2015
2. R. K. Rajput, A text of Fluid Mechanics, S. Chand & Company Ltd,2008

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1657: **Kinematics of Machinery (4)** **Semester: IV**

Rationale: The objective of this course is to give a clear understanding of concepts underlying the design of machines.

Catalog Description: Mechanisms, Kinematic Chains And Inversions, Velocity And Acceleration Analysis Of Mechanisms, Cams, and Gears

Pre-requisites: Engineering mechanics

Course Outline:

Unit I.

Introduction **(2 Lectures)**

Link or element, kinematic pairs, degrees of freedom, Grubler's criterion, Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine.

Mechanisms **(6 Lectures)**

Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms –Peaucellier's mechanism and Robert's mechanism. Intermittent Motion mechanisms –Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism.

Kinematic Chains And Inversions Inversions of Four bar chain; Single slider crank chain and Double slider crank chain. **(3 Lectures)**

Unit II

Velocity And Acceleration Analysis Of Mechanisms (Graphical Methods): Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links, velocity of rubbing. **(9 Lectures)**

Velocity Analysis By Instantaneous Centre Method: Definition, Kennedy's Theorem, Determination of linear and angular velocity using instantaneous center method. **(4 Lectures)**

Unit III

Klein's Construction: Analysis of velocity and acceleration of single slider crank mechanism.

(4 Lectures)

Velocity And Acceleration Analysis Of Mechanisms (Analytical Methods): Analysis of four bar chain and slider crank chain using analytical expressions. (use of complex algebra and vector algebra) **(5 Lectures)**

Unit IV

Gears: Introduction and classification of gears, Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding interference, Back lash, Comparison of involute and cycloidal teeth.

(5 Lectures)

Gear Trains: Simple gear trains, Compound gear trains for large speed reduction, Epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.**(8 Lectures)**

Unit V

Cams: Introduction, types of cams, types of followers, motion of the follower, uniform velocity, SHM uniform acceleration and retardation, profile of cams, cams with specified contours–tangent cam with roller follower and Circular arc cam with Flat-Faced follower.**(5 Lectures)**

Text Book(s):

1. J. J Uicker (Jr), G. R Pennock and J. E Shigley, Theory of Machines and Mechanisms, 3rd Ed., Oxford International Student Edition, 2010
2. S. S. Rattan, Theory of Machines, 4th Ed., Tata McGraw Hill, 2014

Reference Book(s):

1. J. S. Rao, R. V. Dukkipati, Mechanism and Machine Theory, 2nd Ed., New Age International, 2008.
2. T. Bevan, Theory of Machines, CBS Publishers and Distributors, 1984
3. Ghosh and A. K. Mallik, Theory of Mechanisms, and Machines, 3rd Ed., East West Press Pvt Ltd, 2009

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1622: **Computer Aided Drafting Laboratory (2)** **Semester: IV**

Rationale: To make the students learn the basics of creating, manipulation and storage of objects by the application of conventional computer methods using computer graphics system.

Catalog Description: Basic commands, Edit commands, viewing commands, hatching and Exercise.

Pre-requisites: Basic knowledge of Engineering Graphics and Machine Drawing.

Experiments:

1. Basic command to draw 2-D objects like line, point, circle, arc, ellipse, polygon, spline etc

2. Edit commands: erase, extension, break, fillet, chamfer, trim, scale, etc

3. Commands like line type, dimension, text style etc

4. Viewing and other: Zoom, pan, mirror, rotate, move objects, arrange blocks, offset, etc

5. Hatching of sections.

6. Exercises

7. Introduction to 3-D modeling .

9. Modifying commands, view port, USC, etc.

10. Creating Isometric views.

11. Basic of 3D modeling

Text Book(s):

1. Tickoo S, Autocad 2014 for Engineers and Designers (English) , Dreamtech Press Publication

Reference Book(s):

1. N.D. Bhatt., Machine drawing, R.C. Patel Charotar Book Stall Tulshi Sadan, Station Road, Annad, India.
2. Goutam Pohit & Goutham Ghosh ,**Machine Drawing with Auto CAD**, Pearson Education, 1st Indian print.

Journal(s):

E-Resources(s):

Grading System: The final grade will be based on the following weight distribution:

-Internal Evaluation (40%)

-Final exam (60%).

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1631: **Heat Transfer Laboratory (2)** **Semester: IV**

Rationale: To understand the flow of heat transfer in different kinds of materials and learn the basics of Heat Transfer.

Catalog Description: Thermal Resistance, Thermal Conductivity, Temperature Distribution, Natural Convection, Parallel And Counter Flow Heat Exchanger.

Pre-requisites: Concept of Basic Thermodynamics

Experiments:

1. To determine total thermal resistance and thermal conductivity of composite wall.
2. To plot temperature gradient along composite wall structure.
3. To determine Thermal Conductivity of Metal Rod.
4. To study the temperature distribution along the length of a pin fin natural and forced convection.
5. To determine the thermal conductivity of insulating material.
6. The experiment is conducted to determine the emissivity of the non – black surface and compare with the black body.
7. To determine the Heat transfer by Natural convection.
8. To determine the Heat transfer by parallel and counter flow Heat exchanger.
9. To calculate the Stefan-Boltzmann's constant.
10. To determine the axial heat flux in a heat pipe using water as the working fluid with that of a solid copper with different temperatures.

Text book(s):

1. S.P. Sukhatme, Heat Transfer,4th Ed., Tata McGraw Hill,2008

Reference Book(s):

1. Yunus A. Cengel,Heat Transfer – A Practical Approach,2nd Ed., McGraw Hill,2002
2. P.S.Ghoshdastidar,Heat Transfer,2nd Ed.,Oxford University Press,2012

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Assessment – 40 %
End Semester Practical Examination-60 %

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1658: **Mechanical Laboratory -II (2)** **Semester: IV**

Rationale: To understand the inversion of different link and learn the basics of Theory of Machines and Fluid Mechanics.

Catalog Description: Slider crank mechanism, Cam and Follower arrangement, Epicyclic gear system, Meta-centric height and position of the Meta-center and Calibration of Bourden Type Pressure Gauge.

Pre-requisites: Basic Knowledge of Theory of Machine

Course Outline:

Part A

1. To study various types of kinematic pairs, links and mechanisms
2. To study inversions of 4 bar mechanism and slider crank mechanism
3. To study various types of cam and follower arrangement
4. To determine co-efficient of friction between belt and pulley.
5. To generate gear tooth profile using apparatus of gear tooth profile.
6. To calculate gear ratio of the epicyclic gear system

Part B

1. Determination of the meta-centric height of a ship model.
2. Verification of Bernoulli's theorem and its application to venturimeter.
3. Determination of C_d of orifices.
4. Calibration of Bourden Type Pressure Gauge and measurement of pressure using manometers

Text Book(s):

1. S. S. Rattan, Theory of Machines, 4th Ed., Tata McGraw Hill, 2014
2. Jagdish Lal, Hydraulic Machines, 6th Ed., S.K. Kataria & Sons, 1975

Reference Book(s):

1. Ghosh and A. K. Mallik, Theory of Mechanisms, and Machines, 3rd Ed., East West Press Pvt. Ltd, 2009
2. R. K. Rajput, A text of Fluid Mechanics, S. Chand & Company Ltd,2008

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal assessment – 40 %
Semester Practical exam-60 %

Academic Council Approval:

The Assam Kaziranga University,
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Koraikhowa, Jorhat, Assam-785006

ET 1664: **Fluid Mechanics Laboratory (2)** **Semester: IV**

Rationale: To make the students learn the basics of Fluid Mechanics by doing experiments.

Catalog Description: Venturimeter, Rotameter, Orifice Meter, Turbines, Flywheels And Pumps.

Pre-requisites: Basic knowledge of Fluid Mechanics and Machines.

Experiments:

1. Measurement of pressure using pressure gauges and manometers.
2. Determination of co-efficient of discharge of the given rotometer.
3. Determine of major losses in straight pipe section.
4. Determine of minor losses in pipes due to sudden enlargement and sudden contraction.
5. Determination ofMeasurement of force exerted by a jet on different shape of vanes
6. To investigate the result on discharge and total head of operating pumps in series and in parallel.
7. Performance test on Pelton wheel (a) at constant head and (b) at constant speed.
8. Performance test on Francis Turbine.
9. Performance test on single stage reciprocating pump.
10. Performance test on centrifugal Pump.
11. Performance test on Centrifugal blower.

Text Book(s):

1. Jagdish Lal, Hydraulic Machines, 6th Ed.,S.K. Kataria & Sons, 1975
2. S.K. Som & G. Biswas, Introduction to Fluid Mechanics and Fluid Machines,3rd Ed.,TMH,2011

Reference Book(s):

1. P.N Modi, S.M Seth, Hydraulics and Fluid Mechanics,20th, Standard Book House,2015
2. R. K. Rajput, A text of Fluid Mechanics, S. Chand & Company Ltd,2008

Journal(s):
E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 40%

End Semester Exam: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1133: **Extra Academic Activity-I (1)** **Semester: IV**

Rationale: In placement-oriented professional courses like engineering and technology, communicative competence and proficiency in English plays a crucial role. The course *Extra Academic Activity 1* is designed to familiarize learners with the various kinds of language usage in a professional scenario. In a professional set-up, it is essential that individuals are able to articulate and conduct themselves effectively and appropriately. Hence, imparting training to students to enable them to become competent language users and well-groomed professionals is an indispensable part of an engineering and technology program. Professional Skills training is an emphatic step towards making them industry-ready. Speaking skills, especially in English, in a practical industrial atmosphere is a must-be developed skill in an academic centre of higher learning. The sessions need to be principally activity-based to drive the purpose of the course towards better fulfillment.

Catalog Description: The course is divided into three units. The first two units acquaint learners with the two skills of learning English, i.e. Reading & Writing skills. The third unit focuses on the enrichment of vocabulary.

Pre-requisites: Intermediate to advanced level proficiency in English.

Course Outline:

Unit-I: Reading Skills **(4 Lectures)**
Book & magazine review; newspaper reading; Jig-saw reading, article reading, etc.

Unit-II: Writing Skills: **(8 Lectures)**

Paragraph writing / Article synopsis / Story-building & Story writing from bullet points or pictures, cartoons, etc., / Maintaining a journal / Essay writing/ Analysis on audio-visual inputs/ Dictogloss/ Project Drafting, etc.

Unit –III: Vocabulary Building: **(6 Lectures)**

Crosswords/ Editing activities/ Gap filling activity / Scrabbles/ Spell bees, etc.

Other Activities: Ice breakers: Chinese Whispers; Tongue twisters. **(6 Lectures)**

Five-minute activities: Hangman, Star of my life, Backs to the board.

Follow up activity: Group discussion, Ad/Jingle/Short movie making, etc.

N.B.: The instructors can come-up with activities other than the above-mentioned ones. All the sessions need to be activity-based so as to make the classes more productive and successful. Active and euphoric participation is to be encouraged.

Grading System:

The evaluation will be a continuous process based on class activities/presentations.

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1126:Engineering Economics and Principles of Management (2) Semester-V

Rationale: Impart fundamental economic principles that can assist engineers to make more efficient and economical decisions.

Catalog Description: This subject covers the concepts of engineering economics including basic principles, comparison of alternatives, depreciation, inflation and taxesand principles of Management.

Pre-requisites: NIL

Course Outline:

SECTION-1: ENGINEERING ECONOMICS

Unit-I: Basics(2 lectures)
Economic reasoning, Circular Flow in an economy, Law of supply and demand, Economic efficiency, Element of costs, Marginal cost, Marginal Revenue, Sunk cost, Private and Social cost, Opportunity cost, Functions of Money and commercial Banking

Unit-II: Basic Principles(6 lectures)
Time value of money, Quantifying alternatives for decision making, Cash flow diagrams
Equivalence, Single payment in the future (P/F, F/P), Present payment compared to uniform series payments (P/A, A/P), Future payment compared to uniform series payments (F/A, A/F), Arithmetic gradient, Geometric gradient

Unit-III: Comparison of Alternatives(7 lectures)
Present, future and annual worth method of comparing alternatives, Rate of return, Incremental rate of return, Break-even comparisons, Capitalized cost analysis, Benefit-cost analysis

Unit-IV: Depreciation, Inflation and Taxes(01 lectures)
Depreciation, Inflation and Taxes

SECTION-2: PRINCIPLES OF MANAGEMENT: (10 lectures)

Unit-I: Basic concepts of management: Definition – Essence, Functions, Roles, Levels. Functions of Management: Planning – Concept, Nature, Types, Analysis, Management by objectives; Organization Structure – Concept, Structure, Principles, Centralization, Decentralization, Span of Management; Directing/Leading, Controlling.

Unit-II: Management and Society – Concept, External Environment, CSR, Corporate Governance, Ethical Standards. People Management – Overview, Job design, Recruitment & Selection, Training & Development, Stress Management. Managerial Competencies – Communication, Motivation, Team Effectiveness, Conflict Management, Creativity, Entrepreneurship.

Unit-III: Leadership: Concept, Nature, Styles. Decision making: Concept, Nature, Process, Tools & techniques. Customer Management – Market Planning & Research, Marketing Mix, Advertising & Brand Management.

Text Book(s):

1. Panneerselvam, R. Engineering Economics, Prentice Hall of India, New Delhi, 2012.

Reference Book(s):

1. Wheeler R(Ed) Engineering Economic Analysis, Oxford University Press, 2004.

Journal(s):

E-Resource(s):

1. Construction Economics and Finance- Web Course, NPTEL

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1621: **Operations Research (4)** **Semester: V**

Rationale: The objective is to make students understand fundamental methods of Operations Research and their applications at an introductory level**.**

Catalog Description: It includes The Linear Programming, Transportation Model/ Assignment Problems Problems, Waiting Line Theory,Decision Theory and Game Theory.

Pre-requisites:

Course Outline:

Unit-I:Introduction (10 Lectures)

Definition and Development of Operations Research, Necessity and scope of OR in Industry,Operations Research in Decision making, Models in OR, Fields of application, Difficulties and Limitation ofOR.

General Linear Programming Problems: Introduction, Maximization and minimization of function with orwithout Constraints, Formulation of a linear programming problem, Graphical method and Simplex method,Big M method, Degeneracy, Application of Linear Programming (LPP) in Mechanical Engineering.

Unit-II: (15 Lectures)

The Transportation Problems: Mathematical formulation, Stepping stone method, Modified DistributionMethod, Vogels Approximation Method, Solution of balanced and unbalanced transportation problems andcase of Degeneracy.

The Assignment Problems: Mathematical formulation of assignment problems, Solution of assignmentproblems, Traveling salesman problems, Air crew Assignment problems.

Unit-III: (12 Lectures)

Waiting Line Theory: Basic queuing process, Basic structure of queuing models, Some commonly knownqueuing situations, Kendall's notation, Solution to M/M/1: ∞ /FCFS models.

Unit-IV: (15 Lectures)

Decision Theory and Game Theory: Decision making, Steps in decision theory approach, Decision makingunder certainty, Uncertainty and under condition of risk, Decision Tree, Theory of Games, Two person zerosum game, Methods for solving two person zero sum game.

Simulation: Basic concept of simulation, Applications of simulation, Merits and demerits.

Text Books(s):

1. Kanti Swarup, P.K. Gupta and Man Mohan, Operation Research, S. Chand and Sons, New Delhi
2. Prem Kumar Gupta and D.S Hira, Operation Research -An Introduction, S. Chand and Company Ltd., New Delhi.

Reference Book(s):

1. F.S Hillier and G.J Lieberman, Introduction to Operation Research, 6th Ed. McGraw Hill International Edition
2. G. Hadley, Linear Programming, Narosa Publication House

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1640:Manufacturing Technology -II (3) **Semester: V**

Rationale: To impart fundamental knowledge on theory of manufacturing processes.

Catalog Description: Includes metal cutting, machine tools and unconventional.

Pre-requisites: Basic knowledge ofMaterial science.

Course Outline:

Unit-I: **(5 Lectures)**
Machinability
Concept and evaluation of Machinability, Mechanism of Tool failure, Tool wear mechanism,Tool life, Taylor's Tool life equation, Machinability index, factors affecting Machinability.
Thermal Aspects in Machining and Cutting Fluid: Source of heat in metal cutting and its distributions, temp measurement in metal cutting, function of cutting fluid, types of cutting fluid.

Unit-II: **(9 Lectures)**
Cutting Tool – Types, requirements, specification & application Geometry of Single Point Cutting Tool – Tool angel, Tool angle specification system, ASA, ORS and NRS.
Mechanics of Metal Cutting: Theories of metal cutting, Chip formation, types of chips, chip breakers, Orthogonal and Oblique cutting, stress and strain in the chip, velocity relations, power and energy requirement in metal cutting.

Unit-III: Machine Tools **(10 Lectures)**
Lathe: Introduction, type, specification, construction, work holding devices & tools, mechanism and attachments for various operations, taper turning, thread cutting operations, capston and turret lathe.
Shaper: Introduction, type, specification, Quick return Mechanisms, Table feed mechanism, work holding devices, shaper operations.

Slotter & Planner: Introduction, specification, types of drives, types of machines.
Milling Machine: Introduction, specification, types, mechanisms and attachments for milling, milling operations, Indexing-simple, compound and differential.

Unit-IV: **(10 Lectures)**

Grinding: Processes, machines, design consideration for grinding, specification of grinding wheel, process parameters, economics of grinding.
Gear Cutting: Principle of gear generations, Gear manufacturing by casting processes, forming processes and Metal removal processes, gear cutting on milling machines (Forming and Generation). Gear finishing processes.
Jigs & Fixtures: Degree of freedom, principles of location and clamping, locating, clamping and indexing devices, principles of design, design of simple jigs and fixtures.

V. **(6 Lectures)**

Unconventional Machining: Advantages, application and limitation, mechanics of metal removal, Principles and process of EDM, ECM, USM, EBM ,LBM and AJM. Applications, advantages and limitations of the processes.

Thread Rolling: Principle, Processes, Types of Thread Rolling, and Grinding.

Text Book(s):

1. P.N. Rao ,Manufacturing Technology (Vol. - I & II),Tata McGraw Hill Pub. Company, New Delhi
2. P.C. Sharma ,A Text Book of Production Technology (Manufacturing Processes & Technology), S. Chand and Company Ltd., New Delhi.
3 . A B Chattophadya ,Manufacturing technology, Wiley India Pvt Ltd,2011

Reference Books(s):

1. Serope Kalpakjian & Schmid, Manufacturing Engineering and Technology ,Pearson Education, Delhi.
2. Kibbe Richard R – PHI ,Machine Tool Practices , New Delhi.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1650: Machine Design I (4) Semester: V

Rationale: The objective is to provide a clear understanding of the theory and understanding of engineering machine design.

Catalog Description: General Considerations, Basic Elements Design, Couplings, Shaft and Axles, Threaded fasteners, Power Screws, Riveted Joints, Welded joint, Pulley & Flywheel, Chain ,Belt& Rope Drive

Pre-requisites: Basic knowledge ofTheory of machine, mechanics and material science.

Course Outline:

Unit-I: General Considerations (3 Lectures)

Selection of Materials, Design Stress, Factor of Safety, Stress concentration factor in tension, bending and torsion, Theories of failures. Notch sensitivity, Design for variable and repeated loadings, Fatigue stress concentration factor, Endurance diagrams, Introduction to fracture mechanics.

Unit-II: Basic Elements Design(19 Lectures)

Types of keys and Splines, Design of Socket-Spigot, Cotter joint, Sleeve and Cotter joint, Gib and Cotter joint, Design of Knuckle joint, Design of Splines.

Couplings: Types of couplings, Design of flange and flexible couplings, Compression coupling, Muff coupling.

Shaft and Axles: Transmission shaft, Design against static load, Design for strength, Rigidity and stiffness,Design under continuous loading for fatigue.

Unit-III: Threaded fasteners (11 Lectures)

Geometry of thread forms, Terminology of screw threads and thread standards, Specifications of steel bolts, Initial tension, Relation between bolt tension and torque, Design of statically loaded tension joints, Design of bolted joints due to eccentric loading.

Power Screws: Power screws, Force analysis for square and trapezoidal threads, Collar friction, Stresses in screw, Coefficient of friction, Efficiency of thread, Design of power Screw.

Unit-IV: Riveted &Welded Joints (12 Lectures)

Types of rivet heads, Types of riveted joints, Failure of riveted joint, Strength of rivet joint, Efficiency of riveted joint, Design of riveted joint, Eccentrically loadedriveted joint.

Types of welded joints, Stresses in butt and fillet welds, Strength of welded joints, Location and dimension of weld design, Eccentrically loaded joint, Welded joint subjected to bending moment, Design procedure, Fillet welds under varying loads, Stress relieving techniques.

Unit-V: **(7 Lectures)**

Pulley & Flywheel: Flywheel Inertia, Stresses in Flywheel and pulleys, failure criterion.

Chain Drives: Chain drives, Roller chains, Geometric relationships, Dimensions of chain components, Polygonal effect, Power rating of roller chains, Selection of Chain drives.

Belt & Rope Drive: Design of Flat and Round belt drives, V-Belt, Timing belt, Wire Rope.

Text Book(s):

1.V.B. Bhandari ,Design of Machine Elements, McGraw HILL Publications. 3rd edition,

2. K.Mahadevan / K.Balveera Reddy,Design Data Handbook for mechanical engineers, CBS publication, 4th Ed., 2013

3. Design of Machine Elements by V.B. Bhandari, McGraw HILL Publications. 3rd edition

Reference Book(s):

1. M.F Spotts, T.E Shoup, L.E. Hornberger, S.R Jayram and C V Venkatesh, Design of Machine Elements, 8th Ed., Person Education.

2. V. B. Bhandari, Design of Machine Elements, 2nd Ed., Tata Mcgraw Hill.

3. R. C. Juvinall and K. M Marshek, Fundamentals of Machine Component Design, 3rd Ed., Wiley Student Edition

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1430: Control System Engineering (4) **Semester V**

Rational: Modern day control engineering (also called control systems engineering) is a relatively new field of study that gained a significant attention during 20th century with the advancement in technology. It can be broadly defined or classified as practical application of control theory. Control engineering or control systems engineering is the engineering discipline that applies control theory to design systems with desired behaviours. The practice uses sensors to measure the output performance of the device being controlled and those measurements can be used to give feedback to the input actuators that can make corrections toward desired performance.

Catalog Description: The course contains 6 chapters – introduces the concept of OL & CL systems, components, block diagram & SFG, Mathematical modelling of physical systems, responses and time-domain analysis.

Pre-requisites: Knowledge in physics, mathematics is required.

Course Outline:

Unit I: Introduction **(5 hrs)**

Concept of Control Systems; classifications- open loop and closed loop systems, linear and non linear systems, continuous and discrete time systems, SISO and MIMO systems, time-invariant and time varying systems, servo systems and automatic regulating systems, adaptive control systems.

Unit II: Control System Components (4 hrs)

Potentiometer, Synchros, DC and AC servomotors, rotating amplifier, stepper motor, tachogenerators.

Unit III: Block Diagram & Signal Flow(6 hrs)

Block diagram representation of physical systems, BD reduction techniques; signal flow graph (SFG); definition, terminology, SFG representation of physical systems, Mason's Gain formula, BD reduction using SFG techniques

Unit IV: Mathematical modelling of Physical Systems(5 hrs)

Differential equations and transfer function form of model, mathematical model of electrical, mechanical and electro mechanical systems, analogous systems.

Unit V: Transient Response Analysis (10 hrs)

Type and order of systems, standard test signal, steady state error and error constants, generalized error series, sensitivity, characteristic equation, transient response of 1^{st},2^{nd} and higher order systems, transient response specifications, definition of absolute and relative stability, Routh-Hurwitz stability criterion.

Unit VI: Root Locus Method(10 hrs)

Introduction, angle and magnitude conditions, construction of complete root locus, stability analysis, effect of addition of poles and zeroes.

Unit VII: Frequency Response Analysis (6 hrs)
Frequency response of systems, frequency domain specifications, correlation between time domain and frequency domain specification, Polar plot, Nyquist plot and Nyquist stability criterion, construction of Bode plot, Gain margin & Phase margin.

Unit VIII: Control System Performance Measurement (3 hrs)
PI, PD, PID Controller.

Text book(s):

1) Control System – SamarjitGhosh.
2) Control System - B.S. Manke.
3) Control System Engineering - Nagrath I J &Gopal M.
4) Modern Control Engineering (PHI) - Ogata K.
5) Control System – Ramesh Babu.

Reference Book(s):

1) Benjamin C. Kuo, -Automatic Control Systems (PHI).
2) Distefano-Feedback and Control Systems (Schaum Series).
3) Sukla R C –Control Systems (DhanpatRai&Sons).
4) M.Gopal – Control Systems Principles & Design (TMH)
5) Naresh K. Sinha, Control Systems, CBS college Publishing, 1986.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
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Koraikhowa, Jorhat, Assam-785006

ET 1659: **Dynamics of Machinery (4)** **Semester: V**

Rationale: To impart students with the knowledge about motion, masses and forces in machines.

Catalog Description:

Static Force and Dynamic Force Analysis, Friction and Belt Drives, Balancing, Governors, Gyroscope.

Pre-requisites: Kinematics of Machinery

Course Outline:

Unit I. (4 Lectures)

Static Force Analysis: Introduction: Static equilibrium. Equilibrium of two and three force members. Members with two forces and torque. Free body diagrams. Principle of virtual work. Static force analysis of four bar mechanism and slider-crank mechanism with and without friction.

Unit II. (7 Lectures)

Dynamic Force Analysis: D'Alembert's principle, Inertia force, inertia torque. Dynamic force analysis of four-bar mechanism and slider crank mechanism. Dynamically equivalent systems. Turning moment diagrams and flywheels. Fluctuation of Energy. Determination of size of flywheels.

Unit III. (4 Lectures)

Belt Drives: Belt drives: Flat belt drives, ratio of belt tensions, centrifugal tension, power transmitted.

Unit IV. (8 Lectures)

Balancing of Rotating Masses: Static and dynamic balancing. Balancing of single rotating mass by balancing masses in same plane and in different planes. Balancing of several rotating masses by balancing masses in same plane and in different planes.

Unit V. (8 Lectures)

Balancing of Reciprocating Masses: Inertia effect of crank and connecting rod, single cylinder engine, balancing in multi cylinder-inline engine (primary & secondary forces), V-type engine; Radial engine – Direct and reverse crank method.

Unit VI. (6 Lectures)

Governors: Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, Isochronism, effort and power.

Unit VII. (4 Lectures)

Gyroscope: Vectorial representation of angular motion. Gyroscopic couple. Effect of gyroscopic couple on ship, plane disc, aeroplane, stability of two wheelers and four wheelers.

Unit VIII. (10 Lectures)

Mechanical Vibrations: Types of vibration, Derivation of equation of motion of single degree of system.Free vibration, Natural frequency, Different types of damping, Logarithmic Decrement, Tortional Vibration Of Geared System.Forced Vibration, Magnification Factor, Vibration Isolation and Transmissibility, Whirling of shafts with single rotor.

Text Book(s):

1. S. S. Rattan, Theory of Machines, 3rd Ed., Tata McGraw Hill.
2. T. Bevan. Theory of Machines, CBS Publishers and Distributors.
3. L. Meirovitch, Elements of Vibration Analysis, McGraw Hill, 1998.
4. W. T. Thomsom and M.D. Dahleh, Theory of Vibration with Applications, 5th Ed., Pearson Education.

Reference Book(s):

1. J. J Uicker (Jr), G. R Pennock, and J. E Shigley, Theory of Machines and Mechanisms, 3rd Ed., Oxford International Student Edition, 2010.
2. J S Rao and R V Dukkipat, Mechanism and Machine Theory, 2nd Ed., New Age Intl., 2008.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1633: **Theory of Machines Laboratory(2)** **Semester: V**

Rationale: To make the students learn the basics of Dynamics of Machinery by doing experiments.

Catalog Description: Moment of Inertia, reciprocating masses, Coriollis Component, Cam Analysis Machine,whirling speed of shaft, motorized gyroscope, Universal Governor Apparatus and Journal Bearing Apparatus

Pre-requisites: Basic knowledge of Dynamics of Machinery

Course Outline:

1. To determine the Moment of Inertia of a Disk & Ring in rotational motion.
2.To study and analyse the balance & unbalance of the reciprocating masses
3. To study & determine Coriollis Component of Acceleration of a slider crank mechanism.
4. To Plot N-θ curve and to observe the Jump phenomenon using Cam Analysis Machine
5. To determine whirling speed of shaft theoretically and experimentally.
6.
   I) To verify the relation simple pendulum
   II) To verify the relation of compound pendulum & to determine the radius of gyration using Universal Vibration apparatus
7. To determine gyroscopic couple on motorized gyroscope
8. To determine the characteristics of governor using universal governor apparatus.
Universal Governor Apparatus
9.
   I) To study the pressure profile of lubricating oil at various conditions of load and speed.
   II) Plotting the Cartesian polar pressure curves.
   III) To measure the frictional torque and power transmit Journal Bearing Apparatus

Text Book(s):

1.S. S. Rattan, Theory of Machines, 3rd Ed., Tata McGraw Hill.

Reference Book(s):

1.J S Rao and R V Dukkipat, Mechanism and Machine Theory, 2nd Ed., New Age Intl., 2008

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-
Internal assessment – 40 %
Semester Practical exam-60 %

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1660: **Manufacturing Technology Laboratory (2)** **Semester: V**

Rationale: To make the students learn the basics of manufacturing processes by using the machines to create models.

Catalog Description: Gas and TIG welding, Gas cutting, shaper, milling, planner, slotting, surface grinding and lathe.

Pre-requisites: Basic knowledge of Manufacturing Process

Course Outline:

Introduction and practice of different welding processes- gas and TIG.

Introduction to gas cutting and its application.

Introduction and practice of different machining processes- shaper, milling, planner, slotting, surface grinding and lathe.

Text Book(s):

1. P.N. Rao, Manufacturing Technology (Vol. - I & II), Tata McGraw Hill Pub. Company, New Delhi
2. P.C. Sharma, A Text Book of Production Technology (Manufacturing Processes & Technology), S. Chand and Company Ltd., New Delhi.
3 . A B Chattophadya, Manufacturing technology, Wiley India Pvt Ltd,2011

Reference Book(s):

1. Serope Kalpakjian & Schmid, Manufacturing Engineering and Technology, Pearson Education, Delhi.
2. Kibbe Richard R – PHI, Machine Tool Practices, New Delhi.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal assessment – 40 %
Semester Practical exam-60 %

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1134: **Extra Academic Activity - II (1)** **Semester: V**

Rationale: Aptitude tests measure an individual's work-related cognitive capacity. Aptitude tests are one of the most commonly used assessments in measuring candidates' suitability for a role. The most commonly used set of cognitive tests includes – abstract/conceptual reasoning, verbal reasoning and numerical reasoning. Aptitude tests are also integral part of tests conducted for getting admission into higher studies (such as CAT, MAT, GMAT etc) or for any competitive exams (SSC, RRB, CSAT etc). It is estimated that more than 80% of the engineering students will have to appear for at least one aptitude or psychometry test after they complete their graduation, and hence it is paramount to understand and practice the skills required to score well in these tests.

Catalog Description: Course is divided into three units, namely: Numerical Reasoning or Quantitative Aptitude, Abstract/Conceptual/Logical Reasoning and Verbal Abilities

Prerequisite: Proficiency in English & Mathematics

Course Outline:

1. Overview of Engineering & Technical Aptitude Skill Development
2. Unit 1: Quantitative Aptitude
    - Number System
    - Percentage, Fraction and Ratios
    - Interests
    - Profit, Loss & Discount
    - Ratio, Proportion & Variation
    - Mixtures, Solutions & Averages
    - Time, Work, Speed & Distance
    - Indices, Logarithms & Surds
    - Progressions
    - Theory of Equations
    - Permutation & Combinations
    - Probability
    - Clocks and Calendars
    - Others (Area, Surface Area, Volume, Height & Distance, Pipes & Cistern, Boats & Streams)
    - Data Interpretation (Graphs, Charts, Diagrams)

    Unit 2: Logical Reasoning
    - Fundamentals
    - Arrangements
    - Analytical Puzzles
    - Blood Relationship
    - Oxymoron, Coding-Decoding
    - Cubes, Dice & Networks
    - Others (Symbols & Notations, Input & Output, Data sufficiency, Decision making, Deductions)

Unit 3: Verbal Reasoning

- Verbal 1 (Assumption, Conclusion, Argument)
- Verbal 2 (Analogies, Syllogism, Cause & Effect)

Grading System:

The evaluation will be a continuous process based on class activities and mock tests

Text Book:

- VistaMind Basic Learning Material Books on Quantitative Aptitude, Analytical Reasoning and Vocabulary

Reference Books:

- The Quantitative Aptitude For Competitive Examinations by R.S. Aggarwal (S.Chand Publications)
- Wiley's Quantitative Aptitude Book by P.A. Anand (Wiley)
- Wiley's Verbal Ability and Reasoning for Competitive Examinations by Lalit Singh P.A. Anand (Wiley)
- Fast Track Objective Arithmetic by Rajesh Verma (Arihant)
- The Pearson Guide to Quantitative Aptitude for Competitive Examinations – Dinesh Khattar (Pearson)

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1634: **Machine Design II (4)** **Semester: VI**

Rational:

The objective is to provide a clear understanding of theory of engineering machine design.

Catalog Description: Includes different type of gears, bearing, brakes, spring and clutches

Pre-requisites: Basic knowledge of Mechanics, Theory of Machine and Material Science

Course Outline:

Unit-I: **(5 Lectures)**

Spur gears: Introduction, Types of failure, design requirements, gear terminology, design analysis, stress concentration, dynamic load, surface compressive stress, beam strength, plastic deformation, gear materials, design procedure, design as recommended by AGMA. Gear Lubrication.

Unit-II: **(8 Lectures)**

Helical Gears: Terminology of Helical Gears, Virtual number of teeth, Tooth proportions, Force analysis, Beam strength, Effective Load on gear tooth, design procedure.
Bevel Gears: Terminology of Bevel Gears, Force Analysis, Beam strength, effective load on gear tooth, design procedure, design as recommended by AGMA.

Unit-III: **(13 Lectures)**

Rolling Contact Bearings: Types of ball and roller bearing, Selection of bearing for radial and axial load, Bearing life, design procedure, mounting and lubrication.
Plain or Journal Bearings: Types of lubrication, Viscosity, Hydrodynamic theory of lubrication, Somerfield number, Heat balance, design procedure. Self-contained bearings, bearing materials.

Unit-IV: **(6 Lectures)**

Spring: Spring Materials and their Mechanical Properties, Equation for stress and deflection, Helical coil springs of circular section for tension, compression and torsion, Dynamic loading, Fatigue loading, Wahl line. Leaf spring and disc springs.

(18 Lectures)

Unit-V

Brakes: Introduction, Block Brake, design procedure, Internal Expanding Shoe Brake, design procedure, Band brakes, design procedure, Disc brake, design procedure.
Clutches: Introduction, Friction materials, Torque transmitting capacity, Single & Multiple plate clutch, Centrifugal clutches, Cone clutch.
System Design Approach , Overview of Optimization in Design; Reliability and Robust Design; Communicating the Design.

Text Book(s):

1. V.B. Bhandari ,Design of Machine Elements by, McGraw HILL Publications. 3rd edition,
2.K.Mahadevan / K.Balveera Reddy,Design Data Handbook for mechanical engineers, CBS publication, 4th Ed., 2013
3. V.B. Bhandari ,Design of Machine Elements, McGraw HILL Publications. 3rd edition

Reference Book(s):

1. M.F Spotts, T.E Shoup, L.E. Hornberger, S.R Jayram and C V Venkatesh, Design of Machine Elements, 8th Ed., Person Education,2006.
2. V. B. Bhandari, Design of Machine Elements, 2nd Ed., Tata Mcgraw Hill, 2008.
3. R. C. Juvinall and K. M Marshek, Fundamentals of Machine Component Design, 3rd Ed., Wiley Student Edition, 2007.

Journal(s):
E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1635: **Refrigeration and Air Conditioning (4)** **Semester: VI**

Rationale: The objective of this course is to provide insights in how thermodynamic principles are applied within the refrigeration and air conditioning system. It gives details on how different components work and influence each other.

Catalog Description: Includes brief review of various methods of refrigeration, vapour compression and absorption system, equipments and air conditioning system**.**

Pre-requisites: Basic knowledge ofThermodynamics and Heat transfer

Course Outline:

Unit-I: Introduction to Refrigeration **(3 Lectures)**
Need and applications, refrigeration machine, Unit of refrigeration and C.O.P. ,Mechanical Refrigeration – reversed carnot cycle. Air Refrigeration: Bell Coleman cycle and Brayton Cycle, Actual air refrigeration system problems – Refrigeration needs of Aircrafts.
(3 hours)

Unit-II: Vapour compression refrigeration **(12 Lectures)**

Limitations of Reversed Carnot cycle and its modification, working principle and essential components of the plant – simple Vapour compression refrigeration cycle – COP – Representation of cycle on T-S and p-h charts – effect of sub cooling and super heating – cycle analysis – Actual cycle Influence of various parameters on system performance – Use of p-h charts – numerical Problems.
System Components: Compressors – General classification – comparison – Advantages and Disadvantages. Condensers, evaporators, expansion devices – classification – Working Principles

Unit-III: Refrigerants **(5 Lectures)**
Desirable properties – classification refrigerants used – Nomenclature – Ozone Depletion – Global Warming.

Unit-IV: **Vapor Absorption System** **(6 Lectures)**

Calculation of max COP – description and working of NH3 – water system and Li Br –water (Two shell & Four shell) System. Principle of operation Three Fluid absorption system, salient features.

Unit-V: **Steam Jet Refrigeration System**
Working Principle and Basic Components. Principle and operation of (i) Thermoelectric refrigerator (ii) Vortex tube or Hilsch tube.
(4 hours)

VI
Introduction to Air Conditioning : Psychometric Properties and Processes – Characterization of Sensible and latent heat loads -Need for Ventilation, Consideration of Infiltration – Load concepts

of RSHF, GSHF- Problems, Concept of ESHF and ADP.
(8 hours)

Human comfort requirements and concept of effective temperature - Comfort chart – Comfort Air conditioning – Requirements of Industrial air conditioning, Air conditioning Load Calculations.
(6 hours)

Air Conditioning systems - Classification of equipment, cooling, heating humidification and dehumidification, filters, grills and registers, fans and blowers.
Heat Pump – Heat sources – different heat pump circuits.
(7 hours)

Text books:

1. C. P. Arora ,Refrigeration and Air-Conditioning, 2nd Ed.,Tata McGraw Hill Publication,2006
2. W. F. Stoecker ,Refrigeration and Air-Conditioning, Tata McGraw Hill Publication

Reference Books:

1. J L Threkeld, Thermal Environmental Engineering, 2nd ed, Prentice Hall Inc, 1970
2. McQuistion, ,Heating, Ventilation and Air Conditioning, Wiley Students edition, 5th edition
3. Air conditioning PITA, 4th edition, Pearson
4. ASHRAE, Hand Book

Journal:

E-Resources:

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1643: **Computer Aided Design & Manufacturing (4)** **Semester: VI**

Rationale: To make the students understand the nature and importance of Computer Aided Design & Manufacturingand to acquaint them with the major aspects of Computer Aided Design & Manufacturing.

Catalog Description: Computers' role in design and manufacturing and manufacturing environment,Hardware In CAD, Computer Graphics, NC, CNC, DNC Technology, CNC Machine Tools, CNC Programming, APT Programming, Concept of Computer Aided Inspections, AGV(Automated Guided Vehicle) ,Robot and Computer Integrated Manufacturing. Advanced Manufacturing process.

Pre-requisites: Basic knowledge of computers and manufacturing processes.

Course Outline:

Unit-I: **(5 Lecture)**

Introduction

Computers' role in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional & computerized manufacturing environment. Introduction to CAD, Introduction to CAM. Merits and Demerits of CAD and CAM.

Hardware In CAD

Basic Hardware structure, working principles, usage and types of hardware for CAD - input and output Devices, memory, CPU, hardcopy and Storage devices.

Unit-II: **Computer Graphics** **(4 Lecture)**

Software configuration of a graphic system, function of a Graphics package, construction of geometry, wire frame and solid modelling, . Geometric 2 D and 3 D homogeneous transformations with simple problems.

Unit-III: **NC, CNC, DNC Technology** **(4 Lecture)**

NC, CNC, DNC modes, NC elements, advantages and limitations of NC, CNC. Functions of computer in DNC.

Unit-IV: **CNC Machine Tools** **(5 Lecture)**

Turning tools geometry, milling tooling systems, tool presetting, ATC work holding. CNC machine tools, Overview of different CNC machining centres, CNC turning centres, high speed machine tools.

Unit-V: **CNC Programming** **(6 Lecture)**

Part program fundamentals – steps involved in development of a part program. Manual part programming-milling & turning

Unit-VI: APT Programming **(6 Lecture)**

APT Programming in drilling, milling and turning with problems

Unit-VII: **(7 Lecture)**

Concept of Computer Aided Inspections, AGV (Automated Guided Vehicle) ,Robot and Computer Integrated Manufacturing. Advanced Manufacturing process.

Text Book(s):

1. Groover& Zimmers,Computer-Aided Design and Manufacturing, ,PHI, 1st Ed.,2003
2. P.N. Rao ,CAD/CAM Principles and Application , Tata McGraw Hill,3rd Ed., 2010

Reference Book(s):

1. Chris McMahon & Jimmie Browne ,CAD/CAM, Pearson education Asia 2001.
2. I. Zied, CAD/CAM Theory and Practice, Tata McGraw Hill, 2000.
3. K. Lee, Principles of CAD/CAM/CAE systems, Addison Wesley, 1999

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1644: **Internal Combustion Engine(4)** **Semester: VI**

Rationale: The objective of this course is to make students familiar with the design and operating characteristics of internal combustion engines.

Catalog Description: It includesAir standard cycles and fuel-air cycles, S.I. Engines, C.I. Engines, Engine systems and components, Performance characteristics &Testing of I.C. Engine and Fuels.

Pre-requisites: Basic Knowledge of Thermodynamics

Course Outline:

Unit-I: Air standard cycles and fuel-air cycles (10 Lectures)
Assumptions, Otto, Diesel & Dual cycles, comparison of cycles, fuel air cycle, Valve timing diagram, Actual engine cycle.

Unit-II: S.I. Engines (8 Lectures)
Theory of Carburetion, Types of carburetors , Electronic fuel injection system, GDI,Combustion in spark Ignition engines, stages of combustion, flame propagation, rate of pressure rise, abnormal combustion, Phenomenon of Detonation in SI engines, effect of engine variables on Detonation. Combustion chambers. Rating of fuels in SI engines, Additives. (Numericals on carburetion)

Unit-III: C.I. Engines (8 Lectures)
Fuel supply system, types of fuel pump, injector and distribution system, Combustion in compression ignition engines, stages of combustion, factors affecting combustion, Phenomenon of knocking in CI engine. Effect of knocking, Types of combustion chambers, rating of fuels in CI engines. Dopes & Additives, Comparison of knocking in SI & CI engines, Concepts of Supercharging and Turbo charging.(Numericals on fuel injuction)

Unit-IV: Engine systems and components (6 Lectures)
Ignition system.(battery, magneto & electronic), Lubrication system, Engine starting system, Engine cooling system, Governing system (quality and quantity hit & miss governing), Intake and exhaust systems (two valves & four valves), Drive train (cam shaft, valves etc.)

Unit-V: Performance characteristics &Testing of I.C. Engine (10 Lectures)
Introduction to Indian Standards for testing of I.C. Engine, Mean effective pressure, indicated power, brake power, friction power, Methods to determine power and efficiencies. Variables affecting performance of engine, characteristic curves, heat balance sheet, Methods of improving engine performance (Numericals) & simple numericals on super & turbocharged engines.

Unit-VI: Fuels (8 Lectures)
Chemical structure of the Petroleum, Refining process for petroleum, important qualities of the Engine fuels - (SI & CI engines), Alternate fuels (SI & CI engines)- Liquid fuels, gaseous fuels, hydrogen engines (LPG, HC NG (15%, 20%, 25 % Blends Hydrogen and Biofuels), diesel, Gasoline fuels Indian specifications.

Text Book(s):

1. V. Ganeshan , Internal Combustion Engine ,TMH, 4th Ed., 2012
2. Pulkrabek ,Engineering Fundamentals of the Internal Combustion Engines, Practice Hall of India, 2003

Reference Book(s):

1. Heywood, John B. Internal Combustion Engine Fundamentals,McGraw-Hill, 1st Ed., 2011
2. Obert E.F., Internal Combustion Engines Analysis and Practice, International Text Books Co., 2nd Ed.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation:	30%
End Semester Exam:	70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1646: **Industrial Engineering (4)** **Semester: VI**

Rationale: To provide the fundamental concepts and principles of Industrial Engineering

Catalog Description: Includes Management, Plant Location, Site Selection and Plant Layout, Work Study, Method Study, Work Measurement, Ergonomics, Maintenance Management, Value Engineering & Value Analysis, Project Management, PERT,CPM, Industrial Engineering and Information Technology, Business Process Re-Engineering and Trade Union

Pre-requisites: None.

Course Outline:

Unit-I: Introduction: (2 Lectures)
Definition of Industrial engineering, History & development, Objective of Industrial Engineering, Contribution of Industrial Engineering, Function of Industrial engineer, Place of Industrial engineering in an organization.

Unit-II: Plant Location, Site Selection and Plant Layout: (5Lectures)
Need for a suitable location, Urban, Suburban, Systems approach, Factors affecting location, Quantitative method for evaluation of plant location, Objectives & Principles of plant layout, Types of layout and their suitability, Software packages for layout analysis.

Unit-III: Work Study: (2 Lectures)
Productivity and work study, Introduction and definition of Work-study, Prerequisites of conducting a work study.

Unit-IV: Method Study: (3Lectures)
Introduction, definition, procedure, Recording techniques, Flow Process Charts, Critical examination by questioning technique, man-machine chart, Motion economy principles, Micro motion study – Therbligs.

Unit-V: Work Measurement: (3Lectures)
Definition, Objectives, Techniques of Work measurement, Selection & timing the job, Rating, Allowances, Normal and standard time determination, Work sampling.

Unit-VI: Ergonomics:I (2 Lectures)
Introduction to ergonomics and its application.

Unit-VII:Maintenance Management: (4Lectures)
Objectives and need for maintenance, Types of maintenance, Breakdown, Predictive and Preventive Maintenance, Condition based maintenance system.

Unit-VIII: Value Engineering & Value Analysis: (9 Lectures)
Definition, Objectives & use of value analysis, Application & techniques. Project Management,

PERT,CPM, Network Representation, Techniques for drawing network, Resource smoothing and levelling, Project cost, Optimum project duration, Project crashing, Updating, Time estimation in PERT .

Unit-IX: Industrial Engineering and Information Technology : (4Lectures)
Role of IT/ IS in Industry, increasing value of Information Technology, IT as a New Business tool, IT as Business Enabler, IT as business driver, Internet worked enterprise, Internet, Intranet and Extranet, Globalization and IT, Competitative advantage with IT.

Unit-X: Business Process Re-Engineering: (4Lectures)
Definition, Need & characteristics, Industrial Engineering & Reengineering, Framework for Reengineering, Process of Reengineering, Information Technology leverage in Reengineering, advantages of Re-engineering.

Unit-XI:Trade Union: (2Lectures)
Meaning and Origin, Objectives of Trade Union, History of Trade Union in India, Laws related to Trade Union.

Text book(s):

1. Martand Telsang ,Industrial Engineering and Production Management ,S Chand & Company
2. S. K. Sharma, Savita Sharma, Industrial Engineering and Organization Management, 1st Ed., SK Kataria & Sons

Reference Book(s):

1. Philip E Hicks ,Industrial Engineering & Management –A new perspective, , Mcgraw Hill
2. S. Dalela, Mansoor Ali, Industrial Engineering and Management Systems ,Standard Publishing Distributors.

Journal(s):

E-Resource(s):

Grading System: The final grade will be based on the following weight distribution: -

- Internal Evaluation (30%)
- End Semester Examination (70%)

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1629: **Mechanical Measurement (3)** **Semester: VI**

Rationale: To provide basic foundational knowledge of mechanical measurement

Catalog Description: Generalized Measurement System , Measurement , Measurement of Strain, Measurement of flow, Data acquisition system and Metrology.

Pre-requisites:

Course Outline:

Unit-I: Generalized Measurement System (4 Lectures)
Introduction to measurement and measuring instruments, Generalized measuring system and functional elements, Units of measurement, Static and dynamic performance characteristics of measurement devices, Calibration, Concept of error, Sources of error, Statistical analysis of errors sensors and Transducers – Types of sensors, Type of transducers and their characteristics.

Unit-II: Measurement (12 Lectures)
Measurement of displacement and angular velocity. Measurement of pressure: Gravitational direct acting, Elastic and indirect type pressure transducers. Measurement of very low pressure–Mcleod gauge and Pirani gauge. Measurement of temperature: Measurement of temperature by thermometers, Bimetallic, Thermocouples, Thermistors and pyrometers-total radiation and optical pyrometry, Thermocouples, RTDs, Pyrometers, Pyrometeric Cones.
Measurement of Strain: Type of strain gauges and their working, Strain gauge circuits, Mcleod guage, Pirani guage, Temperature compensation. Strain rosettes, Analysis of strains, Measurement of force and torque.

Unit-III: Measurement of flow (14 Lectures)
Obstruction meters, Variable head meters, Hot wire and magnetic meters, Ultrasonic flow meters. Vibration and noise measurement: Seismic instruments, Vibration pick ups and decibel meters.
Data acquisition system: Introduction to data acquisition systems, Single and multi channel systems, Microprocessors and PC based data acquisition systems. Input – output devices signal transmission and Processing, Devices and systems.

Unit-IV: Metrology (6 Lectures)
Measurement of angles, threads, surface finish, inspection of straightness, flatness and alignment, gear testing, digital readouts, coordinate measuring machine.

Text Book(s):
1. E.O. Doebelin, Measurement systems- Applications and Design, 4th Ed., Tata McGraw-Hill.
2. T.G. Beckwith, R.D. Marangoni and J.H. Lienhard, Mechanical Measurements, 5th Ed., Addison Wesley.
3. R.K. Jain, Engineering Metrology, Khanna Publishers, New Delhi.

Reference Book(s):

1. R.S. Figiola and D.E. Beasley, Theory and design for mechanical measurements, 2nd Ed., John Wiley.
2. J.W. Dally, W.F. Riley and K.G.McConnell, Instrumentation for engineering measurements, 2nd Ed., John Wiley & Sons.
3. E.O. Doebelin, Engineering Experimentation, McGraw-Hill.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following:-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1645: **Internal Combustion Engine Laboratory(2)** **Semester: VI**

Rational: To make the students learn the basics of Internal Combustion Engine laboratory by doing experiments.

Catalog Description: 2 stroke and 4 stroke petrol and diesel engine model,water type and fire tube boiler model, rope brake dynamometer, performance test on a 4-stroke cylinder diesel engine

Pre-requisites: Basic knowledge of Internal Combustion Engines.

Experiments:

Part A

1.Study of cut sections of 2 stroke and 4 stroke diesel engine.
2.Study of cut sections of 2 stroke and 4 stroke petrol engine.
3.To study and determine BHP of rope brake dynamometer.

Part B

1.To perform constant speed performance test on a 4-stroke cylinder diesel engine & draw the curves of (i) BP Vs Fuel rate (ii) BP Vs BMEP (iii) Mechanical efficiency Vs BSFC.
2. To study and draw the valve timing diagram of 4-stroke, single cylinder petrol engine.
3. To study and determine the effect of air-fuel ratio on the single cylinder petrol engine.
4. To prepare heat balance sheet on single cylinder petrol engine.
5. To analysis of exhaust gas from 4-stroke, single cylinder petrol engine.

Text Book(s):

1.V. Ganeshan , Internal Combustion Engine ,TMH, 4th Ed., 2012

Reference Book(s):

1.Pulkrabek ,Engineering Fundamentals of the Internal Combustion Engines, Practice Hall of India, 2003

Journal(s):
E-Resources(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 40%
End Semester Exam: 60%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1632: **Metrology Laboratory (2)** **Semester: VI**

Rationale: To make the students learn the basics of Metrology by doing experiments.

Catalog Description: Load cell, thermocouple, slip gauge, pressure transducer, strain gauges, response time.

Pre-requisites: Basic knowledge of Metrology

Experiments:

1) Calibration of Load cell.
2) Calibration of thermocouple
3) Calibration of micrometer using slip gauge
4) Measurement of stress and strain on a cantilever beam
5) Measurement of pressure of fluid in a pipe using pressure transducer
6) Measurement of load using a load cell on a tutor
7) Determination of modulus of elasticity of a mild steel specimen using strain gauges.
8) Study of various temperature measurement instruments and measure their response time.

Text Book(s):

1.R.K. Jain, Engineering Metrology, Khanna Publishers, New Delhi

Reference Book(s):

1.E.O. Doebelin, Engineering Experimentation, McGraw-Hill

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Assessment – 40 %
End Semester Practical Examination-60 %

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1662: **Mechanical Laboratory – III (2)** **Semester: VI**

Rationale: To make the students learn the basics of Refrigeration and Fuel properties by doing experiments.

Catalog Description: Constructional features of Vapour Compression systems, COP, Flash & fire point, Calorific value, viscosity of lubricating oil.

Pre-requisites: Basic knowledge of Internal Combustion engines and fuel properties.

Course Outline:

Part A

1. To study construction and working of a Vapour Compression System
2. To evaluate performance of the Refrigerator by calculating the C.O.P of the system

Part B

1. Determination of Flash point and Fire point of lubricating oil using Abel Pensky and Marten's (closed) / Cleavland's (Open Cup) Apparatus.
2. Determination of Calorific value of solid, liquid and gaseous fuels.
3. Determination of Viscosity of a lubricating oil using Redwoods, Saybolt and Torsion Viscometers.
4. Valve Timing/port opening diagram of an I.C. engine (4 stroke/2 stroke).

Text Book(s):

1. C. P. Arora ,Refrigeration and Air-Conditioning, 2nd Ed.,Tata McGraw Hill Publication,2006
2. W. F. Stoecker ,Refrigeration and Air-Conditioning, Tata McGraw Hill Publication
3. V. Ganeshan , Internal Combustion Engine ,TMH, 4th Ed., 2012

Reference Book(s):

1. Air conditioning PITA, 4th edition, Pearson
2. ASHRAE, Hand Book
3. Pulkrabek ,Engineering Fundamentals of the Internal Combustion Engines, Practice Hall of India, 2003

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal assessment – 40 %
Semester Practical exam-60 %

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1666: **Seminar (1)** **Semester: VI**

Rationale: The purpose of this seminar is to train the students to address to a group of people and to present technical topics in a well organised manner to the audience. It is also intended for improvement of communication skills of students, to make them confident in expressing their views with clarity and to make them capable of taking part in debates. This will help create self-esteem and confidence that are essential for engineers.

Catalog Description: The students shall have to select a suitable current and relevant topic in Mechanical Engineering from technical literature and present a seminar on that topic.

Pre-requisite: Upto 6th semester B.Tech Mechanical Engineering course.

Course Outline:

Individual students should be asked to choose a topic in any field of Mechanical engineering, preferably from outside the B. Tech. syllabus and deliver a seminar on that topic for about thirty (30) minutes. It enables the students to gain knowledge in any of the technically relevant current topics and acquire the confidence in presenting the topic.

The student will undertake a detailed study on the chosen topic under the supervision of a faculty member, by referring papers published in reputed journals and conferences. Each student has to submit a seminar report (in two copies), based on these papers; the report must not be reproduction of any original paper. A committee consisting of three/four faculty members (preferably specialized in different sub-fields of Mechanical Engineering) will evaluate the seminar. One of the two copies submitted by the student should be returned to him/her after duly certifying it by the chairman of the assessing committee and the other shall be kept in the departmental library.

Text Book(s):

Reference Book(s):

Journal(s):
E-Resource(s):

Grading System: The final grade shall be based on the following :-

- 20% - Relevance of the topic and literature survey
- 50% - Presentation and discussion
- 20% - Report
- 10% - Regularity in the class and Participation in the seminar
-

Academic Council Approval:

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ET1135 : **Extra Academic Activity – III (1)** **Semester: VI**

Rationale: Aptitude tests measure an individual's work-related cognitive capacity. Aptitude tests are one of the most commonly used assessments in measuring candidates' suitability for a role. The most commonly used set of cognitive tests includes – abstract/conceptual reasoning, verbal reasoning and numerical reasoning. Aptitude tests are also integral part of tests conducted for getting admission into higher studies (such as CAT, MAT, GMAT etc) or for any competitive exams (SSC, RRB, CSAT etc). It is estimated that more than 80% of the engineering students will have to appear for at least one aptitude or psychometry test after they complete their graduation, and hence it is paramount to understand and practice the skills required to score well in these tests.

Catalog Description: Course is divided into three units, namely: Engineering & Technical Aptitude, IT Skills & Aptitude, Facing Technical Interviews

Prerequisite: Fundamental knowledge on engineering and computer programming skills, English proficiency

Course Outline:

1. Overview of Engineering & Technical Aptitude Skill Development – Part 2
2. Unit 1: Engineering & Technical Aptitude
    a. Course will cover the fundamental concepts of the respective engineering streams (ie, Computer Science, Electronics, Electrical, Mechanical and Civil engineering

Unit 2: Information Technology Aptitude

- Fundamentals of Computing and IT
- Basic programming concepts in C & Java
- Basic concepts of Databases and SQL
- Basic concepts of SMACS (Social, Mobile, Analytics, Cloud & Security)

Unit 3: Facing Technical Interviews

- Practising mock technical interviews in the above mentioned subject areas

Grading System:

The evaluation will be a continuous process based on class activities and mock tests

Text Book:

- Respective engineering textbooks as recommended by instructor, classroom notes and Technical Interview dossier prepared by Kaziranga University

Reference Books:

- GATE Guides for Engineering Subjects – Any publisher
- Cracking the Coding Interview – By Gayle Laakmann McDowell

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1630: **Production Management (3)** **Semester: VII**

Rationale: To make the students understand the nature and importance of production management and to acquaint them with the major aspects of production management.

Catalog Description: Production Management, Sales Forecasting, Material Management, Procurement, Stores Keeping, Production Planning and Control, Materials Handling, Costing and Cost Analysis, Inventory Control, Supply Chain Management, Quality Control, Statistical Quality control

Pre-requisites: None

Course Outline:

Unit-I: Production Management **(6 Lectures)**
Definition, Objectives, Scope, Benefits, Functions of production management, Place of production management in an organization, Types of production system, Product life cycle, Product design and development, production cycle.
Sales Forecasting: Purposes, Methods – Delphi, Linear regression, Economic indicators, Time-series analysis, Adjustment for seasonal variations, Moving average, Exponential smoothing.

Unit-II: **(8 Lectures)**
Material Management: Objectives and functions of materials management, Organization of materials management, MRP I and MRP II.
Procurement: Objectives of purchase department, Purchase responsibilities and organization, Types of purchasing, Purchase procedures, Import and Export.
Stores Keeping: Stores management, Functions of stores, Classification of materials, Standardization of materials, Identification and maintenance of layout of stores, Physical control of materials, Pricing of stores, Issuing of stores.

Unit-III: **(8 Lectures)**
Production Planning and Control : Functions, , Scheduling, Routing, Loading, Sequencing, etc
Materials Handling: Principles of materials handling, Unit load, Types of materials handling equipment, Relation between materials handling and plant layout.
Costing and Cost Analysis: Elements of costs, Break even analysis, Incremental costs, make or buy decision.

Unit-IV: **(9 Lectures)**
Inventory Control: Objective, Scope and functions of inventory control, Inventory control techniques, Economic ordering quantity, Periodic ordering quantity, A.B.C. analysis, General idea regarding inventory control under risk and uncertainty.
Supply Chain Management: Introduction, Definition of supply Chain, Major derivers of supply chain, Supply Chain Strategies, A model for strategy formulation in SCM. Information Systems in supply chain.

Unit-V: **(7 Lectures)**

Quality Control : Inspection , quality, quality control and quality assurance, Concept of TQM, Customer satisfaction, 5-S system, Kaizen. Quality of conformance, Quality of design, Economics of quality.

Statistical Quality control: Concept of variables and attributes, quality control charts, Acceptance sampling, Procedure's risk and Consumer's risk, Operating characteristic curve for single sampling plan.

Text Book(s):

1. P. Ramamurty ,Production and operation Management , New Age International Publication, 2nd Ed.,2006
2. Martand Telsang , Industrial Engineering & Production Management , S. Chand & Co.
3. R.P. Mohanty & S G Deshmukh , Supply Chain Management, Biztantra Publications, reprint edition, 2005
4. Samuel Eilan ,Elementing of Production Planning and Control , Universal Book Corporation, Bombay.

Reference Book(s):

1. R. Mayer ,Production and operation Management, Tata McGraw Hill publication.
2. Adam and Ebert ,Production and operations Management , PHI
3. Samuel Eilon ,Production planning and Control, Navneet Prakashan Ltd., Bombay.
4.A. Muplemann, T. Oakland and K. lockyer, Production and Operation Management , Macmillan

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
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ET 1637: **Non-Conventional Energy Resources (3)** **Semester:VII**

Rationale: The objective of this course is to make the student identify non-conventional sources of energy and understand the principle of conservation of energy.

Catalog Description: Solar Energy, Solar Thermal Systems, Wind Energy, Bio mass energy, Geothermal energy, Ocean Energy, Emerging Technology

Pre-requisites: Nil

Course Outline:

Unit-I:Introduction:(3 Lectures)

Energy sources, India's production and reserves of commercial energy sources, need for non-conventional energy sources, energy alternatives, solar, thermal, photovoltaic. Water power, wind biomass, ocean temperature difference, tidal and waves, geothermal, tarsandsand oil shale, nuclear (short descriptions); Merits and Demerits, comparison.

Unit-II: Solar Energy – Basics(4 Lectures)

Sun as asource of energy. Sun earth radiation spectrums. Spectral energy distribution of solar radiation. Measurement of solar radiation. Empiricalequations for estimating solar radiation availability.

Unit-III: Solar Thermal Systems:(7 Lectures)

Solar collectors, comparison of concentrating and non-concentrating types of solar collectors. Effect of various parameters and performances. Solar water heaters, solar refrigeration and air conditioning systems, solar cooker,solar furnaces, solar greenhouse, solar dryer, solar distillation, solar thermo-mechanical systems.

Solar cell fundamentals, classification of solar PV systems.

Unit-IV:Wind Energy:(5 Lectures)

Wind energy, energy estimation of wind, power extraction from wind, classification and description of wind machines. Elementary design principles; coefficient of performance of a wind mill rotor, aerodynamic considerations of wind mill design

Unit-V:Bio mass energy:(4 hours)

Usable forms of bio mass, their composition and fuel properties. Bio gas production from waste biomass.

Unit-VI:Geothermal energy:**(3 hours)**

Applications, Types and analysis of geothermal resources.

Unit-VII:Ocean Energy:(4 hours)

Tidal energy technology, ocean thermal energy, origin and characteristics of resources.

Unit-VIII:Emerging Technology:(7 hours)

Fuel cell, classification, performances, efficiency of fuel cell. Applications
Hydrogen energy, Properties and Conversion into useful forms of energy, Applications

Text Book(s):

1. G.D RaiK ,Non-Conventional Energy Sources , Khanna Publishers.
2. Subhas P Sukhatme ,Solar energy, Tata McGraw Hill.

Reference Book(s):

1. N.K.Bansal, Manfred Kleeman&MechaelMeliss , Renewable Energy Sources and Conversion Technology ,Tata McGraw Hill.
2. , John W.Twidell Anthony D. Weir , Renewable Energy Resources, Taylor & Francis
3. P.K.Nag ,Solar Power Engineering, Tata McGraw Hill.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
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ET1665: Industrial Training (1) **Semester:VII**

Rationale: This course offers an opportunity to relate the concepts learned in the classroom to the field. It also gives an exposure to intense writing experience and his/her observations regarding technical aspects, safety and ethical issues.

Catalog Description:

- Student must complete a minimum of 250 hours industrial training.
- Students must work for an approved organization.
- The training must be in relevant branch related organization.

Pre-requisite: Upto 6th semester B.Tech Mechanical Engineering Course.

Course Outline:

To successfully complete this course, students must submit a report describing their work experience. The report format is: a bound, 15-20page, typed, size-12, Arial, single spaced, 1-inch margin all sides. The report must contain the following eight sections:

1. Cover Page: Report title, author's name, course number, university name, instructor's name, and date.
2. Table of Contents: headings/subheadings and page numbers. See "Table of Contents" of any textbook for guidance.
3. Company Profile: describe your employer's type of business and specify its sector, annual volume of work, number of employees, years in the business, org-chart, etc.
4. Project Assignment: Describe the project(s) on which you worked and specify size, features, challenges, start and finish dates, and budget.
5. Duties and Responsibilities: Describe the functions/duties/responsibilities given to you during this experience and include supporting documents to substantiate your statements (i.e., graphs, photos, figures, etc).
6. Examples of Safety and Ethics Learned: Describe a few good examples of safety and ethics issues you witnessed and learned from during your work experience. Specific incidences that you experienced must be described and text will include location and context of the events. Additional lesson learned topics are also required for inclusion in your report.
7. Concluding Remarks: Summarize the skills and knowledge you gained from this construction experience and specify ways to improve such benefits for other future students. In other words, what would you change if you were to repeat this experience?
8. Appendices: Proof of employment, project photos, project charts, and other supporting materials.

Text Book(s):

Reference Book(s):

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 50%

End Semester Exam: 50%

Academic Council Approval:

The Assam Kaziranga University,
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ET1667:**MinorProject (4)** **Semester:VII**

Rationale: The purpose of this course is to carry out a design project in one of the specializations of Mechanical engineering so as to simulate real life situations related to Mechanical engineering and impart adequate training so that confidence to face and tackle any problem in the field is developed.

Catalog Description: The students are guided in such a way so that they carry out a work on a topicas a forerunner to the full-fledged project work to be taken subsequently in VIII semester. The project work shall preferably consist of substantial multidisciplinary component.

Pre-requisites: Upto 6th semester B.Tech Mechanical Engineering course.

Course Outline:

The minor project shall consist of

- Identification of the problem
- Literature Survey
- Methodology and synopsis of the project
- Submission of interim report
- Presentation to an expert committee

The students will carry out a project in anyMechanical engineering area with substantial multidisciplinary component involving Architecture,Mechanical engineering, Electrical engineering, Biotechnology, Chemical engineering, Computerscience, etc.

Student groups will be formed (4-5 in a group) and a faculty member will beallocated to guide them. The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through 'progress seminars' and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each student is expected to prepare a report in the prescribed format, for final evaluations based on the project work. Members of the project group will present the relevance, design and implementation of the project to the project evaluation committee.

Each group will submit the copies of the completed project report signed by the guide to the department. The head of the department will certify the copies and return them to the students. One copy will be kept in the departmental library and one by the respective guide.

Text Book(s):

Reference Books:

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

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School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1677: **Power Plant Engineering(3)** **Semester: VII**

Rationale: The aim is to acquaint students with the methods engineers use to design and evaluate the thermal processes used for the production of electricity.

Catalog Description: Includes steam, hydro, diesel, nuclear power plants and power station economics

Pre-requisites: Basic Knowledge of Thermodynamics

Course Outline:

Unit-I: Introduction **(4 Lectures)**
General Sources of power, Importance of Central Power Stations, Types of power stations – steam, Nuclear, Diesel and hydro – Elements of modern power stations (Steams only) brief layout and arrangement of elements and complements, Sitting of different power stations, Foundation, Elements of Electric power systems primary and secondary distribution substations (in brief).

Unit-II: Steam Power Plant **(12 Lectures)**
Steam power plants selection of working medium, Heat Balance in steam cycles, Heat rates, Comparison of efficiencies gas loop, Fuels and fuel handling System and Ash handling System, Air pre-heater, Feed water pre-heaters, Steam re-heaters, Dearators, Feed water treatment, Pumping and regulation water walls, Modern developments in steam boilers, Important instrumentation and piping of gas and water loop. Factors to be controlled from maximum efficiency and variable output.

Unit-III:L Hydro Electric power station **(10 Lectures)**
Potential power with reference to rainfall and catchments area, Water storage,Equipment used in hydro electric power stations, Characteristics of hydraulic turbines, Comparison of the factors governing the cost of hydro steam and diesel power stations.

Unit-IV: Diesel power station **(6 Lectures)**
Application of Diesel in power field, Suitability of diesel engines for bulk power, Layout of Diesel Power Plant, Advantages and limitations of diesel, Power stations, Performance Characteristics.

Unit-V: Nuclear Power Station **(10 Lectures)**
Evolution of nuclear energy from atoms by fission and fusion, Chain reactions, Fission materials, Types of reactors, gas cooled, Boiling water liquid, Metal cooled and fast reactor, Arrangements of various elements in a nuclear power station, Steam cycles and boilers coolant heat exchangers, Reactor control, Reactor shielding and safety methods.

Unit-VI: **(12 Lectures)**

Variable load problems: Idealized and realized load curves, Effect of variable load on plant design and operation variable load operation and load dispatch.

Power station Economics: Source of income, Cost of plant and production, Elements of cost, depreciation and replacement theory of rates.

Text Book(s):

1. P.K. Nag ,Power Plant Engineering, 2nd Edn., Tata McGraw-Hill Pub. Com.
2. F.T. Morse Affiliated East ,Power Plant Engineering, West Press Pvt. Ltd

Reference Book(s):

1. M.M. E1 – Wakil ,Power Plant Technology , McGraw Hill, International Edition
2. R.Yadav, Fundamental of Power Plant Engineeering, Central Publishing House Allahabad.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1627: **Composite Materials(3)** **Semester: VII**

Rationale: To make the students understand the nature and importance of Composite Materials and to acquaint them with the major aspects of Composite Materials.

Catalog Description: Includes types**,** Macro and Micro mechanical analysis of Lamina and Laminates, Failure Analysis and Design.

Pre-requisites: Basic knowledge of Strength of Material

Course Outline:

(6Lectures)

Unit-I: Introduction
Classifications, terminologies, manufacturing processes.

Unit-II: Macro mechanical analysis of lamina **(12 Lectures)**
Hooke's law for anisotropic, monoclinic, orthotropic, transversely isotropic and isotropic materials– 2D Unidirectional and angle ply lamina – Strength theories of lamina.

Unit-III:Micro mechanical analysis of lamina **(10 Lectures)**
Volume and mass fraction, density and void content – Evaluation of Elastic modulii, Ultimate strength of unidirectional lamina.

Unit-IV:Macromechanical analysis of laminates **(12 Lectures)**
Laminate code, Stress strain relations – Inplane and Flexural modulus, Hygrothermal effects.

Unit-V:Failure Analysis and Design **(10 Lectures)**
Special cases of laminates, symmetric, cross ply, angle ply and antisymmetric laminates, failure criteria and failure modes

Text Book(s):

1.Madhujit Mukhopadhyay ,Mechanics of Composite Materials and Structures, Universities Press.
2.Arthur, K Kaw, Mechanics of Composite Materials, CRC Press.
3. Reddy J N, Mechanics of Laminated Composite Plates, CRC Press

Reference Book(s):

1. Jones, R M, Mechanics of Composite Materials, Scripta Book Co.
2. Agarwal, B D and Broutman, J. D, Analysis and Performance of Fiber Composites, New York, John Willey and Sons.
3. Mallik, P. K, Fiber reinforced composites : materials, manufacturing and design, New York-Marcel and Dekker.
4.Mallik, P. K, Composite Engineering Hand Book, New York, Marcel and Dekker.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1628: **Numerical Heat Transfer and Fluid Flow(3)** **Semester: VII**

Rationale: Numerical Heat Transfer and Fluid flowmainly involves the numerical solution and analysis of governing differential equations of fluid flow and heat transfer systems. The purpose of this course is to develop an introductory understanding of the use numerical technique in the solution of differential equation governing the transport of mass, momentum and energy in fluid flow systems

Catalog Description: Methods of Prediction ,Governing differential Equation, Discretization methodology, Conduction, Convection and diffusion, Pressure-velocity coupling for steady flow.

Pre-requisites: Basics of Engineering Mathematics, Fluid dynamics, Heat and Mass Transfer.

Course Outline:

Unit-I: Introduction **(2 Lectures)**
Introduction to computational fluid dynamics

Unit-II: Governing differential Equation **(10Lectures)**
Meaning of differential equation,Types of Partial Differential Equation: parabolic, elliptic and hyperbolic equations, Continuity equation, Momentum equation, Energy equation, Nature of co-ordinates.

Unit-III: Discretization methodology **(10Lectures)**
Taylor series formulation, variational formulation, method of weighted residuals, Control volume formulation, four basic rules of discretization.

Unit-IV: Conduction problem **(8 Lectures)**
Objective, Steady 1-D conduction, Basic equation, grid spacing, Interface conductivity, Non linearity, Source term linearization, Boundary conditions, Solution of linear algebraic equation using TDMA.
Unsteady 1-D conduction, 2-D and 3-D situations, over relaxation and under relaxation.

Unit-V: Convection and diffusion problem **(10 Lectures)**
Steady 1-D convection and diffusion, Central differencing scheme, upwind scheme, exponential scheme, Hybrid scheme, power law scheme. Properties of discretization scheme- conservativeness, boundedness, transportiveness.
Generalized formulation, 2-D and 3-D situations.

Unit-VI: Pressure-velocity coupling for steady flow **(8 Lectures)**
Introduction, staggered grid, SIMPLE algorithm, SIMPLER algorithm.

Text Book(s):
1. S V Patankar, Numerical Heat Transfer and Fluid Flow ,Hemisphere Publishing Corporation
2. H. K. Versteeg & W. Malalsekera ,An introduction to computational fluid dynamics, the finite volume method, Longman Scientific & Technical

Reference Book(s):

1. J.D.Anderson ,Computational fluid dynamics. The basics with applications , 1st Ed.,TMH,2012
2. Anil Date ,Introduction to Computational Fluid Dynamics, Cambridge University Press.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1668: **Gas Turbine and Compressor(3)** **Semester: VII**

Rationale: Turbo Machines has been an essential subject in engineering curriculum. Study of this subject will enable the st6udents to have details theoretical knowledge mainly on different types of Gas turbine and compressor in design and development in industrial field, as well as pursue further academic achievements through research.

Catalog Description: This module includes the study of basic concepts of turbo machines, geometries of blade and blade rows of different types of turbo machines, cascade mechanics. The study of fan, blowers, axial and centrifugal compressors, Gas turbines, performance of turbo machines is also included in this subject.

Pre-requisites: Basic knowledge of Compressor andGas Turbine

Course Outline:

Unit-I: **(3 Lectures)**
Basic concepts of turbo machines, Classifications.

Unit-II: **(12 Lectures)**
Efficiencies of Compressor, preheat factor of compressor, efficiencies of turbines, reheat factor in turbine, loses in turbo machines, efficiencies of turbo machines. Blade theory, aerofoil sections, drag and lift, blade term logy , cascade nomenclature.

Unit-III: **(10 Lectures)**
Centrifugal compressor, blower, fan, slip factor, stage pressure rise, diffuser, degree of reaction.

Unit-IV: **(12 Lectures)**
Axial flow compressor: Advantages, working principle, velocity triangles for an axial flow compressor. Comparison between centrifugal and axial flow compressor. Surge and stall.

Unit-V: **(14 Lectures)**
Gas Turbine: Basic cycle, types of gas turbines, open and closed cycle, constant pressure and constant volume cycle, combustion chamber, improvement of performance of gas turbine plant, inter cooling, reheating and regenerating, study of jet propulsion and matching of gas turbine components.

Text Book(s):
Ganesan, V., Gas Turbines, 3rd edition, Tata McGraw Hill,2010

Reference Book(s):
1.Sarvanamuttoo, H. I.H., Rogers, G. F. C. and Cohen, H. Gas Turbine Theory, 6th edition, Pearson Prentice Hall,2008.
2. Arasu, A.Valan,Turbo Machines ,2nd edition, Vikas Publishing House,2013

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

ELECTIVE II

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1641: **Convective Heat and Mass Transfer (3)** **Semester: VII**

Rationale: To acquire the ability to handle convective heat and mass transfer problems, to gain a feel for the process of convection

Catalog Description: An introduction to convection, transport properties including a view from molecular level, the governing equations, one dimensional, closed form solution, laminar duct flow, laminar boundary layers, transition to turbulence and fundamentals of turbulence, turbulence boundary layer and turbulent duct flows.

Pre-requisites: Preliminary knowledge of heat and mass transfer

Course Outline:

Unit-I: **(10 Lectures)**
An introduction to convection, introduction of rate equation, transport properties including a view at molecular level, the governing equations, continuity, species mass, momentum, energy and modeling of porous media. One dimensional, closed-form solution, including some phase change.

Unit-II: **(8 Lectures)**
Couete and Poiseulle flows, the Stefan problems-applications. Laminar duct flows, entrance flow, non-circular duct, property effects-applications.

Unit-III: **(12 Lectures)**

Laminar boundary layers, similarity solutions, integral solutions, applications. Transition to turbulence and fundamental of turbulence, including Reynolds average equations.

Unit-IV: **(12 Lectures)**
Turbulent boundary layers, universal profiles, integral solutions, recovery factor, turbulent modeling, and a brief introduction to turbulent measurement method.

Unit-V: **(8 Lectures)**
Turbulent duct flows, fully developed flows, entrance, roughness and curvature, applications.

Text Book(s):
1.Kays, W.M. and Crawford, M.E., Convective heat and mass Transfer, 4th edition,2004

Reference Book(s):
1.L. C. Burmeister, Convective heat and mass transfer, Wiley, 2nd edition,1993

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1642: **Fluidized Bed System (3)** **Semester: VII**

Rationale: To impart the students with the theories of fluidization, heat transfer and design for various applications.

Catalog Description: To introduce the concepts of fluidization and heat transfer in fluidized beds and to understand the design principles and apply the same for industrial applications.

Pre-requisites: Fluid dynamics and heat transfer preliminaries

Course Outline:

Unit-I: Fluidized Bed Behaviour **(12 Lectures)**
Characterization of bed particles – comparison of different methods of gas – solid contacts. Fluidization phenomena – regimes of fluidization – bed pressure drop curve. Two phase and well-mixed theory of fluidization. Particle entrainment and elutriation – unique features of circulating fluidized beds.

Unit II: Heat Transfer **(10 Lectures)**
Different modes of heat transfer in fluidized bed – to wall heat transfer – gas to solid heat transfer – radiant heat transfer – heat transfer to immersed surfaces. Methods for improvement – external heat exchangers – heat transfer and part load operations.

Unit III: Combustion And Gasification **(8 Lectures)**
Fluidized bed combustion and gasification – stages of combustion of particles – performance – start-up methods. Pressurized fluidized beds.

Unit IV: Design Considerations **(10 Lectures)**
Design of distributors – stoichiometric calculations – heat and mass balance – furnace design – design of heating surfaces – gas solid separators.

Unit V: Industrial Applications **(12 Lectures)**
Physical operations like transportation, mixing of fine powders, heat exchange, coating drying and sizing. Cracking and reforming of hydrocarbons, carbonization, combustion and gasification. Sulphur retention and oxides of nitrogen emission Control

Text Book(s):
1.Kunii, D and Levespiel, O., Fluidization Engineering, John Wiley and Son Inc, New York, 1969

Reference Book(s):
1. Howard,J.R.,Fluidized Bed Technology:Principles and Applications,Adam Hilger, NewYork, 1983.
2. Geldart, D., Gas Fluidization Technology, John Willey and Sons, 1986.
3. Howard, J.R. (Ed), Fluidized Beds: Combustion and Applications, Applied Science Publishers, NewYork, 1983.
4 .Botteril, J.S.M., Fluid Bed Heat Transfer, Academic Press, London, 1975.

5. Yates, J.G.Fundamentals of Fluidized bed Chemical Processes, Butterworths, 1983

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1647: **Wind Energy (3)** **Semester: VII**

Rationale: The objective of this course is to prepare the students in deeper theoretical knowledge which will enable them tackle Wind energy in design and developments in industrial field, as well as pursue further academic achievements through research.

Catalogue Description: Origin and nature of wind energy, wind turbines, wind-diesel hybrid system.

Pre-requisites: Basic knowledge of sources of energy

Course Outline:

Unit I:**Introduction** **(7 Lectures)**

The Nature of the Wind , Geographical Variation in the Wind Resource , Long-term Wind-speed Variations, Annual and Seasonal Variations , Synoptic and Diurnal Variations, Turbulence, Gust Wind Speeds , Extreme Wind Speeds , Turbulence in Wakes and Wind Farms, Turbulence in Complex Terrain.

Unit II: **Aerodynamics of Wind Turbine Blades** **(9 Lectures)**
Aerodynamics of Horizontal-axis Wind Turbines, Wind-turbine Performance, Conceptual Design of Horizontal Axis Wind Turbines, Component Design.

Unit III: Wind Measurement. Wind Resource Assessment **(9 Lectures)**

Unit V:**Wind Turbine Generator (WTG) Components** **(7 Lectures)**
Blades, hub, nacelle, Gearbox, generator, brakes, Tower, foundation, control system.

Unit VI: **Basics of Electricity and Generators**. **(7 Lectures)**
Electrical Fundamentals, Electrical Machines, Power Converters and Ancillary Equipment.

Unit VII: **Environmental Impact of Wind Projects** **(5 Lectures)**

Unit VIII: **Financial Modelling of Wind Projects.** **(8 Lectures)**
Engineering Economics Basics, Wind Turbine Cost Analysis. Planning and Execution of Wind Projects.

Text Book(s):

1. Pramod Jain, Wind Energy Engineering, The McGraw-Hill Company, 2010

Reference Book(s):

1. Tony Burton, Nick Jenkins, David Sharpe, Ervin Bossanyi,Wind Energy Handbook, 2nd Edition,,John Wiley, 2011

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1649: **Combustion (3)** **Semester: VII**

Rationale: The objective of the programme is to prepare the students in deeper theoretical knowledge which will enable them to tackle practical combustion problems in design and developments in industrial field, as well as pursue further academic achievements through research.

Catalog Description: Chemical thermodynamics, gas mixture with variable compositions, chemical kinetics, ignition process, flame propagation, droplet combustion.

Pre-requisites: Basic of thermodynamics.

Course Outline:

Unit-I: **(12Lectures)**
Chemical thermodynamics of Isolated system, Adiabatic systems, Closed Open Systems, Simple Systems, Composite system Equilibrium, Variables that define the state of a system.

Unit-II: **(8Lectures)**
Stoichiometry, Adiabatic flame temperatures, Chemical Equilibrium, Equilibrium products of combustion, applications.

Unit-III: **(6Lectures)**
Mass transfer and application of mass transfer in combustion.

Unit-IV: **(11Lectures)**

Chemical kinetics, ignition, flames, Laminar diffusion and premixed flames, droplet evaporation and burning, turbulent flames, burning of solids, coal combustion, emissions.

Unit-V: **(12Lectures)**
Fuels, solid, liquid and gaseous and characteristics, alternate fuels.

Text Book(s):
Stephen R. Turns, An Introduction to Combustion, McGraw Hill Education (India), third edition,2012

Reference Book(s):
1. Irvin Glassman,Richard Yetter, Combustion, September 8, 2008
2. Steve Worland, Combustion,Penguin Australia, 2013, First Edition

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

ELECTIVE III

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1663: **Quality and Reliability Engineering (3)** **Semester: VIII**

Rationale: To make the students understand the nature and importance of Quality & Reliability Engineeringand to acquaint them with the major aspects of production management.

Catalog Description: Includes Management of Product Quality, Creating Quality by Design, Total Quality Management, Process Control, Quality Management Systems, Strategic Tools and Techniques for TQM, Reliability, Case Studies.

Pre-requisites: None

Course Outline:

Unit-I: Management of Product Quality **(4 Lectures)**
Evolution of quality control, Changing Quality Concepts, Modern Concepts of Total Quality Management, Quality Masters (Deming, Juran, Crosby, Ishikawa, Taguchi)

Unit-II:Creating Quality by Design **(4 Lectures)**
Assessment of Customer's Needs, Formulation of Design Specifications, Standardization, Costs of Quality, Quality Circles, 5-S Concept.

Unit-III: Total Quality Management **(5 Lectures)**
Concept of Total Quality, Difference between Quality Management and Total Quality Management, Total Quality Maintenance, Total Quality in Service Sector, Role of Customer and People in Total Quality Management, Steps for Quality Improvement, Kaizen, Organizing for Effective Quality Management.

Unit-IV: Process Control **(5 Lectures)**
Control Charts, Statistical Quality Control Tools, Statistical Process Control and Process Capability, Zero Defect Programme, Six Sigma Approach.

Unit-V:Quality Management Systems **(3 Lectures)**
ISO 9000 Series of Standard, ISO 14000 Series of Standards.

Unit-VI. Strategic Tools and Techniques for TQM **(5 Lectures)**
Needs for Tools and Techniques in TQM. Commonly used Tools for TQM.Approaches and Deployment of Tools for Quality Planning- Quality Function Deployment(QFD), Concurrent Engineering, Failure Mode and Evaluation Analysis (FMEA), Fault Free Analysis. Tools for Continous Improvement- Deming's Plan- Do-Check-Act (PDCA) cycle, Poka-Yoke (Mistake-Proofing), Taguchi's Quality Loss Function.

Unit-VII Reliability **(6 Lectures)**
Concept of Reliability, Definition of reliability, Design for Reliability. Reliability and Failure, Type of Failure, Failure Patterns. Measurement of Reliability, System Reliability.

Unit-VIII. Case Studies **(4 Lectures)**

Text Book(s):

1.H Lai, Total Quality Management- A Practical Appraoch, New Age International (P) Ltd (Publishers
2.Dr. S.K Mondal, Total Quality Management Principle and Practice, Vikas Publication House Pvt. Ltd.
3. AV Feigenbum, Total Quality Control, McGraw Hill Book Company.

Reference Book(s):

1. Juran's Quality Control Handbook, McGraw Hill Book Company
2. Amitava Mitra- Qulaity Control and Improvement, Pearson.
3. Grant and Leavanworth, Statistical Quality Control, 7th Ed., TATA McGraw HILL
4. E Balaguru Swamy, Reliability Engineering

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1669: **Design of Heat Transfer Equipment (3)** **Semester: VIII**

Rationale: The objective of the programme is to prepare the students in deeper theoretical knowledge which will enable them to tackle practical heat and mass transfer problems in design and developments in industrial field, as well as pursue further academic achievements through research.

Catalog Description: Introduction, Various Methods of Classification of Heat Exchangers, LMTD and NTU Methods of HeatExchangers, Counter flow double pipe (Hair-Pin) heat exchangers, shell and tube heat exchangers, boilers,condensers, cooling towers.

Pre-requisites: Basic of Heat and mass transfer

Course Outline:

Unit-I: (8 **Lectures**)

Classification of Heat Exchangers, overall heat transfer coefficient, uses of LMTD, parallel flow heat exchanger, the counter flow heat exchangers, special operating condition.

Unit-II: (14 **Lectures**)

Heat exchanger analysis, the effectiveness-NTU method, effectiveness –NTU relations, heat exchanger design and performance calculations, use of effectiveness-NTU method, Compact heat exchangers. LMTD method for multipass and cross flow heat exchangers.

Unit-III: (15 **Lectures**)

Boiling heat transfer, Regime of boiling, Nucleate boiling, correlations of boiling heat transfer data, forced convection boiling. Dimensionless parameter in boiling and condensation, condensation heat transfer, drop wise condensation, laminar film condensation on a vertical plate, condensation on horizontal tube, condensation number, turbulent film condensation. Cooling towers.

Text Book(s):

1. Incropera, F. P. and De Witt, D. P., Fundamentals of Heat and Mass Transfer, 6th Edition, Wiley India,2010.
2. Kern, D. Q., Process Heat Transfer,Tata McGraw Hill, New Delhi, 2001.

Reference Book(s):

1.Nag , P. K.,Heat Transfer,1st Edition, Tata McGraw Hill, New Delhi, 2012.
2. Kays, W. M. and London, A. K.,Compact Heat Exchangers,3rd Edition, Krieger Publishing Company,1998.
3. Detlev Kroger,,Air-cooled Heat Exchangers And Cooling Towers: Thermal-flower Performance Evaluation And Design, Vol. 2 **,**Pennwell Corp (July 30, 2004)

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1672: **Materials Handling System (3)** **Semester: VIII**

Rationale: The objectives of this course are for students to understand the underlying mechanisms of material handling techniques and how they can be effectively and efficiently used to support facility objectives.

Catalog Description: The course covers the basic principles of Materials Handling, types of materials Handling systems and its application to real situations.

Pre-requisites: Basics of Material science.

Course Outline:

Unit-I: **(8 Lectures)**
Definition of material handling; Classification of materials, bulk load, unit load, their characteristics. Classification of mechanical handling equipments; different types of elevators and lowerers for handling materials in bulk and for unit loads and their working principles and estimation of handling capacity.

Unit-II: **(10 Lectures)**
Belt conveyor; Picking belts, their construction, capacity and power requirements; other conveyors like apron, steel plate and slat conveyors; flight and screw conveyors; vibrating and oscillating trough conveyors- estimation of their handling capacity and power requirement.

Unit-III: **(10 Lectures)**
Automatic feeding devices for elevators and conveyors. Gravity chutes and gravity roller runways, humper, stacker and gadget; live rollers; pneumatic and hydraulic methods of conveying; endless rope and chain haulage; Aerial ropeways, monorails, telphers and blast furnace hoists.

Unit-IV: **(8 Lectures)**
Loading/ unloading and operation of railway wagons, motor trucks and fork lift trucks. Wire ropes, pulley blocks, crab winch, grabs and lifting magnets; different types of cranes. Definition and types of robots- basic concept, working principle and application of robotics; manipulators.

Text Book(s):
1. Siddharta Ray,Introduction to Materials Handling,New Age International publication, 1st Ed.,2010
2. Dr. K. C. Arora&Vikas V. Shinde, Aspects of Material Handling, Laxmi Publication, 1st Ed.,2007

Reference Book(s):
1. Theodore H Allegri ,Materials Handling: Principles and Practice, 1st Ed., CBS publication, 2006
2. Apple, J.M -- Material Handling System Design, John Wiley & Sons
3. Allegri,T.H. Materials Handling: Principles and Practice, CBS Publishers & Distributors, N.Delhi
4. Immer- Materials Handling , J.R, McGraw Hills
5. Spivakovsky,A and Dyachkov,V- Conveyors and Related Equipment, Peace Publishers, Moscow
6. Alexandrov,M.P- Materials Handling Equipment, Part-I and II, Mir Publishers, Moscow

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

The Assam Kaziranga University,
School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1639: **Solar Energy (3)** **Semester: VIII**

Rationale: The objective of this course is to prepare the students in deeper theoretical knowledge which will enable them tackle Solar energy in design and developments in industrial field, as well as pursue further academic achievements through research.

Catalog Description: Solar energy, basic sun-earth relationships, coordinates of the sun, solarradiation measurement and prediction,, solar thermal devices, photovoltaic power.

Pre-requisites: Basic knowledge of sources of energy

Course Outline:

Unit-I: **(8 Lectures)**
Sun as a source of energy. Sun earth radiation spectrums. Spectral energy distribution of solar radiation. Measurement of solar radiation. Empirical equations for estimating solar radiation availability.

Unit-II: **(10 Lectures)**
Solar collectors, comparison of concentrating and non-concentrating types of solar collectors. Effect of various parameters and performances.

Unit-III: **(10 Lectures)**
Solar water heaters, Liquid flat plate collectors, solar air heaters, solar refrigeration and air conditioning systems, solar cooker, solar furnaces, solar greenhouse, solar dryer, solar distillation, solar thermo-mechanical systems. Thermal energy storage.

Unit-IV: **(10 Lectures)**

Solar cell fundamentals, classification of solar PV systems. Wind energy, energy estimation of wind, power extraction from wind, classification and description of wind machines.

Text Book(s):
Sukhatme, S.P. and Nayak, J.K., Solar Energy - Principles of Thermal Collection and Storage,Tata McGraw Hill, New Delhi, 2008

Reference Book(s):
Duffie, J.A. and Beckman, W.A., Solar Energy-Thermal Processes,John Wiley, 2001

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

Koraikhowa, Jorhat, Assam-785006

ET1678: **Advanced Manufacturing Technology (3)** **Semester: VIII**

Rationale:

· To impart the concepts of various Unconventional Material Removal Processes.
· To develop understanding about modern techniques used for machining.

Catalog Description: Includes Classification of Non-traditional machining processes, need for Non-traditional Machining processes and various process parameters and their influence on performance and their applications.

Pre-requisites: Basic knowledge of Material Science, Manufacturing Technology I and Manufacturing Technology II.

Course Outline:

Unit-I: **(4 Lectures)**

Introduction: Introduction to Advanced Manufacturing Technology, Need for Non-traditional machining processes, Its advantage over conventional machines and Classification of Non-traditional machining processes.

Unit-II: **(10 Lectures)**

Mechanical Processes: Abrasive Jet Machining (AJM), Ultrasonic Machining (USM), Water Jet Machining (WJM) and Abrasive Water Jet Machining (AWJM) [Principle, equipment's, types and applications]

Unit-III: **(8 Lectures)**

Electrochemical Processes: Electrochemical Machining (ECM), Electrochemical Grinding (ECG) and Electro Jet Drilling (EJT) [Principle, equipment's, types and applications]

Unit-IV: **(8 Lectures)**

Electro-Thermal Processes: Electro Discharge Machining (EDM), Laser Beam Machining (LBM) and Electron Beam Machining (EBM) [Principle, equipment's, types and applications]

Unit-V: **(6 Lectures)**

Chemical Processes: Chemical Machining (CHM) and Photochemical Milling (PCM) [Principle, equipment's, types and applications]

Unit-VI: **(4 Lectures)**

Additive Manufacturing: Introduction to additive manufacturing and its application in manufacturing.

Text book(s):

1. Rahul Jain, Unconventional manufacturing processes, 2nd Ed., KATSON books.
2. P N Rao, Manufacturing Technology, 4th Ed., McGraw Hill.

Reference Book(s):

1. Amitabha Ghosh and Asok Malik, Manufacturing Science, 2nd Ed, Pearson publishers.

2. P C Sharma, Production Technology, 2nd Ed, S Chand publishers.

Journal(s):

E-Resource(s): NPTEL

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

ELECTIVE IV

School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1673:Heating, Ventilation and Air-conditioning Design (3) **Semester: VIII**

Rationale:
To impart knowledge on principles of refrigeration, cooling and heating load calculation, design of air conditioning system and selected systems in comfort engineering

Catalog Description: IncludesPrinciples of refrigeration and psychrometry, Cooling and heating load calculation, Design of air conditioning system, Heating systems-warm air systems

Pre-requisites: Basics of thermodynamics, fluid mechanics, and heat transfer

Course Outline:

Unit-I: **(10Lectures)**
Principles of Refrigeration andPsychrometry. Psychrometric properties and processes. Airconditioning systems and its applications – Psychrometric chart- various process-sensible cooling and heating- adeabate saturation- use & Absorbent or Adsorbent - Heating and Humidification - cooling and Dehumidification - mixing of air streams - use of psychrometric chart for air conditioning - various process - S.H.F, G..S.H.F, E.S.H.F Etc.

Unit-II: **(9Lectures)**
Cooling and heating load calculation - selection of design temperatures - sources of heat load- heat transfer through structures - solar radiation - Infiltration and ventilation- Heat generation inside theconditioned space - heat storage, Diversity and stratification.

Unit-III:(8 Lectures)
Design of air conditioning system. Continuity equation, Bernoulli's equation, pressure losses, Duct design- pressure drop in ducts, pressure drop by graphical method- method of duct design- Arrangements of ducts, fan – design, thermal insulation

Unit-IV: **(12Lectures)**
Heating systems-warm air systems-hot water systems steam heating systems-panel and central heating systems-heat pump circuit. Applications- comfort air conditioning-effective temperature- thermal analysis of human body- Air conditioning systems- evaporate cooling- low humidity applications Automobile and Train car air conditioning.

Text book(s):
1. C. P. Arora, Refrigeration and Air Conditioning, TMH.
2. Air conditioning' PITA, 4th edition, pearson-2005

Reference Book(s):
1. Carriers Handbook system design of Air Conditioning
2. McQuistion, Heating, Ventilation and Air Conditioning', Wiley Students Edition, 5th Ed., 2000.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

Koraikhowa, Jorhat, Assam-785006

ET 1674: **Mechatronics (3)** **Semester: VIII**

Rationale: Mechatronics is a combination of mechanical, electronic, control and system engineering. Mechatronics responds to industry's increasing demand for engineers who can work across the boundaries of engineering disciplines. This course is aimed at imparting basic concepts of Mechatronics and its application.

Catalog Description: Includes Transducers And Sensors, Elements Of CNC Machines, Electrical And Hydraulic Actuators, Signal Conditioning.

Pre-requisites: Basic electronics , electrical and hydraulic machinery

Course Outline:

Unit-I: Introduction **(6 Lectures)**

Definition of Mechatronics, Multi-disciplinary scenario, origins. Evaluation of Mechatronics, an over view of mechatronics. Design of mechatronics system. Measurement system and function of main elements of measurement systems. Need for mechatronics in industries.

Objectives, advantages and disadvantages of mechatronics. Microprocessor based controllers. Principle of working of automatic camera, engine management system, automatic washing machine.

Review Of Transducers And Sensors: Definition and classification of transducers. Definition and classification of sensors. Principle of working and applications of light sensors, proximity sensorsand Hall effect sensors.

Unit-II:Elements Of CNC Machines **(10 Lectures)**

Structure, guide ways – Friction, Autifriction and Frictionless guide ways, Merits and demerits. Drives – Recirculating ball screw and nut. Advantages and disadvantages over conventional screw and nut. Concept of stick-slip phenomenon, Concept of preloading of ball nuts. Roller screw-planetary roller screw recirculation roller screw. Spindle and spindle bearings in machine tool. Various types of loadsencountered by spindle and spindle bearing. Types of bearings – friction, antifriction and frictionless bearing. Merits and demerits of each. Selection of spindle and spindle bearing, preloading of bearings, different method of preloading in detail.

Unit-III: Electrical Actuators **(9 Lectures)**

Actuator and actuator system. Classifictions of actuator system with examples. Mechanical switches, Concept of bouncing Methods of Preventing bouncing of mechanical switches. Solenoids, Relays. Solid state switches – Diodes, Thyristors, Triacs, Transistors, Darlington pair. Electrical actuator. Principle, construction and working of AC, DC motors, stepper motors, permanent magnet motors, servomotors, Servo systems and control.

Unit-IV: Hydraulic Actuators **(9 Lectures)**

Valves, Classification, Pressure Control valves-Pressure relief valves, Pressure regulating/reducing

valves, Pressure sequence valve. Flow control valves – principle, needle valve, globe valve. Direction control valve-sliding spool valve, solenoid operated. Symbols of hydraulic elements. Hydraulic cylinders – constructional features, classification and applications. Hydraulic motors – Types, vane motors and piston

Unit-V: Signal Conditioning **(6 Lectures)**

Concept, necessity, op-amps, protection, filtering, wheat stone bridge digital signals- Multiplexer. Data acquisition-Introduction to digital signal processing-Concepts and different methods.

Text book(s):

1.W.Bolton, Longman ,Mechatronics, , 2Ed, Pearson Publications,.
2. HMT ltd. Mechatronics, Tata Mcgraw-Hill, New Delhi

Reference Book(s):

1. G.W. Kurtz, J.K. Schueller, P.W. Claar . II, Machine design for mobile and industrial applications, SAE.
2. T.O. Boucher, Computer automation in manufacturing - an Introduction, Chappman and Hall.
3. Mechatronics, Intl. J. published by Pergamon Press

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET 1675: **Automobile Engineering (3)** **Semester: VIII**

Rationale:
· To impart the concepts of automobile engineering.
· To develop understanding about various automobile components.

Catalog Description: Includes Classification of vehicles, fuel supply systems, Cooling system, Lubrication, Electrical, Chassis systems, Transmission systems, Suspension and steering system.

Pre-requisites: Basic knowledge of Internal Combustion Engine.

Course Outline:

Unit-I: **(7Lectures)**
Introduction: Classification of vehicles – different options of prime movers, transmission and arrangements.
Engine: classifications - number of strokes, cylinders, types of combustion chambers for petrol and diesel engines, valves and its arrangements, operating mechanisms of valves, piston - design basis, types, piston rings, firing order, fly wheel.

Unit-II: **(8 Lectures)**
Petrol and diesel engines' fuel supply systemsfor, fuel pumps - mechanical and electrical diaphragm pumps, air and fuel filters, carburettors, fuel injection systems for diesel and petrol engines, electronic fuel injection, super chargers, mufflers.

Unit-III: **(8 Lectures)**
Cooling system of I.C. engines:-Necessity, methods of cooling, air cooling, water cooling, components of water cooling systems.
Lubrication systems:-Objective of lubrication, requirements of lubricant, types of lubricant, various systems of engine lubrication.
Electrical systems:-Ignition system, distributor, electronic ignition, magneto, dynamo, alternator, regulator, starting motor, introduction to various accessories, typical wiring diagram.

Unit-IV: **(10Lectures)**
Chassis systems: Introduction of chassis and its classification, conventional construction, frameless construction, introduction to vehicle dimensions.
Transmission systems: single plate clutch introduction, wet and dry type, clutch actuating mechanisms, study of clutch components, fluid fly wheel. Gear box - Theory, four speed and five speed sliding mesh, constant mesh and synchromesh type, selector mechanism, automatic transmission, overdrive, transfer box four wheel drive, torque converter, propeller shaft.

Unit-V: **(7 Lectures)**
Suspension and steering system:
Suspension: Systems, springs, shock absorbers, axles - front and rear, different methods of floating rear axle, front axle and wheel alignment, types of rims and tyres.
Steering mechanisms, types of brakes and brake actuation mechanisms.

Text book(s):

1. Joseph Heitner ,Automotive Mechanics, 2nd Ed., East-West student edition.
2. Kripal Singh, Automobile Engineering, 12th Ed., Standard publisher distributors.

Reference Book(s):

1. Steed and Garrette ,Motor Vehicle by Newton, , 2nd ed., Butterworth.
2. Crouse ,Automotive Mechanics, McGrawhill.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%
End Semester Exam: 70%

Academic Council Approval:

School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1676: **Energy Conservation and Waste Heat Recovery System (3)** **Semester: VIII**

Rational: The objective of this course is to provide insights in how thermodynamic principles are applied within heat energy conservation and waste heat recovery system.

Catalog Description: Energy resources and its use, Coupled cycles and combined plants, Exergy analysis

Pre-requisites: Coupled cycles and combined plants, Exergy analysis, Gas-to-gas, gas-to-liquid heat recovery systems, Utilization of low grade reject heat from power plants, Gas-to-gas, gas-to-liquid heat recovery systems, Heat pipes and Utilization of low grade reject heat from power plants

Course Outline:

Unit-I: **(3 Lectures)**
Energy resources and its use. Potential for energy conservation. Optimal utilization of fossil fuels.

Unit-II: **(5 Lectures)**
Coupled cycles and combined plants. Cogeneration systems.

Unit-III: **(7 Lectures)**
Exergy analysis. Utilization of industrial waste heat. Properties of exhaust gas.

Unit-IV: **(8 Lectures)**
Gas-to-gas, gas-to-liquid heat recovery systems. Recuperators and regenerators. Shell and tube heat exchangers. Spiral tube and plate heat exchangers. Waste heat boilers: various types and design aspects.

Unit-V: **(9 Lectures)**
Heat pipes: theory and applications in waste heat recovery. Prime movers: sources and uses of waste heat. Fluidized bed heat recovery systems. Utilization of waste heat in refrigeration, heating, ventilation and air conditioning systems. Thermoelectric system to recover waste heat. Heat pump for energy recovery. Heat recovery from incineration plants.

Unit-VI: **(6 Lectures)**
Utilization of low grade reject heat from power plants. Need for energy storage: Thermal, electrical, magnetic and chemical storage systems. Thermo-economic optimization.

Text book(s):

1. J. H. Harlock, Combined Heat and Power, Pergaman Press.
2. F. Kreith and R. E. West, Energy Efficiency, CRC handbook, CRC Press.

Reference Book(s):

1.Kays and London, Compact Heat Exchangers, 3rd edition, McGraw-Hill, New York.

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

Internal Evaluation: 30%

End Semester Exam: 70%

Academic Council Approval:

School of Engineering & Technology
Koraikhowa, Jorhat, Assam-785006

ET1671: **Major Project (8)** **Semester:VIII**

Rationale: Techniques to handle and manage the fundamentals and concepts studied in theories have to be converted and utilized in practical knowledge so that the confidence in understanding is enhanced.

Catalog Description: Theoretical aspects will be applied in real practical field in order tofamiliarize and experience the handling and management of real problems exists thereafter constitutes to the development of new strategic solutions and further knowledge.

Pre-requisites: Minor Project

Course Outline:

The Major Project of the project shall consist of

1. Experimental design/set-up
2. Experimental work/studies
3. Report Writing
4. Evaluation of project report by the internal /external guides

The project work started in the seventh semester will continue in this semester. The students should complete the project work in this semester and present it to the assessing committee (as constituted in the seventh semester). The performance of the students in the project work shall be assessed on a continuous basis by the project evaluation committee through 'progress seminars' and demonstrations conducted during the semester. Each project group should maintain a log book of activities of the project. It should have entries related to the work done, problems faced, solution evolved etc.

There shall be at least an Interim Evaluation and a final evaluation of the project in the 8th semester. Each project group has to submit an interim report in the prescribed format for the interim evaluation. Each student is expected to prepare a report in the prescribed format, for final evaluations based on the project work. Members of the project group will present the relevance, design, implementation, and results of the project to the project evaluation committee.

Each group will submit the copies of the completed project report signed by the guide to the department. The head of the department will certify the copies and return them to the students. One copy will be kept in the departmental library and one by the respective guide.

The assessment committee and project guides will award the marks for the individual students in a project as follows: 50% of the mark is to be awarded by the guide and 50% by the evaluation committee.

Text Book(s):

Reference Book(s):

Journal(s):

E-Resource(s):

Grading System: The final grade shall be based on the following :-

40% - Experimental
30% - Presentation & demonstration of results
20% - Report
10% - Regularity in the class

Academic Council Approval: