ASSAM SCIENCE AND TECHNOLOGY UNIVERSITY

Guwahati

Course Structure and Syllabus

(From Academic Session 2018-19 onwards)

B.Tech 2nd Semester (Group A)

For the branches:
- **Civil Engineering (CE)**
- **Mechanical Engineering (ME)**
- **Chemical Engineering (ChE)**
- **Industrial and Production Engineering (IPE)**

NOTE: **Four weeks Mandatory Internship need to be done in 2nd semester break (summer break) as per the AICTE mandate**

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Course Structure and Syllabus
(From Academic Session 2018-19 onwards)

B.Tech 2nd Semester (Group A)

Semester II/ B.TECH

NOTE: Four-weeks mandatory Internship need to be done in the 2nd semester break and the report is to be submitted and evaluated in 3rd semester as per the AICTE mandate

Sl. No.	Sub-Code	Subject	Hours per Week			Credits
			L	**T**	**P**	**C**
Theory						
1	PH181201	Physics-201	3	1	0	4
2	MA181202	Mathematics-II	3	1	0	4
3	CE181103	Engineering Graphics and Design	1	0	4	3
4	ME181104	Engineering Mechanics	3	0	0	3
5	HS181105	Sociology	2	0	0	2
Practical						
1	PH181211	Physics-201 Lab	0	0	2	1
2	ME181114	Engineering Mechanics Lab	0	0	2	1
3	ME181216	Workshop	0	0	4	2
		TOTAL	12	2	12	**20**
Total Contact Hours per week : 26						
Total Credits: 20						

Course Code	Course Title	Hours per week L-T-P	Credit C
PH181201	**Physics-201**	**3-1-0**	**4**

MODULE 1: Mechanics (17 Lectures)

Conservative & non-conservative forces, Central forces, Conservation of angular momentum, Non-inertial frames of reference; Rotating co-ordinate system- Centripetal and Coriolis acceleration. **(6 Lectures)**

Harmonic Oscillator, damped harmonic motion – over-damped, critically damped and under damped oscillators; forced oscillation and resonance. **(5 Lectures)**

Elasticity, Hooke's law, factors affecting elasticity, Poisson's ratio, Relations in elasticity, twisting couple on a wire, bending of beams with symmetric cross-section, Cantilever. **(6 Lectures)**

MODULE 2: Fluid Mechanics (5 Lectures)

Bernoulli's Theorem and its important applications, Viscosity, Co-efficient of Viscosity, Streamline and Turbulent flow, Reynolds Number, Critical velocity, Poiseuille's equation for flow of liquid through a tube, Motion of a Rigid body in a viscous medium, Rotational viscometer.

MODULE 3: Acoustics (6 Lectures)

Decibel level of sound, Weber–Fetchner law, Reverberation & Reverberation time, Sabine's formula for reverberation time (Derivation not required), Absorption co-efficient, Factors affecting acoustics of buildings and their remedies, Acoustic design of a hall.
Production and properties of ultrasonic waves, Applications of Ultrasonic.

MODULE 4: Optics (3 Lectures)

Aberration in lenses, Spherical and Chromatic Aberration, Method of minimization of Spherical and Chromatic Aberration.

MODULE 5: Nanomaterials and Advanced materials (7 Lectures)

Introduction to Nanomaterials, Properties of Nanomaterials, Potential Well and Quantum Confinement (qualitative), Types of Nanomaterials and their applications. **(4 Lectures)**

Advanced materials: Shape memory alloys and Biomaterials. **(3 Lectures)**

<u>Note:</u> The syllabus of Physics PH181201 for Group A is designed as per the AICTE directives to teach different topics of Physics to different branches of Engineering to cater to their specific needs. However, in order to give the students a complete essence of Physics, the following topics may be taught in brief (maximum 4 hours) in tutorial classes, or may be encouraged to learn these topics by using online resources e.g. NPTEL lectures etc. and

assignments may be given to ensure their learning. These topics, however, are not to be included in end semester examinations:

- Principle of production of LASER beams (Qualitative only), properties and uses of LASER beams;
- Classification of magnetic materials (qualitative only) and their properties;
- Definition of Electric Dipole, Dipole moment and Dielectric constant.

Text Books:

1. Engineering Physics – V. Rajendran (Tata McGraw Hill education Pvt. Limited)
2. Engineering Physics – D.K. Bhattacharya and Poonam Tandon (Oxford University Press)

Reference Books:

1. Elements of Properties Matter – D.S. Mathur (S. Chand and Company Pvt. Limited)
2. Applied Physics for Engineers – Neeraj Mehta (PHI Learning Pvt. Limited)

Course Outcomes: After successful completion of the course, the students will be able to:

CO1: Apply the fundamentals of mechanics to solve simple Engineering problems.

CO2: Explain the basic principles of Fluid Mechanics along with their applications.

CO3: Apply the principles of Acoustics to solve related simple Engineering problems.

CO4: Explain the different types of aberration in lenses along with their minimization.

CO5: Explain the fundamentals of nanomaterials and advanced materials.

Course Code	Course Title	Hours per week L-T-P	Credit C
MA181202	Mathematics-II	3-1-0	4

CALCULUS, ORDINARY DIFFERENTIAL EQUATIONS AND COMPLEX VARIABLE

MODULE 1: Vector Calculus (10 lectures)

Differentiation of vectors, Gradient, Divergence and Curl, Directional Derivatives, Line, Surface and volume Integrals; Green, Gauss and Stokes Theorems (without proof) and their applications.

MODULE 2: First order ordinary differential equations (6 lectures)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

MODULE 3: Ordinary differential equations of higher orders (10 lectures)

Second order linear differential equations with constant co-efficients, Power series solutions: Legendre Polynomials, Bessel functions of first kind and their properties.

MODULE 4: Complex Variable – Differentiation: (6 lectures)

Differentiation, Analytic functions, Cauchy-Riemann equations, Harmonic functions, Finding harmonic conjugate; Elementary analytic functions (exponential, trigonometric, logarithm) and their properties; Conformal mappings, Mobius transformations and their properties.

MODULE 5: Complex Variable – Integration: (8 lectures)

Contour integrals, Cauchy-Goursat theorem (without proof), Cauchy Integral formula (without proof), Liouville's theorem and Maximum-Modulus theorem (without proof); Taylor's series, zeros of analytic functions, singularities, Laurent's series; Residues, Cauchy Residue theorem (without proof), Evaluation of definite integral involving sine and cosine, Evaluation of certain improper integrals using the Bromwich contour.

Suggested Text/Reference Books

1. G.B. Thomas and R.L. Finney, Calculus and Analytic geometry, 9th Edition, Pearson, Reprint, 2002.
2. Erwin kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
3. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edn., Wiley India, 2009.
4. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.

5. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
6. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
7. J. W. Brown and R. V. Churchill, Complex Variables and Applications, 7th Ed., Mc-Graw Hill, 2004.
8. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2008.
9. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 36th Edition, 2010.

Course Outcomes: After successful completion of the course, the students will be able to:

CO1: Apply techniques for evaluating multiple integrals, ordinary and partial differentiation equations and that of complex variables to deal with varied Engineering problems.

CO2: Make use of advanced level of Mathematics as tools for solving problems related to modelling of physical processes.

Course Code	Course Title	Hours per week L-T-P	Credit C
CE181103	**Engineering Graphics and Design**	1-0-4	3

MODULE 1: Introduction to Engineering Drawing (8 Lectures)

  i. Principles of Engineering Graphics and their significance, usage of Drawing instruments.
  ii. Lettering: Single stroke letter – Vertical and inclined capital and small letter,
  iii.Scales: Plain scale and Vernier scale.
  iv.Curves: Conic sections – Ellipse, parabola, hyperbola, different methods of construction of conic sections, tangents and normal to conics.

MODULE 2: Orthographic Projections (14 Lectures)

  i. Principles of Orthographic Projections- Conventions
  ii. Projection of points: Introduction of projection, quadrants, 1st, 2nd, 3rd and 4th angle projection of points.
  iii. Projection of lines (First angle only): Line parallel to one or both planes, line perpendicular to a plane, line inclined to one plane and parallel to other, line inclined to both plane.
  iv. Projections of planes (First angle only): Plane perpendicular to one plane and parallel to other, plane perpendicular to both plane, plane inclined to one plane and perpendicular to other.
  v. Projection of solids (First angle only): Axis perpendicular to one plane and parallel to other, axis parallel to both plane, axis inclined to one plane and parallel to other, axis inclined to both plane.

MODULE 3: Sections and Sectional Views of Right Angular Solids (4 Lectures)

Section of solids: Section plane parallel to one plane and perpendicular to other, section plane inclined to one plane and perpendicular to other.

MODULE 4: Isometric Projections (4 Lectures)

Principles of Isometric projection – Isometric Scale, Isometric Views, Conventions; Isometric Views of lines, Planes, Simple and compound Solids; Conversion of Isometric Views to Orthographic Views and Vice-versa, Conventions.

MODULE 5: Introduction of Computer Graphics (6 Lectures)

Demonstrating knowledge of the theory of CAD software such as: The Menu System, Toolbars (Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, Crosshairs, Coordinate System), Dialog boxes and windows, Shortcut menus (Button Bars), The Command Line (where applicable), The Status Bar, Different methods of zoom as used in CAD, Select and erase objects.; applying dimensions to objects, applying annotations to drawings; Setting up and use of Layers, layers to create drawings, Create, edit and use customized layers; Changing line lengths through modifying existing lines

(extend/lengthen). Drawing simple shapes such as circle, parabola, etc. Drawing geometric solids; Drawing annotation, solid, surface, and wireframe models.

MODULE 6: Demonstration of simple team design (Students Project as group work) (4 Lectures)

Creation of engineering models and their presentation in standard 2D blueprint form, 3D wire-frame and shaded solids; meshed topologies for engineering analysis. Drawing of floor plans, front elevation and sectional elevation showing floor level to ceiling of a simple two storied building with doors and windows.

<u>NOTE</u>:
1. **Assessment of student based on above syllabus comprises of three parts**
   a. Theory examination covering Module 1 to Module 4
   b. Practical Examination covering Module 5
   c. Project covering Module 6

<u>Text/Reference Books</u>:

1. Bhat, N.D.& M. Panchal (2008), Engineering Drawing, Charotar Publishing House
2. Shah, M.B. & B.C. Rana (2008), Engineering Drawing and Computer Graphics, Pearson Education
3. Dhawan, R.K. (2007), A Text Book of Engineering Drawing, S. Chand Publications
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.
5. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
6. User manual of CAD software.

Course Outcome: After successful completion of the course, the students will be able to:

CO1: Explain the basic principles of Engineering Graphics.

CO2: Apply the principles of orthographic and isometric problems to represent simple Engineering objects.

CO3: Apply the principle of sectioning to represent different views of Right Angular Solids.

CO4: Create simple shapes like Circle, parabola, geometric solids etc. using CAD software.

CO5: Demonstrate team work spirit through creation of Engineering models and their presentations.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181104	**Engineering Mechanics**	**3-0-0**	**3**

MODULE 1: Equilibrium of Rigid Bodies (6 Lectures)

Introduction, Free body diagram (FBD), Types of supports and their reactions, System of forces, Resultant of coplanar concurrent forces and non-concurrent force systems, Conditions of equilibrium, (i) concurrent forces in space (ii) non-concurrent forces in space.

MODULE 2: Analysis of Structures (3 Lectures)

Method of joint, method of sections, graphical methods.

MODULE 3: Friction (3 Lectures)

Introduction, laws of Coulombs friction, equilibrium of bodies involving dry friction; inclined plane, ladder friction, wedge friction.

MODULE 4: Centre of Gravity and Moment of Inertia (6 Lectures)

(i) Centre of gravity and centroid; location of centroid and centre of gravity (ii) Moment of inertia of plane area, Parallel axis theorem, perpendicular axis theorem, mass moment of inertia, polar moment of inertia, radius of gyration, product of inertia, M.I. of simple and composite bodies.

MODULE 5: Lifting Machines (4 Lectures)

Introduction, Principles of machines, reversibility of machines, lever, pulley, simple wheel and axle.

MODULE 6: Virtual Work and Energy Method (4 Lectures)

Introduction, virtual displacement, principle of virtual work, application of virtual work.

MODULE 7: Impulse, Momentum, Work and Energy (4 Lectures)

Linear impulse and momentum, Principle of work-energy conservation.

Text Books:

1. Engineering Mechanics by IH Shames, PHI.
2. Engineering Mechanics, Mariam and Craig, Wiley.

Reference Books:

1. Engineering Mechanics by S. Timoshenko and D.H. Young, McGraw Hill Int.
2. Engineering Mechanics by R.K. Banshal, Laxmi Publication (P) Ltd.
3. Engineering Mechanics by K.L. Kumar, McGraw Publishing Co.
4. Engineering Mechanics by Hibbler.

5. Engineering Mechanics by D.P Sharma, Pearson.
6. Engineering Mechanics Statics and Dynamics by A Nelson, McGraw Hill.
7. Engineering Mechanics by S.S. Bhavikatti, New Age International Publishers.

Course Outcome: After successful completion of the course, the students will be able to:

CO1: Explain the construction of Free Body Diagrams of rigid bodies in equilibrium, subjected to coplanar concurrent and non-concurrent forces.

CO2: Analyse structures by the method of joints, sections and graphically.

CO3: Apply the concepts of C.G. and M.I. to find the C.G. and M.I. of simple and composite bodies.

CO4: Explain the working principle of Lifting Machines.

CO5: Apply the principle of Virtual work and Work-Energy Conservation to solve simple Engineering problems.

Course Code	Course Title	Hours per week L-T-P	Credit C
HS181105	Sociology	2-0-0	2

MODULE 1: Understanding of Sociology (5 Lectures)

Introduction to sociology: Meaning and definition of sociology, nature and scope of sociology, significance of sociology; understanding of society and social institutions: family, community, group, culture and civilization, marriage, family, religion.

MODULE 2: Gender and Society (4 Lectures)

Concept of gender, differences between sex and gender, changing gender roles in society, gender equality and inequality, gender and poverty, gender discrimination.

MODULE 3: Social Change (5 Lectures)

Meaning and definition of social change, nature and characteristics of social change, modernization, industrialization, information and technology. Social disorganization and social problems (over population, poverty, unemployment, corruption and black money.

MODULE 4: Industrial Disputes (5 Lectures)

Meaning and definition of industrial disputes, causes and methods of settlement of industrial disputes. Trade union- definition of trade union, functions of trade union, problems of trade union in India. Indian factories Act, 1948.

MODULE 5: Human Resources (5 Lectures)

Meaning of human resources, significance of human resources, meaning of manpower planning, concept of productivity, factors of productivity, factors affecting productivity, workers' participation in management, unilateral and cooperative participation.

Textbooks/ References:

1. C.N. Shankar Rao: Principles of Sociology, New Delhi: S.Chand & Co. Ltd., 2006.

2. Mamoria C.B. , Mamoria S and Gankar. Dynamics of Industrial Relations in India, Himalaya Publishing House, New Delhi.

3. John, Mary E. Women's studies in India. New Delhi: Penguin, 2008.

4. Tong, R. Feminist Thought. Colorado: Westview Press, 2009.

5. Ram Ahuja - Social Problems in India, Jaipur: Rawat Publications, 2001.

6. M.N.Srinivas: Caste in Modern India, Oxford University Press, 1992.

7. Principles of Sociolgy by R.N. Sharma.

8. Labour problems and social welfare by R.C.Saxena.

9. Labour problems and social welfare by U.C.Kulshrestha.

Course Outcome: After successful completion of the course, the students will be able to:

CO1: Develop their sociological thinking to demonstrate sociological understandings of phenomena, for example, how individual biographies are shaped by social structures, social institutions, cultural practices, and multiple axes of difference and/or inequality.

CO2: Identify the major concepts and perspectives of sex-gender systems and practices in contemporary society.

CO3: Develop the ability of critical thinking through the ability to analyze and evaluate social, political, and/or cultural changes in society.

CO4: Exhibit the knowledge of sociological perspective of industry, conflict resolution and labour/management relation in industry.

CO5: Analyse the significance of human resources and its participation in various sectors of society.

Course Code	Course Title	Hours per week L-T-P	Credit C
PH181211	**Physics-201 Lab**	**0-0-2**	**1**

List of Experiments:

1. To find the value of the modulus of rigidity of the material of a rod by using: Vertical Twisting apparatus / Horizontal Twisting apparatus.
2. To find the Moment of Inertia of a given body by using the Moment of Inertia Table.
3. To find the coefficient of viscosity of water by capillary flow method.
4. To find the refractive index of the material of a prism using a spectrometer (by finding the angle of the prism and the angle of minimum deviation of the prism).
5. To find the specific heat of a given liquid by the method of cooling.
6. To find the ratio of two low resistances by using a potentiometer.
7. To find the average resistance of the Meter Bridge wire by Carey Foster's method.
8. To find the refractive index of water by using a convex lens and a mirror.
9. Determination of Planck's constant.
10. To find the velocity of ultrasonic waves in a given liquid.

Text Books:

1. A Text Book on Practical Physics – K.G. Mazumdar and B. Ghosh (Sreedhar Publishers).
2. A Text book of Practical Physics - Samir Kumar Ghosh (New Central Book Agency).

Course Outcome: After successful completion of the course, the students will be able to:

CO1: Carry out experiments to determine Modulus of rigidity of a rod using Vertical Twisting apparatus/Horizontal Twisting apparatus

CO2: Determine Moment of Inertia and Coefficient of Viscosity of water

CO3: Determine Refractive Index of the material of prism and specific heat of a given liquid

CO4: Determine the ratio of two low resistance using potentiometer and average resistance of the Meter Bridge wire

CO5: Determine Refractive Index of water using Convex lens and a mirror

CO6: Carry out experiments to determine Plank's Constant and velocity of Ultrasonic waves in a given liquid.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181114	**Engineering Mechanics Lab**	**0-0-2**	**1**

List of Experiments:

1. To verify the law of polygon of forces for a numbers of coplanar forces in equilibrium.
2. Parallel Forces Apparatus:
   A. To show experimentally the inverse relationship between reactive forces at support and the distance of the point of application of loads from supports.
   B. To find the reactive forces at the supports using:

   (i) Experimentally, (ii) Analytical method

3. Rolling Friction Apparatus:
   Experimental Computation of Co-Efficient of Friction between an Inclined Plane (Glass) and Trolley (Iron).
4. Square Threaded Screw Jack

   A. To determine the Velocity Ratio, Mechanical Advantage and Efficiency of a Square Threaded Screw Jack
   B. To construct the Curves showing relations of P – W, MA – W, η - W
5. To verify the Law of Moments by using a Bell Crank Lever
6. To verify the equilibrium of forces with the help of force polygon apparatus
7. To determine the co-efficient of friction between the slider and the inclined plane (sliding friction)

Course Outcome: After successful completion of the course, the students will be able to:

CO1: Establish the law of polygon of forces and equilibrium of forces through experimentation.

CO2: Determine the reactive forces at support and its relationship with the distance of the point of application of loads from support.

CO3: Determine the co-efficient of Rolling and Sliding friction on an inclined plane through experimentation.

CO4: Determine the velocity ratio, Mechanical advantage and efficiency of a square threaded screw jack.

CO5: Verify the law of moments by using a Bell crank lever.

Course Code	Course Title	Hours per week L-T-P	Credit C
ME181216	Workshop	0-0-4	2

1. Lathe:

(a) Lathe – Functions, Classification and Specification, Different parts, Drive mechanisms for speed, feed, depth of cut, Taper turning, other operations, Machining time. Lathe accessories and Attachments.

(b) Semi-Automatics – Capstan and Turret Lathes – Different parts – Tools – Work and Tool holding devices. Indexing and Bar Feeding mechanism, Tool layout and Tool schedule chart.

2. Shaper, Planar, Slotting and Broaching Operations

(a) Shaper - Function, Classification and Specification, Different part of a shaper – Quick return and feed mechanism – Shaper Operations, Cutting speed and Machining time calculations.

(b) Planar - Function, Classification and Specification, Difference between shaper and planar - Table drives and field mechanism – Planar operations – Machining time.

(c) Broaching – Purpose, Broaching tool and machine

(d) Slotting Machine – Purpose, Slotting tool and machine.

3. Drilling:

(a) Drilling machines – Classification – Specification – Parts drilling machine – Spindle drive mechanism – tool and work holding devices.

(b) Types of Drills and twist drill nomenclature, drill size and designation of drills.

(c) Deep hole drilling operation.

(d) Speed, feed and depth of cut and machining time in drilling.

(e) Reaming operation, Reaming tools, Reaming allowances.

(f) Tapping operation, tap drill size, difference with die (solid and adjustable).

4. Milling:

Introduction – Classification – Principal parts of a column and knee type Milling machine – Specifications, Spindle drive and feed mechanism, elements of a milling cutter, Milling processes – Up Milling – down milling – face milling – end milling, cutting speed, feed and depth of cut – machining time, indexing and dividing head, indexing methods, spur and helical gear milling operations – Selection of cutter for gear cutting.

5. Grinding:

Introduction – Kinds of Grinding – Grinding processes – Centerless Grinders – Surface Grinders – Tool and cutter Grinder – Specification Grinding wheel – Abrasives – Bonding Processes – Grid , Grade and Structure – Marking System of Grinding wheel – Selection of Grinding wheel, Mounting, Dressing, Truing and Balancing of grinding wheel.

6. Pattern making and Foundry:
Pattern making and sand casting – Pattern materials – Types – Pattern allowances, Coreprints, Moulding sand – Ingredients – Classification – Sand additives – Properties of Moulding sand – Sand preparation and testing, Green sand mould preparations, Cores and core making – Types of Cores.

BOOKS:
1. Elements of Workshop Technology – Vol. I and II, S.K. Hajra Choudhury and A.K. Hajra Choudhury.
2. A course in Workshop Technology (Vol. I and Vol. II) – B.S, Raghuwanshi.
3. Manufacturing Technology – P.N. Rao – Tata McGraw Hill.
4. Workshop Technology – I – P.K. Sapra and R.K. Kapur – Bikas Publishing.
5. Elements of Manufacturing Processes – B.S. Nagendra Parasar and R.K. Mittal – PHI
6. Introduction to Machining Science – G.K. Lal, New Age International Ltd.

Course Outcome: After successful completion of the course, the students will be able to:

CO1: Demonstrate the different types, working principle, different operations and attachments of lathe and semi-automatic lathe.
CO2: Differentiate the different types along with parts, mechanisms and operations of shaper, planar, broaching and slotting machines
CO3: Differentiate the different types of drilling machines, drills and reamers along with the different operations
CO4: Explain the different types of milling machines, milling cutters, along with milling operations
CO5: Explain the basic principles of grinding, different types of grinding machines, grinding operations, specifications, dressing and truing of grinding wheels.

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