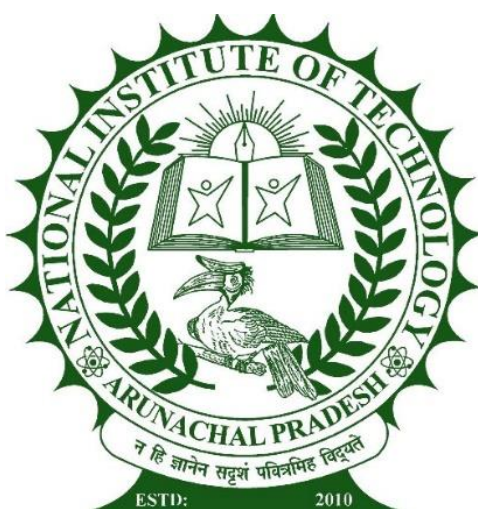# Course Curriculum for B. Tech.

First Year

(For students admitted in 2019-20 onwards)

National Institute of Technology Arunachal Pradesh

P.O. - Yupia, Dist.–Papumpare, Arunachal Pradesh, Pin–791112
Phone No: 0360-2284801/2001582
Fax No: 0360-2284972
www.nitap.ac.in

COURSE STRUCTURE

B. Tech. 1st Year, Semester I

Sl. No	Course Code	Course Title	L	T	P	C
1	CY-101	Engineering Chemistry	3	0	0	3
2	CY-102	Engineering Chemistry Lab	0	0	2	1
3	MA-101	Engineering Mathematics I	3	1	0	4
4	ME-101	Engineering Mechanics	3	0	0	3
5	ME-102	Workshop Practice I	0	0	3	1.5
6	MH-101	Communication Skill	0	3	0	3
7	BIO-101	Bio-Science	3	0	0	3
8	MH-113	NSS/NCC	0	0	2	0
		Total Credits	12	4	7	18.5

B. Tech. 1st Year, Semester II

Sl. No	Course Code	Course Title	L	T	P	C
1	PHY-101	Engineering Physics	3	0	0	3
	PHY-102	Engineering Physics Lab	0	0	2	1
2	MA-102	Engineering Mathematics II	3	1	0	4
3	CY-108	Environmental Engineering	3	0	0	3
4	CSE-112	Introduction to Computer Programming	2	0	0	2
5	CSE-113	Introduction to Computer Programming Laboratory	0	0	4	2
6	ME-121	Engineering Drawing	1	0	3	2.5
7	MH-106	Fundamentals of Economics	3	0	0	3
8	MH-113	NSS/NCC	0	0	2	0
		Total Credits	15	1	11	20.5

Name of the Module: Engineering Chemistry
Module Code: CY 101
Semester: 1st
Credit Value: 3 [L=3, P=0, T=0]

A. Course Objectives:
a) To enable the students to acquire knowledge about chemistry and its technology, covering all important topics of research and related areas.
b) To bring adaptability to new developments in engineering chemistry and a knowledge of contemporary issues relevant to engineering
c) To understand applicability of chemistry for engineering purposes.
d) To make them apply the knowledge of fundamental chemistry for design system components or processes considering the public health and safety, and the cultural, societal, and environmental considerations.

B. Course Content

Chemical thermodynamics: the first law, work, heat, energy and enthalpy; the relation between Cp and Cv; second law: entropy, free energy and chemical potentials; chemical equilibrium; chemical kinetics: rate of reaction, elementary reaction and chain reaction; surface chemistry: liquid surface, surfactants, colloidal systems; electrochemistry: conductance of electrolytic solutions, Kohlrausch's law, transport numbers, cell EMF and its thermodynamic significance, hydrogen and quinhydrone cell.

Shapes of inorganic compounds, ligand, nomenclature, isomerism, valence bond theory, crystal field and molecular orbital theory, bond order and energy, charge transfer transition, d-d transition, John-Teller effect, magnetic properties, spectrochemical series; bioinorganic and organometallic chemistry.

Hybridization, inductive effect, resonance, hyperconjugation, carbocation, carbanion and free radicals, substitution and addition reactions, introduction to instrumental methods (IR, UV-vis, NMR and Mass).

Polymers and materials: addition and condensation polymerization, degree of polymerization, thermoplastic & thermosetting plastics, conducting polymers, composite materials, nanomaterials, nanocomposites, explosive materials, corrosion-introduction; corrosion mechanisms.

C. Text Books:

1. Organic chemistry, R. T. Morrison, R. N. Boyd and S. K. Bhattacharjee, 7th Ed., Pearson education, New Delhi, 2010.
2. Physical chemistry, P. C. Rakshit, 7th Ed., Sarat book distributors, Kolkata, 2004.
3. Inorganic chemistry: principles of structure and reactivity, J. E. Huheey, E. A. Keiter, R. L. Keiter, 4th Ed., Pearson Education, New Delhi, 2009.

D. Reference Books:

1. Engineering chemistry, B. C. Ray, S. N. Das and S. Biswas, New Central Book Agency, Kolkata, 2008.
2. Polymer science, V. R Gowariker, N. V Viswanathan and J. Sreedhar, New Agency International, Kolkata, 2012.
3. Selected topics in inorganic chemistry, W. U. Malik, G. D. Tuli and R. D. Madan, S. Chand, New Delhi, 2012.
4. Organic reaction mechanisms, V. K. Ahluwalia and R. K. Parashar, 4th Ed., Narosa publishing house, Kolkata, 2013.

E. Course Outcomes:

After studying this course, students will be able to

a) an ability to function on multidisciplinary subjects.
b) design economically, environmental friendly and new methods of synthesis nano materials.
c) apply their knowledge for protection of different metals from corrosion.
d) a knowledge of exothermic and endothermic processes.
e) categorize the materials on the basis of their properties.
f) select appropriate method of analysis and interpret its result.

Name of the Module: Engineering Chemistry Lab
Module Code: CY 102
Semester: 1st
Credit Value: 1 [L=0, P=2, T=0]

A. Course Objectives:
a) To enable the students to acquire knowledge about chemistry practical and its technological importance towards research works.
b) To bring adaptability to new developments in engineering chemistry and a knowledge of contemporary issues relevant to engineering and research.
c) To understand applicability of chemistry for engineering and research purposes.
d) To make them apply the knowledge of fundamental chemistry for design system components or processes and researches considering the public health and safety, and the cultural, societal, and environmental considerations.

B. List of Experiments:

1. Determination of the concentration of NaOH solution.
2. Standardization of $KMnO_4$ solution by Mohr's salt.
3. Estimation of hardness of water using EDTA titration.
4. Conductometric titration for
   a) Determination of the strength of a given HCl solution by titration against a standard NaOH solution.
   b) Analysis of a mixture of strong and weak acid by strong base.
5. Estimation of available chlorine in bleaching powder.
6. Determination of pH value of the solution by digital pH meter and pH paper.
7. Production of methyl ester from vegetable oil.

C. Reference Books:

1. Laboratory Mannual for Engineering and Physical Chemistry, M. V. Basaveswara Rao, Studium Press (India) PVT. Ltd. 2013.
2. Vogel's Qualitative Inorganic Analysis, Vogel Arthur Israel, Publisher: Pearson Education Limited, ISBN: 9780582218666, 0582218667

D. Course Outcomes:

After studying this course, students will be able to

   a) an ability to function on research areas in multidisciplinary subjects.
   b) design economically, environmental friendly and new methods of synthesis for various needful products.
   c) apply their knowledge for protection of environment by controlling the experimental methods.
   d) a knowledge of production of methyl ester from vegetable oil.
   e) a knowledge titration for various kinds of acid-base for new experimental aspects.
   f) select appropriate method of analysis and interpret its result.

Name of the Module: Engineering Mathematics- I
Module Code: MA 101
Semester: 1st
Credit Value: 4[P=0, T=1, L=3]

_

A. Course Objectives:

The course is designed to meet with the objectives of:

a) providing high quality education in pure and applied mathematics in order to prepare students for graduate studies or professional careers in mathematical sciences and related fields,

b) imparting theoretical knowledge and to develop computing skill to the students in the area of Science and Technology,

c) providing teaching and learning to make the students competent to their calculating ability, logical ability and decision making ability,

d) giving students theoretical knowledge of Calculus, Algebra and their practical applications in the various fields of Science and Engineering,

e) apply their knowledge in modern industry or teaching, or secure acceptance in high-quality graduate programs in Mathematics and other fields such as the field of quantitative/Mathematical finance, Mathematical computing, statistics and actuarial science.

B. Course Content:

Linear Algebra: Basic concept of matrices, Determinant, Jacobi's theorem. Singular and non-Singular matrices, Inverse and its properties, Orthogonal matrix and its properties, Trace of a matrix, Rank of a matrix, System of homogeneous and non-homogeneous linear equations, Introduction to vector space (up to basis), Eigen values and Eigen vectors of a square matrix (of order 2 or 3), Cayley-Hamilton theorem and its applications.

Differential Calculus: Limit and Continuity, Higher order derivatives, Leibnitz's theorem and its application, Rolle's theorem and its application, Mean Value theorems – Lagrange & Cauchy and their application, Taylor's theorem and its application, Expansions of functions by Taylor's and Maclaurin's theorem.

Integral Calculus: Single integrals, double and triple integrals and evaluation of area and Reduction formulae both for indefinite and definite integrals, volume, Change of order of integration.

C. Text Books

1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 11th edition, 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd edition, 2014.

D. Reference Books

1. Ross L. Finney and George B. Thomas, Calculus and Analytical Geometry (Linear Algebra), Narosa Publishing House, 6th edition 1998.
2. K. M. Hofmann and R. Kunze, Linear Algebra, Prentice hall, 2nd edition, 2015.
3. Bartle and Sherbart, Introduction to Real Analysis, Wiley 4th edition, 2014.
4. T. M. Apostol, Calculus, Vol I and II, John Wiley and Sons Ltd Wiley; 2nd edition, 2007.
5. James Stewart, Transcendental Calculus, Cengage; 2nd edition, 2014.
6. S. K. Mappa, Higher Algebra, Shrat book House, 2014.
7. S. K. Mappa, Real Analysis, Shrat book House, 7th edition, 2013.
8. Clarence Reymond Wylie and Louis C. Barrett, Advanced Engineering Mathematics, McGraw Hill, 1995.

E. Course Outcomes:

The outcomes of course are following:

1. Students will become more confident about their computing skill, logical skill and decision making skill,
2. Students will find various applications of calculus and algebra in the practical fields science and engineering,
3. Students will become more competent to analyse mathematical and statistical problems, precisely define the key terms, and draw clear and reasonable conclusions,
4. Student will be able to use mathematical and statistical techniques to solve well defined problems and present their mathematical work, both in oral and written format, to various audiences (students, mathematicians, and non-mathematicians),
5. Student will be able to understand, and construct correct mathematical and statistical proofs and use the library and electronic data-bases to locate information on mathematical problems,
6. Student will be able to explain the importance of mathematics and its techniques to solve real life problems and provide the limitations of such techniques and the validity of the results,
7. Student will be able to propose new mathematical and statistical question and suggest possible software packages and/or computer programming to find solutions to these questions.

Name of the Module: Engineering Mechanics
Module Code: ME-101
Semester: I
Credit Value: 3 {L = 3, T = 0, P = 0}

A. Course Objectives:
The course is designed to meet with the following objectives:
1. Ability to utilise scalar and vector analytical techniques for analysing forces in statically determinate structures.
2. Ability to apply fundamental concepts of kinematics and kinetics of particles to the analysis of simple, practical problems.
3. Student gets a basic idea of Centre of gravity, moment of inertia, mass moment of inertia, friction.

B. Course Content:
Forces and Moments: Force, Moment and Couple, Wrench, Equivalent force and moment, Forces in space equilibrium, FBD, general equations of equilibrium-Lami's theorem, analysis of forces in truss and frames, brief introduction to vector approach.

Friction: Introduction to dry friction, laws of friction, friction of simple machines, inclined planes, Screw jacks, clutch, and collar pivot bearing (uniform wear and uniform pressure assumptions).

Centre of gravity and moment of inertia: Centre of gravity, volume and composite bodies, Area moment of inertia and mass moment of inertia for plane figures and bodies.

Dynamics: Kinematics and Kinetics, Rectilinear motion of particles, determination of position velocity and acceleration under uniform rectilinear motion (uniform and non-uniform accelerated rectilinear motion), Relative motion, construction of x-t, v-t and a-t graphs (simple problems),Projectile motion, Normal and Tangential components, Radial and Transverse components, simple problems, Equation of motion, D. Alembert's principle, principle of virtual work, planar kinematics and kinetics of system of particles and rigid bodies.

C. Text Books:
1. Timoshenko S. and Young D.H., "Engineering Mechanics", 5th Ed., 2017, MGH.
2. Beer and Johnston, "Vector Mechanics for Engineers: Statics and Dynamics", 10th Ed., 2012, TMGH.

D. Reference Books:
1. Meriam, J. L. and Kraige, L. G., "Engineering Mechanics, Volume 1: Statics", 8th Ed., 2017, Wiley.
2. Meriam, J. L. and Kraige, L. G., "Engineering Mechanics, Volume 2: Dynamics", 5th Ed., 2006, Wiley.
3. Shames, I. H. and Rao,G. K., "Engineering Mechanics: Statics and Dynamics'", 4thEd., 2006, Pearson.

4. Nelson A., "Engineering Mechanics: Statics and Dynamics", 1st Ed., 2017, TMGH.

E. Course Outcomes:
Upon completion of the subject, students should have the knowledge of:
1. different type of forces and how to resolve forces.
2. centre of gravity of different size, shape, and solid.
3. centre of gravity, moment of inertia, mass moment of inertia, friction.

Name of the Module: Workshop Practice-I
Module Code: ME-102
Semester: I
Credit Value: 1.5 {L = 0, T = 0, P = 3}

A. Course Objectives:
The course is designed to meet the following objectives:
1. Acquire skills in basic engineering practice.
2. Identify the hand tools and instruments.
3. Acquire measuring skills.
4. Acquire practical skills in the trades.
5. Acquire practical skills in welding, carpentry, fitting.

B. List of experiments:
1. Study of various hand tools.
2. Making various joints (carpentry, fitting, sheet metal)
3. Welding (surface preparation and welding practice)
4. CNC assembly/disassembly (lathe and milling using kit)
5. 3-D printing (assembly kit)

C. Reference Books:
1. Choudhury, S. K. H., Choudhury, A. K. H., Roy, N., "Elements of Workshop Technology" Vol-1, 2008, Media promoters & pubmishers pvt ltd.
2. Begeman, M. L. and Amstead, B. H., "Manufacturing Process"8th edition, 1987, Wiley.
3. Chapman, W. A. J. and Arnold E., "Workshop Technology, Vol. I, II & III", 5th, 4th and 3rd editions, 2001, 2005 and 1995, CRC press, Prentice Hall.

D. Course Outcomes:
Upon completion of the subject, students should have the knowledge of:
1. Workshop safety.
2. Handling workshop tools, machines.
3. Different welding types.
4. Different carpentry joints.
5. Working principle of different tools.

Module Name: **Communication Skills**
Module Code: **MH-101**
Semester: **Semester I**
Credit: 03 {L=0, T=3, P=0}

A. Objectives:

The course is designed to meet the following objectives:

1. to increase the student's confidence to improve and utilize the skills necessary to be competent interpersonal communicator.

2. to increase the student's linguistic understanding of his or her own communication behaviour.

3. to increase the student's understanding of other communication behaviours.

4. to improve the student's listening, speaking, reading and writing skills in both social and professional contexts.

B. Course Content:

Basics of Communication

Concept and meaning, Communication cycle, Objectives, Barriers to communication (linguistic and semantic, psychological, physical, mechanical, cultural), The importance of audience and purpose, Types of communication, Styles of communication, Verbal and non-verbal communication, Comparing general communication and technical communication language skills (listening, speaking, reading, writing), Transactional analysis.

Listening Skills

Listening: Types of listening, Listening to classroom lectures/talks on engineering/technology- podcasts, Differentiation of minimal pairs and accents, Listening comprehension. **Activities:** Ear drills and listening exercises.

Speaking Skills

Speaking: Introducing oneself - exchanging personal information, Dialogue building, Demo presentations, Effective oral presentation skills, Neutral accent, **Activities:** Pronunciation Drills- vowels, consonants drills, songs, rhymes, chants and tongue twister drills, repetition drills.

Reading and Writing Skills

Reading: Types of reading, Reading longer technical texts- identifying the various transitions in a text- Paragraphing.

Technical writing: Techniques to define an object, Writing instructions, Language exercises based on types of expositions (description of an object & explanation of a process), Blogs,

Tweets, Online résumé, E-mails, SMS and online texting, Report writing, Describing charts and tables, Writing for media on current events, Résumé writing, Letters, Technical report writing. **Activities:** Various reading and writing activities

C. Text Books:
1. English Language and Communication Skills for Engineers (as per AICTE Syllabus), Sanjay Kumar and Pushp Lata, New Delhi: Oxford University Press (OUP), 2018.
2. Technical Communication: Principles and Practice, Second Edition by Meenakshi Raman and Sangeeta Sharma, Oxford Publications, 2017.

D. Reference Books:
1. Communication Skills, Sanjay Kumar and Pushp Lata, Second Edition, New Delhi: Oxford University Press (OUP), 2018.
2. A Comprehensive Grammar of the English Language, Randolph Quirk, Sidney Greenbaum, Geoffrey Leech, Jan Svartvik. Pearson Education India; First edition (2010).

Programme Outcomes:
- Display competence in oral, written, and visual communication.
- Apply communication theories in various speech acts.
- Use current technology to the communication field.
- Understand the process of communication and its effect on giving and receiving information\

Name of the Module: Bio
Science Module Code: BIO-101
Credit Value: 3 [L=3, T=0, P=0]

A. Course Objectives:
The course is designed to:
1. impart knowledge on the origin of Earth and life forms on Earth, appreciating importance of biological diversity and understanding biomolecules being the main component of life
2. understand "Cell" – the basic unit in different life forms, and structure and function of different tissue systems in plants and animals
3. impart knowledge on water relations, nutrient uptake and assimilation, and metabolism in plants
4. provide knowledge on Bioenergetics of plant cells, an introduction to DNA and genetic engineering

B.   Course Content:

Origin of Life: History of earth, theories of origin of life and nature of the earliest organisms. Varieties of life: Classification, Five kingdoms, viruses (TMV, HIV, Bacteriophage), Prokaryote (Bacteria-cellstructure, nutrition, reproduction), Protista, Fungi, Plantae and Animalia.

Chemicals of life: (Biomolecules) - Carbohydrates lipids, amino acids, proteins, nucleic acids and identification of biomolecules in tissues.

Cell: Cell concept, structure of prokaryotic and eukaryotic cells, plant cells and animal cells, cell membranes, cell organelles and their function, Structure and use of compound microscope.

Histology: Meristematic tissue (apical, intercalary, lateral) and their function; simple tissue (parenchyma, collenchymas, sclerenchyma); Complex tissue (xylem and phloem); Tissue systems (epidermal, ground, vascular); primary body and growth (root, stem, leaf); Secondary growth (root, stem). Animal tissues (Epithelial, connective, muscle and nervous tissues) and their functions in the body.

Transport: Plant water relationships, properties of water, diffusion, osmosis, imbibition, uptake of water by roots and theories of transport of water through xylem (ascent of water in xylem, cohesion- tension theory), apoplast and symplast theory; Transpiration-structure of leaf, opening and closing mechanisms of stomata, factors affecting transpiration and significance of transpiration.

Nutrition: Mineral Nutrition in plants, Heterotrophic nutrition in plants; Photosynthesis (Autotrophic- forms of nutrition), Chloroplast structure, two pigment systems, photosynthetic UNIT, light absorption by chlorophyll and transfer of energy, phosphorylation and electron transport system, Calvin-Benson Cycle (C3), Hatch Slack Pathway (C4), Crassulacan Acid Metabolism (CAM), factors affecting photosynthesis.

Genetics: Introduction to Principles of inheritance, Discovery of DNA as genetic material, Structure and Function of DNA, DNA mutation and types, Genetic diseases, Applications of Genetic engineering.

C. Text Books:

1. Rajveer Singh Chauhan: A Text Book of Life Science Paperback, 3rd Revised 12 Aug. 2010 edition, Publisher: International Book Distributing Co

2. P. S Verma and V K Agarwal: Cell Biology Paperback – Jan 2016 edition, S. Chand *Publishing,* S. Chand and Company PVT. LTD., Ram Nagar, New Delhi

3. P. S Verma and VK.Agarwal: Genetics, 2010 edition, S. Chand *Publishing,* S. Chand and Company PVT. LTD., Ram Nagar,

New Delhi

4. B. P Pandey: College Botany Volume III Paperback, 2015 edition, S.
   Chand *Publishing,* S. Chand and Company PVT. LTD., Ram Nagar,
   New Delhi

D. Reference Book:

P.S Verma and VK.Agarwal: Cell Biology, Genetics, Molecular
Biology, Evolution and Ecology, 2015 edition, S. Chand *Publishing,*
S. Chand and Company PVT. LTD., Ram Nagar, New Delhi

E. LearningOutcomes:

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

1. understand the characteristics of living organisms; appreciate the
   importance of diversity of life and their interaction with the
   environment
2. explain the interrelationship between biomolecules and the living
   system, and influences of biomolecules upon the structure and
   function of intracellular components
3. have a broad knowledge on Bioenergetics of plant cells; DNA and
   genetic engineering
4. understand the concept of DNA as hereditary material and harmful
   consequences of mutation thereby enable them to initiate a healthy
   lifestyle and environment

Name of the Module: Engineering Physics
Module Code: PHY 101
Semester: 2nd
Credit Value: 3 [P=0, T=0, L=3]

A. Course Objectives:

The course is designed to meet with the objectives of:

a) imparting theoretical & practical knowledge to the students in the area of engineering physics.
b) providing teaching and learning to make students acquainting with modern state-of-art of Engineering.
c) injecting the future scope and the research direction in the field of Physics with specific specialization.
d) making students competent to design & development of Engineering Physics.

B. Subject matter:

Physical Optics:

Superposition of waves, Interference: Newton's ring, Diffraction: single slit diffraction, double slit diffraction and diffraction granting, Polarization.

Electricity and Magnetism:

Coulombs law in vector form, Electric field, Gauss's law (differential and integral form), Electric potential and energy, multipole expansion of electric potential, Boundary value problem (Poisson's Eqn. and Laplace's Eqn.). Dielectric, Biot-Savart law, Ampere's law (differential and integral form), Faraday's law of electromagnetic induction, Maxwell'sfield equation in vacuum and matter.

Modern Physics and Quantum Mechanics:

Photo electric effect, Compton effect, Blackbody radiation (no derivations), Wave particle duality, two slit experiments, De-broglie's hypothesis, Heisenberg's uncertainty principle, concept of wave function and wave packet**,** phase velocity and group velocity, Formulation of quantum mechanics and basic postulates, physical interpretation of wave function, Schrodinger's wave equation, Steady state of Schrodinger's wave equation, One dimensional quantum problems:Free particle, particle in a box, particle in a step potential.

C. **Text Books:**

1. A. Ghatak, "Optics" 6th Edition, Tata McGraw Hill Education India Private Limited, 2017 .
2. David J. Griffiths, "Introduction to Electrodynamics," 4th edition, Pearson Education India Learning Private Limited, 2015.
3. David J. Grifths, "Introduction to Quantum Mechanics," 2nd edition, Pearson Education, 2015.

D. **Reference Books:**

1. A. Beiser, S. Mahajan and S. R. Choudhury, "Concepts of Modern Physics," 7th Edition, McGraw-Hill Education, 2017.
2. F. A. Jenkins & H. E. White, "Fundamental of Optics", 4th Editions, McGraw-Hill Education, 2017.
3. K. Krane, "Modern Physics", Wiley, 2016.
4. Richard P. Feynman, Robert B. Leighton and Matthew sands, "The Feynman Lectures on Physics Vol. 1 to Vol. 3" The New Millennium Edition, 2012.

E. **Course Outcomes:**
   Students successfully completing this module will be able to:

1. demonstrate competency and understanding of the basic concepts found in physics.
2. utilize the scientific method for formal investigation and to demonstrate competency with experimental methods that are used to discover and verify the concepts related to content knowledge.
3. engineering applications capability to understand advanced topics in engineering.
4. identify formula and solve engineering problems.
5. adequately trained to become engineers.
6. substantially prepared to take up prospective research assignments.
7. apply quantum mechanics to engineering phenomena
8. found employment in their field or related area or continue in a professional school.

Name of the Module: Engineering Physics Lab
Module Code: PHY 102
Semester: 2nd
Credit Value: 1 [P=2, T=0, L=0]

A. Course Objectives:
The course is designed to meet with the objectives of:

a) imparting theoretical & practical knowledge to the students in the area of engineering physics.
b) student will have exposure to various experimental skills which is very essential for an engineering student.
c) to gain practical knowledge by applying the experimental methods to correlate with the physics theory.
d) to develop intellectual communication skills and discuss the basic principles of scientific concepts in a group.
e) to learn the usage of various areas of physics like optics, mechanics, electricity and magnetism systems for various measurements.
f) apply the analytical techniques and graphical analysis to the experimental data.

B. List of Experiments:

1. Determination of wavelength of light by Newton's ring method.
2. Determination of surface tension of water.
3. Determination wavelength of light by using diffraction grating.
4. Determine the refractive index of the material of prism by using spectrometer.
5. Determination of Planck's constant using photocell.
6. Verification of Stefan's radiation law.
7. Verification of Bohr's atomic orbital theory through Frank-Hertz experiment.
8. Verification of Biot-Savart's law.

C. Reference Books:

1. C. L. Arora, "Practical Physics", S. Chand Publications, 2010.
2. G. L. Squires, "Practical Physics", Cambridge University Press, 2014.

D. Course Outcomes:

Students successfully completing this module will be able to:

a) apply the various procedures and techniques for the experiments.
b) apply the mathematical concepts/equations to obtain quantitative results.
c) develop basic communication skills through working in groups in performing the laboratory experiments and by interpreting the results.
d) understand principle, concept, working and application of new technology and comparison of results with theoretical calculations.
e) gain knowledge of new concept in the solution of practical oriented problems and to understand more deep knowledge about the solution to theoretical problems.
f) understand measurement technology, usage of new instruments and real time applications in engineering studies.

Name of the Module: Engineering Mathematics- II
Module Code: MA 102
Semester: 2nd
Credit Value: 4[P=0, T=1, L=3]

_____
__

A. Course objectives:
The course is designed to meet the following objectives:

a) imparting theoretical knowledge to the students about three and more dimensional objects in space and to improve their capability of visualizing of objects in space.
b) making student competent enough to construct a differential equation/ mathematical modeling for every real life situation with its solution.
c) giving students theoretical knowledge of vectors with the flavour of Calculus.
d) introduce the concepts of Laplace and Fourier transforms and its application to the solution of differential equations (ODE & PDE) to the students.

B. Course Content:

Vector Calculus: Surfaces, Differentiation and integration of vector functions, scalar and vector fields, Gradient, Tangents, Normal, Curvature, Directional derivative, Divergence, Curl, Line integral, Surface integral and Volume integral, Green's, Gauss' and Stokes' theorems (without proofs) and their simple applications.

Ordinary Differential Equations: Formulation of Differential equations, Equation of first order and first degree, Exact ODE, Integrating factor, Equation reducible to first order linear ODE, Fundamental Systems and General Solution of Homogeneous equation of Order Two, Wronskian, Method of Reduction of Order, Higher order linear differential equation with constant coefficients, Operator method, Euler's homogeneous equation and reduction to

an equation with constant coefficients, Methods of undermined coefficients, Method of Variation of Parameters, Series solutions (Ordinary point),

Partial Differential Equations: First order partial differential equations; solutions of linear and nonlinear first order PDEs; classification of second-order PDEs; method of characteristics; boundary and initial value problems (Dirichlet and Neumann type) involving wave equation, D'Alembertmethod, heat conduction equation, Laplace's equations and solutions by method of separation of variables (Cartesian coordinates).

Laplace & Fourier transform solution of ODE by Laplace and Fourier transform.

C. Text Books :
1. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley, 11th edition, 2010.
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 43rd edition, 2014.

D. Reference Books:
1. Thomas and Finney, Calculus and Geometry (Linear Algebra), 9th edition, 2010.
2. S. L. Ross, Ordinary Differential Equation, Wiley and Sons Ltd., 3rd edition, 2010
3. Boyce and Richard C. Diprima, Elementary Differential Equations and Boundary value Problems, Wiley publications, 9th edition, 2009.
4. I. N. Sneddon, Elements of Partial Differential Equations, Dover Publications Inc. 2nd edition, 2013.
5. S. J. Farlow, Partial Differential Equation for Scientists and Engineers, Dover Publications, 1st edition, 1993.
6. Alan Jeffrey,Advanced Engineering Mathematics,Academic Press, 1st edition, 2001.
7. Dennis G. Zilland and Warren S. Wright, Advanced Engineering Mathematics, 4th edition, 2010.
8. Earl Coddington, Norman Levinson, Introduction to Ordinary Differential Equations McGraw Hill Education; 1st edition, 2017.

E. Course Outcomes:
Upon completion of the subject:
1. Students will have have strong visualizing capability in their mind about any object.
2. Students are so trained that they will recognize various real life situation/ problem and able to solve them by constructing a differential equation/ mathematical model.
3. Students will be able to find the Laplace and Fourier representation as transforms of functions of one variable.

Name of the Module: Environmental Engineering
Module Code: CY-108
Semester: 2nd
Credit Value: 3 [L=3, P=0, T=0]

A. Course Objectives:

a) Imparting the knowledge to the students in the area of Environmental Engineering.
b) Providing teaching and learning to make students acquainting with advanced science and technology in Environmental Science.
c) Injecting the future scope and the research direction in the discipline of Environmental Engineering.
d) Making students competent to the research and development in Environmental Engineering.

B. Course Content : *Yet to approved*

C. Text Books:

1. Environmental engineering, G. Kiely, McGraw Hill, New Delhi 2013.
2. Introduction to environmental engineering and science, G. M. Masters and W. P. Ela, PHI Learning/Pearson, New Delhi, 2015.

3. Principles of environmental science: inquiry & applications,W. P. Cunningham and M. A. Cunningham, 4th Ed., Tata McGraw Hill, New Delhi, 2011.

4. Chemistry for environmental engineering and science, C. N. Sawyer, P. L. Mccarty and G. F. Parkin, 5th Ed., Tata McGraw Hill, New Delhi, 2009.
5. Richard O. Mines, Environmental engineering: principles and practice, John Wiley & Sons, 2014.
6. Solar Energy–Principals of thermal collection and storage, S. P.Sukhatme, J. K. Nayak, 3rd Ed., Tata McGraw Hill, New Delhi, 2008.
7. Renewable Energy recources, J. Twidell and T. Weir, 2nd Ed., Taylor & Francis, London, 2006.
8. N.S. Rathore and N. L. Panwar, "Renewable Energy Sources for Sustainable Development", New India Publishing Agency, New Delhi, 2007.

D. Reference Books:

1. Environmental chemistry, A. K. De, 7th Ed., New Age, Kolkata, 2010.

2. Environmental engineering, N. N. Basak, McGraw Hill, New Delhi, 2014.
3. Environmental science: principles and practice, R. C. Das and D. K. Behera, PHI Learning, New Delhi, 2008.

E. Course Outcomes:

After studying this course, students will be able to

a) adequately train them to become Scientist, trainers and Chemical Engineers
b) be skilled both to control and maintenance in Environmental pollution, waste water treatment and other related activities in Environmental Engineering.
c) substantially prepared to take up prospective research assignments.

Name of the Module: Introduction to Computer Programming
Module Code: CS - 112
Credit Value: 2 {L = 2, T = 0, P = 0}

A. Course Objectives:
The course is designed to:

a) Introducing the basic and fundamental components of computers and programming language.
b) Teaching and training of different problems in prior of data structures course.
c) Guiding and training students to write efficient coding,
d) Guiding & training students to fragment problems into different functions or units.

B. Course Content:

Introduction: The von Neumann architecture, machine language, assembly language, high level programming languages, compiler, interpreter, loader, linker, text editors, operating systems, flowchart.

C Fundamentals: Introduction to C, Data types, Constants and variable declaration, Scope, Storage classes, Data input and output functions, Sample programs.

Operators & Expressions: Arithmetic, Relational, Logical, Bitwise operators, Conditional, Assignment, Library functions.

Decision making: Simple If statement, if-else statement, nested if else statement, Switch statement, nested switch, the operator, goto statement.

Decision making & branching: while statement, do-while statement, for statement.

Array: Declaration, Initialization and processing One-dimension array, Two-dimension array and multi dimension array and their operations.

20

String & pointer: String: Operation on String without using library function and using library function. Pointer: Declaration of pointer variables, accessing the variable by using pointer, pointer increment and decrement operator, pointer and array.

Functions: Basic functions, function type, function with no argument & no return value, function with no argument but return value, function with argument & return value, Storage class identifier, Call by reference, Recursive function. Pointer to function.

Structure & Union: Defining a structure, accessing of structure variable, structure and array, array within structure. Nested structure, structure & functions, Pointer & structure, unions, enum.

File management system: Advantage of using file, Open, close, read, write in the files, Operation on files.

Dynamic memory Allocation: use of malloc, calloc, realloc, free. Library functions, Implementation of Linked list and their various operations.

The pre-processor: macro statements.

Introduction to object-oriented programming.

C. Text Books:
1. Kerninghan and Ritchie, The 'C' programming language, 2nd Edition, Pearson, 2008.
2. Yashavant P. Kanetkar, Let Us C, 8th, Infinity Science Press, 2008.
3. Balaguruswamy, Programming In ANSI C, 7th Edition, Tata McGraw-Hill Education, 2017

D. Reference Books:
1. Yashavant P. Kanetkar, ―Let Us C, 16th Edition, BPB Publication, 2017.
2. Zed A. Shaw, Learn C the Hard Way: Pratical Exercises on Computational Subjects You Keep Avoiding(Like C), 2015.
3. Deepali Srivastava and S.K Srivastava, C in Depth, BPB Publication, 2017.
4. Griffiths David and Dawn Griffiths, Head First C, A Brain Friendly Guide, 2012.
5. Grey Perry and Dean Miller, C Programming Absolute Beginner's Guide, 3rd Edition, 2013.

E. Program Outcomes:
At the end of the course, a student will be able to:

a) Understand the basic terminology used in computer programming.
b) Write, compile and debug programs in C language in different operating systems.
c) Design programs involving decision structures, loops and functions.
d) Use and apply the dynamics of memory by the use of pointers in engineering applications.

e) Use and apply the differences between structure oriented and function oriented programming in programming applications.

Name of the Module: Introduction to Computer Programming Laboratory
Module Code: CS - 113
Credit Value: 2 {L = 0, T = 0, P = 4}

F. Course Objectives:

The course is designed to:

e) The student will gain a thorough understanding of the fundamentals of C programming.
f) A student can code, compile and test C programs.
g) Could take Systems programming or Advanced C programming course.
h) Although this course does not deal with object-oriented programming methodology, it will assist the student build the required foundations to undertake a course in OOP..

G. Course Content:

Module l: To write a C program in each case, to find the sum of individual digits of a positive integer, generate the first n terms of the Fibanocci sequence and generate all the prime numbers between 1 and n, where n is a value supplied by the user; to calculate the Sum $=1-x 2 /2! +x4 /4!-x 6 /6!+x8 /8!-x 10/10!$

Module 2: To write C programs that use both recursive and non-recursive functions, To find the factorial of a given integer and To find the GCD (greatest common divisor) of two given integers; Also, to write a C program, which takes two integer operands and one operator from the user, performs the operation and then prints the result. (Consider the operators +,-,*, /, % and use Switch Statement) and to write a C program that uses functions to perform the Addition of Two Matrices and Multiplication of Two Matrices;

Module 3: To write a C program that uses functions to perform the operations: To insert a sub-string in to a given main string from a given position; To delete n Characters from a given position in a given string; To write a C program to determine if the given string is a palindrome or not; Also to write a C program that displays the position or index in the string S where the string T begins, or – 1 if S doesn't contain T; To write a C program to count the lines, words and characters in a given text.

22

Module 4: To write a C program to generate Pascal's triangle and also to construct a pyramid of numbers; Also to write a C program that uses functions to perform the following operations on singly linked list: Creation, Insertion, Deletion, Traversal;

Module 5: To write C programs that implements stack (its operations) using Arrays, Pointers and that implements Queue (its operations) using Arrays, Pointers;

Module 6: To write a C program that implements the following sorting methods to sort a given list of integers in ascending order using - Bubble sort, Selection sort; Also, to write C programs that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers- Linear search, Binary search;

Module 7: To write a C program that implements the following sorting method to sort a given list of integers in ascending order- Quick sort; Also to write a C program that implements the following sorting method to sort a given list of integers in ascending order Merge sort;

H. Text Books:
4. Kerninghan and Ritchie, The 'C' programming language, 2nd Edition, Pearson, 2008.
5. Yashavant P. Kanetkar, Let Us C, 8th, Infinity Science Press, 2008.
6. Balaguruswamy, Programming In ANSI C, 7th Edition, Tata McGraw-Hill Education, 2017

I. Reference Books:
6. Yashavant P. Kanetkar, ―Let Us C, 16th Edition, BPB Publication, 2017.
7. Zed A. Shaw, Learn C the Hard Way: Pratical Exercises on Computational Subjects You Keep Avoiding(Like C), 2015.
8. Deepali Srivastava and S.K Srivastava, C in Depth, BPB Publication, 2017.
9. Griffiths David and Dawn Griffiths, Head First C, A Brain Friendly Guide, 2012.
10. Grey Perry and Dean Miller, C Programming Absolute Beginner's Guide, 3rd Edition, 2013.

J. Program Outcomes:
At the end of the course, a student will be able to:

f) Understand the basic terminology used in computer programming.
g) Write, compile and debug programs in C language in different operating systems.
h) Design programs involving decision structures, loops and functions.
i) Use and apply the dynamics of memory by the use of pointers in engineering applications.

Name of the Module: Engineering Drawing
Module Code: ME-121
Semester: II
Credit Value: 2.5 {L = 1, T = 0, P = 3}

A. Course Objectives:

The course is design to meet with the following objectives:
1. Increase ability to understand Engineering Drawing.
2. Learn to sketch and take field dimensions.
3. Learn to take data and transform it into graphic drawings.
4. Learn basic Auto Cad skills.
5. Learn basic engineering drawing formats.
6. Prepare the student for future Engineering positions.

B. Course Content:

Indian Standards: Sheet layout, type of lines and their representations, scales.

Principles of Orthographic Projection (multi view drawing): 1st and 3rd angle projection.

Projections: Points, lines, surfaces and solids.

Projection of sections and intersections of solids; Isometric projection.

C. Reference Books:

a) *Dhananjay, A. J., "Engineering Drawing", 1st Ed., 2017, TMH.*
b) *Bhatt, N.D. and Panchal, V.M., "Engineering Drawing", 43rd ed., 2014, Charotar Publishing House Pvt.Ltd.*
c) *Venugopal, K. and Prabhu,V. R., "Engineering Graphics", 15th Ed., 2018, New Age International Pvt. Ltd.*

D. Course Outcomes:

Upon completion of the subject student's ability to**:**
1. hand letter will improve.
2. perform basic sketching techniques will improve.
3. draw orthographic projections and sections will improve.
4. use architectural and engineering scales will increase.
5. produce engineered drawings will improve.
6. convert sketches to engineered drawings will increase.
7. cope up and become familiar with office practice and standards will increase.

8. handle and become familiar with Auto Cad two dimensional drawings will improve.
9. develop good communication skills and team work will improve.

Name of the Module: Fundamentals of Economics
Module Code: MH-106
Semester: Second semester
Credit Value 3 [P=0, T =0 L=3]

A. Objectives:
The course is design to meet the following objectives:

1. Learn the fundamentals of Engineering Economics
2. Understand and use of Economic concepts in making business decision
3. Use economic information to manage the organization
4. Use economic tools with respect to acceptance or rejection of investment proposals
5. Know the current issues relating to economic environment

B. Course content

Basics of Economics
Basic Concepts, Scope, Importance and definitions, Relevant to Managerial Economics-Factors Influencing Managerial Decision – Managerial economics and other disciplines, Relation between Science, Engineering, Technology and Economics

Demand Analysis
Managerial Decisions-Meaning of Demand- Types of Demand –Determinants of Demand – Demand Functions – Demand Elasticity – Demand Forecasting Methods – Accuracy of Forecasting

Cost concept
Costs Concepts - Accounting Cost and Economic Cost – determinants of Cost – Cost – Output Relationship – Estimation of Cost – Output Relationship, Break Even Analysis-linear approach (Simple numerical problems to be solved).

Market Structure and Product Pricing
Perfect and Imperfect Market Structures. Conditions of Perfect Competition. Price of a Product under demand and supply forces. Equilibrium Price. Pricing under Monopoly and Monopolistic Competition. Pricing under Oligopoly. Kinked Demand Curve. Discriminating Prices.
Inflation, Business cycle, National Income

Inflation- meaning, feature, Types, causes, Factors Causing Increases in Demand, Factors Causing Decrease in Supply, Impacts/ Effects of Inflation , Measures to Control Inflation. Business Cycle - Features of Business Cycle, Causes of Business Cycle, Types of Business Cycle, Theories of Business Cycle ,Impacts/Effects of Business Cycle, Measures to Control Business cycle,   National Income & Current Issues- Concepts of National Income, Factors Determining Level (Size) of National Income, Methods of Measurement of National Income, Choice of Methods of National Income, Importance of Measurement of National Income, Difficulties in Measuring National Income.

C. **Text Books:**
1. Panneerselvam, R., Engineering Economics, Second Edition, New Delhi, PHI Learning Private Limited, 2013.
2. Parvin, K., Fundamentals of Engineering Economics, New Delhi, John, and Wiley, 2012.

C. Reference Books:
1. Chan S. P., Fundamentals of Engineering Economics, Fourth Edition, New York, Pearson, 2018
2. Seema, S., Economics for Engineering Students, Second Edition .I.K. International Publishing House, Delhi, 2014.
3. Joel, **D.,** Managerial Economics, Englewood Cliffs, N.J.: **Prentice**-**Hall, 2011**
4. Gupta, G.S., Managerial Economics, New Delhi, Tata McGraw Hill Publication, 2010.
5. Diwedi, D.N., Managerial Economics, New Delhi, Pearson Education India, 2012.
6. Varshney, S.C., Managerial Economics, New Delhi Sultan Chand & Sons, 2010

E. Programme outcomes:

1. Learn the fundamentals of Engineering Economics
2. Understand and use of Economic concepts in making business decision
3. Use economic information to manage the organization
4. Use economic tools with respect to acceptance or rejection of investment proposals
5. Know the current issues relating to economic environment