B.Tech. SYLLABUS

(I YEAR)

2019-20 Onwards

(Suggestions incorporated)

NATIONAL INSTITUTE OF TECHNOLOGY

TIRUCHIRAPPALLI - 620015

TAMILNADU, INDIA

B.Tech. Curriculum Structure – Students admitted in 2019 – 20 (CL, CE, ME, MT, PR)

Semester I (July Session)

Sl. No.	COURSE	Credits	Category
1	English for Communication (Theory)	2	GIR
2	English for Communication (Lab)	2	GIR
3	Matrices and Calculus	3	GIR
4	Chemistry	3	GIR
5	Chemistry Lab	2	GIR
6	Branch Specific Course	2	GIR
7	Basics of Electrical and Electronics Engineering (For **CL, CE, ME, MT, PR**)	2	GIR
8	Engineering Graphics	3	GIR
	Total	**19**	

Semester II (January Session)

Sl. No.	COURSE	Credits	Category
1	Complex Analysis and Differential Equations	3	GIR
2	Physics	3	GIR
3	Physics Lab	2	GIR
4	Introduction to Computer Programming (Theory & lab)	3	GIR
5	Basics of Civil Engineering (for **CL, ME, MT, PR**)	2	GIR
6	Energy and Environmental Engineering	2	GIR
7	Engineering Practice	2	GIR
8	Programme Core – I	4	PC
	Total	**21**	

B.Tech. Curriculum Structure – Students admitted in 2019 – 20 (CS, EE, EC and IC)

Semester I (July Session)

Sl. No.	COURSE	Credits	Category
1	Energy and Environmental Engineering	2	GIR
2	Linear Algebra and Calculus	3	GIR
3	Physics	3	GIR
4	Physics Lab	2	GIR
5	Introduction to Computer Programming (Theory & lab)	3	GIR
6	Basics of Mechanical Engineering (For **CE, EE, EC, IC & CS**)	2	GIR
7	Engineering Practice	2	GIR
8	Basics of Civil Engineering (For **EE, EC, IC & CS**)	2	GIR
	Total	**19**	

Semester II (January Session)

Sl. No.	COURSE	Credits	Category
1	English for Communication (Theory)	2	GIR
2	English for Communication (Lab)	2	GIR
3	Complex Analysis and Differential Equations	3	GIR
4	Chemistry	3	GIR
5	Chemistry Lab	2	GIR
6	Branch Specific Course	2	GIR
7	Engineering Graphics	3	GIR
8	Programme Core – I	4	PC
	Total	**21**	

CHIR11 CHEMISTRY

Course Code:	CHIR11	No. of Credits:	03
Course Name:	Chemistry	Prerequisite:	Nil

OBJECTIVES

To introduce the student's basic principles of Electrochemistry and Corrosion. They will be familiar with phase rule & its applications. Students will know about the essential requirements of water and its importance in day-to-day life. To provide students with a brief outline of the types and applications of polymers. Finally, students will be equipped with the usage of spectroscopy in industrial applications.

COURSE CONTENT

Electrochemistry and Corrosion

Cell EMF- its measurement and applications - concentration cell - electrode electrolyte concentration cell - concentration cell with and without transference - Dry corrosion and wet corrosion, mechanisms, types of corrosion, Differential metal corrosion, differential aeration corrosion, intergranular, Passivity, Pitting, Polarization - Chemical conversion coatings and organic coatings- Paints, enamels.

Phase rule

Definition of terms – phase- components- degree of freedom- derivation of Gibbs phase rule – one component system – H_2O, CO_2, Sulfur – Two-component system – Eutectic systems – reduced phase rule - Pb-Ag system – Compound Formation with congruent melting – Zn- Mg Alloy system- Copper-nickel alloy system - systems with incongruent melting – Na_2SO_4- H_2O system and simple three-component systems.

Water

Sources, Hard & soft water, Estimation of hardness by EDTA method, Scale & Sludge- Caustic embrittlement - softening of water, zeolite process & demineralization by ion exchangers, boiler feed water, internal treatment methods-specifications for drinking water, BIS & WHO standards, treatment of water for domestic use, desalination - Reverse osmosis & Electrodialysis.

Spectroscopy

Interaction of electromagnetic radiation with matter, Electronic spectroscopy - Theory of electronic transitions, instrumentation, Beers Lambert law, Woodward FIESER rule, applications. IR spectroscopy - Fundamentals, Instrumentation, and applications, Raman spectroscopy – Fundamentals and applications.

Polymers and Composites

Concept of macromolecules- Tacticity- Classification of Polymers- Types of Polymerization- Mechanism- - Ziegler Natta Polymerization - Effect of Polymer structure on properties - Important addition and condensation polymers –synthesis and properties – Molecular mass determination of polymers- Static and dynamic methods, Light scattering- Rubbers – Vulcanization – Synthetic rubbers – Conducting polymers- Composite materials

COURSE OUTCOME

- Students will learn about the Electrochemistry and phase rule.
- They will be familiarized with the importance of polymer and its application in industries.
- Additionally, a brief introduction in the area of water, spectroscopy will be very useful for the students in future endeavour

References & Text Books

1. P.C. Jain, M. Jain, *Engineering Chemistry*, Dhanpat Rai Publishing Company, New Delhi, 2005.
2. P. Atkins, J.D. Paula, *Physical Chemistry*, Oxford University Press, 2002.
3. B.R. Puri, L.R. Sharma, M.S. Pathania, *Principles of Physical Chemistry*, Vishal Publishing Company, 2008
4. F.W. Billmayer, *Textbook of Polymer Science*, 3rd Edison, Wiley. N.Y. 1991.
5. S.S. Darer, S.S. Umare, *A Text Book of Engineering Chemistry*, S. Chand Publishing, 2011.

CHIR12 CHEMISTRY LAB

Course Code:	CHIR12	No. of Credits:	02
Course Name:	Chemistry Lab	Prerequisite:	Nil

LIST OF EXPERIMENTS

1. Estimation of carbonate, non-carbonate and total hardness in the given water sample.
2. Estimation of dissolved oxygen in the given water sample.
3. Determination of the percentage of Fe in the given steel sample.
4. Estimation of Fe^{3+} by spectrophotometer.
5. Corrosion rate by polarization technique
6. Conductometric titration
7. Potentiometric titration
8. pH-metric titration
9. Percentage purity of bleaching powder
10. Determination of molecular weight of the polymer by Viscometry
11. Study of three component system.
12. Demonstration experiments using Advanced Spectroscopic Techniques, (UV-Vis, FTIR, Raman)

COURSE OUTCOME

- The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.
- The students will learn how to estimate various components from the corresponding bulk mixture.

Reference Books

1. *Laboratory Manual*, Department of Chemistry, National Institute of Technology, Tiruchirappalli.
2. S.K. Bhasin, S. Rani, *Laboratory Manual on Engineering Chemistry*, Dhanpat Rai Publishing Company, New Delhi, 2011.

ENIR 11 ENERGY AND ENVIRONMENTAL ENGINEERING

Course Code:	ENIR11	No. of Credits:	02
Course Name:	Energy and Environmental Engineering	Prerequisite:	Nil

OBJECTIVES

- To teach the principal renewable energy systems.
- To explore the environmental impact of various energy sources and also the effects of different types of pollutants.

COURSE CONTENT

Present Energy resources in India and its sustainability - Different type of conventional Power Plant--Energy Demand Scenario in India-Advantage and Disadvantage of conventional Power Plants – Conventional vs Non-conventional power generation.

Basics of Solar Energy- Solar Thermal Energy- Solar Photovoltaic- Advantages and Disadvantages-Environmental impacts and safety.

Power and energy from wind turbines- India's wind energy potential- Types of wind turbines- Offshore Wind energy- Environmental benefits and impacts.

Biomass Resources-Biomass conversion Technologies- Feedstock preprocessing and treatment methods- Bioenergy program in India-Environmental benefits and impacts.

Geothermal Energy resources –Ocean Thermal Energy Conversion – Tidal.

Air pollution- Sources, effects, control, air quality standards, air pollution act, air pollution measurement. Water Pollution-Sources and impacts, Soil Pollution-Sources and impacts, disposal of solid waste.

Greenhouse gases – effect, acid rain. Noise pollution. Pollution aspects of various power plants. Fossil fuels and impacts, Industrial and transport emissions- impacts.

COURSE OUTCOME

Students will be introduced to the Principal renewable energy systems and explore the environmental impact of various energy sources and also the effects of different types of pollutants.

References

1. Boyle G, *Renewable energy: Power for a sustainable future*. Oxford University press, 2004.
2. B H Khan, *Nonconventional Energy Resources,* The McGraw –Hill Second edition.
3. G. D. Rai, *Nonconventional energy sources,* Khanna Publishers, New Delhi, 2006.
4. Gilbert M. Masters, *Introduction to Environmental Engineering and Science*, 2nd *Edition, Prentice Hall, 2003.*
5. G Sargsyam, M Bhatia, S G Banerjee, K Raghunathan and R Soni, *Unleashing the Potential of Renewable Energy in India*, World bank report, Washington D.C, 2011.
6. Godfrey Boyle, Bob Everett and Janet Ramage, *Energy Systems and Sustainability: Power for a sustainable future.* Oxford University press, 2010.

HSIR11 ENGLISH FOR COMMUNICATION

Course Code:	HSIR11	No. of Credits:	04
Course Name:	English for Communication	Prerequisite:	Nil

OBJECTIVES

The primary objective is to develop in the under-graduate students of engineering a level of competence in English required for independent and effective communication for academic and social needs.

COURSE CONTENT

Theory: Language and communication-reading strategies: skimming, scanning, inferring, predicting and responding to content – Guessing from context – Note making – Vocabulary extension - speed reading practice – use of extensive reading texts.

Analytical and critical reading practice- critical, creative and lateral thinking- language and thinking – thinking process and language development.

Effective writing practice – Vocabulary expansion - Effective sentences: role of acceptability, appropriateness, brevity & clarity in writing – Cohesion & coherence in writing –Writing of definitions, descriptions - Paragraph writing.

Reciprocal relationship between reading and writing –thinking and writing - Argument Writing practice – Perspectives in writing –professional writing - Narrative writing.

Lab: Listening process & practice – Exposure to recorded & structured talks, class room lectures – Problems in comprehension & retention – Note-taking practice – Listening tests- Importance of listening in the corporate world.

Barriers to listening: Physical & psychological – Steps to overcome them – Purposive listening practice – Active listening and anticipating the speaker – Use of technology to improve the skill.

Fluency & accuracy in speech –Improving self-expression – Tonal variations – Listener oriented speaking -Group discussion practice – Interpersonal Conversation -Developing persuasive speaking skills.

Barriers to speaking – Building self-confidence & fluency – Conversation practice- Improving responding capacity - Extempore speech practice – Speech assessment.

COURSE OUTCOME

The students will be able to express themselves in a meaningful manner to different levels of people in their academic and social domains.

Reference Books

1. M. Ashraf Rizvi, *Effective Technical Communication*, Tata McGraw-Hill, New Delhi, 2005.
2. Strunk, William, and E B. White, *The Elements of Style*. Boston: Allyn and Bacon, Pearson Edition, 1999.
3. Garner, Bryan A, *HBR Guide to Better Business Writing*, Hardvard Business Review Press, Boston, Massachusetts, 2013.

MAIR11 MATRICES AND CALCULUS

(Common to Chemical, Civil, Mechanical, Metallurgy and Production Engineering)

Course Code:	MAIR 11	No. of Credits:	03
Course Name:	Matrices and Calculus	Prerequisite:	Nil

OBJECTIVES

- Introduce eigen value and eigen vectors and its properties.
- Determine canonical form of given quadratic form.
- Discuss the convergence of infinite series.
- Analyze and discuss the extrema of the functions of several variables.
- Evaluate the multiple integrals and apply in solving problems.
- Introduce vector differential operator for vector function and important theorems on vector functions to solve engineering problems

COURSE CONTENT

Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem. Quadratic form.

Sequence and series: Convergence of sequence. Infinite Series-Tests for Convergence-Integral test, comparison test, Ratio test, Root test, Raabe's test, Logarithmic test, and Leibnitz's test; Power series.

Functions of two variables: Limit, continuity and partial derivatives; Total derivative, Jacobian, Taylor series, Maxima, minima and saddle points; Method of Lagrange multipliers; Double and triple integrals, change of variables, multiple integral in cylindrical and spherical coordinates.

Gradient, divergence and curl; Line and surface integrals; Green's theorem, Stokes theorem and Gauss divergence theorem (without proofs).

COURSE OUTCOME

1. Compute eigenvalues and eigenvectors of the given matrix.
2. Transform given quadratic form into canonical form.
3. Discuss the convergence of infinite series by applying various test.
4. Compute partial derivatives of function of several variables
5. Write taylor's series for functions with two variables.
6. Evaluate multiple integral and its applications in finding area, volume.
7. Compute the dot product of vectors, lengths of vectors, and angles between vectors.
8. Perform gradient, div, curl operator on vector functions and give physical interpretations.
9. Use green's, gauss divergence and stoke's theorems to solve engineering problems.

References

1. Dennis Zill, Warren S. Wright, Michael R. Cullen, *Advanced Engineering Mathematic*s, Jones & Bartlett Learning, 2011
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 2019.
3. Jerrold E. Marsden, Anthony Tromba, *Vector Calculus*, W. H. Freeman, 2003
4. Strauss M.J, G.L. Bradley and K.J. Smith, *Multivariable calculus*, Prentice Hall, 2002.
5. Ward Cheney, David Kincaid, *Linear Algebra: Theory and Applications*, Jones & Bartlett Publishers, 2012.

MAIR12 LINEAR ALGEBRA AND CALCULUS

(Common to CSE, EEE, ECE and ICE)

Course Code:	MAIR12	No. of Credits:	03
Course Name:	Linear Algebra and Calculus	Prerequisite:	Nil

OBJECTIVES

1. Introduce vector space and inner product space and it properties.
2. Introduce eigen value and eigen vectors and its properties.
3. Determine canonical form of given quadratic form.
4. Discuss the convergence of infinite series.
5. Analyze and discuss the extrema of the functions of several variables.
6. Evaluate the multiple integrals and apply in solving problems.

COURSE CONTENT

Vector space – Subspaces – Linear dependence and independence – Spanning of a subspace– Basis and Dimension. Inner product – Inner product spaces – Orthogonal and orthonormal basis – GramSchmidt orthogonalization process. Linear transformation. Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem. Quadratic form

Sequence and series: Convergence of sequence. Infinite Series-Tests for Convergence-Integral test, comparison test, Ratio test, Root test, Raabe's test, Logarithmic test and Leibnitz's test; Power series;

Functions of two variables: Limit, continuity and partial derivatives; Total derivative, Jacobian, Taylor series, Maxima, minima and saddle points; Method of Lagrange multipliers; Double and triple integrals, change of variables, multiple integral in cylindrical and spherical coordinates.

COURSE OUTCOME

1. Compute eigenvalues and eigenvectors of the given matrix.
2. Identity vector space and its basis.
3. Construct orthonormal basis for a given vector space.
4. Transform given quadratic form into canonical form.
5. Discuss the convergence of infinite series by applying various test.
6. Compute partial derivatives of function of several variables
7. Write taylor's series for functions with two variables.
8. Evaluate multiple integral and its applications in finding area, volume.

References

1. Dennis Zill, Warren S. Wright, Michael R. Cullen, *Advanced Engineering Mathematics*, Jones & Bartlett Learning, 2011
2. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 2019.
3. Strauss M.J, G.L. Bradley and K.J. Smith, *Multivariable Calculus*, Prentice Hall, 2002.
4. Ward Cheney, David Kincaid, *Linear Algebra: Theory and Applications*, Jones & Bartlett Publishers, 2012.

MAIR21 COMPLEX ANALYSIS AND DIFFERENTIAL EQUATIONS

(Common to CL, CV, ME, MME and PR)

Course Code:	MAIR21	No. of Credits:	03
Course Name:	Complex Analysis and Differential Equations	Prerequisite:	Nil

OBJECTIVES

The course presents

1. an introduction to analytic functions and power series.
2. various Cauchy's theorems and its applications in evaluation of integral.
3. various approach to find general solution of the ordinary differential equations
4. Laplace transform techniques to find solution of differential equations Partial differential equations and methods to find solution.

COURSE CONTENT

Analytic functions; Cauchy-Riemann equations; Line integral, Cauchy's integral theorem and integral formula (without proof); Taylor's series and Laurent series; Residue theorem (without proof) and its applications.

Higher order linear differential equations with constant coefficients; Second order linear differential equations with variable coefficients; Method of variation of parameters; Cauchy-Euler equation; Power series solutions; Legendre polynomials, Bessel functions of the first kind and their properties.

Laplace Transform of Standard functions, derivatives and integrals – Inverse Laplace transform – Convolution theorem – Periodic functions – Application to ordinary differential equation.

Formation of partial differential equations by eliminating arbitrary constants and functions – solution of first order partial differential equations – four standard types – Lagrange's equation. Method of separation of variables.

COURSE OUTCOME

Completion of the course, student will be able to

1. understand analytic functions discuss its properties
2. obtain series representation of analytic functions
3. evaluate various integrals by using Cauchy's residue theorem
4. classify singularities and derive Laurent series expansion
5. find the solutions of first and some higher order ordinary differential equations
6. apply properties of special functions in discussion the solution of ODE.
7. Find Laplace transform of a given function and its inverse Laplace transform.
8. Find solution of first order partial differential equations.

References

1. James Ward Brown, Ruel Vance Churchill, *Complex Variables and Applications*, McGraw-Hill Higher Education, 2004
2. Dennis Zill, Warren S. Wright, Michael R. Cullen, *Advanced Engineering Mathematics*, Jones & Bartlett Learning, 2011
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 2019.
4. William E. Boyce, Richard C. DiPrima, Douglas B. Meade, *Elementary Differential Equations and Boundary Value Problems*, Wiley, 2017.
5. Ian N. Sneddon, *Elements of Partial Differential Equations*, Courier Corporation, 2013

MAIR22 COMPLEX ANALYSIS AND DIFFERENTIAL EQUATIONS

(Common to CSE, EEE, ECE and ICE)

Course Code:	MAIR22	No. of Credits:	03
Course Name:	Complex analysis and Differential Equations	Prerequisite:	Nil

OBJECTIVES

The course presents

1. an introduction to analytic functions and power series.
2. various Cauchy' theorems and its applications in evaluation of integral.
3. various approach to find general solution of the ordinary differential equations
4. Laplace transform techniques to find solution of differential equations
5. Partial differential equations and methods to find solution of it.

COURSE CONTENT

Analytic functions; Cauchy-Riemann equations; Line integral, Cauchy's integral theorem and integral formula (without proof); Taylor's series and Laurent series; Residue theorem (without proof) and its applications.

Higher order linear differential equations with constant coefficients; Second order linear differential equations with variable coefficients; Method of variation of parameters; Cauchy-Euler equation.

Laplace Transform of Standard functions, derivatives and integrals – Inverse Laplace transform – Convolution theorem – Periodic functions – solution of ordinary differential equation and simultaneous equations with constant coefficients and integral equations by Laplace Transform.

Formation of partial differential equations by eliminating arbitrary constants and functions – solution of first order equations – four standard types – Lagrange's equation. Method of separation of variables.

COURSE OUTCOME

Completion of the course, student will be able to

1. understand analytic functions discuss its properties
2. obtain series representation of analytic functions
3. evaluate various integrals by using Cauchy's residue theorem
4. classify singularities and derive Laurent series expansion
5. find the solutions of first and some higher order ordinary differential equations
6. apply properties of special functions in discussion the solution of ODE.
7. Find Laplace transform of a given function and its inverse Laplace transform.
8. Find solution of first order partial differential equations.

References

1. James Ward Brown, Ruel Vance Churchill, *Complex Variables and Applications*, McGraw-Hill Higher Education, 2004
2. Dennis Zill, Warren S. Wright, Michael R. Cullen, *Advanced Engineering Mathematics*, Jones & Bartlett Learning, 2011
3. Erwin Kreyszig, *Advanced Engineering Mathematics*, John Wiley & Sons, 2019.
4. William E. Boyce, Richard C. DiPrima, Douglas B. Meade, *Elementary Differential Equations and Boundary Value Problems*, Wiley, 2017.
5. Ian N. Sneddon, *Elements of Partial Differential Equations*, Courier Corporation, 2013

PHIR11 PHYSICS

Course Code:	PHIR11	No. of Credits:	03
Course Name:	Physics	Prerequisite:	Nil

OBJECTIVES

- To introduce the notions of light matter interaction, fabrication of lasers, light propagation in waveguides, applications of lasers and optical fibers to engineering students.
- To comprehend and explain the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale.
- To teach the fundamentals of nuclear forces, models and classification of matter.
- To impart knowledge about the basics of conductors, superconductors, nanomaterials and their applications in science, engineering and technology.

COURSE CONTENT

Lasers: Introduction to Laser-characteristics of Lasers-spontaneous and stimulated emissions – Einstein's coefficients – population inversion and lasing action – laser systems: He-Ne Laser, semiconductor laser-applications.

Fiber Optics: Snell's law-optical fiber – principle and construction – acceptance cone - numerical aperture –types of fibers - fiber optic communication principle – fiber optic sensors.

Quantum Mechanics: Inadequacy of classical mechanics-black body radiation, photoelectric effect- wave and particle duality of radiation – de Broglie concept of matter waves – electron diffraction – Heisenberg's uncertainty principle – Schrodinger's wave equation – eigen values and eigen functions – superposition principle – interpretation of wave function – particle confined in one dimensional infinite square well potential.

Nuclear and Particle Physics: Nuclear properties and forces - Nuclear models - Shell model - Nuclear reaction - Radioactivity - types and half-life. Fundamental forces - Particle physics - classification of matter - quark model.

Physics of Advanced Materials: Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity. Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory (qualitative). Nanomaterials: introduction and properties – synthesis – top-down and bottom-up approach – applications.

COURSE OUTCOME

1. On completion of this course, the students will be able to,
2. know principle, construction and working of lasers and their applications in various science and engineering.
3. explain light propagation in optical fibers, types and their applications.
4. experience and appreciate the behaviour of matter at atomic scale, and to impart knowledge in solving problems in modern science and engineering.
5. understand the role of nuclear and particle physics in applications like radioactivity and nuclear reactions.
6. recognize, choose and apply knowledge to develop materials for specific applications for common needs.

References

1. William T. Silfvast, *Laser Fundamentals*, 2nd Edition, Cambridge University press, New York, 2004.
2. D. Halliday, R. Resnick and J. Walker, *Fundamentals of Physics*, 6th Edition, John Wiley and Sons, New York, 2001.
3. Arthur Beiser, *Concepts of Modern Physics*, Tata McGraw-Hill, New Delhi, 2010.
4. R. Shankar, *Fundamentals of Physics*, Yale University Press, New Haven and London, 2014.
5. R. Shankar, *Fundamentals of Physics II*, Yale University Press, New Haven and London, 2016.
6. C.P. Poole and F.J. Owens, *Introduction to Nanotechnology*, Wiley, New Delhi, 2007.
7. Charles Kittel, *Introduction to Solid State Physics*, 8th Edition, John Wiley & Sons, NJ, USA, 2005.

PHIR12 PHYSICS LAB

Course Code:	PHIR12	No. of Credits:	02
Course Name:	Physics Lab	Prerequisite:	Nil

OBJECTIVES

- To introduce the spirit of experiments to verify physics concepts such as reflection, refraction, diffraction and interference on light matter interaction.
- To perform experiments to estimate the materials properties and to check their suitability in science and engineering.
- To familiarize physics concepts and to design instruments and experimental set up for better and accurate measurements.
- To teach and apply knowledge to measure and verify the values of certain constants in physics.

LIST OF EXPERIMENTS

1. Determination of rigidity modulus of a metallic wire
2. Conversion of galvanometer into ammeter and voltmeter
3. Wavelength of laser using diffraction grating
4. Dispersive power of a prism – Spectrometer
5. Radius of curvature of lens-Newton's Rings
6. Numerical aperture of an optical fiber
7. Field along the axis of a Circular coil
8. Wavelength of white light – Spectrometer
9. Calibration of Voltmeter – Potentiometer
10. Thickness of a thin wire – Air Wedge
11. Specific rotation of a liquid – Half Shade Polarimeter
12. Photoelectric effect – Planck's constant

COURSE OUTCOME

On completion of this course, the students will be able to

1. Know how to calibrate a galvanometer and convert it into a current and voltmeters.
2. To make experimental setup to verify certain physics concepts of wave and particle nature of light.
3. Understand the light propagation in fibers, light matter interaction and use of lasers in science and engineering.
4. Acquire knowledge, estimate and suggest materials for engineering applications.

References

1. *Physics Laboratory Manual*, Department of Physics, National Institute of Technology Tiruchirappalli, 2018.
2. R.K. Shukla, Anchal Srivastava, *Practical Physics*, New age international, 2011.
3. C.L Arora, *B.Sc. Practical Physics*, S. Chand & Co., 2012.

CSIR11 INTRODUCTION TO COMPUTER PROGRAMMING
(Common to CL, CV, ME, MME, PR)

Course Code:	CSIR11	No. of Credits:	03
Course Name:	Introduction to Computer Programming	Prerequisite:	Nil

OBJECTIVES

- To learn the fundamentals of computers.
- To learn the problem solving techniques using algorithms and procedures
- To read, write and execute simple Python Programs
- To learn and use Python data structures – lists, tuples and dictionaries

COURSE CONTENT

Introduction to computers – Computer Organization – Characteristics – Hardware and Software – Modes of operation – Types of programming languages – Developing a program. Algorithms – Characteristics – Flowcharts.

Data types; variables, assignments; immutable variables; numerical types; arithmetic operators and expressions; comments; understanding error messages; Conditions, Boolean logic, logical operators; ranges; Control statements: if-else, loops (for, while); short-circuit (lazy) evaluation

Strings and text files; manipulating files and directories, OS and SYS modules; text files: reading/writing text and numbers from/to a file; creating and reading a formatted file (csv or tab-separated). String manipulations: subscript operator, indexing, slicing a string; strings and number system: converting strings to numbers and vice versa. Binary, octal, hexadecimal numbers

Lists, tuples, and dictionaries; basic list operators, replacing, inserting, removing an element; searching and sorting lists; dictionary literals, adding and removing keys, accessing and replacing values; traversing dictionaries.

Design with functions: hiding redundancy, complexity; arguments and return values; formal vs actual arguments, named arguments- Program structure and design- Recursive functions – Introduction to classes and OOP.

List of Programs

1. Programs using sequential constructs
2. Programs using selection constructs
3. Programs using Iterative constructs
4. Programs using nested for loops
5. Programs using lists
6. Programs using tuples and dictionaries
7. Simple Python functions
8. File input and output
9. Sorting and searching programs
10. Recursion

COURSE OUTCOME

- Write algorithms for problems
- Use syntax and semantics of Python programming language for problem solving
- Code a given logic in Python language
- Appreciate and apply appropriate Data structures available in Python language for solving problems

References

1. Kenneth A. Lambert, *Fundamentals of Python: First Programs*, CENGAGE Learning, 2012.
2. Guido van Rossum and Fred L. Drake Jr, *An Introduction to Python – Revised and updated for Python 3.2*, Network Theory Ltd., 2011.
3. Reema Thareja, *Python Programming using Problem Solving Approach*, Oxford University Press, 2017
4. Allen B. Downey, *Think Python: How to Think Like a Computer Scientist*, 2nd edition, Updated for Python 3, Shroff/O'Reilly Publishers, 2016. (http://greenteapress.com/wp/thinkpython/)
5. John V Guttag, *Introduction to Computation and Programming Using Python*, Revised and expanded Edition, MIT Press, 2013.

CSIR12 INTRODUCTION TO COMPUTER PROGRAMMING

(Common to CS, EEE, ECE, ICE)

Course Code:	CSIR12	No. of Credits:	03
Course Name:	Introduction to Computer Programming	Prerequisite:	Nil

OBJECTIVES

- To learn the fundamentals of computers.
- To learn the problem solving techniques writing algorithms & procedures.
- To learn the syntax and semantics for C programming language.
- To develop the C code for simple logic.
- To understand the construct of structure program including conditionals and iterations

COURSE CONTENT

Introduction to computers - Types of programming languages- Developing a program - Algorithms- Characteristics- Flow Charts- Principles of structured programming- Sequential selecting structures- Repetitive Structures-Bounded, Unbounded and Infinite iterations.

Introduction to C- C character set- Identifiers and Keywords- Data types- Constants- Variables- Declarations- Expressions- Statements- Symbolic Constants- Operators- Library Functions- Data input and output: Single character input and output- Entering input data- Writing output data- gets and puts functions - Control Statements- Branching: if-else-looping: while- do-while- for; Nested control Structures- switch statements- Break statements- Continue Statements- Comma operator- goto statements.

Modular Programming- Functions and Procedures - Examples- Parameters passing methods - Arrays- Defining an array- Processing an array- Multi dimensional arrays- Pointers- Variables definitions and initializations- Pointer operators- Pointer expressions and arithmetic- Pointers and one dimensional arrays - String operations.

Functions- Defining function- Accessing a function- Function prototypes- Passing arguments to a functions- Passing arrays to a function- Passing Pointers to function- Recursion – Dynamic memory allocation - malloc, calloc, realloc – Structures – Declaration – Structures and Functions – Arrays of Structures – Pointers to structures – Typedef - Unions – Bit-fields.

Files – Input / Output using files – fread, fwrite, fprintf, fscanf – Formatted input – File access - argc, argv.

COURSE OUTCOME

- Ability to write algorithms for problems
- Knowledge of the syntax and semantics of C programming language
- Ability to code a given logic in C language
- Knowledge in using C language for solving problems

References

1. Byron Gottfried, *Programming with C*, 3rd Edition, Tata McGraw Hill Education, 2010.
2. R.G. Dromey, H*ow to solve it by Computers?* Prentice Hall, 2011.
3. Brian W Kernighan and Dennis Ritchie, *The C Programming language*, 2nd Edition, Prentice Hall, 1988.
4. J.R.Hanly and E.B. Koffmann, *Problem Solving and Program design in C*, 6th Edition, Pearson Education, 2009.
5. Paul Deital and Harvey Deital, *C How to Program*? 7th Edition, Prentice Hall, 2012.
6. YashvantKanetkar, *Let Us C*, 12th Edition, BPB Publications, 2012.

MEIR11 BASICS OF MECHANICAL ENGINEERING

(Common to all branches except ME)

Course Code:	MEIR11	No. of Credits:	02
Course Name:	Basic Mechanical Engineering	Prerequisite:	Nil

OBJECTIVES

1. To introduce and define the basics concept of mechanical engineering.
2. To familiarize the working principles of IC engines and automobile systems.
3. To enable the students to understand the details about the energy systems and its components.
4. To demonstrate the various machine elements, materials and its function.
5. To help the students acquire knowledge about the various manufacturing process.

COURSE CONTENT

Introduction to Mechanical Engineering, Thermal Engineering, Design, manufacturing Engineering.

IC Engines – 2 Stroke and 4 stroke systems in IC Engines. Automobiles - Transmission systems, Suspension system, E-Vehicles.

Energy Systems - Power plants, Types, Gas Turbines, Steam Turbines, Utility boilers, R & A/C system- Green Energy production and Devices.

Engineering materials, Machine elements, Transmission, Fasteners, Support systems.

Manufacturing, Classification, Metal forming, Casting, Lathe, Drilling machines, Milling machines, Metal joining.

COURSE OUTCOME

At the end of the course, students will be able

1. To identify the basic concept and fundamentals of mechanical engineering.
2. To understand the working principle of IC engines and Energy systems.
3. To appreciate the process and materials involved in the manufacture of various machine element components.

References

1. Basant Agarwal and C.M. Agarwal, *Basic Mechanical Engineering*, Wiley India Pvt. Ltd., 2008.
2. Sadhu Singh, *Basic Mechanical Engineering*, S. Chand & Company Limited, 2009.
3. P.K. Nag, Karthikeya Tripathi, C.S. Pawar, *Basic Mechanical Engineering*, Tata McGraw Hill Publishing Company, 2009.
4. Lecture notes prepared by Department of Mechanical Engineering, NITT, 2018.

MEIR12 ENGINEERING GRAPHICS

Course Code:	MEIR12	No. of Credits:	03
Course Name:	Engineering Graphics	Prerequisite:	Nil

OBJECTIVES

1. Irrespective of engineering discipline, it has become mandatory to know the basics of Engineering Graphics. The student is expected to possess the efficient drafting skill depending on the operational function in order to perform day to day activity.
2. Provide neat structure of industrial drawing.
3. Enables the knowledge about position of the component and its forms Interpretation of technical graphics assemblies.
4. Preparation of machine components and related parts.

COURSE CONTENT

Fundamentals Drawing standard - BIS, dimensioning, lettering, type of lines, scaling-conventions.

Orthographic projection Introduction to orthographic projection, drawing orthographic views of objects from their isometric views - Orthographic projections of points lying in four quadrants.

Orthographic projection of lines parallel and inclined to one or both planes Orthographic projection of planes inclined to one or both planes. Projections of simple solids - axis perpendicular to HP, axis perpendicular to VP and axis inclined to one and both planes.

Sectioning of solids Section planes perpendicular to one plane and parallel or inclined to other plane.

Intersection of surfaces Intersection of cylinder & cylinder, intersection of cylinder & cone, and intersection of prisms.

Development of surfaces Development of prisms, pyramids and cylindrical & conical surfaces. Isometric and perspective projection Isometric projection and isometric views of different planes and simple solids, introduction to perspective projection.

COURSE OUTCOME

At the end of the course student will be able to visualize the engineering components. A number of chosen problems will be solved to illustrate the concepts clearly.

References

1. Bhatt, N. D. and Panchal, V.M, *Engineering Drawing*, Charotar Publishing House, 2010.
2. Ken Morling, *Geometric and Engineering Drawing*, 3rd Edition, Elsevier, 2010
3. Jolhe, D. A., *Engineering drawing*, Tata McGraw Hill, 2008
4. Shah, M. B. and Rana, B. C., *Engineering Drawing*, Pearson Education, 2009
5. K.V. Natarajan, *A text book of Engineering Graphics*, Dhanalakshmi Publishers, Chennai, 2006.

CEIR11 BASIC CIVIL ENGINEERING
(All Branches except CE)

Course Code:	CEIR11	No. of Credits:	02
Course Name:	Basic Civil Engineering	Prerequisite:	Nil

OBJECTIVES

- To give an overview of the fundamentals of the Civil Engineering fields to the students of all branches of Engineering.
- To realize the importance of the Civil Engineering Profession in fulfilling societal needs.

COURSE CONTENT

Properties and uses of construction materials - stones, bricks, cement, concrete and steel.

Site selection for buildings - Component of building - Foundation- Shallow and deep foundations - Brick and stone masonry - Plastering - Lintels, beams and columns - Roofs.

Roads-Classification of Rural and urban Roads- Pavement Materials-Traffic signs and road Marking-Traffic Signals.

Surveying - Classification-Chain Survey-Ranging-Compass Survey-exhibition of different survey equipment.

Sources of Water - Dams- Water Supply-Quality of Water-Wastewater Treatment – Sea Water Intrusion – Recharge of Ground Water.

COURSE OUTCOME

1. The students will gain knowledge on site selection, construction materials, components of buildings, roads and water resources
2. A basic appreciation of multidisciplinary approach when involved in Civil Related Projects.

References

1. Punmia, B.C, Ashok Kumar Jain, Arun Kumar Jain, *Basic Civil Engineering*, Lakshmi Publishers, 2012.
2. Satheesh Gopi, *Basic Civil Engineering*, Pearson Publishers, 2009.
3. Rangwala, S.C, *Building materials*, Charotar Publishing House, Pvt. Limited, Edition 27, 2009.
4. Palanichamy,M.S, *Basic Civil Engineering*, Tata McGraw Hill, 2000.
5. Lecture notes prepared by Department of Civil Engineering, NITT.

EEIR11 BASICS OF ELECTRICAL AND ELECTRONICS ENGINEERING
(For CL, CE, ME, MME, PR)

Course Code:	EEIR11	No. of Credits:	02
Course Name:	Basic Electrical and Electronics Engineering	Prerequisite:	Nil

OBJECTIVES

- This course aims to equip the students with a basic understanding of Electrical circuits and machines for specific types of applications.
- The course gives a comprehensive exposure to house wiring.
- This course also equips students with an ability to understand basics of analog and digital electronics.

COURSE CONTENT

DC & AC Circuits: Current, voltage, power, Kirchhoff's Laws - circuit elements R, L and C, phasor diagram, impedance, real and reactive power in single phase circuits.

DC & AC Machines: DC Motor, Induction motor, Synchronous motor, Synchronous generator and Transformers- construction, principle of operation, types and applications.

House wiring & safety: Single phase and three phase system – phase, neutral and earth, basic house wring - tools and components, different types of wiring – staircase, florescent lamp and ceiling fan, basic safety measures at home and industry.

Analog Electronics: semiconductor devices – p-n junction diode, Zener diode, BJT, operational amplifier – principle of operation and applications – Introduction to UPS.

Digital Electronics: Introduction to numbers systems, basic Boolean laws, reduction of Boolean expressions and implementation with logic gates.

COURSE OUTCOME

The students shall develop an intuitive understanding of the circuit analysis, basic concepts of electrical machines, house wiring and basics of electronics and be able to apply them in practical situation.

References

1. Hughes revised by Mckenzie Smith with John Hilcy and Keith Brown, *Electrical and Electronics Technology*, 8th Edition, Pearson, 2012.
2. R.J. Smith, R.C. Dorf, *Circuits Devices and Systems*, 5th Edition, John Wiley and sons, 2001.
3. P. S. Dhogal, *Basic Electrical Engineering – Vol. I & II*, 42nd Reprint, McGraw Hill, 2012.
4. Malvino, A. P., Leach D. P. and Gowtham Sha, *Digital Principles and Applications*, 6th Edition, Tata McGraw Hill, 2007.
5. Vincent Del Toro, *Electrical Engineering Fundamental*, Prentice Hall India, 2002.

PRIR11 ENGINEERING PRACTICE

Course Code:	PRIR11	No. of Credits:	02
Course Name:	Engineering Practice	Prerequisite:	Nil

OBJECTIVES

- To use hand tools and machinery in Carpentry, welding shop, Foundry, Fitting shop and Sheet Metal work.
- To manufacture engineering products or prototypes.

COURSE CONTENT

Foundry: Mould preparation for Flange and Hand Wheel, Plastic moulding / Wax moulding.

Welding: Fabrication of Butt Joint and Fabrication of Lap Joint.

Carpentry: Wood sizing exercise in planning, marking, sawing, chiseling and grooving to make; Tee Through Halving Joint and Dovetail Scarf Joint.

Fitting: Preparation of joints, markings, cutting and filling for making; Semi-circle part with the given work piece, Dovetail part with the given work piece.

Sheet metal: Fabrication of Dust Pan and Fabrication of Corner Tray.

COURSE OUTCOME

1. Know to utilize hand tools and machineries in Carpentry, Welding shop, Foundry, Fitting shop and Sheet Metal work.
2. Produce simple engineering products or prototypes

References

1. R.K. Rajput, *Workshop Practice*, Laxmi Publications (P) Limited, 2009.
2. Shashi Kant Yadav, *Workshop Practice*, Discovery Publishing House, New Delhi, 2006.