2024

Curriculum and Syllabus

B.Tech. / I Year

(2024-25)

NATIONAL INSTITUTE OF TECHNOLOGY
TIRUCHIRAPPALLI - 620 015
TAMIL NADU, INDIA

VISION OF THE INSTITUTE

- To be a university globally trusted for technical excellence where learning and research integrate to sustain society and industry.

MISSION OF THE INSTITUTE

- To offer undergraduate, postgraduate, doctoral and modular programmes in multi-disciplinary / inter-disciplinary and emerging areas.
- To create a converging learning environment to serve a dynamically evolving society.
- To promote innovation for sustainable solutions by forging global collaborations with academia and industry in cutting-edge research.
- To be an intellectual ecosystem where human capabilities can develop holistically.

GENERAL INSTITUTE REQUIREMENTS (GIR) COURSES

Sl. No.	Course	Number of Courses	Max. Credits
1.	Mathematics	3	10
2.	Physics	1	3
	Physics Laboratory	1	2
3.	Chemistry	1	3
	Chemistry Laboratory	1	2
4.	Industrial Economics *	1	3
5.	English for Communication	1	4
6.	Energy and Environmental Engineering	1	2
7.	Professional Ethics *	1	3
8.	Engineering Graphics	1	3
9.	Engineering Practice	1	2
10.	Basic Engineering	2	4
11.	Introduction to Computer Programming	1	3
12.	Branch Specific Course (Introduction to the Branch of study)	1	2
13.	Summer Internship	1	2
14.	Project work	1	6
15.	Comprehensive viva	1	1
16.	Industrial Lecture	1	1
17.	NSS / NCC / NSO	1	Pass / Fail
Total		**22**	**56**

*Refer to the Curriculum and Syllabus of the respective Department.

B. Tech. Curriculum Structure

Students admitted in 2024 - 25 (CL, CE, ME, MT, PR)

Semester I (July Session)

Sl. No.	Course Code	Course Title	Credits	Category
1.	HSIR11	English for Communication (Theory and Laboratory)	4	GIR
2.	MAIR11	Matrices and Calculus	3	GIR
3.	CHIR11	Chemistry	3	GIR
4.	Branch Specific Course (for **CL, CE, ME, MT, PR**)		2	GIR
	CLIR15	Introduction to Chemical Engineering		
	CEIR15	Introduction to Civil Engineering		
	MEIR15	Introduction to Mechanical Engineering		
	MTIR15	Introduction to Metallurgical and Materials Engineering		
	PRIR15	Introduction to Productions Engineering		
5.	EEIR11	Basics of Electrical and Electronics Engineering (for **CL, CE, ME, MT, PR**)	2	GIR
6.	MEIR11	Basics of Mechanical Engineering (for **CE** only)		
7.	MEIR12	Engineering Graphics	3	GIR
8.	CHIR12	Chemistry Laboratory	2	GIR
		Total	**19**	

Semester II (January Session)

Sl. No.	Course Code	Course Title	Credits	Category
1.	MAIR21	Complex Analysis and Differential Equations	3	GIR
2.	PHIR11	Physics	3	GIR
3.	CSIR12	Introduction to Computer Programming (Theory and Laboratory) (for **CL, CE, ME, MT, PR**)	3	GIR
4.	CEIR11	Basics of Civil Engineering (for **CL, ME, MT, PR**)	2	GIR
5.	ENIR11	Energy and Environmental Engineering	2	GIR
6.	PRIR11	Engineering Practice	2	GIR
7.	PHIR12	Physics Laboratory	2	GIR
8.	SWIR11	NSS/NCC/NSO	0	GIR
9.	Programme Core – I (for **CL, CE, ME, MT, PR**) [#]		4	PC
	CLPC11	Process Calculations		
	CEPC10	Engineering Mechanics		
	MEPC10	Engineering Mechanics		
	MTPC11	Metallurgical Thermodynamics and Kinetics		
	PRPC10	Applied Mechanics		
		Total	**21**	

[#]Refer to the Curriculum and Syllabus of the respective Department.

B. Tech. Curriculum Structure

Students admitted in 2024 - 25 (CS, EE, EC and IC)

Semester I (July Session)

Sl. No.	Course Code	Course Title	Credits	Category
1.	MAIR12	Linear Algebra and Calculus	3	GIR
2.	PHIR11	Physics	3	GIR
3.	ENIR11	Energy and Environmental Engineering (For **CS, EE, EC, IC**)	2	GIR
4.	CSIR11	Introduction to Computer Programming (Theory and Laboratory) (For **CS, EE, EC, IC**)	3	GIR
5.	CEIR11	Basics of Civil Engineering (For **CS, EE, EC, IC**)	2	GIR
6.	MEIR11	Basics of Mechanical Engineering (For **CS, EE, EC, IC**)	2	GIR
7.	PRIR11	Engineering Practice	2	GIR
8.	PHIR12	Physics Laboratory	2	GIR
		Total	**19**	

Semester II (January Session)

Sl. No.	Course Code	Course Title	Credits	Category
1.	HSIR11	English for Communication (Theory and Laboratory)	4	GIR
2.	MAIR21	Complex Analysis and Differential Equations	3	GIR
3.	CHIR11	Chemistry	3	GIR
4.	Branch Specific Course (for **CS, EE, EC, IC**)		2	GIR
	CSIR15	Essentials of Computer Science		
	EEIR15	Introduction to Electrical and Electronics Engineering		
	ECIR15	Introduction to Electronics and Communication Engineering		
	ICIR15	Introduction to Instrumentation and Control Systems Engineering		
5.	MEIR12	Engineering Graphics	3	GIR
6.	CHIR12	Chemistry Laboratory	2	GIR
7.	SWIR11	NSS/NCC/NSO	0	GIR
8.	Programme Core – I (for **CS, EE, EC, IC**) [#]		4	PC
	CSPC11	Discrete Structures		
	EEPC10	Circuit Theory		
	ECPC11	Network Analysis and Synthesis		
	ICPC11	Circuit Theory		
		Total	**21**	

[#]Refer to the Curriculum and Syllabus of the respective Department.

Course Code	**:**	HSIR11
Course Title	**:**	**English for Communication (Theory and Laboratory)**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	Develop proficient and effective English communication skills for academic, social, and professional contexts.
CLO2	Enhance students' ability to use English confidently and accurately in professional settings.
CLO3	Cultivate effective writing skills in English.
CLO4	Improve reading comprehension and listening abilities in English.
CLO5	Develop fluency and accuracy in spoken English.

Course Content

Theory:

Language and communication – Tools of communication – Levels of communication – Barriers in communication – Role and importance of communication in the corporate world.

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 - Reciprocal relationship between reading and writing.

Analytical, Critical, creative and lateral thinking- language and thinking - thinking process and language development - Thinking and writing - Perspectives in writing - Argument Writing practice.

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

Laboratory:

Listening process & practice - Exposure to recorded & structured talks, classroom 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.

References

1. M. Ashraf Rizvi, *Effective Technical Communication,* Tata McGraw-Hill, NewDelhi, 2005.
2. Meenakshi Raman and Sangeetha Sharma, *Technical Communication*, OUP, New Delhi, 2011
3. William Strunk and E B. White, *The Elements of Style.* Boston: Allyn and Bacon,Pearson Edition, 1999.
4. Bryan A Gamer, *HBR Guide to Better Business Writing,* Harvard Business ReviewPress, Boston, Massachusetts, 2013.
5. Quintanilla, Kelly, M. and Shawn T. Wahl. *Business and Professional Communication*. Sage Publications: London. 2017

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Communicate effectively and confidently in English across academic and social contexts.
CO2	Produce clear and coherent oral presentations in English, expressing ideas with appropriate language.
CO3	Write clear, well-structured texts in English, demonstrating effective use of grammar and vocabulary.
CO4	Read a variety of English texts with comprehension and at an appropriate pace.
CO5	Demonstrate effective listening skills by understanding and responding to spoken English in different contexts.

Course Code	**:**	MAIR11
Course Title	**:**	**Matrices and Calculus (CL, CE, ME, MT and PR)**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	introduce fundamental concepts of eigenvalues, eigenvectors and their properties.
CLO2	explain criteria for convergence of sequences and infinite series using various tests.
CLO3	analyse and discuss continuity, partial derivatives, total derivative and extrema of functions of several variables.
CLO4	explore the fundamentals of multiple integrals and its applications.
CLO5	teach the use of Green's theorem, Stoke's theorem and Gauss divergence theorem in solving problems related to line, surface and volume integrals.

Course Content

Matrices – Eigenvalues and eigenvectors – Diagonalization of matrices – Cayley-Hamilton theorem and quadratic form.

Sequences and series – Convergence of sequences – Infinite series –Tests for convergence of series – 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 integrals in cylindrical and spherical coordinates – Applications.

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

References

1. D. Zill, W. S. Wright and M. R. Cullen, Advanced Engineering Mathematics, 4th edition, Jones & Bartlett Learning, 2011.
2. T. M. Apostol, Calculus vol. I & II, 2nd edition, Wiley, 2022.
3. J. E. Marsden and A. Tromba, Vector Calculus, 5th edition, W. H. Freeman, 2009.
4. M.J. Strauss, G.L. Bradley and K.J. Smith, Multivariable Calculus, 3rd edition, Prentice Hall, 2002.
5. W. Cheney and D. Kincaid, Linear Algebra: Theory and Applications, 2nd edition, Jones and Bartlett Publishers, 2012.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	find eigenvalues, eigenvectors of matrices and perform the process of diagonalization.
CO2	test the convergence of sequences and series.
CO3	explain the properties of functions of two variables, including limits, continuity, partial derivatives and evaluate extrema.
CO4	evaluate multiple integrals in cylindrical and spherical polar coordinates.
CO5	apply Green's, Stoke's and Gauss divergence theorems to evaluate line, surface and volume integrals.

Course Code	**:**	CHIR11
Course Title	**:**	**Chemistry**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	to the basic principles of spectroscopy and its applications
CLO2	to the importance of photochemistry
CLO3	to the principles and applications of coordination chemistry
CLO4	to phase rule and energy systems
CLO5	to the industrial applications of polymers

Course Content

Spectroscopic Techniques: Interaction of electromagnetic radiation with matter - Born–Oppenheimer approximation - IR spectroscopy: Selection rules - instrumentation and applications - Franck–Condon principle - Electronic spectroscopy: Theory of electronic transitions - instrumentation - Beer–Lambert's law - applications - NMR spectroscopy: Fundamentals - chemical shift - spin–spin splitting - applications.

Photochemistry and Applications: Photochemical and thermal reactions - laws of photochemistry - quantum yield - excited states - spin allowed and spin forbidden processes - Kasha's rule - Jablonski diagram - fluorescence - phosphorescence - chemiluminescence - photosensitisation - applications of photochemistry - light emitting diodes (LED) - photovoltaic cells, panels and arrays (design, construction and working).

Coordination Chemistry: Coordinate bond - EAN rule - 16 & 18 electron rule and its applications - crystal field theory - splitting of d orbitals in octahedral, tetrahedral and square planar complexes - colour and magnetic properties of complexes - Applications of coordination compounds in catalysis and medicine: Wilkinson catalysis - cisplatin (structure and function).

Phase rule: Definition of terms - phase - components - degree of freedom - derivation of Gibbs phase rule - One component system: H_2O, CO_2 - Two component system - reduced phase rule - Pb–Ag system - compound formation with congruent melting - Zn–Mg alloy system.

Energy Systems: Basics of electrochemistry and cells - types of batteries - primary battery - dry cell - secondary battery - lead acid battery - lithium-ion battery - fuel cells (H_2-O_2) - supercapacitors.

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 - light scattering - rubbers - vulcanization - synthetic rubbers - conducting polymers - composite materials.

References

1. P.C. Jain, M. Jain, Engineering Chemistry, 17th Edition, Dhanpat Rai Publishing Company, New Delhi, 2017.
2. D. L. Pavia, G. M. Lampman, G. S. Kriz, J. A. Vyvyan, Introduction to Spectroscopy, 5th Edition, Cengage Learning, 2013.

3. W. Kemp, Organic Spectroscopy, 3rd Edition, Macmillan, 2019.
4. J. Singh, J. Singh, Photochemistry and Pericyclic Reactions, 3rd Edition, New Age Science, 2009.
5. K.K. Rohatgi-Mukherjee, Fundamentals of Photochemistry, 3rd Edition, New Age International Publishers, 2017.
6. J.E. Huheey, E.A. Keiter, R.L. Keiter, O.K. Medhi, Inorganic Chemistry: Principles of Structure and Reactivity, 5th Edition, Person, 2022.
7. B.R. Puri, L.R. Sharma, M.S. Pathania, Principles of Physical Chemistry, 47th Edition, Vishal Publishing Company, 2020.
8. F.W. Billmayer, Textbook of Polymer Science, 3rd Edition, Wiley, 2007.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	learn about the principles and applications of spectroscopy
CO2	learn about the importances of photochemistry and coordination chemistry
CO3	learn about the principles and applications of coordination chemistry
CO4	learn about phase rule and energy systems
CO5	learn about the industrial applications of polymers

Course Code	**:**	CLIR15
Course Title	**:**	**Introduction to Chemical Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To have an overview on basics of chemical engineering principles
CLO2	To understand the basic physics and chemistry principles in chemical engineering
CLO3	To design and formulate basic mass and energy balance in involved in chemical engineering
CLO4	To apply mathematical knowledge for solving chemical engineering problems with and without chemical reactions
CLO5	To introduce the students the role of unit operations and unit process in process industries

Course Content

Overview of chemical Engineering. Introduction to Unit Operations. Introduction to Unit Processes. Development of Process Flow Sheeting. Physio-Chemical Calculations.

Conservation Equations in Chemical Engineering. Principles and Applications of flow of Fluids. Principles and Applications of particle Mechanics.

Principles and Applications of Heat transfer. Principles and Applications of Mass transfer.

Chemical Reaction Kinetics. Concepts of Scale up. Modeling and Simulation Techniques in Chemical Processes. Introduction to Process Control.

Significance of Chemical Engineering in Food, Health, Energy and Environment. Few Case studies: State of the Art Technology in Chemical Industries.

References

1. W. L. McCabe, J. C. Smith and P. Harriot, Unit Operations of Chemical Engineering, 7th Edition, McGraw Hill, New York, 2021.
2. Anderson L. B. and L. A. Wenzel, Introduction to Chemical Engineering, McGraw Hill Publications, 1998.
3. 3.S. K. Ghosal, S. K., Sanyal and S. Datta, Introduction to Chemical Engineering, TMH Book Company, 1998.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	understand basics of chemical engineering principles
CO2	apply basic physics and chemistry principles in chemical engineering
CO3	integrate the data and formulate the mass and energy balance in chemical engineering problems.
CO4	use mathematical knowledge for solving chemical engineering problems with and without chemical reactions
CO5	use the unit operations in process industries

Course Code	:	CEIR15
Course Title	:	**Introduction to Civil Engineering**
Type of Course	:	GIR
Prerequisites	:	-
Course Assessment Methods	:	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To Understand fundamental principles of Structural Engineering.
CLO2	To Apply Geotechnical Engineering concepts to solve construction challenges.
CLO3	To Analyze transportation systems and design appropriate pavements.
CLO4	To Design infrastructure for water and wastewater management.
CLO5	To Utilize geomatics techniques for precise surveying and mapping in civil engineering projects.

Course Content

Role of Civil engineers in society, Ethics in Civil Engineering Practice, outstanding accomplishments of the profession, future trends, Types of projects, stages of projects, Specifications and Scope.

State of the art lectures on Structures, Transportation, Water Resources, Environment, Geotechnical and GIS / GPS / RS. Introduction to Engineering geology and seismology.

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

Site selection for buildings – components of building foundation – shallow and deep foundations – brick and stone masonry – plastering – lintels, beams and columns – roofs.

References

1. Sushil Kumar, Building construction, Standard Publishers, 2001
2. Rangwala S.C, Building materials, Charotar Publishing House Pvt. Limited, Edition 27, 2009.
3. Subinay Gangopadhyay, Engineering Geology, Oxford University Press, 2013
4. M. S. Palanichamy, Basic Civil Engineering, Tata Mc Graw Hill, 2000.
5. Lecture Notes Prepared by Civil Engineering Department, NIT-T.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Apply principles of analysis and design to various structural systems in buildings, bridges, and infrastructure projects.
CO2	Apply principles of analysis and design to various structural systems in buildings, bridges, and infrastructure projects.
CO3	Evaluate transportation systems, design pavements using conventional and new materials, and understand airfield pavement structure.
CO4	Design infrastructure for water and wastewater management in civil engineering projects.
CO5	Utilize surveying methods, maps, aerial photographs, GPS, LiDAR, UAV surveys, and GIS in civil engineering projects effectively.

Course Code	**:**	MEIR15
Course Title	**:**	**Introduction to Mechanical Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To introduce and define the basics concept of mechanical engineering.
CLO2	To familiarize the working principles of IC engines and automobile systems.
CLO3	To enable the students to understand the details about the energy systems and its components.
CLO4	To demonstrate the various machine elements, materials and its function.
CLO5	To help the students acquire knowledge about the various manufacturing process.

Course Content

Introduction to Mechanical Engineering, Thermal Engineering, Design, manufacturing Engineering. Role and Responsibilities of a Mechanical Engineers

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

Energy Systems - Power plants, Types, Gas Turbines, Steam Turbines, Utility boilers, R & A/C system- Green Energy production and Devices – Fluid Movers, Pumps and Compressors

Engineering materials, Machine elements and its functions

Manufacturing, Classification, Metal forming, Casting, Lathe, drilling machines, Milling machines, Metal joining, Additive Manufacturing.

References

1. Lecture notes prepared by Department of Mechanical Engineering, NITT.
2. K. Venugopal, 'Basic mechanical Engineering' ISBN: 9788187721291, Anuradha Agencies Pub-Chennai, 2014

Course Outcomes (COs)

At the end of the course student will be able to

CO1	apply basic concepts mechanical engineering in real world problems
CO2	understand the working principle of automobile subsystems.
CO3	know the functioning of various thermal energy production systems
CO4	identify various materials and its characteristics
CO5	select suitable manufacturing method for the production of a mechanical component

Course Code	**:**	MTIR15
Course Title	**:**	**Introduction to Metallurgical and Materials Science Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To develop an understanding of the basic knowledge of Metallurgical and Materials Engineering.
CLO2	To gain knowledge on overview of developments in the field of materials over periods.
CLO3	To become familiar with the metals and materials industry.
CLO4	To become familiar with classification of metals and materials based on their properties.
CLO5	To understand the role of metal and materials in aerospace, telecommunication and Indian medicines

Course Content

Historical perspective, scope of materials science and of materials engineering – Role of metals in civilization and in wars – rise and fall of emperors who conquered world- Metallurgy and materials of India – Damascus sword – Delhi iron Pillar etc.

Metals and Materials – Classification – Properties – Mechanical, electrical, thermal, magnetic, optical, decorative and its applications. Illustrative examples of practical uses of materials. Modern materials – Bio and Nano materials.

Role of metals and materials in aerospace and telecommunication, Role of metals and materials in Indian medicines – Siddha, Ayurveda, etc.

References

1. Rajput R.K. “Engineering Materials and Metallurgy” S. Chand & Co., New Delhi. 2006
2. Transaction of Indian Institute of Metals, Special issue on Nonferrous materials – Heritage of India. Vol.59, No.6, 2006.
3. Pooler and F.J. Owens, Introduction to nano technology, Wiley student edition, 2003.
4. Sujata V Bhat, Bio Materials, Narosa Publishing House, New Delhi, 2004.
5. Ravisankar B and Angelo P.C., Periodic table of elements, Mahi Publications, 2019

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Define engineering materials technology and understand each stage of the materials cycle, material selection criteria
CO2	Understand the impact of Metallurgical and Materials Engineering solutions in a global, economic, environmental, and societal context
CO3	Describe the science behind the development of metals and materials
CO4	Describe the current trends / developments in the metals and materials
CO5	Identify the role of metals and materials in various industrial sectors including aerospace, telecommunication, Indian medicines, etc.

Course Code	**:**	PRIR 15
Course Title	**:**	**Introduction to Production Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To introduce fundamental manufacturing processes, including casting, welding, machining, and advanced techniques, along with their applications.
CLO2	To acquire knowledge of engineering materials, including ferrous, non-ferrous, composites, and polymers, and their relevance in product design and development.
CLO3	To introduce the basics of material handling, reliability, maintenance, productivity, and industrial safety in production environments.
CLO4	To impart knowledge of engineering economy, cost analysis, and work system design for effective decision-making and resource management.
CLO5	To introduce students to mechanical system design through the basics of the theory of machines.

Course Content

Role of Production Engineer, Introduction to Manufacturing Processes – Casting, Welding, Metal Forming, Machining, Powder Metallurgy, Advanced Manufacturing Processes.

Introduction to Product Design and Development, Rapid Prototyping. Introduction to Engineering Materials – Ferrous Materials, Non-ferrous Materials, Composites, Polymers, Types of Industries.

Introduction to Metrology and Quality Control, Total Quality Management (TQM), Material Handling, Reliability and Maintenance, Productivity, Industrial Safety.

Introduction to Engineering Economy and Costing, Work System Design, Facility Design, Production Planning and Inventory Control.

Introduction to Operation Research, Quality Management, Management Information System (MIS), Intellectual Property Rights (IPR) , Supply Chain Management (SCM), Computer Aided Manufacturing(CAM), Computer Integrated Manufacturing(CIM). Introduction to Theory of Machines.

References

1. E.Paul De Garmo, J.J.Black, Ronald A. Kohser, Materials and Processes in Manufacturing, 8th edition, PHI, 2008.
2. P.C.Sharma, A Text Book of Production Engineering, S.Chand and Company Limited, 2008 3. Kalpakjian, Manufacturing Technology, Addision Wesley Publishing Company, England, 2003
3. Groover M.P., Fundamentals of Modern Manufacturing, Materials, Processes and Systems, John Wiley, 2006.
4. Amitabha Ghosh, Asok Kumar Mallik, Manufacturing Science, EWP Pvt. Ltd, 2007.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Understand the production engineer's role in optimizing traditional and advanced manufacturing processes.
CO2	Select suitable engineering materials for effective product design and development.
CO3	Apply metrology and quality control principles to enhance manufacturing precision and consistency.
CO4	Improve productivity and safety through effective material handling, reliability, and maintenance strategies.
CO5	Integrate advanced tools like CAM, CIM, and operations research to optimize manufacturing systems and processes.

Course Code	**:**	EEIR11
Course Title	**:**	**Basics of Electrical and Electronics Engineering (For CL, CE, ME, MT, PR)**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	Familiarising the students with the basics of Electrical circuits
CLO2	Describing the fundamentals of electrical machines and its applications
CLO3	Providing comprehensive exposure to house wiring
CLO4	Presenting the basics of analog electronic devices and its applications
CLO5	Introducing number systems and principles of 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.

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.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Upon completion of the course, the student will be able to analyse simple electrical circuits
CO2	Upon completion of the course. the student will be able to classifiy and select electrical machines for specific application
CO3	Upon completion of the course, the student will be able to understand house wiring concepts
CO4	Upon completion of the course, the student will be able to explain the working of simple anlog electronics circuits
CO5	Upon completion of the course, the student will be able to practice different number systems and build digital circuits with logic gates

Course Code	**:**	MEIR12
Course Title	**:**	**Engineering Graphics**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	Develop the ability to create precise technical drawings for various components, ensuring accurate representation and functional clarity.
CLO2	Provide neat structure of industrial drawing.
CLO3	Enables the knowledge about position of the component and its forms Interpretation of technical graphics assemblies.
CLO4	Preparation of machine components and related parts.
CLO5	Demonstrate the ability to develop surface patterns and create accurate projections of solids, including isometric and perspective views.

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.

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

Course Outcomes (COs)

At the end of the course student will be able to

CO1	apply BIS drawing standards and conventions in technical drawings.
CO2	draw orthographic and perspective projections of points, lines, planes, and solids in various orientations.
CO3	draw sectional views of solids cut by cutting planes in various orientations
CO4	draw intersections of surfaces such as cylinder-cylinder, cylinder-cone, and prisms.
CO5	draw the development of hollow cylinders, cones and prisms

Course Code	**:**	CHIR12
Course Title	**:**	**Chemistry Laboratory**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	to the analysis of water samples
CLO2	to electrochemistry experiments
CLO3	to the estimation of Fe
CLO4	to the analysis of polymers
CLO5	to the analysis of corrosion and three component system

Course Content

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. Conductometric titration
6. Potentiometric titration
7. pH-metric titration
8. Percentage purity of bleaching powder
9. Determination of molecular weight of a polymer by viscometry.
10. Corrosion rate by polarization technique
11. Study of three component system.
12. Demonstration experiments using advanced spectroscopic techniques, (UV-Vis & FT-IR).

References

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.

Course Outcomes (COs)

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

CO1	learn about the analysis of water samples
CO2	learn about the electrochemistry experiments
CO3	learn about the estimation of Fe
CO4	learn about the analysis of polymers
CO5	Learn about the analysis of corrosion and three component system

Course Code	**:**	MAIR21
Course Title	**:**	**Complex Analysis and Differential Equations**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	introduce the analytic functions, power series, various Cauchy's theorems and its applications in evaluation of integrals.
CLO2	discuss various approaches to find general solution of ordinary differential equations.
CLO3	investigate series solution techniques for solving ordinary differential equations.
CLO4	study fundamentals of Laplace transform techniques and its applications.
CLO5	familiarize the basics of partial differential equations and the use of method of separation of variables.

Course Content

Analytic functions – Cauchy-Riemann equations – Line integrals – 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 its properties.

Laplace transforms of standard functions – Derivatives and integrals – Inverse Laplace transforms – 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.

References

1. D. Zill, W. S. Wright and M. R. Cullen, *Advanced Engineering Mathematics*, 4th edition, Jones & Bartlett Learning, 2011.
2. T. Veerarajan, Transforms and Partial Differential Equations, 3rd edition, McGraw Hill Education, 2016.
3. J. W. Brown and R. V. Churchill, *Complex Variables and Applications*, 9th edition, McGraw-Hill Higher Education, 2021.
4. I. N. Sneddon, *Elements of Partial Differential Equations*, Dover Publication, 2006.
5. W. E. Boyce, R. C. Di Prima and D. B. Meade, *Elementary Differential Equations and Boundary Value Problems,* 12th edition, Wiley, 2021.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	decide analyticity of a function, find its series representation and apply Cauchy's residue theorem to evaluate contour integrals.
CO2	solve various types of first and higher order ordinary differential equations.
CO3	obtain series solutions of ordinary differential equations.
CO4	apply Laplace transforms to solve initial value problems.
CO5	formulate and solve standard partial differential equations.

Course Code	**:**	PHIR11
Course Title	**:**	**Physics**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To introduce the notions of light matter interaction, fabrication of lasers, light propagation in waveguides, applications of lasers and optical fibers to engineering students.
CLO2	To comprehend and explain the concepts of matter waves, wave functions and its interpretation to understand the matter at atomic scale.
CLO3	To teach the fundamentals of nuclear forces, models and classification of matter.
CLO4	To impart knowledge about the basics of dielectrics, conductors, superconductors, and their applications in science, engineering and technology.
CLO5	To understand the behavior of matter at the atomic scale and the macroscopic behavior of materials.

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: Fermat's principle-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 Materials: Dielectric materials - electric polarization - Clausius-Mossotti relation- Conductors: classical free electron theory (Lorentz –Drude theory) – electrical conductivity - classification of magnetic materials - Superconductors: definition – Meissner effect – type I & II superconductors – BCS theory (qualitative).

References

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

Course Outcomes (COs)

At the end of the course student will be able to

CO1	know principle, construction and working of lasers and their applicationsin various science and engineering.
CO2	explain light propagation in optical fibers, types and their applications.
CO3	experience and appreciate the behaviour of matter at atomic scale, and toimpart knowledge in solving problems in modern science and engineering.
CO4	understand the role of nuclear and particle physics in applications likeradioactivity and nuclear reactions.
CO5	recognize, choose and apply knowledge to develop materials for specific applications for common needs.

Course Code	**:**	CSIR12
Course Title	**:**	**Introduction to Computer Programming (Theory and Laboratory) (Common to CL, CE, ME, MT, PR) / Python**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To learn the fundamentals of computers.
CLO2	To learn the problem-solving techniques using algorithms and procedures.
CLO3	To learn, write and execute simple Python Programs.
CLO4	To learn and use Python data structures – lists, tuples and dictionaries.
CLO5	To learn the concepts of Object-oriented programming.

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 tabseparated). 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

References

1. Kenneth A. Lambert, Fundamentals of Python: First Programs, CENGAGE Learning, 2012.
2. Reema Thareja, Python Programming using Problem Solving Approach, Oxford University Press, 2017
3. Guido van Rossum and Fred L. Drake Jr, An Introduction to Python – Revised and updated for Python 3.2, Network Theory Ltd., 2011.
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.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Write algorithms for problems.
CO2	Use syntax and semantics of Python programming language for problem solving.
CO3	Code a given logic in Python language.
CO4	Appreciate and apply appropriate Data structures available in Python language for solving problems.
CO5	To use the OOPs concept for problem solving

Course Code	**:**	CEIR11
Course Title	**:**	**Basics of Civil Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To Identify and describe the properties and uses of stones, bricks, cement, concrete, and steel in construction projects.
CLO2	To Demonstrate proficiency in constructing foundations, masonry (brick and stone), plastering, and installing lintels, beams, columns, and roofs.
CLO3	To Classify rural and urban roads, evaluate pavement materials, and analyze traffic signs, road markings, and traffic signals.
CLO4	To Learn and apply chain surveying, ranging, and compass survey techniques, using various survey equipment effectively.
CLO5	To Investigate water sources, dams, water supply systems, wastewater treatment methods, and strategies for managing groundwater and preventing sea water intrusion.

Course Content

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

Surveying Importance – Principles – Types – Equipment - Types of Maps – Advanced Surveying Techniques

Transportation: Modes of Transportation - Classification of Roads - Cross Sectional Elements - Pavements - Traffic Parameters - Traffic Management Systems.

Sources of Water – Characteristics of water - Water Supply - Quality of Water - Wastewater Treatment.

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.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Gain knowledge on site selection, construction materials, components of buildings, roads and water resources
CO2	Appreciate multidisciplinary approach when involved in Civil Related Projects.
CO3	Comprehend the classification of rural and urban roads, pavement materials, and traffic management.
CO4	Demonstrate proficiency in surveying techniques and equipment.
CO5	Understand various sources of water, water supply systems, quality assessment, wastewater treatment, and groundwater management.

Course Code	**:**	ENIR 11
Course Title	**:**	**Energy and Environmental Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	Get introduced to energy scenario in India and its implications on environment
CLO2	Gain knowledge on the causes, effects and control or prevention measures of environmental pollution
CLO3	Develop an understanding on various renewable energy resources and technologies.
CLO4	Develop an understanding on various energy conversion processes and their impacts on environment
CLO5	Learn to apply basic engineering principles in design of various energy technologies

Course Content

Contents	Hours
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	L6
Students may be assigned to do at least one project eg: a) Studying/assessing sustainability in your place/neighbourhood with reference to education, housing, water resources, energy resources, food supplies, land use, environmental protection etc. b) Assessing/observing the air pollution status around your locality and provide suitable solutions	P2
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.	L6
Students may be assigned to do at least one project for eg: a) Assessing/observing the pollution status of a small area with respect to air, water, noise and soil b) Programmes for enhancing public environmental awareness c) Propose/come up with different measures that can be adopted for solid waste management around your locality	P2
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- Off shore Wind energy- Environmental benefits and impacts.	L10
Students may be assigned to do at least one project eg: a) Find out the energy savings that can be achieved by the installation of a solar PV and thermal. b) Conduct a feasibility study for the installation of micro wind and micro hydro power plants in India	P2
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.	L6

Students may be assigned to do at least one project eg: a) Consider the design aspects of a sustainable building for your campus b) Explore the different methods that can be adopted for maintaining a sustainable transport system in your city.	P2
Greenhouse gases – effect, acid rain. Noise pollution. Pollution aspects of various power plants. Fossil fuels and impacts, Industrial and transport emissions- impacts.	L7
Students may be assigned to do at least one project eg: a) Identify the threats for sustainability in any selected area and explore solutions for the same. b) Programmes for enhancing public environmental awareness	P2

References

1. Boyle, G. 2004.' Renewable energy: Power for a sustainable future'. Oxford Universitypress.
2. B H Khan, 'Non Conventional Energy Resources'-The McGraw –Hill Second edition.
3. G. D. Rai, 'Non conventional energy sources', Khanna Publishers, New Delhi, 2006.
4. Gilbert M. Masters, 'Introduction to Environmental Engineering and Science', 2nd Edition, Prentice Hall, 2003.
5. G.D. Rai, 'Non-conventional Energy Sources'.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	understand the role of conventional power plants and their impacts on environment.
CO2	assess the environmental quality in terms of air, water, soil and noise pollution
CO3	suggest a solution, suitable for a given locality to improve the quality of the environment.
CO4	estimate the potential of various renewable energy sources available at any location.
CO5	understand the energy efficiency of various renewable energy power plants.

Course Code	**:**	PRIR11
Course Title	**:**	**Engineering Practice**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To introduce fundamental skills in foundry practices, including mould preparation.
CLO2	To provide hands-on experience in welding techniques, including the fabrication of various joints.
CLO3	To develop basic carpentry skills such as wood sizing, planning, marking, sawing, chiselling, and joining.
CLO4	To develop fitting skills through the preparation of joints and shaping work pieces.
CLO5	To familiarize with sheet metal fabrication processes for creating practical items.

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.

References

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

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Prepare and evaluate moulds for foundry applications.
CO2	Fabricate different welded joints.
CO3	Demonstrate carpentry skills to create accurate joints.
CO4	Produce precise components by applying fitting techniques like marking, cutting, and filing to fabricate different parts.
CO5	Fabricate functional sheet metal products.

Course Code	:	PHIR12
Course Title	:	**Physics Laboratory**
Type of Course	:	GIR
Prerequisites	:	-
Course Assessment Methods	:	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To introduce the spirit of experiments to verify physics concepts such as reflection, refraction, diffraction and interference on light matter interaction.
CLO2	To perform experiments to estimate the materials properties and to check their suitability in science and engineering.
CLO3	To familiarize physics concepts and to design instruments and experimental set up for better and accurate measurements.
CLO4	To teach and apply knowledge to measure and verify the values of certain constants in physics.
CLO5	To perform experiments in electricity, magnetism and mechanics to understand their applications.

Course Content

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. Wavelengths 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

References

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

Course Outcomes (COs)

At the end of the course student will be able to

CO1	calibrate and operate voltmeter, ammeter, potentiometer and galvanometer.
CO2	demonstrate the principle of dispersion, diffraction, interference and polarization using optical instruments like spectrometer, travelling microscope and polarimeter.
CO3	design experimental setup in order to verify concepts of wave and particle natureof light.
CO4	explain the principle of light propagation in fibers and light matter interactionusing lasers and conventional light sources.
CO5	acquire knowledge of electricity, magnetism and mechanics to estimate the fundamental constants in Physics.

Course Code	**:**	MAIR12
Course Title	**:**	**Linear Algebra and Calculus (CS, EE, EC, IE)**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	introduce vector spaces, inner product spaces and their properties.
CLO2	study eigenvalues, eigenvectors and their properties.
CLO3	discuss the convergence of sequences and infinite series.
CLO4	analyse and discuss continuity, partial derivatives, total derivative and the extrema of real valued functions of several variables.
CLO5	evaluate multiple integrals and explore their applications.

Course Content

Vector spaces – Subspaces – Linear dependence and independence – Spanning of subspaces – Bases and dimensions – Inner products – Inner product spaces– Orthonormal bases – Gram-Schmidt orthogonalization process – Linear transformations.

Matrices – Eigenvalues, eigenvectors and their properties – Diagonalization of matrices – Cayley-Hamilton theorem – Quadratic forms.

Sequences and series – Convergence of sequences – Infinite Series –Tests for convergence of series – Integral test, comparison test, ratio test, root test, Raabe's test, logarithmic test and Leibnitz's test – Power series.

Functions of several 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 integrals in cylindrical and spherical coordinates – Applications.

References

1. D. Zill, W. S. Wright and M. R. Cullen, Advanced Engineering Mathematics, 4th edition, Jones & Bartlett Learning, 2011.
2. T. M. Apostol, Calculus vol. I & II, 2nd edition, Wiley, 2022.
3. M.J. Strauss, G.L. Bradley and K.J. Smith, Multivariable Calculus, 3rd edition, Prentice Hall, 2002.
4. W. Cheney and D. Kincaid, Linear Algebra: Theory and Applications, 2nd edition, Jones and Bartlett Publishers, 2012.
5. S. H. Friedberg, A. J. Insel and L. E. Spence, Linear Algebra, 5th edition, Pearson, 2022.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	find a basis and the dimension of a given vector space, identify linear transformations and produce orthogonal basis using Gram-Schmidt process.
CO2	compute eigenvalues, eigenvectors of matrices and transform quadratic form into canonical form.
CO3	examine the convergence of sequences and series using various tests.
CO4	calculate partial and total derivatives of functions and apply the techniques of differential calculus to find the extrema of functions of several variables.
CO5	evaluate multiple integrals and apply them to find area and volume.

Course Code	**:**	CSIR11
Course Title	**:**	**Introduction to Computer Programming (Theory and Laboratory) (Common to CS, EE, EC, IC) / C language**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To learn the fundamentals of computers.
CLO2	To learn the problem-solving techniques, writing algorithms & procedures
CLO3	To develop the C code for simple logic by learning the syntax and semantics in C
CLO4	To understand the construct of structure program including conditionals and iterations
CLO5	To learn function and file handling techniques.

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-whilefor; 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

List of Programs

1. Programs using Operators
2. Programs using Branching
3. Programs using Looping
4. Programs using nested control structures
5. Programs using Switch, Break, Continue, Goto statements
6. Programs using Functions
7. Programs using Arrays and Pointers
8. Programs using Strings
9. Programs using Dynamic memory allocation
10. Programs using Files

References

1. Byron Gottfried, Programming with C, 3rd Edition, Tata McGraw Hill Education, 2010.
2. Brian W Kernighan and Dennis Ritchie, The C Programming language, 2nd Edition, Prentice Hall, 1988.
3. R.G. Dromey, How to solve it by Computers? Prentice Hall, 2011.
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? 7 th Edition, Prentice Hall, 2012.
6. YashvantKanetkar, Let Us C, 12th Edition, BPB Publications, 2012.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Write algorithms for problems
CO2	Knowledge of the syntax and semantics of C programming language.
CO3	Ability to code a given logic in C language.
CO4	Knowledge in using C language for solving problems.
CO5	To handle the file structure.

Course Code	**:**	MEIR11
Course Title	**:**	**Basics of Mechanical Engineering (For CE, EE, EC, IC & CS)**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To introduce and define the basics concept of mechanical engineering.
CLO2	To familiarize the working principles of IC engines and automobile systems.
CLO3	To enable the students to understand the details about the energy systems and its components.
CLO4	To demonstrate the various machine elements, materials and its function.
CLO5	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.

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.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	To apply basic concepts mechanical engineering in real world problems
CO2	To understand the working principle of automobile subsystems.
CO3	To know the functioning of various thermal energy production systems
CO4	To identify various materials and its characteristics
CO5	To select suitable manufacturing method for the production of a mechanical component

Course Code	**:**	CSIR15
Course Title	**:**	**Essentials of Computer Science**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To make the student understand the basic building blocks of a computing system
CLO2	To make the student understand the flow of Concept-Program-Input-Processing-Output
CLO3	To understand the role of Virtual machine in program execution
CLO4	To learn the features of Compilers and Operating Systems
CLO5	To understand the instruction set and assembly level language

Course Content

Demo of simple high level language program to low level machine level language program - tracing their execution from high level to circuit level/ gate level - Overview of the Hardware Description Language (HDL) - Designing a set of elementary logic gates from primitive NAND gates.
Design of binary adders - culminating in the construction of a simple ALU (Arithmetic Logic Unit) using logic gates - Design of memory hierarchy from elementary flipflop gates to registers and RAM units of arbitrary sizes using logic gates.

Introducing an instruction set in both binary and assembly (symbolic) versions - Writing some low-level assembly programs - Other details of computer architecture - Basic language translation techniques: parsing - symbol table - macro - assembly

The role of virtual machines in modern software architectures like Java and .NET - Introduction of a typical VM language - focusing on stackbased arithmetic - logical - and memory access operations - VM abstraction and implementation - focusing on stack-based flow-of-control and subroutine call-and-return techniques.

Context-free grammars and recursive parsing algorithms - Building a syntax analyzer (tokenizer and parser) - The syntax analyzer to generate XML code reflecting the structure of the translated program - Code generation - low- level handling of arrays and objects.

Discussion of OS/hardware and OS/software design tradeoffs - and time/space efficiency considerations - Design and implementation of OS - memory management - string processing - I/O handling algorithms.

References

1. Noam Nisan Shimon Schocken, “The Elements of Computing System: Building a Modern Computer from First Principles”, MIT Press 2005
2. Paul Carl Reynolds, “ Principles of Computer Science”, Schaum’s Series, 2005
3. Raman Mata – Toledo, Pauline K. Cushman, “ Introduction to Computer Science”, Schaum Series, 2000

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Trace the fundamentals of digital logic design
CO2	Prepare themselves for designing a compiler
CO3	Generate low level code for simple programs
CO4	Design simple arithmetic and memory units
CO5	Handle and use the virtual machine

Course Code	:	EEIR15
Course Title	:	**Introduction to Electrical and Electronics Engineering**
Type of Course	:	GIR
Prerequisites	:	-
Contact Hours	:	
Course Assessment Methods	:	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	to get a comprehensive exposure to electrical and electronics engineering.

Course Content

Brief overview of the curriculum, department, laboratories and software packages. History, major inventions, scope, significance and job opportunities in electrical and electronics engineering. Interaction with Alumni and industrial experts on recent developments in electrical and electronic industries.

Introduction to various energy resources, basics of energy conversion, power apparatus used in power generation, transmission and distribution, power apparatus used in various industries.

Introduction to different types of electrical circuits, basic idea about utility supply, house wiring, SI units and representations, electricity tariff, electrical safety, energy audit and importance of energy saving, introduction to standards.

Introduction to electronic components, specifications of electronic components, importance of datasheet, development in electronic devices, electronic testing and measuring equipment, electronic industries.

Introduction to electronic circuits for signal processing, processors and controllers, embedded systems, computer applications in electrical and electronics engineering.

References

1. Clayton Paul, Syed A Nasar and Louis Unnewehr, 'Introduction to Electrical Engineering', 2nd Edition, McGraw-Hill, 1992.
2. Hughes, 'Electrical and Electronic Technology', Pearson Education India, 10th Edition, 2010.

Useful Weblinks:

1. Shock and Awe: The Story of Electricity -- Jim Al-Khalili BBC Horizon
   https://www.youtube.com/watch?v=Gtp51eZkwoI

Course Outcomes (COs)

At the end of the course student will be able to

CO1	develop an insightful knowledge on various aspects of electrical and electronics engineering
CO2	understand the electricity tariff, house wiring concepts, power plant structure and components
CO3	understand the significance of electronics and computing systems in various industrial applications

Course Code	**:**	ECIR15
Course Title	**:**	**Introduction to Electronics and Communication Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Contact Hours	**:**	2
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	Introducing the Electronics and Communication Engineering curriculum to the students
CLO2	Acquainting the ECE students with the fundamental concepts of their discipline of study
CLO3	Motivating the students to learn the courses in the curriculum through the knowledge of practical applications in the fields of different subjects
CLO4	Imparting knowledge about signals and basic communication systems
CLO5	Motivating the students to learn the courses in the curriculum through the knowledge of practical applications in the fields of different subjects

Course Content

Introduction to signals and systems, basic signals, types of signals, signal energy and power, transformations, system properties, convolution, Fourier series and transform.

Sampling theorem, discrete-time signal, basics of digital signal processing and applications to image processing: image enhancement, filtering.

Introduction to semiconductor physics, intrinsic and extrinsic semiconductors, carrier generation and recombination, pn junction diode, V-I characteristics of junction diode, diode applications, voltage regulator, Zenor diode, introduction to BJT, FET and operational amplifiers.

Introduction to digital electronics, introduction to number systems (Binary, Octal and Hexa-decimal), basic Boolean laws, reduction of Boolean expressions, Implementation of Boolean expressions with logic gates.

Introduction to communication systems, analog communication: modulation techniques, digital communication: modulation techniques, ASK, FSK, PSK.

References

1. Oppenheim, Alan V and Willsky, Alan S, Signals and Systems, Prentice Hall of India.
2. Gonzalez Rafael C and Woods Richad E, Digital Image Processing, New Delhi: Pearson.
3. A.S. Sedra & K.C. Smith, Microelectronic Circuits (6/e), Oxford.
4. B.G. Streetman, S.K. Banerjee: Solid state Electronic devices, (6/e), PHI.
5. Malvino, A. P., Leach D. P. and Gautam Saha, Digital Principles and Applications, Tata McGraw Hill.
6. BP Lathi and Zhi Ding, Modern Digital and Analog Communication Systems. Oxford.

Course Outcomes (COs)

At the end of the course student will be able to

CO1	analyze different signals and system properties.
CO2	apply the concepts of digital signal processing in the application field of digital image processing.
CO3	understand the physics of semiconductor devices and their applications.
CO4	implement Boolean expressions with logic gates.
CO5	perform comparative study of different modulation techniques in communication systems.

Course Code	**:**	ICIR15
Course Title	**:**	**Introduction to Instrumentation and Control Engineering**
Type of Course	**:**	GIR
Prerequisites	**:**	-
Contact Hours	**:**	28
Course Assessment Methods	**:**	Continuous Assessment, End Assessment

Course Learning Objectives (CLOs)

CLO1	To introduce the students the role and values of Instrumentation Engineering in the society.
CLO2	To emphasize the importance of codes and standards in Instrumentation and Control Engineering relevant to industry
CLO3	To make the student appreciate the relation between the building blocks of instrumentation and control engineering in a device or a plant
CLO4	To make the student sketch the basic building blocks of instrumentation and control engineering for various industrial and scientific applications
CLO5	To make the student relate fundamental physical theories to the working principles behind the blocks of instrumentation and control engineering

Course Content

Place of engineers in society and in an industrial organization. The technical manpower pyramid. Introduction to the program, subjects of study and their relevance, Opportunities for training, placement and for higher studies.

Overview of industry and scope of the discipline - Preliminary project design requirements – Various process conditions. Knowing client requirements and collection of specific data for projects.

Objectives, general concepts, terminologies, types and basic block diagram of instrumentation system.

Introduction to instrumentation and control engineering codes and standards and their relevance to industry.

Case studies: Introduction to instrumentation and control in a typical application like temperature, flow or pressure control.

References

1. Alan S Moris, Measurement and Instrumentation Principles, Butterworth-Heinemann Limited, 3rd Edition, 2001
2. Bolton W, Industrial Control and Instrumentation, University Press, Fi1st Edition, 2005
3. Chesmond C J, Basic Control System Technology, Viva Books Private Limited, 1998
4. ISA standards
5. Bureau of Indian Standards

Course Outcomes (COs)

At the end of the course student will be able to

CO1	Know what an engineer does for the benefit of society.
CO2	Describe the role of instrumentation and control engineering in an industrial organization.
CO3	List the standards used in instrumentation and control engineering.
CO4	Apply basic building blocks of instrumentation and control engineering for a typical application.
CO5	Identify applications of instrumentation and control engineering in advanced scientific and industrial systems