COURSE STRUCTURE & CURRICULUM

(AS PER NATIONAL EDUCATION POLICY- 2020)

For

B. Tech. Program

In

BIOTECHNOLOGY

Department of Biotechnology
Motilal Nehru National Institute of Technology Allahabad
Prayagraj -211004 (UP)

VISION AND MISSION OF THE INSTITUTE

Vision

To attain a distinct identity for the Institute through technology innovation, knowledge creation and dissemination for the benefit of the society.

Mission

To nurture an eco-system for continuous enhancement of value based teaching and learning process in the emerging areas of technology.
To train quality human and knowledge resources in the service of society.
To develop sustainable products and technologies.

Objectives of undergraduate programs of the institute *(adapted from UG ordinances)*

The objectives of the Undergraduate Program at the Motilal Nehru National Institute of Technology Allahabad (MNNIT Allahabad) are:

- To provide the highest level of education in technology and science and to produce competent, creative and imaginative engineers and scientists.
- To promote a spirit of free and objective enquiry in different fields of knowledge.
- To make a significant contribution towards the development of skilled technical manpower, and
- To create an intellectual reservoir to meet the growing demands of the nation.

The undergraduate program are designed to achieve these objectives and to inculcate in the student concepts and intellectual skills, courage and integrity, awareness and sensitivity towards the needs and aspirations of the society.

VISION AND MISSION OF THE DEPARTMENT

Department Vision

Biotechnology program vision is to provide quality teaching with a strong core science concepts and an application-oriented undergraduate and post-graduate education along with solid foundation in the rapidly expanding fields of biotechnology that enable them to produce high quality professionals. Our goal is to provide students with a sound knowledge and understanding of current theories, concepts and laboratory practices in biotechnology

Department Mission:

To generate high quality engineering professionals by offering UG (B.Tech.) and PG (M.Tech. and Ph.D.) program in Biotechnology and to develop a premier biotechnology teaching and research department to cater the needs and challenges of the region and the country.

Mapping of the Departmental Vision with the Institute Vision

	Institutional Vision			
Department Vision	Establishing unique identity	Knowledge creation	Knowledge acquisition	Knowledge dissemination for benefit of society
Provide qualityteaching with a strongcore science concept	✓	✓	✓	✓
Application oriented UG and PG education	✓	✓	✓	✓
Generation of high quality engineering professionals	✓	✓	✓	✓
Imparting practical knowledge	✓	✓	✓	✓
To cater the needs and challenges of the region and country	✓	✓	✓	✓

Mapping Departmental Mission with Institutional Mission

		Institute mission	
Department mission	To generate high quality human and knowledge resource	Make valuable contribution in technology for Social and economic development	Make organised effort for continuous enhancement of academic process, infrastructure and ambience
Generate high quality professionals	✓	✓	✓
To develop a premier biotechnology teaching and research department	✓	✓	✓
Cater the needs and challenges of region and country	✓	✓	✓

About the Department

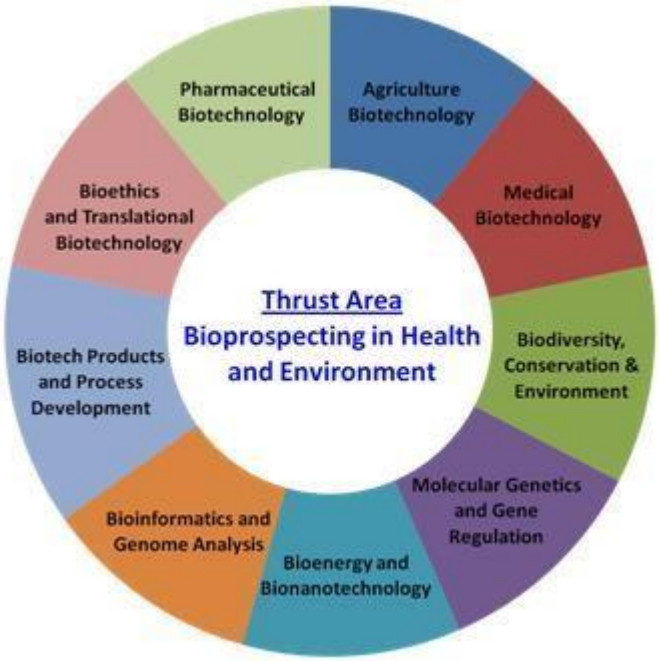
Biotechnology at MNNIT Allahabad was established as a new academic unit under Applied Mechanicsin 2006, with the objective of integrating life sciences with engineering and to develop cutting-edge technology through research, training and technological innovation. Initially as a part of the Department of Applied Mechanics, an administratively independent Department of Biotechnology was established in the April, 2012. Since its inception, the department has witnessed a consistent rise in the students demand for the subject. Keeping a beat to the global demands for researchers in this field, a full-fledged post graduate degree course (M. Tech) in Biotechnology was introduced in the year 2010. The department has also started a PhD program in biotechnology since 2009.

The department is well equipped with the all necessary instruments and number of research facilities. The department has a young, enthusiastic and well qualified faculty actively involved in research and teaching. The teachers are available to the students for academic as well as personal counseling. The department has been encouraging the students to independently think as well as implement research ideas. Presently, B. Tech, M. Tech (Biotechnology) and PhD program is being run under Biotechnology with the involvement of thirteen faculty members.

During this short span of time, the discipline has grown in every sphere. The faculty has been able to generate the external funding from various government agencies viz., DST, DBT, UGC, MNRE etc. and published papers in national/ International journals of repute. The department has been able to generate externally funded research grants of more than 2 crores within the short span. The faculty is frequently visiting various academic institutes/ research laboratories both in India and abroad. In addition, a national & International conference supported by various government agencies was also organized regularly. The infrastructure in terms of equipment and other aspects has also grown significantly. All the Bachelor students in Biotechnology have passed, are either placed in good companies or pursuing their higher studies (MS and PhD program) in India or abroad. In addition, students of the department have been successful in prestigious GRE, CSIR-UGC (NET), GATE examinations.

The department aims to establish advanced research laboratories in all the identified areas. Apart from fundamental research, the goals of the department are also targeted to meet the demands of the biotechnology based industries.

Departmental Thrust Area



Proposed model curriculum for B. Tech. (Biotechnology) based on NEP 2020

Program Educational Objectives (PEOs):

PEO1. Generate adequate human resources for employment opportunities in the critically important and dynamic biotechnology industry in the context of a socio-economic and sustainable society.

PEO2. Impart a uniquely combinatorial theoretical and practical knowledge in biotechnology with cutting-edge biotechnology research and teaching.

PEO3. Develop trained manpower with strong knowledge and ethics to undertake and execute sponsored and collaborative research programmes and consultancies to promote long term academia industrial collaboration as well as for generating resources.

Program outcomes

PO1. To inculcate strong foundation in the basic fundamentals of engineering and sciences.

PO2. Apply the knowledge of basic, emerging and scientific advancements in the field of Biotechnology for problem solving fulfilling societal, environmental and ethical functional constraints

PO3. Identify and define biotechnological problems, and offer potential solutions by conducting experiments, investigating, analyzing and interpreting data to arrive at substantial inferences and conclusions, with comprehensive oral and written expression of technical and scientific literature.

PO4. Give reasoning and assess societal, industrial, health, and cultural issues with competency in professional biotechnological practices.

PO5. Have awareness regarding environmental protection and biodiversity conservation and their responsibilities and duties towards it, both as a biotechnologist and as an individual.

PO6. Apply the subject related technical knowledge for biotechnology related innovations and develop entrepreneurial outcomes for the benefit of mankind and human use and manifest the understanding of production and manufacture of different bio-related products.

PO7. Demonstration of application of principles of biology/ biotechnology in inter/ multidisciplinary projects and attainment of the ability to translate the acquired knowledge and core competence among his/her professionals, clients and society.

Program specific outcomes

PSO 1.Acquire an in-depth understanding of fundamental concepts of Biotechnology and capability to apply the gained knowledge in their professional development and to fulfil the emerging industrial demands of the country.

PSO 2. Develop scientific aptitude and strong oral and written communication skills, specifically with respect to scientific and technical report writing.

PSO 3. Have the knowledge of all the facets of biotechnology and its multidisciplinary applications and ability to implement it for the benefit of humanity.

PSO 4. Demonstrate high ethical, cultural and societal values with distinctive leadership traits and pursuit of life-long learning.

GENERAL COURSE STRUCTURE & THEME

Definition of credit

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
2 Hours Practical (P) per week	1 Credit

B.Tech Biotechnology Course Structure First Year Semester I

Structure of B.Tech. 1st Year Biotechnology) Program: The structure of B.Tech. program shall have essentially thefollowing categories of courses with the breakup of credits as given:

S. No.	Course	Category	L	T	P	Credits	Contact hours	Remarks
1	Physics/chemistry	CEF	2	1	2	4	5	Branch specific physics and chemistry courses (alternatively in each semester) (Physics-III; PH11103)
2	Mathematics-I	CEF	3	1	0	4	4	Common course for all branches
3	English language and technical communication/Introduction to AI and machine learning	PCE	2	0	2	3	4	Common course for all branches *As per the clause 23. 13 of the NEP 2020
4	**Basics of Bio-manufacturing**	**CEE**	**2**	**0**	**2**	**3**	**4**	**Branch specific course for student of that branch only**
5	Introductory Cell and Molecular Biology	**CEE**	**3**	**0**	**0**	**3**	**3**	**Branch specific course for student of that branch only**
6	Engineering graphics/workshop and manufacturing processes	PCE	1	0	2	2	3	Common course (alternatively in each semester) *If any department does not want to adopt this/these course(s) for the specific branch, the department may float branch branch-specific course in its/their place
7	Environment and Climate change	PCE	2	0	0	0	2	Common course for all branches @Audit Course
8	Extra academic activity (A/B)	EAA	-	-	4	2	4	Common course for all branches (with different titles) ** Engagement beyond Academic Activity Duration &The evaluation of grading system should be worked out
Total			14	3	12	21	29	

B.Tech. Course Structure First Year Semester II

Note: Flexible L-T-P structure indicates the course may have any combination of L-T-P with assigned credits as listed above

S No	Course	Category	L	T	P	Credits	Contact hours	Remarks
1	Physics/chemistry	CEF	2	1	2	4	5	Branch specific physics and chemistry courses (alternatively in each semester)
2	Mathematics-II	CEF	3	1	0	4	4	Branches Specific Mathematics Course
3	English language and technical communication/Introduction to AI and machine learning	PCE	2	0	2	3	4	Common course for all branches *As per the clause 23. 13 of the NEP 2020
4	Fundamentals of Biotechnology	CES	2	1	0	3	3	Courses to be floated by each department $Only for the students of other branches
5	**Biosafety and Bioethics**	CEE	2	1	0	3	3	Branch specific course for student of that branch only
6	Engineering graphics/workshop and manufacturing processes	PCE	1	0	2	2	3	Common course (alternatively in each semester) #If any department does not want to adopt this/these course(s) for the specific branch, the department may float branch branch-specific course in its/their place
7	Extra academic activity (A/B)	EAA	-	-	4	2	4	Common course for all branches (with different titles) ** Engagement beyond Academic Activity Duration &The evaluation of grading system should be worked out
Total			13	3	10	21	26	

The “Extra Academic Activity”, Course will include the following

Extra Academic Activity-A (Compulsory)	Extra Academic Activity-B (Choice Based)
Professional Ethics and Social values	• Health Education & Personal Hygiene • Nutrition and Balanced Diet • Yoga & Ayush (Indian System of Medicine) • Self Defence • Training and practice in Sport and games based on one’s own interest • Training Methods in Physics Education • Foreign Languages/Ancient/Indian Languages etc • Traditional art and Lok Vidya such as Sculpture, Fine Art, Performing Art, Wood and Mental work, Folk Art and Culture, etc. • NCC/NSS • Multimedia/Mass communication /Journalism • Literary Skills

Semester	1
Course Name	BASICS OF BIO-MANUFACTURING
Course Code	BTXXXX
Credits	03
Contact hours/ week	2-0-2 (LTP)
Prerequisite	Nil
Course objective	This course introduces students to the basic principles of bio-manufacturing techniques and their application in biotechnology sector and industrial demand.
Course outcome	• Basic understanding and training related to manufacturing of substances of industrial importance by biological interventions. • Identification of key-factors in the manufacturing of biological compounds in a regulated environment with quality control aspects. • Analyzing examples and case studies highlighting key challenges in bio-manufacturing

Theory component:

UNIT I: [5L]
Introduction, scope, market economy and need of Bio manufacturing. GMPs & GLPs related to Biotechnology.
UNIT II: [5L]
Overview of bio-manufacturing of important products, process control, validation and testing.
UNIT III: [5L]
Basics of cell culture, microbial growth and inhibition, product formulations, bio-therapeutics, cosmetics, biocompatible materials having diverse applications.
UNIT IV: [5L]
Market analysis, and case studies.

Basics of Bio manufacturing Laboratory [2 hrs per week]

1. Preparation of emulsions and colloids
2. Preparation of liposomes
3. Preparation of herbal formulation
4. Preparation of nano-formulations
5. Industrial report writing and Industrial workshop

Text Books

- Drug discovery and analytical methods for pharmaceutical formulations: Lambert Publications, Germany
- Biomanufacturing, Chander Prakash, S. Singh, S. Ramakrishna, B. S. Pabla, S. Puri, M. S. Uddin, Springer

Reference Books

- Introduction to biomanufacturing, The Northeast Bio-manufacturing center and collaborative (CNB), Montgomery County Community College.
- Biomaufacturing: 87 Advances in Biochemical Engineering/ Biotechnology, Eds Ziang Ziang Zhong, Springer.

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	✓	✓					
CO2		✓	✓			✓	
CO3			✓			✓	✓

Semester	1
Course Name	INTRODUCTORY CELL AND MOLECULAR BIOLOGY
Course Code	BTXXXX
Credits	03
Contact hours/ week	3-0-0 (LTP)
Prerequisite	Nil
Course objective	Cell and molecular biology is the study of cells, their structure and function which provides students with a solid foundation in cell biology and molecular biology with an understanding how cells work in healthy and diseased states.
Course outcome	• Students will be able to understand and integrate knowledge of chemical and biological principles of living systems, central dogma of the cell andits regulation at various levels. • Knowledge gained in this course will serve as a foundation for other advanced courses of the same stream.

Theory component:

UNIT I: **[8L]**
Introduction, Basic properties of cells, Prokaryotic and eukaryotic cells, cell organelles.

UNIT II: **[8L]**
Introduction to bio-membranes, membrane transport, cytoskeleton and cell motility, cell-cell junction.

UNIT III: **[10L]**
Biomolecules: Carbohydrates, proteins, nucleic acids and vitamins, enzyme, gene.

UNIT IV: **[5L]**
Cell metabolism. Cell cycle and Cell signaling

Text Books:

- Essential Cell Biology by Alberts.
- L. M.Prescott, J.P. Harley and D.A.Klein, Microbiology, 6th Ed, McGraw Hill, 2005.

Reference Books

- The Cell: A molecular Approach by Cooper.
- Cell Biology by Pollard and Earnshaw.
- Genes to clone by T. A. Brown, Blackwill publication.
- Biotechnology and Genetic engineering by S. Mitra

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	✓	✓				✓	✓
CO2	✓	✓				✓	✓

Semester	2
Course Name	BIOSAFETY AND BIOETHICS
Course Code	BTXXXX
Credits	03
Contact hours/ week	2-1-0 (LTP)
Prerequisite	Nil
Course objective	1. To make students familiar with key concepts of bio-ethics and bio-safety. 2. To understand the various ethical issues involved in research and development to aware about various ethical conflicts.
Course outcome	• Understand basic principles of biosafety and bioethics and its possible impact on biological sciences in both academia and industries • Realize the importance of biosafety practices and guidelines in research activities.

Theory component:

UNIT I: **[8L]**
Biosafety: Containment for biohazards; bio-safety levels and assessment; GRAS, GMOs & LMOs.

UNIT II: **[10L]**
Safety Issues: Laboratory design and facilities, Basic laboratory guidelines, Institutional bioethics and biosafety committees

UNIT III: **[8L]**
Bioethics: Ethical conflicts and legal issues. Ethics of new technology.

UNIT IV: **[5L]**
Plagiarism, Conflict of Interest, Ethical Issues in research with living organisms.

Text Books:

- IPR, Biosafety and Bioethics, Goel D &Prashar S – Pearson.
- Industrial documents/ biosafety guidelines

Reference Books

- IPR, Biosafety and biotechnology Management. Senthil Kumar Sand Mohammed Jaabir,-Jasen Publications.
- Biological Safety: Principles and Practices, Dawn P. Wooley and Karen B. Byers, Wiley

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1		√		√	√	√	√
CO2		√		√	√	√	√

Semester	2
Course Name	FUNDAMENTALS OF BIOTECHNOLOGY
Course Code	BTXXXX
Credits	03
Contact hours/ week	2-1-0 (LTP)
Prerequisite	Nil
Course objective	To provide fundamental knowledge of the field of Biotechnology and its applications
Course outcome	• This will introduce students with the concepts of biology and their applications • Students will gain foundation to understand basic biochemistry, microbiology, cell biology, immunology, bioinformatics and biochemical principles.

Theory component:

UNIT I: **[8L]**
Introduction to biotechnology, its interventions and applications; Biotechnology sector: strength opportunities and challenges.

UNIT II: **[8L]**
Introduction to cell and biomolecules: structure, function and regulation. Enzyme, Gene: expression and regulation

UNIT III: **[8L]**
Introduction to bioinformatics, major bioinformatics resources and database searches. Genetically modified plants and animals.

UNIT IV: **[6L]**
Application of biotechnology, Current challenges and success stories/startups in biotechnology.

Text Books:

- D. L. D. L. Nelson and M. M. Cox, Lehninger Principles of Biochemistry, 5th Ed Macmillan Worth, 2007.
- Biotechnology by B.D. Singh; Kalyani Publisher India

Reference Books

- B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts,P. Walters, Molecular Biology of Cell, 5th Ed, Garland Publishing, 2007
- B. Lewin, Genes IX, International Edition,Pearson education, 2008
- Marketa Zvelebil, Jeremy O. Baum. Understanding Bioinformatics. Garland Science, 2007

Course outcome and program outcome mapping

PO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	✓		✓			✓	
CO2	✓		✓				✓

Department of Civil Engineering

DEPARTMENT OF CIVIL ENGINEERING
COURSE STRUCTURE

I Year (1st Semester)

S. No.	Category	Course Title	Hours per Week			Credits
			L	T	P	
1	CEF	Physics/Chemistry	2	1	2	4
2	CEF	Mathematics-I	3	1	0	4
3	HSS	Professional Communication	2	0	2	3
4	CEE/CES	Building Engineering-I	2	0	2	3
5	CEE	Plumbing & Sanitation Systems	2	0	2	3
6	PCE	Engineering Graphics and 3D Modelling	1	0	2	2
7	PCE	Environment and Climate Change	2	0	0	2
8	EAA	Professional Ethics & Social Values	-	-	4	2
		Total	**14**	**2**	**14**	**23**

I Year (2nd Semester)

S. No.	Category	Course Title	Hours per Week			Credits
			L	T	P	
1	CEF	Chemistry/Physics	2	1	2	4
2	CEF	Mathematics-II	3	1	0	4
3	PCE	Introduction to AI and Machine Learning	2	0	2	3
4	CES	1. Sustainable Urban Habitat 2. Introduction to Transportation Systems 3. Infrastructure Engineering	2	1	0	3
5	CEE/CES	Building Engineering-II	2	1	0	3
6	PCE	Workshop & Manufacturing Processes	1	0	2	2
7	EAA	1. Yoga & Ayush 2. NCC/NSS 3. Foreign Lang/Ancient/Indian Lang. 4. Health & Nutrition 5. Nutrition & Balanced Diet 6. Self Defence	-	-	4	2
		Total	**12**	**4**	**10**	**21**

II Year (3rd Semester)						
S. No.	**Category**	**Course Title**	**Hours per Week**			**Credits**
			L	**T**	**P**	
1	HSS	Management Concepts and Applications	3	0	0	3
2	EAA	Extra Academic Activity-B	0	0	4	2
3	CEE	Solid Mechanics	3	1	2	5
4	CEE	Concrete Technology & Construction Management	3	0	2	4
5	CEE	Fluid Mechanics & Hydraulic Machines	3	1	2	5
6	CEE	Engineering Geology	2	0	2	3
7	CEE	Surveying	3	1	2	5
		Total	**17**	**3**	**14**	**27**

II Year (4th Semester)*						
S. No.	**Category**	**Course Title**	**Hours per Week**			**Credits**
			L	**T**	**P**	
1	HSS	Business Economics	3	0	0	3
2	CEE	Water Supply Engineering	3	1	0	4
3	CEE	Structural Analysis-I	3	1	0	4
4	CEE	Highway & Traffic Engineering	3	1	0	4
5	CEE	Geotechnical Engineering-I	3	0	2	4
6	CEE/CES	Geoinformatics	3	1	0	4
		Minors Course*				
		Total	**18**	**4**	**2**	**23**

** Minor courses for students of other department students will be offered in 4th, 5th & 6th semester*

III Year (5th Semester)*						
S. No.	**Category**	**Course Title**	**Hours per Week**			**Credits**
			L	**T**	**P**	
1	CEE	Pavement Engineering & Management	3	0	2	4
2	CEE	Geotechnical Engineering-II	3	1	2	5
3	CEE	Waste Water Engineering	3	1	2	5
4	CEE	Concrete Structures-I	3	1	0	4
5	CEE	Irrigation Engineering	3	1	0	4
6	CEE	Structural Analysis-II	3	1	2	5
		Minors Course*				
		Total	**18**	**5**	**8**	**27**

** Minor courses for students of other department students will be offered in 4th, 5th & 6th semester*

III Year (6th Semester)*#						
S. No.	**Category**	**Course Title**	**Hours per Week**			**Credits**
			L	**T**	**P**	
1	CEE	Steel Structures	3	1	2	5
2	CEE	Concrete Structures-II	3	0	2	4
3	CEE	Design of Hydraulic Structures	3	1	0	4
4	CEE	Software Applications in Civil Engineering	0	0	4	2
5	CEE	Engineering Hydrology	2	1	0	3
6	CEE/CES	Professional Elective-I	3	0	0	3
7	HSS	Soft Skills and Personality Development	2	0	1	3
		Minors Course*				
		Honours Course#				
		Research Course#				
		Total	**16**	**3**	**9**	**24**

** Minor courses for students of other department students will be offered in 4th, 5th & 6th semester*

 # Honours & Research Courses will be offered in 6th & 7th semester in addition to the courses listed in 6th & 7th sem

IV Year (7th Semester)#

S. No.	Category	Course Title	Hours per Week			Credits
			L	T	P	
1	CEE	Railway & Airport Engineering	3	1	0	4
2	CEE	Earthquake Resistant Design	2	1	0	3
3	CEE/CES	Professional Elective-II	3	0	0	3
		Honours Course#				
		Research Course#				
Total			**8**	**2**	**0**	**10**

 # Honours & Research Courses will be offered in 6th & 7th semester in addition to the regular courses.

IV Year (8th Semester) [Only B.Tech/Honours/Research/Minors]

S. No.	Course Type	Course Title	Credits
1	IG/GP	Job Orientation/GP/Research[@]	14
Total			**14**

[@] *The students opting for Research in addition to the Regular B.Tech Programme will have to do a Research Project in the Institute in 8th semester.*

Credits for Regular B.Tech Only

Name of Degree	Duration (years)	Semester	Credits Proposed			Credit Requirement
			Per Semester	Year	Degree	
Certificate	1	1	23	44	44	40-45
		2	21			
Diploma	2	3	27	50	94	80-90 (+6)
		4	23			
B.S.	3	5	27	51	145	120-135 (+9)
		6	24			
B.Tech	4	7	10	24	**169**	160-170
		8	14			

Credits for B.Tech with Honours/ Research

Name of Degree	Duration (years)	Semester	Credits Proposed		
			Per Semester	Year	Degree
Certificate	1	1	23	44	44
		2	21		
Diploma	2	3	27	50	94
		4	23		
B.S.	3	5	27	27	121
		6	24 (6^{th} sem B.Tech Only) + 10 (7^{th} sem B.Tech Only) + 20 (For Honours/ Research in 6^{th} & 7^{th} Sem)	54	175
B.Tech	4	7			
		8	14	14	**189**

POOLS OF COURSES FOR HONOURS (OFFERED IN 6TH & 7TH SEMESTER)

*** Credit Requirement: 20 credits**
*** For completing the credit requirement, student can opt only for maximum two courses from any pool.**

S. No.	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
STRUCTURAL ENGINEERING						
1	HN****	Structural Dynamics	3	1	0	4
2	HN****	Advanced Concrete Design	3	1	0	4
3	HN****	Finite Element Method	3	1	0	4
4	HN****	Seismic Design of Structures	3	1	0	4
TRANSPORTATION ENGINEERING						
1	HN****	Traffic Flow Theory	3	1	0	4
2	HN****	Intelligent Transportation Systems	3	1	0	4
3	HN****	Software Applications in Transportation Engineering	3	0	2	4
ENVIRONMENTAL ENGINEERING						
1	HN****	Environmental Chemistry & Microbiology	3	1	0	4
2	HN****	Principles of Biological Wastewater Treatment	3	1	0	4
3	HN****	Physicochemical Processes for Water & Waste Water Treatment	3	1	0	4
GEOTECHNICAL ENGINEERING						
1	HN****	Geotechnical Earthquake Engineering	3	1	0	4
2	HN****	Rock Engineering	3	0	2	4
3	HN****	Ground Improvement	3	1	0	4
WATER RESOURCES & GEOINFORMATICS						
1	HN****	Artificial Intelligence for Remotely Sensed Image Processing and GIS	3	1	0	4
2	HN****	Advanced Geological and Geophysical Investigations	3	1	0	4
3	HN****	Water Resources and Climate Change	3	1	0	4
4	HN****	Hydropower Engineering	3	1	0	4
CONSTRUCTION ENGINEERING						
1	HN****	Advanced Construction Management	3	1	0	4
2	HN****	Energy Efficient Construction	3	1	0	4
3	HN****	3D Modelling and 3D Printing for Civil Engineering	3	1	0	4
ONLINE COURSES (MOOCS/ NPTEL)						
T-his pool will be created after receiving guidelines from Dean Acad. Office						

Note: The courses in pools will be offered based on the availability of the faculty

POOLS OF COURSES FOR RESEARCH (OFFERED IN 6TH & 7TH SEMESTER)

*** Credit Requirement: 20 credits**
*** Student can opt all courses from one specialization only**

POOL I-STRUCTURAL ENGINEERING						
S. No.	**Course Code**	**Course Title**	**Hours per Week**			**Credits**
			L	T	P	
1		Structural Dynamics	3	1	0	4
2		Advanced Concrete Design	3	1	0	4
3		Elective-I	3	1	0	4
4		Elective-II	3	1	0	4
5		Elective-III	3	1	0	4

S. No.	Course Code	Elective-I	S. No.	Course Code	Elective-II	S. No.	Course Code	Elective-III
1		Advanced Concrete Technology	1		Durability Assessment and Structural Strengthening of Reinforced Concrete	1		Structural Health Monitoring
2		Theory of Elasticity and Plasticity	2		Finite Element Method	2		Soft Computing Methods in Engineering Problem Solving
3		Seismic Design of Structures	3		High Rise Structures	3		Optimization Methods in Civil Engineering

POOL II-TRANSPORTATION ENGINEERING						
S. No.	**Course Code**	**Course Title**	**Hours per Week**			**Credits**
			L	T	P	
1		Transportation System Planning	3	1	0	4
2		Intelligent Transportation Systems	3	1	0	4
3		Elective-I	3	1	0	4
4		Elective-II	3	1	0	4
5		Elective-III	3	1	0	4

S. No.	Course Code	Elective-I	S. No.	Course Code	Elective-II	S. No.	Course Code	Elective-III
1		Software Applications in Transportation Engineering	1		Traffic Flow Theory	1		Artificial Intelligence for Remotely Sensed Image Processing and GIS
2		Principles of Transportation Systems	2		Highway Geometric Design	2		Soft Computing Methods in Engineering Problem Solving
3		Logistics Transportation Systems	3		Intersection Design	3		Optimization Methods in Civil Engineering

POOL III-GEOTECHNICAL ENGINEERING						
S. No.	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1		Geotechnical Earthquake Engineering	3	1	0	4
2		Rock Engineering	3	0	2	4
3		Elective-I	3	1	0	4
4		Elective-II	3	1	0	4
5		Elective-III	3	1	0	4

S. No.	Course Code	Elective-I	S. No.	Course Code	Elective-II	S. No.	Course Code	Elective-III
1		Ground Improvement	1		Earth and Earth Retaining Structures	1		Advanced Foundation Engineering
2		Finite Element in Geotechnical Engineering	2		Geo-technology for climate change and sustainable development	2		Theory of Elasticity and Plasticity
3		Clay Mineralogy and Expansive soil	3		Stability analysis of soil and rock slopes	3		Soft Computing Methods in Engineering Problem Solving

IV-ENVIRONMENTAL ENGINEERING						
S. No.	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1		Physicochemical Processes for Water & Waste Water Treatment	3	1	0	4
2		Environmental Chemistry & Microbiology	3	1	0	4
3		Elective-I	3	1	0	4
4		Elective-II	3	1	0	4
5		Elective-III	3	1	0	4

S. No.	Course Code	Elective-I	S. No.	Course Code	Elective-II	S. No.	Course Code	Elective-III
1		Principles of Biological Wastewater Treatment	1		Hazardous Waste Management	1		Soft Computing Methods in Engineering problem Solving
2		Rural Water Supply & Wastewater Disposal	2		Air and Water Quality Modelling	2		Design of Environmental Engineering Structures
3		Advance Wastewater Treatment	3		Groundwater Contamination and Pollution Transport	3		Artificial Intelligence for Remotely Sensed Image Processing and GIS

POOL OF COURSES FOR PROFESSIONAL ELECTIVE-I (III Year 6th Semester)

S. No.	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	CE****	Prestressed Concrete	3	0	0	3
2	CE****	Precast and Modular Construction	3	0	0	3
3	CE****	Geotechnical Processes	3	0	0	3
4	CE****	Geotechnical Explorations	3	0	0	3
5	CE****	Air & Noise Pollution Control	3	0	0	3
6	CE****	Environmental Impact Assessment	3	0	0	3
7	CE****	Rural Roads	3	0	0	3
8	CE****	Astronomy and Photogrammetry	3	0	0	3
9	CE****	Open Channel Hydraulics	3	0	0	3
10	CE****	Isotope applications in Water Resource Management	3	0	0	3

POOL OF COURSES FOR PROFESSIONAL ELECTIVE-II (IV Year 7th Semester)

S. No.	Course Code	Course Title	Hours per Week			Credits
			L	T	P	
1	CE****	Bridge Engineering	3	0	0	3
2	CE****	Construction Equipments & Techniques	3	0	0	3
3	CE****	Repair and Retrofitting of Structures	3	0	0	3
4	CE****	Environmental Geotechnology	3	0	0	3
5	CE****	Geosynthetics	3	0	0	3
6	CE****	Industrial Wastewater Treatment & Reuse	3	0	0	3
7	CE****	Solid & Biomedical Waste Management	3	0	0	3
8	CE****	Transport Asset Management	3	0	0	3
9	CE****	Geological Studies for Rock Cut Slope Stability Analysis	3	0	0	3
10	CE****	Water Resources Systems Management	3	0	0	3

MINOR OPTIONS FOR OTHER DEPARTMENT STUDENTS (Offered in 4th, 5th & 6th)

*** Credit Requirement: Minimum 16 credits**

OPTION 1- Minors in "AI and IoT based Infrastructure Management"

S. No.	Course Code	Course Title	Hours per Week			Credits	Prerequisite	Remarks
			L	T	P			
1	CE****	Internet of Things and Sensors	3	1	0	4	Nil	Compulsory
2	CE****	Geoinformatics	3	1	0	4	Nil	Compulsory
3	CE****	BIM and Infrastructure Management	3	1	0	4	Nil	Compulsory
4	CE****	Infrastructure Engineering	2	1	0	3	Nil	Compulsory
5	CE****	Elective				3	Nil	To be selected from elective pool
					Total	**18**		

ELECTIVE for Minors I (Student has to opt for any one of the courses listed below)								
S. No.	**Course Code**	**Course Title**	**Hours per Week**			**Credits**	**Prerequisite**	**Remarks**
			L	T	P			
1	CE****	Building Engineering-I	2	0	2	3	Nil	Elective
2	CE****	Transport Asset Management	3	0	0	3	Nil	Elective

OPTION 2- Minors in "Smart Cities"

S. No.	Course Code	Course Title	Hours per Week			Credits	Prerequisite	
			L	T	P			
1	CE****	Sustainable Environmental Planning and Management for Urban Settlements	3	1	0	4	Nil	Compulsory
2	CE****	Energy Efficient Construction	3	1	0	4	Nil	Compulsory
3	CE****	Geoinformatics	3	1	0	4	Nil	Compulsory
4	CE****	Sustainable Urban Habitat	2	1	0	3	Nil	Compulsory
5	CE****	Elective				3	Nil	To be selected from elective pool
					Total	**18**		

ELECTIVE for Minors II (Student has to opt for any one of the courses listed below)								
S. No.	**Course Code**	**Course Title**	**Hours per Week**			**Credits**	**Prerequisite**	**Remarks**
			L	T	P			
1	CE****	Infrastructure Engineering	2	1	0	3	Nil	Elective
2	CE****	Introduction to Transportation Systems	2	1	0	3	Nil	Elective

CE XXXX: Building Engineering-I 2-0-2

Course Outcomes

CO1: To understand the fundamentals of Surveying and distance measurement; and apply the theoretical knowledge in the field.

CO2: To understand bearings, angles and methods of measurement; and apply in the knowledge in field Surveying.

CO3: To acquire knowledge of levelling in Surveying; and apply in different operations in Civil Engineering projects.

CO4: Apply the knowledge of building types, building planning and evaluation of building using Green Rating.

CO5: Understand damp proofing and anti-termite treatment and various components of building likes-different types of staircase, doors and windows, floors.

Course Content

Unit-1: Introduction and Measurement of Distance (4L)

Plane and Geodetic Surveying, Principles of Surveying, Classification of Surveys, Plan, Map and Scale, Distance measurement, Chainage & Offsets, Tape corrections, EDM.

Unit-2: Measurement of Direction and Angle (4L)

Designation of Bearings and inter-conversion, Included Angles from Bearings, Prismatic & Surveyors Compass; Vernier Theodolite- Parts & Temporary Adjustments, Measurement of Angles- Repetition & Reiteration method.

Unit-3: Levelling (4L)

Direct Levelling- Basic Terms and Definitions, Fly levelling, Reduction of Field Notes by Height of Instrument and Rise & Fall methods, Dumpy and Tilting Levels, Balancing of Sights, Curvature and Refraction Correction, Reciprocal Levelling.

Unit 4: Building Byelaws & Development Controls (5L)

Types of buildings; Concept of functional planning and efficiency of buildings; Recommendations of NBC 2016 for building planning. Introduction to Green Rating of buildings.

Unit 5: Building Components & Construction Details (7L)

Components of building and area considerations; Damp proofing and anti-termite treatment; Planning, design and construction of vertical circulation means; Different types of floors and roofs; Roof treatments for thermal insulation and water proofing; Different types of doors, windows & ventilators.

List of Practicals

1. To study topographical maps and prepare conventional symbols chart.
2. To measure bearings of a closed traverse by prismatic compass and to adjust the traverse.
3. To find out reduced levels of given points using dumpy level.
4. To perform fly levelling with a tilting level.
5. To measure vertical and horizontal angle by Vernier theodolite.
6. To measure horizontal angle by method of repetition using Vernier theodolite.
7. Planning of buildings with given site conditions.
8. Details of different types of staircase and section through foundation and super structure.
9. Details of commonly used doors and windows.
10. Computation of thermal load and associated design of building for thermal comforts and lighting.
11. Evaluation of a buildings for Green Rating.

References

1. Surveying (Vol-I): B.C. Punmia & A.K. Jain, Laxmi Publications, New Delhi.
2. Surveying (Vol-I): S.K. Duggal, Tata McGraw-Hill Pub. Co. Ltd., New Delhi.
3. Plane Surveying & Higher Surveying: A.M. Chandra, New Age Int. Ltd., New Delhi.
4. Surveying: , A. Bannister, S. Raymond, R. Baker, Pearson Education, New Delhi.
5. A Text Book of Building Construction: S.K. Sharma, S. Chand & Company Ltd.
6. A Text Book of Building Construction: B.C. Punmia, Laxmi Publications, Delhi.
7. A Text Book of Building Construction: S.P. Arora, S. P Bindra, Dhanpat Rai & Sons, Delhi.
8. Manual of tropical housing and building: O.H. Koenisberger, Orient Longman Ltd., Madras.
9. TERI Guide to Sustainable Building Design, TERI, New Delhi

CE XXXX: Building Engineering-II 2-1-0

Course Outcomes

CO1 : Understand the properties and uses of common building materials.

CO2 : Describe the properties and uses of various types of other building materials.

CO3 : Present the quantity surveying, modes of measurement and utility of various types of estimates.

CO4 : Explain the use of current schedule of rates and quantitative resource allocation for the rate analysis.

CO5 : Describe utility, purpose and concepts involved in the building valuation.

Course Content

Unit-1: Introduction to Common Building Materials (6L)

Bricks, Stones, Cement, Lime, Gypsum products, Ferrous and non-ferrous metals, Natural and artificial Pozzolonas, Paints and distempers.

Unit-2: Introduction to Other Building Materials (6L)

Timber and plywood, Seasoning and preservation, Asphalt, Bitumen and Tar, Glass, Plastics.

Unit-3: Estimation Fundamentals (4L)

Importance of estimation; Different types of estimates; General and detailed specifications; Methods of estimation- items of work for estimates, units and measurement of items.

Unit-4: Detailed Estimation of Buildings and Analysis of Rates (4L)

Detailed estimates of a two roomed single storey residential building; Analysis of rates; Material and other cost considerations; Resource planning through analysis of rates; Market rates and P.W.D. schedule rates; Non scheduled items and cost indices for building material and labour.

Unit-5: Valuation of Assets (4L)

Standard terminology; Factors affecting the values of property; Methods of valuation, years purchase, capitalized value and depreciation; Standard rent, free hold and lease hold propriety; Mortgage and easement.

References

1. Building Materials: S.K. Duggal, New Age International Publishers, New Delhi
2. “Civil Engineering Materials “Technical Teachers” Training Institute Chandigarh, Tata McGraw Hill Publishing Company Ltd., New Delhi.
3. Advances in Building Materials and Construction: Rai Mohan and Jai Singh M.P, CBRI Roorkee.
4. Estimating Costing and Valuation in Civil Engg., Principle and Applications: Chakraborty M., (Authors Publication, Kolkata)
5. Estimating Costing and Valuation in Civil Engg., Principle and Applications: Frederick E. Gould. Pearson Education
6. Estimating & Costing in Civil Engineering: B.N. Dutta, UBS Publishers & Distributors Pvt. Ltd. New Delhi.
7. CPWD Works Manual 2012.

CE XXXX: Engineering Graphics and 3D-Modelling 1-0-2

Course Outcomes

CO1 : Understand standard symbols, convention, rules and methods for preparing engineering drawings; and apply the concepts of drawing orthographic projections, isometric projections and perspective views.

CO2 : Apply orthographic projection for points, lines and simple solid objects; sections and associated sectional details of solid objects.

CO3 : Understand and apply the knowledge in the development of surfaces and isometric views of simple solid objects.

CO4 : Understand drawings related to simple mechanical components.

CO5 : Develop 3D-models for a simple building and to use it for engineering applications.

Course Content

Unit 1: **Introduction to Engineering Drawing** (**2L**)
Standard methods; Convention, rules and methods for preparing engineering drawings; Types of projection methods; Orthographic projection of points.

Unit 2: **Orthographic Projection** (**2L**)
Orthographic projection of lines and simple solids

Unit 3: **Development of Surfaces** (**3L**)
Sections of solids through Orthographic projection; Development of Surfaces; Isometric Projections; Drawing of simple mechanical assemblies

Unit 4: Introduction to 3D-Modelling and its Concepts (**3L**)
Integration with building design process; Evolution and development of 3D-Modelling; Object-based parametric modeling.

Unit 5: **Modelling with Autodesk** (**2L**)
Mass and concept modeling; Detailed modeling; Creating, importing and modifying families of objects and elements; Architecture, MEP and structural applications; Creating plans, sections, details, schedules, cover page; Conflicts/Interference checking.

References

1. N.D. Bhatt, Engineering Drawing [2000] , Charotar Publishing House , Ananad
2. N.D. Bhatt, Mechanical Engineering Drawing [2000], Charotar Publishing House, Ananad
3. Eastman, C., Teicholz, P., Sacks, R., & Liston, C. (2011). BIM handbook: A guide to building information modeling for owners, managers, designers, engineers and contractors. John Wiley & Sons.
4. Krygiel, E., & Nies, B. (2008). Green BIM: successful sustainable design with building information modeling. John Wiley & Sons.
5. Issa, R. R., & Olbina, S. (Eds.). (2015, May). Building Information Modeling: Applications and Practices. American Society of Civil Engineers.
6. Eynon, J. (2016). Construction Manager's BIM Handbook. John Wiley & Sons.
7. Duell, R., Hathorn, T, and Hathorn, T.R. (2015), Autodesk Revit Architecture 2016 Essentials, Wiley and Sons, Inc
8. http://www.autodesk.com/education/free-software
9. IS: 962 -1989 : Architectural and Building Drawing

CES XXXXXX Infrastructure Engineering 2-1-0

Course Outcomes

CO1 : Understand the importance of planning in Infrastructure development
CO2 : Evaluate the construction methods for Civil Engineering Infrastructures.
CO3 : Identify suitable materials for construction of the Civil Engineering Structures.
CO4 : Describe the importance, type and characteristics of the transportation infrastructure.
CO5 : Understand and evaluate the environmental, economic, social and sustainability constraints of infrastructure projects.

Course Content

Unit 1: **Introduction**: Definition and Types of Civil Engineering Infrastructure; Historical Development; Role of Engineers for Infrastructure Development; Life Cycle of Infrastructure; Real-World Examples of Infrastructures; Planning Considerations. **(4L)**

Unit 2: Infrastructure Materials and Construction: Construction Materials—Bricks, Stones, Cement, Cement Concrete, Reinforced Cement Concrete, Steel Sections, Timber, Bitumen; Brick Masonry, Stone Masonry, RCC Structural Members, Roofing, Flooring, Damp-Proofing, Water-Proofing Plastering, Painting and White Color Washing Road Construction. **(5L)**

Unit 3: Building Infrastructure: Classification of Buildings; Components of Buildings; Building by Laws; Orientation of Buildings; Ventilation; Acoustic Requirements; Selection of Site; Substructure; Site Inspection; Loads on Buildings; Load Transferring System. **(5L)**

Unit 4: Transportation Infrastructure: Role of Transportation, Modes of Transportation, Characteristics of Transport Modes; Pavements Types; Road Networks in India, Road Development Plans; Air Transport in India, Air Transport Characteristics; Rail Transport Infrastructure-Basic Elements; Water Transportation, Inland Navigation; Emerging Transportation Technologies and Systems. **(5L)**

Unit 5: Smart Infrastructure: Design of smart infrastructure with adaptive capabilities; Design of smart city considering infrastructures of energy, mobility, health and sustainability and their growing interdependencies; Measures of Sustainability; Role of Civil Engineers; Sustainable Design; Green Buildings; Building Rating System; Sustainable Land Development; Water Reuse. **(5L)**

References

1. Penn, M. R., & Parker, P. J.. Introduction to Infrastructure: An Introduction to Civil and Environmental Engineering, Wiley Global Education.
2. Punmia, B. C., Jain, A. K., & Jain, A. K. Building Construction. Laxmi Publications.
3. Kumar, Sushil, Building Construction.
4. Teodorovic, D., & Janic, M.. Transportation Engineering: Theory, Practice and Modelling. Butterworth-Heinemann.
5. Chakroborty, P., & Das, A. Principles of Transportation Engineering. PHI Learning Pvt. Ltd..
6. National Building Code-2016.

CE XXXX: Introduction to Transportation Systems **2-1-0**

Course Outcomes

CO1 : Understand the importance, type and structure of transportation systems.
CO2 : Understand the characteristics, components and elements of road transportation.
CO3 : Understand the characteristics and elements of rail transportation.
CO4 : Understand the characteristics, components and structure of air transportation.
CO5 : Understand the elements and attributes of the water transportation.

Course Content

Unit 1: **Introduction** **(4L)**
Introduction, Significance and Benefits of Transportation, Modes of Transports and Characteristics of Transportation Systems, Dimensions of Transportation Systems.

Unit 2: Road Transportation **(5L)**
Historical Background**,** Road Transport Characteristics, Benefits, Classification of Roads, Pavement Types and Characteristics, Basic of Traffic Controls.

Unit 3: Rail Transportation **(5L)**
Introduction, Rail Transportation in India, Advantages of Railways, Permanent Way, Components of a Railway Track, Stations and Yards.

Unit 4: Air Transportation **(5L)**
Characteristics and Functions of Air Transport, Airports, Airport Planning, Selection of Site, Classification of Aerodromes, Components of an Aircraft, Components of an Airport, Taxiways and Apron.

Unit 5: Water Transportation **(5L)**
Characteristics and Functions of Water Transport, Coastal Structures, Dolphins, Transit Sheds, Seaports, Port Structures, Docks, Buoy, Navigational Aids.

References

1. Kadiyali, L. R.. Transportation engineering. Khanna Publishing.
2. Khanna, S.K.Justo, C.E.G.,and A.Veeraragavan, Highway Engineering, Nemchand Brothers.
3. Chandra,S. and Agrawal,M.M., Railway engineering. Oxford University Press,Inc.
4. Khanna, S.K.,Arora, M.G..,& Jain,S.S. Airport Planning and Design. Nemchand Brothers.
5. Srinivasan, R., & Bhavsar, R. C.. Harbour, Dock and Tunnel Engineering. Charotar Publishing House
6. Teodorovic, D., & Janic, M. Transportation Engineering: Theory, Practice and Modeling. Butterworth-Heinemann.

CE XXXX: Plumbing & Sanitation Systems 2-0-2

Course Outcomes

CO1 : Identify & select the plumbing tools/plumbing materials and fittings.
CO2 : Select appropriate pipes and carry out pipe fitting after carrying out operations like cutting, bending, threading, joining, aligning and other necessary operations
CO3 : Understand the simple water supply system, trace leakage and repair water supply system
CO4 : Prepare the plan, prepare and inspect domestic drainage system
CO5 : Select and install appropriate sanitary appliances

Course Content

Unit-1: Sources of Water (4L)

Sources of water; wells, tube wells, method of construction, types of pumps, with valves and fittings Collection of surface water and its conveyance through pipes, pipe appurtenances, pipe laying, Rainwater harvesting

Unit-2: Water Distribution and Appurtenances (5L)

Water distribution systems; Distribution reservoirs; Storage of water in buildings; Types of tanks; Laying water supply pipe lines, corrosion in pipes and their control measures. Housing Plumbing- Systems and other accessories, Appurtenances in distribution system, Fire hydrants, Concepts of rural water supply and sanitation.

Unit-3: Sewerage System and Sanitation (5L)

Principles of sanitation, Study of Indian standards and plumbing by-laws (NBC). Introduction to various sanitary pipes, joints, fittings and fixtures, their function, placement and constructional details.

Unit-4: Drainage Systems (5L)

Study of internal & external drainage system of various buildings including small residences, apartments, public buildings etc.– one pipe and two pipe system, Single stack system, testing of house drains, Gradients used in laying drains and sewers, Self-cleaning and Sanitary filltings.

Unit-5: Plumbing Equipment and Disposal system (5L)

Plumbing equipments and operations, Repairing of various types of fittings and fixtures, Study, construction and maintenance of privies, Traps, Septic tanks, Soak pits, and Public sewage line. Study of Disposal systems for domestic effluent from fitting to sewer line. Study of low cost sanitary systems (sulabh complexes) and CBRI criteria's.

References

1. Environmental Engineering Vol. I: Water Supply Engineering, S.K. Garg, Khanna Publishers, Delhi, 1998.
2. Environmental Engineering Vol. II: Sewage Disposal & Air Pollution Engineering, S.K. Garg, Khnna Publishers, Delhi, 1998.

3. Elements of Public Health Engineering, K.N. Duggal, S. Chand & Co, New Delhi, 2000.
4. Water Supply & Sanitary Engineering, S.C. Rangawala, Charotar Publishing House, Anand, India, 2000.
5. Water Supply and Sanitary Installations, A C Panchdhari, New Age International, New Delhi, 1993.
6. CPHEEO Manual on Water Supply and Treatment
7. CPHEEO Manual on Sewerage and Sewage Treatment.

List of Practicals for Plumbing and Sanitation Systems

1. To demonstrate and provide hand-on training on various types of water pipes such as PVC pipes, G.I. pipes copper pipes etc. used in building
2. To demonstrate and provide hand-on training on Plumbing Drainage System in Buildings such as Soil Pipes and Waste pipes, vent pipe, rainwater pipe and ant siphonage pipes etc
3. To demonstrate and provide hand-on training on Plumbing Sanitary Fittings used in Buildings
4. To demonstrate and provide hand-on training on Different Types of Pipe Joints.
5. To demonstrate and provide hand-on training on Different Types of connection.
6. To demonstrate and provide hand-on training on different types of valves and fitting in pipes.
7. To demonstrate and provide hand-on training on different types of Tools Used in Common Plumbing Works:
8. To demonstrate and provide hand-on training on different Types of Pipes.
9. To demonstrate and provide hand-on training on different Types of connections for Sanitary Plumbing and drainage.

CE XXXX: Sustainable Urban Habitat 2-1-0

Course Outcomes

CO1: To describe the state of urbanization and identify associate environmental effects .

CO2: To explain the approach of sustainability in the design of urban habitat as per the requirements of sustainable development goals

CO3: To bring out the characterization of future cities for sustainable development.

CO4: To compute the sustainability indicators for urban habitat along with Green rating system.

CO5: To describe Sustainability considerations in planning of Smart City, greenfield smart city project intelligent buildings, alternative building enclosures such as LHP, Urban heat Island mitigation strategies.

Course Content

Unit 1: Urbanization (5L)

Classes of urban vulnerability; Urban inequality and implications for the environment; State of the environment in cities; Effects of environmental changes; Drivers of environmental change; Local and global environment effects of cities; Impacts on human health and well-being in cities; Urban land management, environmentally sustainable and just transformations.

UNIT 2: Approach to Sustainability (5L)

Terminology, Sustainable Buildings–Siting, Form, Design Site Design and Development, External Development and Landscape, Envelope Optimization, Sustainable Materials , Classification of materials based on energy intensity, Traditional efficient materials, water and Waste water management , Building Services Optimization, Construction Practices, Environmental Descriptors in Urban environment.

UNIT 3: Future Cities (5L)

Dimensions of integrated action for urban transformation, Net-zero circular cities, Resilient & sustainable cities, Inclusive and just cities, urban metabolism, Outline of a circular economy

UNIT 4: Sustainability Indicators (5L)

Carbon Foot Prints and Ecological Foot Prints, Green Rating systems, Efficiency of vernacular architecture and traditional building systems, road map for rural habitat

UNIT 5: Sustainability considerations in planning of Smart City (4L)

Greenfield smart city project intelligent buildings, alternative building enclosures LHP, Urban heat Island mitigation strategies.

References

1. Campbell, S. (1996). Green cities, growing cities, just cities? Urban planning and the contradictions of sustainable development. Journal of the American Planning Association, 62(3), pp. 296-312.
2. National Building Code of India 2016, Volume 2 BIS, New Delhi
3. https://unhabitat. or “Ecological Footprint.” The Sustainable Scale Project, Santa-Barbara Family Foundation, www.sustainablescale.org/conceptualframework/understandingscale/measuringscale/ecologicalfootprint.aspx.
4. Kevin Lynch- Imageability of City
5. Ralph Thomlinson -Urban structure, social and Spatial character of cities
6. Bernard Feildan- Conservation of Historic Buildings
7. The Environment (protection) Act 1986
8. The Energy Conservation (Amendment) Act 2001, and Amendments
9. Energy conservation building code 2007
10. National building code – India
11. smartcities.gov.in

NEP based Course Structure & Curriculum

For
B. Tech. Programme
In

Computer Science & Engineering

Motilal Nehru National Institute of Technology Allahabad Department of Computer Science & Engineering

COMPLETE COURSE STRUCTURE OF B.TECH. PROGRAMME WITH RESPECT TO NEP-2020
[AS ON 01.11.2022]

B.Tech. Course Structure 1st Year I Semester

S.No.	Course	Cat.	L	T	P	Credits	Contact hours	Remarks
1.	Physics/Chemistry	CEF (EE)	2	1	2	4	5	Branch Specific Physics and Chemistry Courses (Alternatively in each semester)
2.	Mathematics-I	CEF (EE)	3	1	0	4	4	Common course for all branches
3.	English Language & Technical Communication/Introducing to Artificial Intelligence and Machine Learning*	PCE(SA)	2	0	2	3	4	Common course for all branches *As per the clause 23.13 of the NEP 2020
4.	Core Engineering Essentials Courses-I (Flexible L-T-P) Computer-Programming	CEE (CES)	2	0	2	3	4	Branch specific course for the students of the branch only
5.	Core Engineering Essentials Courses-II (Flexible L-T-P) Computer Organization (CS12101)	CEE (CES)	3	0	0	3	3	Branch specific course for the students of that branch only
6.	Engineering Graphics#/Workshop and Manufacturing Processes# Discrete Mathematics (CS12105)	PCE(EE)	2		0	2	2	Common course (Alternatively in each semester) #If any department does not want to adopt this/these course(s) for the specific branch, the department may float branch-specific course in its/their place
7.	Environment and Climate Change@	PCE (HSS)	2	0	0	2	2	Common course for all branches @Audit Course
8.	Extra Academic Activity-A/ Extra Academic Activity-B	EAA (SA)	-	-	4	2&	4**	Common course for all branches (with different titles) **Engagement beyond Academic Activity Duration &The evaluation of grading system should be worked out
	Total		14	2	14	23	26+4**	

B.Tech. Course Structure 1st Year II Semester

S.No.	Course	Cat.	L	T	P	Credits	Contact hours	Remarks
1.	Chemistry/Physics	CEF (EE)	2	1	2	4	5	Branch Specific Physics and Chemistry Courses (Alternatively in each semester)
2.	Mathematics-II	CEF (EE)	3	1	0	4	4	Branch specific Mathematics Course
3.	Introducing to Artificial Intelligence and Machine Learning*/English Language and Technical Communication	PCE(EE)	2	0	2	3	4	Common course for all branches *As per the clause23.13 of the NEP 2020
4.	Core Engineering Supporting Courses (Flexible L-T-P) Data Structures *	CES (EE)	2	0	2	3	4	Courses to be floated by each department SOnly for the students of other branches (*maximum 180 students).
5.	Core Engineering Essentials Courses-III (Flexible L-T-P) Data Structures	CEE (CES)	2	0	2	3	4	Branch specific course for the students of that branch only
6.	Workshop and manufacturing Processes#/ Engineering Graphics# Programming Paradigms	PCE (CES)	2	0	0	2	2	Common course (Alternatively in each semester) #If any department does not want to adopt this/these course(s) for the specific branch, the department may float branch-specific courses in its/their place
7.	Extra Academic Activity-B/ Extra Academic Activity-A	EAA(SA)	0	0	4	2&	4**	Common course for all branches (with different titles) **Engagement beyond Academic Activity Duration &The evaluation of grading system should be work out
	Total		14	2	12	21	23+4**	

Note: Flexible L-T-P structure indicates the course may have any combination of L-T-P with assigned credits as listed above.

Professional Elective I & II (Pool – 1)	
Sno.	Subject Name
1	Data Compression
2	Design Pattern
3	Functional Programming
4	Genetic Algorithm
5	Network Administration
6	Neural Network
7	SOSE(Service Oriented Software Engg.)
8	XMl Based Applications
9	Real Time Systems
10	IoT : Architecture & Protocol
11	E-Commerce

Professional Elective III (Pool 2)	
Sno.	Subject Name
1	Distributed & Parallel Algorithms
2	Gaming and Animation
3	Information Retrieval
4	Pattern Recognition
5	Semantic Web (Web Ontology)
6	Software Metrics & Quality Assurance
7	Software Testing
8	Theory of Virtualization
9	Web Mining
11	Cloud & Edge Computing

Minor	Course Works in Minor Basket
	Course
B.Tech. with minor in Computer Science	Database Management System
	Operating System
	Object Oriented Programming
	Analysis of Algorithms
	Machine Learning with Python
	Computer Organization

Sl.No.	Course Works in Honors Basket	Sl.No.	Course Works in Research Basket
1	Data Center Networking	1	Soft Computing
2	Distributed Ledger Technology	2	Introduction to Bioinformatics and Genomics
3	Network Security	3	Big Data
4	Advanced Computer Network	4	High Performance Computing
5	Software Defined Networking	5	Medical Image Processing
6	Network Protocol Design & Implementation	6	Data Security and Application Security
7	IOT Security & Trust	7	Data Analytics
8	IOT, ML and Deep Learning		

Syllabus
Semester-I

COMPUTER PROGRAMMING

Syllabus

Prerequisite: NIL

L-T-P: 2-0-2, Credits: 3Type: Core Essential Subjects (CES)

Course Objectives

Students undergoing this course are expected to:	
1	To explore the basic understanding of how a computer works in general.
2	To explore how to solve a computational problem using a computer via writing a program inC programming language.
3	To explore the basic concept of logic thinking, and how to represent a logic using Algorithm and Flowchart.
4	To explore the basic syntax, such as variables, operators, conditionals and loops of C programming language.
5	To explore arrays, pointers, strings and functions in C.
6	To explore how to create user-defined data types using structure and unions.
7	To explore how to operate on files in C.
8	To explore the underlying workings of various macros, and how macro-processor processesthe macros.

Course Outcomes

CO Numbers	Course Outcomes (Action verb should be in italics)	Bloom's taxonomy
CO1	To understand the basics of working of a computer.	Understanding
CO2	To obtain the basic knowledge about how to think logic given a computational problem, represent that via Algorithms and Flowchart, and implement the logic in C.	Understanding
CO3	To have an understanding of concepts of C syntax and semantics	Analyzing
CO4	To understand and apply the concept of Pointers and Functions	Applying
CO5	Understand how to operate on files.	Understanding

Mapping Course Outcomes with Program Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	2	2	1	1	2					2
CO2	3	3	2	2	1	2				
CO3	2	1	1	3	2	2			2	1
CO4	3	1	3	3	1	2				2
CO5	1	2	1		2					
CO (Average) Course Average	2.2	1.8	1.6	1.8	1.6	1.2	-	-	0.4	1

3-High, 2-Medium, 1-Low

Syllabus

Unit 1: Working of a computer – Data representation in various bases, Binary System, Floating-point representation, basic components of computer architecture, operating system, and how they work together, A brief history of programming languages up to C, Stages of a compilation process, An overview of logic thinking – Algorithm, Flowchart.

Unit 2: Basic Syntax of C – Structure of a C Program, Printing on a screen, escape sequences, variables, operators, writing arithmetic and logic expressions, printing variables, format specifiers, reading from a console. Conditional statements – if, else, else if statements. Writing conditions. Nested conditional statements. Loops – for, while, do-while loops and their various formats, infinite loops, break, continue. Nested loops and conditional statements. Switch – switch-case statements and their use. Thinking and implementation of logics involving conditional, loops, switch-case. Patterns.

Unit 3: Functions – Syntax of C functions, parameters, arguments, return statements. Array – Single-dimensional, multi-dimensional arrays, accessing and updating array elements. Pointers – Memory address of a variable and concept of pointers. Single-dimensional and multi-dimensional pointers. Arrays as pointers. Dynamic Memory Management – malloc, calloc, realloc, free. Concept of heap and stack segments. Passing and returning arrays and pointers to and from a function. Call by value, call by reference. Strings – Reading and Writing strings. Allocating strings dynamically. String functions.

Unit 4: Structures and Unions – User-created data types, Structure, Union, accessing and updating their members, pointers to structure and union. Storage class specifiers – auto, extern, static, register. Macros – #include, #define, #ifdef, #ifndef, #endif. Files – Opening a file, opening modes, reading from a file, writing to a file: fopen, fread, fwrite, fprintf, fscanf, fseek, fclose.

Text Books

1. Yashavant Kanetkar, “Let us C”, 17th edition, BPB Publications.
2. R. J. Dromey, “How to solve it by Computer”, Pearson India.
3. Herbert Schield, “Complete Reference in C”, 4th edition, TMH.
4. Yashavant Kanetkar, “Understanding Pointers in C”, 3rd Edition, BPB Publication.
5. K. N King, C Programming: A Modern Approach, Second Edition.

Reference Books

1. Brian W. Kernighan, Dennis M. Ritchie, “The C Programming Language”, 2nd edition, Prentice Hall.

Computer Organization
Syllabus

Prerequisite: Basic knowledge prior to digital electronics, Basic functional units of a computer system
L-T-P: 3-0-0, Credits: 3Type: Core Essential Subjects (CES)

Course Objectives

Students undergoing this course are expected to:	
1	This course will discuss the basic concepts of computer architecture and organization that can help the participants to have a clear view as to how a computer system works. Examples and illustrations will be mostly based on a popular Reduced Instruction Set Computer (RISC) platform.
2	This course qualitatively and quantitatively examines computer design trade-offs and teaches the fundamentals of computer architecture and organization, including CPU, memory, registers, arithmetic unit, control unit, and input/output components
3	Understand the fundamentals of computer architecture.
4	Design and implement single-cycle and pipelined data paths for a given instruction set architecture.
5	Understand the performance trade-offs involved in designing the memory subsystem, including cache, main memory and virtual memory.

Course Outcomes

CO Numbers	Course Outcomes (Action verb should be in italics)	Bloom's taxonomy
CO-1	Study of the basic structure and operation of a digital Computer system.	Identify/Knowledge
CO-2	Analysis of the design of arithmetic & logic unit and understanding of the fixed point and floating-point arithmetic operations.	Analyzing
CO-3	Implementation of control unit techniques and the concept of Pipelining	Applying
CO-4	Understanding the hierarchical memory system, cache memories and virtual memory	Analyzing/understanding
CO-5	Understanding the different ways of communicating with I/O devices and standard I/O interfaces	Understanding

Mapping Course Outcomes with Program Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	2	2	1	1	2					2
CO2	3	3	2	2	1	2				
CO3	2	1	1	3	2	2			2	1
CO4	3	1	3	3	1	2				2
CO5	1	2	1		2					
CO (Average) Course Average	2.2	1.8	1.6	1.8	1.6	1.2	-	-	0.4	1

3-High, 2-Medium, 1-Low

Syllabus

UNIT 1: Introduction: Functional units of digital system and their interconnections, buses, bus architecture, types of buses and bus arbitration. Register, bus and memory transfer. Processor organization, general registers organization, stack organization and addressing modes.

UNIT II: Arithmetic and logic unit: Look ahead carries adders. Multiplication: Signed operand multiplication, Booths algorithm and array multiplier. Division and logic operations. Floating point arithmetic operation, Arithmetic & logic unit design. IEEE Standard for Floating Point Numbers.

Unit III: Control Unit: Instruction types, formats, instruction cycles and sub cycles (fetch and execute etc), micro operations, execution of a complete instruction. Program Control, Reduced Instruction Set Computer, Pipelining. Hardwire and micro programmed control: micro programme sequencing, concept of horizontal and vertical microprogramming.

Unit IV: Memory: Basic concept and hierarchy, semiconductor RAM memories, 2D & 2 ½ D memory organizations. ROM memories. Cache memories: concept and design issues & performance, address mapping and replacement Auxiliary memories: magnetic disk, magnetic tape and optical disks Virtual memory: concept implementation.

UNIT V: Input / Output: Peripheral devices, I/O interface, I/O ports, Interrupts: interrupt hardware, types of interrupts and exceptions. Modes of Data Transfer: Programmed 1/0, interrupt initiated 1O and Direct Memory Access., I/O channels and processors. Serial Communication: Synchronous & asynchronous communication, standard communication interfaces.

Text Books

1. Computer System Architecture - M. Mano
2. Carl Hamacher, Zvonko Vranesic, Safwat Zaky Computer Organization, McGraw-Hill Fifth Edition, Reprint 2012
3. John P. Hayes, Computer Architecture and Organization, Tata McGraw Hill, Third Edition, 1998, Reference books
4. William Stallings, Computer Organization and Architecture-Designing for Performance, Pearson Education, Seventhedition, 2006.

Reference Books

1. Behrooz Parahami, “Computer Architecture”, Oxford University Press, Eighth Impression, 2011.
2. Fundamentals of Microprocessors & Microcontrollers by B.RAMDHANPAT RAI PUBLICATIONS, NEW DELHI
3. David A. Patterson and John L. Hennessy, “Computer Architecture-A Quantitative Approach”, Elsevier, a division ofteed India Private Limited, Fifth edition, 20121
4. Swati Saxena Computer Organization, Dhanpat Rai Publications, NEW DELHI

Discrete Mathematics
Syllabus

Prerequisite*:* Basic of Mathematics
L-T-P: 2-0-0, Credits: 2 Type:EngineeringEssentials (EE)

Course Description

This course is aimed at Computer Science majors who have never taken any type of mathematical theory courses before, though it is also a useful course for developing general reasoning and problem-solving skills. For those that continue studying Computer Science, this course serves as excellent preparation for the required course. However, all students taking this course should benefit by improving their reasoning and abstract thinking skills, learning how to construct sound, logical arguments, and learning to detect flaws in unsound arguments.

Course Outcomes

Students undergoing this course are expected to:		Bloom's taxonomy
CO-1	To learn the expression of mathematical properties formally via the formal language of propositional logic, predicate logic and various proofing methods.	Understanding/ Comprehension
CO-2	Understand set operations, various types of relations and their representations, solving recurrence relations and also be able to verify simple mathematical properties that these objects possess.	Understanding /Analyze
CO-3	Understand various types of graphs, paths, spanning trees, planarity of graphs and coloring theorems. Graph Theory application in real world scenario	Understanding Apply
CO-4	Comprehend the discrete structures of lattices,	Understanding/ Comprehension:
CO-5	Recognize Algebraic structures; Groups, Subgroups, Rings, Fields with extension to concepts of vector spaces, dimensions, linear transformations. Applications of algebraic structure in Cryptographic algorithms, Network management, and various algorithms.	Evaluate

Mapping Course Outcomes with Program Outcomes:

Correlation Matrix

Note: Enter numbers 1, 2 or 3, where the correlation levels are matching

1. Slightly (Low)
2. Moderately (Medium)
3. Substantially (High)

Syllabus

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	1	3	2	3	1	-	-	-	-
CO2	3	1	3	2	3	1	-	-	-	-
CO3	3	1	3	2	3	1	-	-	-	-
CO4	3	1	3	2	3	1	-	-	-	-
CO5	3	1	3	2	3	1	-	-	-	-
CO (Average) Course Average	3	1	3	2	3	1	0	0	0	0

UNIT 1: Formal logic

Simple and compound statement. logical operators. Implication and double implication, Tautologies and contradictions. Valid arguments and fallacy. Propositional functions and quantifiers. Notion of proofs.

UNIT 2: Set, Relations and Functions

Different types of relations, their compositions and inverses. Different types of functions, Recursively defined functions, Recursive algorithms, generating functions and solutions of recurrence relations, Complexity of algorithms, Big-o notation, Euclidean algorithm for finding GCD, Evaluation of polynomial using Horner's method, Russian Peasant method for multiplication. Generating Functions and related issues Recurrence relations and Generating, Functions.

UNIT 3: Graph Theory

Graphs and their basic properties – degree, path, cycle, subgraph, isomorphism, Eulerian and Hamiltonian walk, Matrix representation of Graphs and properties, Planar Graphs, Homeomorphism, Kuratowski's theorem, Spanning trees, shortest spanning tree, Algorithms for finding shortest spanning tree Graph colorings. Four color problem, Digraphs and related definitions, connectivity in diagraphs.

UNIT 4: Lattice and Boolean Algebra

Ordered Sets and Lattices: Partial order relations and Hasse diagram, Supremum and infimum, total ordering, lattices – bounded, distributive, complemented, modular.

UNIT 5: Group Theory and related issues

Algebraic System and Group Theory, Rings; Integral Domains, Division Rings, Fields related issues.

Text Books

1. Rosen: Discrete Mathematics and Its Applications Seventh Edition 7th Edition by Kenneth Rosen, McGraw Hill.
2. https://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-042j-mathematics-for-computer-science-fall-2010/

Reference book

1. Manohar: Discrete Mathematical Structure with Application to Computer Science", J.P Trembley, & R. Manohar.
2. Schaum's DM: Lipschutz S. Schaum's Outlines of Theory and Problems of Discrete Mathematics., 2016. Schaum's Abstract Algebra: Jaisingh LR, Ayres F. Schaum's Outline of Abstract Algebra. McGraw
3. Levin, Oscar. "Discrete mathematics: An open introduction." (2021).
4. Epp, S. S. (2010). Discrete mathematics with applications. Cengage learning.

Syllabus
Semester-II

DATA STRUCTURES

Syllabus

Prerequisite: C programming and Basic of Mathematics.

L-T-P: 2-0-2, Credits: 3 Type: Engineering Essential/ Core Essential

Course Description

This course introduces the student's fundamentals of data structures and takes them forward to software design along with the course on Algorithms. It details how the choice of data structures impacts the performance of programs for given software application. This is a precursor to DBMS and Operating Systems. A lab course is associated with it to strengthen the concepts.

Course Objectives

Students undergoing this course are expected to:	
1	Give Knowledge of elementary Data organization, Complexity, Revision of Programming concepts
2	Give Basic& Advanced Knowledge of Array, Stack ,Queue& Linked List
3	Give Basic & Advanced Knowledge of Tree
4	Give Basic & Advanced Knowledge of Searching and Sorting
5	Give Basic & Advanced Knowledge of Tree Graph
6	Give Knowledge of elementary Data organization, Complexity, Revision of Programming concepts

Course Outcomes

CO Numbers	Course Outcomes (Action verb should be in italics	Bloom's taxonomy
CO-1	Students Understood elementary Data organization, Complexity, Revision of Programming concepts	Identify/Knowledge
CO-2	Students Understood Basic &Advanced Knowledge of Array, Stack ,Queue& Linked List	Understanding /Analyzing
CO-3	Students Understood Basic Advanced Knowledge of Tree	Understanding
CO-4	Students Understood Basic& Advanced Knowledge of Searching and Sorting	Applying
CO-5	Students Understood Basic& Advanced Knowledge of Tree Graph	Understanding/Comprehension

Mapping Course Outcomes with Program Outcomes

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	3	2	3	2	2	0	0	1	2	0
CO2	2	2	3	3	1	0	1	1	2	1
CO3	1	3	3	2	2	0	2	2	1	1
CO4	2	3	3	3	2	1	1	1	1	1
CO5	2	2	3	3	2	1	1	1	1	1
CO (Average) Course Average	2	2.4	3	2.6	1.8	0.4	1	1.2	1.4	0.8

3-High, 2-Medium, 1-Low

UNIT-1: *Introduction:* Basic Terminology, Elementary Data Organization, Algorithm, Efficiency of an Algorithm, Time and Space Complexity, Asymptotic notations: Theta, Big-O, and Omega, Time-Space trade-off. Abstract Data Types (ADT)

UNIT-II:*Arrays*: Definition, Single and Multidimensional Arrays, Representation of Arrays: Row Major Order, and Column Major Order, Application of arrays, Sparse Matrices and their representations.

Linked Lists: Array Implementation and Dynamic Implementation of Singly Linked Lists, Doubly Linked List, Circularly Linked List, Operations on a Linked List. Insertion, Deletion, Traversal, Polynomial Representation and Addition, Generalized Linked List

Stacks: Abstract Data Type, Primitive Stack operations: Push & Pop, Array and Linked Implementation of Stack in C, Application of stack: Prefix and Postfix Expressions, Evaluation of postfix expression, Recursion, Tower of Hanoi Problem, Simulating Recursion, Principles of recursion, Tail recursion, Removal of recursion

Queues: Abstract Data Type, Operations on Queue: Create, Add, Delete, Full and Empty, Circular queues, Array and linked implementation of queues in C, Deque and Priority Queue.

Unit III:*Trees:* Basic terminology, k-ary trees, Binary Trees, Binary Tree Representation: Array Representation and Dynamic Representation, Complete Binary Tree, Algebraic Expressions, Extended Binary Trees, Array and Linked Representation of Binary trees, Tree Traversal algorithms: In order, Preorder and Post order, Binary Search Trees, Threaded Binary trees, Traversing Threaded Binary trees, Forest, Huffman algorithm, Heap, B/B+ Tree, AVL tree

Unit IV: *Searching*& Sorting:

Sequential search, Binary Search, Comparison and Analysis

Internal Sorting: Bubble Sort, Selection Sort, Insertion Sort, Two Way Merge Sort, Heap Sort, Quick Sort Hashing

UNIT V: *Graphs:* Terminology, Sequential and linked Representations of Graphs: Adjacency Matrices, Adjacency List, Adjacency Multi list, Graph Traversal: Depth First Search and Breadth First Search, Connected Component, Spanning Trees, Minimum Cost Spanning Trees: Prims and Kruskal algorithm. Shortest Path algorithm: Dijikstra Algorithm

Text Books:

1. Aaron M. Tenenbaum, YedidyahLangsam and Moshe J. Augenstein “Data Structures Using C and C++”, PHI

Reference Books:

1. Horowitz and Sahani, “Fundamentals of Data Structures”, Galgotia Publication
2. Donald Knuth, “The Art of Computer Programming”, vol. 1 and vol. 3.
3. Jean Paul Trembley and Paul G. Sorenson, “An Introduction to Data Structures with applications”, McGraw Hill
4. R. Kruse etal, “Data Structures and Program Design in C”, Pearson Education
   Lipschutz, “Data Structures” Schaum’s Outline Series, TMH

Programming Paradigms
Syllabus

Prerequisite: Computer Programming and Discrete Mathematics
L-T-P: 4-0-0, Credits: 4Type: Core Essential Subjects (CES)

Course Description

Students undergoing this course are expected to:	
1	The course is aimed at making the student familiar with the general concepts common to all programming languages so as to facilitate learning new languages.
2	Language paradigms (i.e., logic, functional, procedural, object-oriented) are compared and implementation strategies are discussed.
3	Presents examples of important programming languages and paradigms such as LISP, ALGOL, ADA, ML, Prolog, and C++. Students write sample programs in some of the languages studied.
4	The languages are used to illustrate programming language constructs such as binding, binding times, data types and implementation, operations (assignment data-type creation, pattern matching), data control, storage management, parameter passing, and operating environment
5	The model provided by a programming language to discuss concepts, formulate algorithms, and reason about problem solutions. Programming languages define models tailored to thinking about and solving problems in intended application areas

Course Objectives

Students undergoing this course are expected to

- Knowledge of, and ability to use, language features used in current programming languages.
- An ability to program in different language paradigms and evaluate their relative benefits.
- An understanding of the key concepts in the implementation of common features of programming languages.

Course Outcomes

CO Numbers	Course Outcomes (Action verb should be in italics	Bloom's taxonomy
CO-1	Study of the basics of Computer Programming Languages & Language Translation Issues:	Identify/Knowledge
CO-2	Study of the basics of the Data, Data Types, and Basic Statements ,Primitive Data Types, Array, Record & Union , Pointers & References etc.	Knowledge/Understanding/ Comprehension:
CO-3	Study of the Subprograms (Functions) & their Implementations	Applying/Comprehension
CO-4	Understanding the Object-Orientation, Concurrency, and Event handling	Analyzing/Applying
CO-5	Understanding the basics of the Functional and Logic Programming Languages With Introduction to Programming with functional Programming Languages	Creating/Evaluate

Mapping Course Outcomes with Program Outcomes:

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	P10
CO1	1	2	3	2	2	3		1	2	2
CO2	2	2	2	1	2	2			2	2
CO3	2	2	2		2	2		2		2
CO4	2	2	3	3	2	3		2	1	3
CO5	2	2	2	2	2	2		1		3

CO (Average) Course Average	1.8	2	2.4	1.6	2	2.4	-	1.2	1	2.4

3-High, 2-Medium, 1-Low

Syllabus

UNIT 1: Introduction: Role of Programming Languages: Why Programming Languages, Towards Higher-Level Languages, Programming Paradigms, Programming Environments Language Description: Syntactic Structure, Language Translation Issues: Programming Language Syntax, Stages in Translation, Formal Translation Models

UNIT II: Data, Data Types, and Basic Statements: Names , Variables , Binding, Type Checking, Scope, Scope Rules , Lifetime and Garbage Collection, Primitive Data Types, Strings, Array Types, Associative Arrays ,Record Types, Union Types, Pointers and References, Arithmetic Expressions , Overloaded Operators, Type Conversions, Relational and Boolean Expressions, Assignment Statements, Mixed Mode Assignments, Control Structures, Selection ,Iterations, Branching, Guarded Statements

UNIT III: Subprograms and Implementations: Subprograms, Design Issues, Local Referencing, Parameter Passing, Overloaded Methods, Generic Methods, Design Issues for Functions, Semantics of Call and Return, Implementing Simple Subprograms, Stack and Dynamic Local Variables, Nested Subprograms, Dynamic Scoping.

UNIT IV: Object-Orientation, Concurrency, and Event handling: Grouping of Data and Operations — Constructs for Programming Structures, Abstraction Information Hiding, Program Design with Modules, Defined Types, Object Oriented Programming — Concept of Object, Inheritance, Derived Classes and Information Hiding — Templates, Semaphores, Monitors, Message Passing, Threads, Statement Level Concurrency Exception Handling

(Using C++ and Java as Example Language).

UNIT V: Functional and Logic Programming Languages: Fundamentals of Functional Programming Languages, Programming with ML, Introduction to Logic and Logic Programming — Introduction to Programming with HASKELL, SCHEME& SCALA

Text Books:

1. “Programming Languages: Design and Implementations” , Terrance Pratt, Marvin V. Zelkowitz, T.V.Gopa1, Fourth ed., Prentice Hall
2. “Programming in HASKELL” by Graham Hutton , Cambridge University Press
3. “ The Scheme Programming language” by R.Kent , Dybvig
4. “Programming in SCALA by Bill Venners & Martin Odersky , ARTIMA Press, Mount View, California

Reference Books:

1. Concepts of Programming Languages, Robert W. Sebesta, 10th Ed.,Pearson
2. Programming Language Design Concept”, David A. Watt, Willey India
3. “Programming languages: Concepts and Constructs”, Ravi Sethi, Second Ed.,Pearson.
4. “Types and programming Languages”, Benjamin C. Pierce. The MIT Press Cambridge, Massachusetts

Course Structure & Curriculum

for
B. Tech. Programme (1st Year)

in
ELECTRICAL ENGINEERING

Effective from

Academic Session (2022-2023)

Department of Electrical Engineering
Motilal Nehru National Institute of Technology Allahabad
Prayagraj-211004, Uttar Pradesh

Vision of the Institute

To establish a unique identity for the institute amongst national and international academic and research organizations through knowledge creation, acquisition and dissemination for the benefit of society and humanity.

Mission of the Institute

- To generate high quality human and knowledge resources in our core areas of competence and emerging areas to make valuable contribution in technology for social and economic development of the nation. Focused efforts to be undertaken for identification, monitoring and control of objective attributes of quality and for continuous enhancement of academic processes, infrastructure, and ambience.
- To efficaciously enhance and expand, even beyond national boundaries, its contribution to the betterment of technical education and offer international programmes of teaching, consultancy and research.

Vision of the Department

To produce globally competitive technical manpower with sound knowledge of theory and practice, with a commitment to serve the society and to foster cutting edge research in Electrical Engineering pertaining to the problems currently faced by the country and the world.

Mission of the Department

- Development of state of art lab facilities for research and consultancy.
- Development of relevant content for quality teaching.
- Development of infrastructure and procurement of cutting-edge tools/equipment.
- Improving symbiotic relationship with Industry for collaborative research and resource generation.

DEPARTMENT OF ELECTRICAL ENGINEERING

Programme: B.Tech in Electrical Engineering

Programme Educational Objectives (PEOs)

PEO1	To produce students for Industry, Research, Academic Institutions and Government Organization
PEO2	To produce students who are at par with the world classified institutions and useful to society
PEO3	To generate adequate human resources for employment opportunities in the critically important and dynamic electrical industry and in the context of a socio-economic and sustainable society
PEO4	Uniquely combine practical, hands-on training with cutting-edge research and teaching and also to develop trained manpower with strong knowledge base to undertake and execute sponsored and collaborative research programmes and consultancies to promote long term academia industrial collaboration as well as for generating resources

Mapping of mission of the Department with the PEOs

Mission statement	**PEO1**	**PEO2**	**PEO3**	**PEO4**
Development of state of art lab facilities for research and consultancy	**3**	**3**	**2**	**3**
Development of relevant content for quality teaching	**2**	**3**	**2**	**3**
Development of infrastructure and procurement of cutting edge tools/equipment	**3**	**2**	**3**	**3**
Improving symbiotic relationship with Industry for collaborative research and resource generation	**3**	**3**	**3**	**3**

Programme Outcomes (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis:** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions:** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems:**Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage:**Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society:**Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability:** Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work:**Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance:** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning:** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

PSO1: Able to apply fundamental knowledge of mathematics, science and engineering to investigate, identify, formulate and design complex problems in the Electrical Engineering and allied fields.

PSO2: Able to apply the appropriate techniques and modern engineering tools to solve complex Electrical Engineering and real time problems, by working with multi-disciplinary team and inculcate skills for life-long learning.

PSO3: To be an enabler for improved and new technologies for building cost-efficient, reliable, environment friendly and sustainable energy systems for society.

Curricular Components

Credit structure of B. Tech in Electrical Engineering (Major):

Category Symbol	Category	Total Credit
CEF	Core Engg. Fundamental	16
PCE	Professional competence enhancing course	19
CEE	Core Engg. Essentials	59
EAA	Extra Academic Activity related courses	6
CES	Core Engg. Supporting Courses	14
CEL	Core Engg. Elective	32
IT/GP	Industrial Training /Group Project	24
	Total Credits	170

Credits details of B. Tech in Electrical Engineering (Major):

Category Symbol	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credit
CEF	8	8	-	-	-	-	-	-	16
PCE	7	3	4	2	-	-	3	-	19
CEE	6	5	8	12	16	12	-	-	59
EAA	2	2	2	-	-	-	-	-	6
CES	-	3	7	4	-	-	-	-	14
CEL	-	-	4	8	4	8	8	-	32
IT/GP	-	-	-	-	2	-	8	14	24
Total	**23**	**21**	**25**	**26**	**22**	**20**	**19**	**14**	170

Credits details of B. Tech with Minor:

Category Symbol	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credit
CEF	8	8	-	-	-	-	-	-	16
PCE	7	3	4	2	-	-	3	-	19
CEE	6	5	8	12	16	12	-	-	59
EAA	2	2	2	-	-	-	-	-	6
CES	-	3	7	4	-	-	-	-	14
CEL	-	-	4	8	4	8	8	-	32
IT/GP	-	-	-	-	2	-	8	14	24
MR	-	-	-	4	4	4	4	-	16
Total	**23**	**21**	**25**	**30**	**26**	**24**	**23**	**14**	186

Credits details of B. Tech with Honours:

Category Symbol	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credit
CEF	8	8	-	-	-	-	-	-	16
PCE	7	3	4	2	-	-	3	-	19
CEE	6	5	8	12	16	12	-	-	59
EAA	2	2	2	-	-	-	-	-	6
CES	-	3	7	4	-	-	-	-	14
CEL	-	-	4	8	4	8	8	-	32
IT/GP	-	-	-	-	2	-	8	14	24
HN	-	-	-	-	4	4	8	-	16
Total	**23**	**21**	**25**	**26**	**26**	**24**	**27**	**14**	186

Credits details of B. Tech Honours with Minor:

Category Symbol	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credit
CEF	8	8	-	-	-	-	-	-	16
PCE	7	3	4	2	-	-	3	-	19
CEE	6	5	8	12	16	12	-	-	59
EAA	2	2	2	-	-	-	-	-	6
CES	-	3	7	4	-	-	-	-	14
CEL	-	-	4	8	4	8	8	-	32
IT/GP	-	-	-	-	2	-	8	14	24
HN	-	-	-	-	4	4	8	-	16
MR	-	-	-	4	4	4	4	-	16
Total	**23**	**21**	**25**	**30**	**30**	**28**	**31**	**14**	202

Credits details of B. Tech with Research:

Category Symbol	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credit
CEF	8	8	-	-	-	-	-	-	16
PCE	7	3	4	2	-	-	3	-	19
CEE	6	5	8	12	16	12	-	-	59
EAA	2	2	2	-	-	-	-	-	6
CES	-	3	7	4	-	-	-	-	14
CEL	-	-	4	8	4	8	8	-	32
IT/GP/RP	-	-	-	-	2	-	12	14	28
RS	-	-	-	-	4	4	4	-	12
Total	**23**	**21**	**25**	**26**	**26**	**24**	**27**	**14**	186

Credits details of proposed B. Tech with Research & with Minor:

Category Symbol	1st Sem	2nd Sem	3rd Sem	4th Sem	5th Sem	6th Sem	7th Sem	8th Sem	Total Credit
CEF	8	8	-	-	-	-	-	-	16
PCE	7	3	4	2	-	-	3	-	19
CEE	6	5	8	12	16	12	-	-	59
EAA	2	2	2	-	-	-	-	-	6
CES	-	3	7	4	-	-	-	-	14
CEL	-	-	4	8	4	8	8	-	32
IT/GP/RP	-	-	-	-	2	-	12	14	28
RS	-	-	-	-	4	4	4	-	12
MR	-	-	-	4	4	4	4	-	16
Total	**23**	**21**	**25**	**30**	**30**	**28**	**31**	**14**	202

SCHEME OF INSTRUCTION

B.Tech. Electrical Engineering

Course Structure

1. B. Tech. Year-I, Semester-I

Sl. No.	Course	Cat.	L	T	P	Credit	Remarks
1.	Physics/Chemistry	CEF	2	1	2	4	Branch specific Physics or Chemistry Courses (Alternate in each semester)
2.	Mathematics-I	CEF	3	1	0	4	Common course for all branches
3.	English Language & Technical Communication	PCE	2	0	2	3	Common course for all branches
4.	Essentials of Electrical Engineering	CEE	2	0	2	3	Branch specific course for students of Electrical Engg.
5.	Electrical Measurement & Instrumentation	CEE	2	0	2	3	Branch specific course for students of Electrical Engg.
6.	Workshop & Manufacturing Processes	PCE	1	0	2	2	Common course chosen by the department
7.	Environment and Climate Change	PCE	2	0	0	2	Common course for all branches
8.	Extra Academic Activity-A/ Extra Academic Activity-B	EAA	-	-	4	2	Common course for all branches (with different titles) Engagement beyond Academic activity duration & the evaluation of grading system should be worked out
Total		14		2	14	23	

2. B. Tech. Year-I, Semester-II

Sl. No.	Subject	Cat.	L	T	P	Credit	Remarks
1.	Chemistry/Physics	CEF	2	1	2	4	Branch specific Physic or Chemistry Courses (Alternate in each semester)
2.	Mathematics-II	CEF	3	1	0	4	Branch Specific Mathematics Course for students of Electrical Engg.
3.	Introduction to Artificial Intelligence & Machine Learning	PCE	2	0	2	3	Common course for all branches
4.	Core Engineering Supporting Course*	CES	2	0	2	3	Courses floated by department of Electrical Engg. (Only for the students of other branches)
5.	Network Analysis	CEE	3	0	0	3	Branch specific course for students of Electrical Engg.
6.	Electrical Workshop	CEE	1	0	2	2	Branch specific course floated by the department of Electrical Engg. in place of common course
7.	Extra Academic Activity-B/ Extra Academic Activity-A	EAA	0	0	4	2	Common course for all branches (with different titles) Engagement beyond Academic activity duration & the evaluation of grading system should be worked out
			12	2	14	21	

*** Core Engineering Supporting Course (Only for the students of other branches)**

Sl. No.	Subject
1	Basic Electrical Engineering
2	Electrical Measurement & Measuring Instruments
3	Electrical Circuits
4	Introduction to Simulation Tools

Course Detail and Syllabus

Course Title	**Physics**		
Course Code		Credit	4
Core/Elective	CEF	Semester	I/II
Prerequisite Knowledge	Basic Knowledge of Physics		

CO	Statement
PH11101.1	The course provides basics of electromagnetism and electrodynamics which are required for Electrical Engineering, Electronics & Communication Engineering, Computer Science & Engineering professionals for development of advance technology.
PH11101.2	Development of basic understanding of quantum mechanics to address the engineering based problems at molecular level, required for Electrical Engineering, Electronics & Communication Engineering, Computer Science & Engineering professionals for the development of advance technologies such as quantum computation and quantum devices.
PH11101.3	The solid state and semiconductor devices are fundamental units of every electronic equipment. The course provides basic understanding of solid state physics to discover efficient electronic devices. It also helps in the development of new materials.

Syllabus

Electrodynamics

Gradient, divergence and curl operations, Spherical and Cylindrical Coordinates.Gauss divergence theorem and Stoke'stheorem.Poisson's and Laplace equation, Working of Helmholtz galvanometer. Magnetic vector potential, Displacement current, Maxwell's equations (Integral and differential forms) in free space, Propagation of electromagnetic waves in free space

Quantum Mechanics

Wave particle duality, Wave packets, Phase and group velocity, Heisenberg's uncertainty principle and its application, Wave function and its physical interpretation, Probabilities and Normalization, Time independent and dependent Schrodinger wave equation and its simple applications.

Solid State Physics

Crystal structure, Space lattice, Unit cell, Miller indices, Interplaner spacing, X-ray diffraction and Bragg's law, Diamagnetism, Paramagnetism and Ferromagnetism, Hysteresis curve, Curie-Weiss Law.

Practical: List of Experiments

1. To measure height of a building using Sextant.
2. To measure co-efficient of thermal conductivity of rubber by Lee's disc method.
3. To study variation of magnetic field along the axis of a current carrying coil.
4. Magnetic field distribution due to Helmholtz coil setup.
5. To determine resistivity by four probe method.
6. To study variation of magnetic field along axis of Helmboltz coil.
7. To measure surface tension using the "break-away" method.
8. To determine specific heat of copper, lead and glass.

Reference Books

1. D. J. Griffths, Introduction to Electrodynamics, Prentice Hall of India.
2. S. Gasiorowiez, Quantum Physics, John Wiley & Sons.
3. R. Eisberg and R. Resnik, Quantum Physics, John Wiley & Sons.
4. A. Beiser, Concepts of Modern Physics, Tata McGraw-Hill.
5. Charles Kittel, Introduction to Solid State Physics, Wiley India Edition.

Course Title	**Chemistry**		
Course Code		Credit	4
Core/Elective	CEF	Semester	I/II

1. **Chemical Kinetics:** Rate of a chemical reaction, factors affective the rate of reactions: concentration, temperature, pressure and catalyst: elementary and complex reactions, order and molecularity of reactions, rate law, rate constant and its units.

2. **Electrochemistry:** Electrochemical cells and EMF, Applications of EMF, Rechargeable battery, solar cells.

3. **Organic and Polymer Molecules:** Organic optoelectronic molecules & devices, chemical sensors, memory cells, electro chronic devices and non-linear optics.
   Conducting polymers, Thermo sensitive polymers, liquid crystalline polymers, piezoelectric polymers, polymers for optical data storage, fibre-optics.

4. **Chemistry, properties and application**
   - Atomic and Molecular Orbitals
   - Schrodinger equation and applications
   - Semiconductors, insulators, doping in semiconducting materials
   - Organic light-emitting devices
   - Mechanical actuators and switches

- Printed Circuit Boards

Course Title	**Mathematics-I**		
Course Code		Credit	4
Core/Elective	CEF	Semester	I
Prerequisite Knowledge	Basic Knowledge of Mathematics		

MATHEMATICS-I (MA-1101)

UNIT1: Continuity and Differentiability 5(L)

Limit and Continuity (ε-δdefinition of one variable, Rolle's Theorem, Mean Value Theorems, Limit and Continuity (ε-δdefinition for several variables) and Differentiability for several variables.

UNIT2: Partial Derivatives and Taylors Theorem 5(L)

Partial Derivatives, Euler's theorem, Implicit function,Change of variables, Jacobian, Taylor's theorem for functions of several variables, Extrema of functions of several variables, Lagrange method of undetermined multipliers.

UNIT3: Integral Calculus 7(L)

Multiple Integrals (Double & Triple Integral), Change of order of integration, Area of bounded region, Arc length of Curve, Volume and Surface area of solid of revolution, Multiple integral by change of variables, Dirichlet integrals, Moment of Inertia, Center of gravity

UNIT4: Beta and Gamma Functions 5(L)

ImproperIntegrals, Convergence of improper integral, Beta function, Gamma function, Improper integrals involving parameter.

UNIT5: Vector Calculus 8(L)

Gradient, Directional derivatives, Divergence and curl, Line integral, Green's theorem, Surface and volume integrals, Gauss Theorem, Stoke's theorems and their Applications

UNIT6: Ordinary Differential Equation 10(L)

Existence and uniqueness of solutions of first order ODE, Exact differential equation, Solution of linear differential equation, Higher order linear differential equation, Solutions of homogeneous and non-homogeneous ODE (CF+PI), Variation of parameters, Method of undetermined coefficients.

Text Reference Books:

- R.K. Jain and S.R. K lyengar, Advanced Engineering Mathematics, Narosa Pub. House
- Erwin Rreyszig. Advanced Engineering Mathematics, John Wiley & Sons INC.
- B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers

<table>
<tr><td>Course Title</td><td colspan="3">Essentials of Electrical Engineering</td></tr>
<tr><td>Course Code</td><td></td><td>Credit</td><td>3</td></tr>
<tr><td>Core/ Elective</td><td>CEE</td><td>Semester</td><td>I</td></tr>
<tr><td>Prerequisite Knowledge</td><td colspan="3">1. Fundamental of Physics
2. Mathematics</td></tr>
<tr><td>Course Aim</td><td colspan="3">This course aims to (i) demonstrate the fundamental theories of DC/AC circuits/networks, (ii) assist to solve electrical circuits using network theorems, (iii) revisit magnetic circuits and characterize the same.</td></tr>
<tr><td>Course Outcomes (COs)</td><td colspan="3">At the end of the course students will be able to:
CO1: understand DC circuits/networks elements.
CO2: apply different network theorems to solve electrical circuits/networks.
CO3: understand AC circuits, and able to compute power in AC circuits.
CO4: demonstrate the characteristics of magnetic circuits.
CO5: analyze networks using graph theory.</td></tr>
<tr><td>Mapping of COs with POs</td><td colspan="3">
<table>
<tr><th></th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th><th>CO5</th></tr>
<tr><td>PO1</td><td>H</td><td>H</td><td>H</td><td>M</td><td>M</td></tr>
<tr><td>PO2</td><td>H</td><td>H</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>PO3</td><td>M</td><td>H</td><td>H</td><td>H</td><td>M</td></tr>
<tr><td>PO4</td><td>L</td><td>M</td><td>H</td><td>H</td><td>M</td></tr>
<tr><td>PO5</td><td>H</td><td>L</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>PO6</td><td>M</td><td>L</td><td>H</td><td>M</td><td>M</td></tr>
<tr><td>PO7</td><td>M</td><td>L</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>PO8</td><td>L</td><td>L</td><td>M</td><td>L</td><td>M</td></tr>
<tr><td>PO9</td><td>H</td><td>L</td><td>M</td><td>M</td><td>M</td></tr>
<tr><td>PO10</td><td>L</td><td>M</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td>PO11</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td></tr>
<tr><td>PO12</td><td>M</td><td>M</td><td>M</td><td>M</td><td>L</td></tr>
</table>
</td></tr>
<tr><td>Mapping of COs with PSOs</td><td colspan="3">
<table>
<tr><th></th><th>CO1</th><th>CO2</th><th>CO3</th><th>CO4</th></tr>
<tr><td>PSO1</td><td>H</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>PSO2</td><td>H</td><td>H</td><td>H</td><td>H</td></tr>
<tr><td>PSO3</td><td>M</td><td>M</td><td>M</td><td>M</td></tr>
</table>
</td></tr>
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Module 1: Introduction to DC Networks **(5 Hours)**

Introduction to DC and AC circuits, Active & passive elements, unilateral & bilateral elements, Voltage Sources and Current Sources, Ohm's law, Voltage-Current relations for resistor, inductor, and capacitor, Kirchhoff's laws, Node voltage & Mesh Current analysis, Ideal sources Star-Delta Transformation, Independent and dependent/controlled sources with examples.

Module 2: Network Theorems **(5 Hours)**

Superposition theorem, Thevenin's and Norton Theorems, Maximum power transfer theorem, Millman's theorem, Reciprocity theorem.

Module 3: AC Fundamentals **(10 Hours)**

Single-phase AC generation, Average and RMS values of sinusoid, Form and peak factors, Concept of phasor representation, the *j* operator, Power factor, Power in complex notation, Analysis of R-L, R-C, R-L-C circuits.
Resonance: Series and Parallel, Q-factor.
Three phase EMF generation, delta and Y – connection, relationship between line and phase quantities, balanced supply voltage and balanced load, phasor diagram, measurement of power in three phase circuits.

Module 4: Magnetic Circuits **(4 Hours)**

Introduction to magnetic circuits, analogy between electrical and magnetic circuits, Simple magnetic circuit with DC and AC excitations-Faraday's laws, induced emfs and inductances, magnetic leakages, B-H curve, hysteresis and eddy current loss, magnetic circuit calculations, mutual coupling.

Module 5: Graph theory/topology **(4 Hours)**

Graph of a network, Tree, Co-tree, fundamental cut-set, Link, Incidence matrix, Cut set matrix, Tie set matrix.

Text / Reference books

1. Dash. S.S, Subramani. C, Vijayakumar. K," Basic Electrical Engineering", First edition, Vijay Nicole Imprints Pvt.Ltd,2013
2. V. Deltoro, "Principle of Electrical Engineering" PHI
3. SmarajtGhosh, "Fundamentals of Electrical & Electronics Engineering", Second edition, PHI Learning, 2007.
4. Metha V.K, RohitMetha, "Basic Electrical Engineering", Fifth edition, Chand. S & Co, 2012.
5. Kothari. D.P and Nagrath. I.J, "Basic Electrical Engineering", Second edition, Tata McGraw - Hill, 2009.
6. Bhattacharya. S.K, "Basic Electrical and Electronics Engineering", First edition, Pearson Education, 2011.

Course Title	**Electrical Measurement & Instrumentation**		
Course Code		Credit	3
Core/ Elective	CEE	Semester	I
Prerequisite Knowledge	Fundamental of Physics and Mathematics		
Course Aim	To teach the basic electrical and electronics measurements		

Course Outcomes (COs)

CO 1. To analyze various errors in the measurement.

CO 2. To perform an extensive comparative study among the performance of analog instruments and electronic instruments.

CO 3. To analyses the new measurements techniques for measurement of Electrical quantity.

CO 4. To analyses the reasons of the errors in measurements and develop new techniques to reduce the error.

Mapping of COs with POs

CO ↓	PO →												PSO		
	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3
1	H	H	H	H	H	H	L	M	L	L	M	M	H	H	L
2	H	H	M	H	M	M	M	M	L	H	H	M	H	H	M
3	H	M	H	H	M	M	L	L	M	M	M	M	H	M	H
4	H	H	H	H	M	M	L	L	L	L	L	L	H	H	L

L=Low, M=Medium, H=High

UNIT 1 –PRINCIPLES OF MEASUREMENTS AND ANALOG INSTRUMENTS [**8 Hours**]

Methods of measurement, Characteristics of instruments & measurement systems, Errors in measurement & its analysis.Principle of operation of Permanent Magnet Moving Coil (PMMC) and Moving Iron Instruments, Voltmeters & ammeters, Errors in Voltmeter and Ammeters, Range extension, Advantages and disadvantages, Electrodynamometer Instruments, Power (Single Phase and Three Phase) measurement, Compensation due to low Power factor. Induction Types Instruments, Energy (Single Phase and Three Phase) measurement.

UNIT 2 – ELECTRONIC INSTRUMENTS [**3 Hours**]

Digital Instruments for measurement of current, voltage, resistance etc., Measurement of frequency and phase angle,Cathode Ray Oscilloscopes (CRO) –Analog CRO, Lissajous Pattern

UNIT 3 – POTENTIOMETERS & BRIDGES [5 **Hours**]

D.C. Potentiometers, D.C. & A.C. Bridges, Measurement of inductance and capacitance & quality factor, Measurement of low, medium, high resistances. Advantages and Disadvantages of bridges.

UNIT 4 – INSTRUMENT TRANSFORMERS [**6 Hours**]

Principle of operation and applications, Current transformer and its error analysis, Potential transformer and its error analysis, Misc. Measurement**,** Frequency measurement.

UNIT 5-MEASUREMENTOF NON-ELECTRICAL QUANTITY: [**5 Hours**]

Transducers for measurement of displacement, strain, velocity, etc

UNIT 6 − INSTRUMENTATION SYSTEMS:

Role of Instrumentation, Elements of instrumentation system; Use of monitored information; Classification of data acquisition systems; Standards of instrumentation; Calibration; Recent developments, Transducer types.

Text / Reference books

1. E.W.Golding& F.C. Widdis, "Electrical measurement & measuring instruments," A.H.Wheeler&Co.Pvt. Ltd. India, 2011.
2. A. D.Helfrick&W.D.Cooper, "Electronic Instruments & Measurement Technique" Prentice Hall of India, 2008.
3. David A. Bell, "Electronic Instrumentation & Measurement," Oxford University Press-New Delhi, 3rdEdition, 2013.
4. M.B.Stout, "Basic Electrical measurement," Prentice Hall, 2ndEdition, 1965. 5. H. S. Kalsi, "Electronic Instrumentation;" McGraw Hill Education (India) Pvt. Ltd., 3rdEdition
5. D. Patranabis, “Principles of industrial instrumentation,” Tata McGraw Hill Education, 3rd Edition, 2010.

Course Code:	**Workshop and Manufacturing Processes**		Credits: 2
Core/ Elective	PCE	Semester	I

Prerequisites: Nil

Course Outcomes:

CO1	Students will be able to understand the importance of manufacturing which comprises materials, processes and systems.
CO2	Students will be able to understand the metal casting, metal working process and able to perform casting of metals, forging and sheet metal operations through practical classes.
CO3	Students will be able to understand the machining operations, permanent joining processes. They will be able to perform machining operations on Lathe machine and joining through arc and gas welding processes.
CO4	Students will be able to learn and perform operations related to carpentry, fitting, plastic molding, and Computer Numerical Control (CNC) machines.

Course Articulation Matrix:

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2
CO1	2	1	1	-	2	1	1	-	1	1	1	1
CO2	2	1	1	-	-	1	1	-	1	1	1	1
CO3	2	1	1	-	-	1	1	-	1	1	1	1
CO4	2	1	1	-	3	1	1	-	1	1	1	1
ME1110 2	2	1	1	-	2	1	1	-	1	1	1	1

Correlation between ME11102 Workshop subject and the PSOs

Name of the B. Tech. Program	PSO1	PSO2	PSO3	PSO4
B. Tech. (Civil Engineering)	2	1	1	-
B. Tech (Mechanical Engineering)	3	3		
B. Tech (Production & Industrial Engineering)	3	3		

Unit	Details	No. Hrs
1	**Concept of Manufacturing-** Manufacturing definition; Role of materials, processes and systems in manufacturing; Classification and brief introduction of engineering materials such as metals & alloys, Classification and brief introduction of manufacturing processes	4
2	**Sand Casting Process of Metals-** Elements of Green Sand Mould; Pattern design and making, Method of Preparation of Green Sand Mould; Casting Defects	2
3	**Metalworking Processes-** Classification of Metalworking Processes-brief introduction of bulk and sheet metal processes, Hot Vs Cold Working; Hot and Cold Rolling; Types of Rolling Mills, Forging, Extrusion, Drawing	3
4	**Machining Processes:** Classification of machining processes & machine tools; Construction, Specification, and operations on Lathe Machine and Drilling machine	2
5	**Fabrication Processes-** Classification of Welding Operations, Types of Joints & Welding Positions; Brief description of Arc, Resistance and Gas welding techniques. Brazing and Soldering	3

List of Practical

1. **Safety in Workshop (Demonstration)**
   Safety precautions and utilization of hand tools and machines of different shops with safe working habits.Introduction to measuring equipments and gauges of different shops.
2. **Carpentry**

Study of wood works, types of hand tools and machine. Making of one job involving wood work joint

3. **Fitting**
   Study of different fits and hand tools. Making of one job involving fitting to size, male-female fitting with drilling and tapping
4. **Welding**
   Study of electric arc welding and gas welding, tools, types of weld joints and safety precaution during welding.Making of one joint using electric and gas welding. Students will be introduced to brazing and soldering (demonstration)
5. **Sheet Metal Work**
   Study of different hand tools, machine and sheet metal joints. Making of one utility job in sheet metal
6. **Foundry**
   Principles of molding, methods, core & core boxes, preparation of sand mould of given pattern and casting (demonstration)
7. **Black Smithy**
   Introduction to hot working and Study of forging hand tools, furnace and machine. Making a job on hot upset forging.
8. **Machining**
   Study of lathe machine, cutting tools and turning related operations.Making of one job on lathe machine including facing, step and taper turning, threading operations.
9. **Plastic Processing**
   Introduction to plastics and different plastic moldingtechniques.Study of injection molding process with demonstration.
10. **Computer Numerical Control (CNC)**
    Introduction to automation & CNC, Assembly of models of CNC, CNC wood router, engraving and exposure to part programming.Preparation of part program for simple profiles.Making a job on CNC (Demonstration).
11. **Mini Project**
    Team activity – Fabrication of prototype model based on above practical.

Textbooks:

1 Fundamental of Modern Manufacturing: Materials, Processes and Systems — Mikell P. Groover — John Wiley

References:

1. Elements of Workshop Technology (Volume 1: Manufacturing Processes, Volume 2: Machine Tools), S. K. HajraChoudhury, A. K. HajraChoudhury and N. Roy, Media Promoters & Publishers Pvt Ltd., 2010
2. Manufacturing Engineering and Technology, SeropeKalpakjian and Steven R. Schmid Pearson, 2013
3. Machinery's Handbook Erik Oberg, Franklin D. Jones, Holbrook L. Horton, Henry H. Ryffel, and Christopher J. McCauley Laura Brengelman Industrial Press, Inc., 2020
4. Mechatronics HMT McGraw Hill Education, 2017
5. Manufacturing Processes I,https://nptel.ac.in/courses/112107144, NPTEL course
6. Fundamentals of manufacturing processes, ttps://onlinecourses.nptel.ac.in/noc22_me71/preview

Course Title	**Mathematics-II**		
Course Code		Credit	4
Core/ Elective	CEF	Semester	II

Unit –I Linear Algebra:(6 Lectures)

Vector spaces, Subspaces, Linear dependence and independence, Basis and dimension, Dimension theorem. Linear Transformation, Rank – Nulity Theorem (Statement only), Computation of Rank and nullity of LT, Solution of linear simultaneous algebraic equations

Unit –II Eigenvalues and Eigenvectors:(6 Lectures)

Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Application of Eigen Values and Eigen Vectors: Quadratic form, Diagonalization, Canonical forms and solving system of first order differential equations.

Unit – III Partial Differential Equation: (8 Lectures)

First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non-Linear First Order PDE, Some Standard form -I, II, III, IV. Charpit's method. Higher Order Homogeneous linear PDE with constant coefficients, C. F. & P.I, Non-homogeneous PDE with constant coefficients, C. F. & P. I. Method of separation of variables.

Unit- IV Laplace Transform: (7 Lectures)

Laplace transformation and its properties, Unit – step, Impulse and Periodic functions, Error Function. Inverse Laplace Transform, Convolution Theorem, Evaluation of Integral by Laplace Transform, Application of Laplace transform to solution of ODE & PDE.

Unit-V Fourier Series (6 Lectures):

Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral.

Unit-VI Fourier Transform: (7 Lectures):

Fourier Transform, Fourier Sine and Cosine Transform, Finite sine and cosine transform, Convolution theorem, Application of Fourier Transform to solve boundary value problems (ODE & PDE).

Reference Books:

1. R. K. Jain and S. R. K. Iyenger, Advanced Engineering Mathematics, Narosa Pub. House
2. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers.
3. Erwin Kreyszig, Advanced Engineering Mathematics, John Wiley & Sons.
4. QaziZameeruddin & Surjeet Singh, Modern Algebra, S Chand Publication

Course Title	**BASIC ELECTRICAL ENGINEERING (Core Engg. Supporting Courses)** **(For Other Department)**		
Course Code		Credit	3
Core/ Elective	CES	Semester	II
Prerequisite Knowledge	Basic Knowledge of Physics		
Course Aim	To provide comprehensive idea about AC and DC circuit analysis, working principles and applications of basic machines in electrical engineering, and general electrical safety procedures.		
Course Outcomes (COs)	At the end of the course students will **CO1:** be able to conceptualize DC circuits, andanalyze and simulate the DC networks/ circuits. **CO2:** be able to conceptualize magnetic circuits, and to analyze and simulate them. **CO3:** be able to conceptualize AC circuits, and to analyze and simulate them. **CO4:** be able to draw the construction of basic electrical machines, i.e., transformer and DC motor/ generators. Understand the working principle of these machines. **CO5:** acquire the general idea of electrical safety.		

UNIT 1 – FUNDAMENTALS OF DC CIRCUITS: (6 Hours)

Introduction to DC and AC circuits, Active and passive two terminal elements, Ohms law, Voltage-Current relations for resistor, inductor, capacitor , Kirchhoff's laws, Mesh analysis, Nodal analysis, Ideal sources –equivalent resistor, current division, voltage division, Star-Delta Transformation, DC Network Theorems

UNIT 2 – MAGNETIC CIRCUITS: (6 hours)

Introduction to magnetic circuits, analogy between electrical and magnetic circuit, Simple magnetic circuit with DC and AC excitations-Faraday's laws, induced emfs and inductances, magnetic leakages, B-H curve, hysteresis and eddy current loss, magnetic circuit calculations, mutual coupling

UNIT 3– AC CIRCUITS: (6 hours)

Sinusoids, Generation of AC, Average and RMS values, Form and peak factors, concept of phasor representation, J operator Analysis of R-L, R-C, R-L-C circuits Introduction to three phase systems - types of connections, relationship between line and phase values.

UNIT 4 –SINGLE- PHASE TRANSFORMER: (6 hours)

Principle of operation, construction, emf equation, equivalent circuit, power losses, efficiency, introduction to auto transformer

UNIT 5 – ELECTRICAL MACHINES: (6 hours)

Working principle, construction and applications of DC machines and AC machines, single phase induction motors, Double revolving field theory, Equivalent circuit, No load and blocked rotor tests, Starting methods, Repulsion Motor, split phase, capacitor start and capacitor start & run motors).

Text / Reference books

1. Dash. S.S, Subramani. C, Vijayakumar. K, "BasicElectrical Engineering", First edition, Vijay Nicole Imprints Pvt.Ltd,2013
2. V. Deltoro,"Principle of Electrical Engineering" PHI
3. SmarajtGhosh, "Fundamentals of Electrical & Electronics Engineering", Second edition, PHI Learning, 2007.
4. Metha V.K, RohitMetha, "Basic Electrical Engineering", Fifth edition, Chand. S & Co, 2012.
5. Kothari.D.P and Nagrath.I.J, "Basic Electrical Engineering", Second edition, Tata McGraw - Hill, 2009.
6. Bhattacharya.S.K, "Basic Electrical and Electronics Engineering", First edition, Pearson Education, 2011.

Course Title	**ELECTRICAL MEASUREMENT AND MEASURING INSTRUMENTS** (Core Engg. Supporting Course)**(For Other Department)**		
Course Code		Credit	3
Core/ Elective	CES	Semester	II
Prerequisite Knowledge	Physics, Mathematics		
Course Aim	To understand the operating principle of various measuring devices and thereby able to select appropriate device for measuring different process variables.		
Course Outcomes (COs)	At the end of the course students will be able **CO1:** to analyze various errors in the measurement. **CO2:** to perform an extensive comparative study among the performance of analog instruments and electronic instruments. **CO3:** to calculate different circuit parameters AC & DC bridges. **CO4:** to compute the errors of instrumentation transformer(s). **CO5:** to understand the operating principles of D/A & A/D converters.		

UNIT 1 –PRINCIPLES OF MEASUREMENT AND ERROR ANALYSIS:

Methods of measurement, Characteristics of instruments & measurement systems, Errors in measurement & its analysis.

UNIT 2 –ANALOG INSTRUMENTS:

Classification, Principle of operation of Permanent Magnet Moving Coil (PMMC) and Moving Iron Instruments, Voltmeters & ammeters, Errors in Voltmeter and Ammeters, Range extension, Advantages and disadvantages, Electrodynamometer Instruments, Power & Energy measurement

UNIT 3 – ELECTRONIC INSTRUMENTS:

Digital Instruments for measurement of current, voltage, resistance etc., Measurement of frequency & phase, Cathode Ray Oscilloscopes (CRO) –analog and special CRO.

UNIT 4 – POTENTIOMETERS & BRIDGES:

D.C. & A.C. Potentiometers, D.C. & A.C. Bridges, Measurement of inductance and capacitance & quality factor, Measurement of low, medium, high resistances and earth Resistances.

UNIT 5 – INSTRUMENT TRANSFORMERS:

Principle of operation and applications, Current transformer and its error analysis, Potential transformer and its error analysis, Misc. Measurement**,** Frequency & power factor, Harmonic analyser, Power analyser.

UNIT 6–INTRODUCTION TO DAC & ADC SYSTEM:

Analog to Digital Conversion: Ramp, Voltage to Frequency Converter (Integrating type), Dual slope integration Techniques, Digital to Analog Conversion: Weighted Resistor type, R-2R Ladder type, Specification of D/A Converter -Resolution, Accuracy.

Text/ Reference Books:

1. E.W.Golding&F.C.Widdis, "Electrical measurement & measuring instruments," A.H.Wheeler&Co.Pvt. Ltd. India, 2011.
2. A.D.Helfrick&W.D.Cooper, "Electronic Instruments & Measurement Technique" Prentice Hall of India, 2008.
3. David A. Bell, "Electronic Instrumentation & Measurement," Oxford University Press-New Delhi, 3rdEdition, 2013.
4. M.B.Stout, "Basic Electrical measurement," Prentice Hall, 2ndEdition, 1965.
5. H. S. Kalsi, "Electronic Instrumentation," McGraw Hill Education (India) Pvt. Ltd., 3rdEdition, 2010.

<table>
<tr><td>Course Title</td><td colspan="3">Introduction to Simulation Tools (Core Engg. Supporting Course)
(For Other Department)</td></tr>
<tr><td>Course Code</td><td></td><td>Credit</td><td>3</td></tr>
<tr><td>Core/ Elective</td><td>CES</td><td>Semester</td><td>II</td></tr>
<tr><td>Prerequisite Knowledge</td><td colspan="3">Physics, Mathematics, Basic Electrical Engineering.</td></tr>
<tr><td>Course Aim</td><td colspan="3">To teach the basics electrical engineering and application of mathematics with Simulation Software.</td></tr>
<tr><td>Course Outcomes (COs)</td><td colspan="3">At the end of the course students will (Number may vary)
CO 1. To understand the Modeling of Electrical Circuits and other Physical system.
CO 2. To analyze the transient and steady state response of electrical Circuit .
CO 3. To understand system characteristic with MATLAB/SIMULINK and other simulation software.
CO 4. To understand system characteristic with PSCAD/EMTDC and PSpice simulation software.</td></tr>
<tr><td>Mapping of COs with POs</td><td colspan="3">
<table>
<tr><th rowspan="2">CO ↓</th><th colspan="12">PO →</th><th colspan="3">PSO</th></tr>
<tr><th>1</th><th>2</th><th>3</th><th>4</th><th>5</th><th>6</th><th>7</th><th>8</th><th>9</th><th>10</th><th>11</th><th>12</th><th>1</th><th>2</th><th>3</th></tr>
<tr><td>1</td><td>H</td><td>H</td><td>H</td><td>H</td><td>M</td><td>H</td><td>M</td><td>L</td><td>M</td><td>L</td><td>L</td><td>L</td><td>H</td><td>M</td><td>M</td></tr>
<tr><td>2</td><td>H</td><td>H</td><td>M</td><td>H</td><td>M</td><td>M</td><td>M</td><td>M</td><td>L</td><td>H</td><td>H</td><td>M</td><td>H</td><td>M</td><td>M</td></tr>
<tr><td>3</td><td>H</td><td>M</td><td>H</td><td>H</td><td>M</td><td>L</td><td>L</td><td>L</td><td>M</td><td>M</td><td>M</td><td>M</td><td>H</td><td>M</td><td>H</td></tr>
<tr><td>4</td><td>H</td><td>H</td><td>H</td><td>H</td><td>M</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td><td>L</td><td>H</td><td>H</td><td>H</td></tr>
</table>
L=Low, M=Medium, H=High</td></tr>
</table>

UNIT 1 –INTRODUCTION TO MODELING OF ELECTRICAL CIRCUITS [6 Hours]

Fundamental Concepts in Mathematical Modelling: Basic properties– linearity and superposition – balance and conservation laws and the system – boundary approach. Lumped – Element Modelling: Mechanical systems – Translational, rotational. RLC Electrical Systems, Transients in Electrical Circuit. Pole-Zero approach

UNIT 2: Basics of MATLAB Coding [5 Hours]

UNIT 3 – Introduction to MATLAB/SIMULINK [7 Hours]

Different simulations tools boxes for Electrical Engineering in MATLAB/SIMULINK. Introduction to MATLAB/SIMULINK software, Simulation of BASIC RLC circuit using MATLAB, Transfer of data to MATLAB and Different Types of the Non Linearities: Saturation, Delay, etc Numerical Solution of Linear and Non-Liner Equation.

GAUSS elimination method, LU Matrix Decomposition method, GAUSS-SEIDEL method, Newton iterative method, Chebyshev Polynomials. EULERS method.

UNIT 4 – Introduction to LabView

Unit 5- Introduction to HIL Simulation

Text / Reference books

1. S. Rosloneic,"Fundamental numerical methods of Electrical Engineering, lecture Notes in Electrical Engineering, Springer 2018
2. J. Robert, D.K. Tran, Modelling and Simulation of Electrical Machines and Power Systems: International Symposium Proceedings Hardcover – Import, 1 May 1988.
3. Dr. V P Singh , System Modeling And Simulation by, New Age International (P) Ltd., Publishers,2016
4. Dac-Nhuong Le, SairamTadepalli, Jyotir Moy Chatterjee, Pramod Singh Rathore, Abhishek Kumar Pandey Network Modeling, Simulation and Analysis in MATLAB: Theory and Practices, PHI 2018

Course Title	**Electrical Circuits** (Core Engg. Supporting Course) **(For Other Department)**		
Course Code		Credit	3
Core/ Elective	CES	Semester	II
Prerequisite Knowledge	1. Basic Electrical Engineering 2. Mathematics-I		
Course Aim	Understand the basic concepts, basic laws and methods of analysis of DC and AC networks and reduce the complexity of network using source shifting, source transformation and network reduction using transformations.		
Course Outcomes (COs)	At the end of the course students will be able to: CO1: Solve complex electric circuits using network theorems. CO2: Discuss resonance in series and parallel circuits and also the importance of initial conditions and their evaluation. CO3: Synthesize typical waveforms using Laplace transformation. CO4: Solve unbalanced three phase systems and also evaluate the performance of two port networks.		

Mapping of COs with POs

	CO1	CO2	CO3	CO4
PO1	H	H	H	M
PO2	H	H	H	H
PO3	M	H	H	H
PO4	L	M	H	H
PO5	H	L	H	H
PO6	M	L	H	M
PO7	M	L	M	M
PO8	L	L	M	L
PO9	H	L	M	M
PO10	L	M	L	L
PO11	L	L	L	L
PO12	M	M	M	M

Mapping of COs with PSOs

	CO1	CO2	CO3	CO4
PSO1	H	H	H	H
PSO2	H	H	H	H
PSO3	M	M	M	M

Module 1: Basic Concepts: (9 Hours)

Active and passive elements, Concept of ideal and practical sources. Source transformation and Source shifting, Concept of Super-Mesh and Super node analysis. Analysis of networks by (i) Network reduction method including star – delta transformation, (ii) Mesh and Node voltage methods for ac and DC circuits with independent and dependent sources. Duality

Module 2: Network Theorems: (8 Hours)

Super Position theorem, Reciprocity theorem, Thevenin's theorem, Norton's theorem, Maximum power transfer theorem and Millman's theorem. Analysis of networks, with and without dependent ac and DC sources.

Module 3: Resonant Circuits: (4 Hours)

Analysis of simple series RLC and parallel RLC circuits under resonances. Problems on Resonant frequency, Bandwidth and Quality factor at resonance

Module 4:Transient Analysis: (5 Hours)

Transient analysis of RL and RC circuits under DC excitations: Behavior of circuit elements under switching action(t=0 and t=∞) , Evaluation of initial conditions.

Module 5: Two Port networks: (4 Hours)

Definition, Open circuit impedance, Short circuit admittance and Transmission parameters and their evaluation for simple circuits, relationships between parameter sets.

Textbooks

1 Engineering Circuit Analysis William H Hayt et al McGraw Hill 8th Edition , 2014
2 Network Analysis M.E.Vanvalkenburg Pearson 3rd Edition , 2014
3 Fundamentals of Electric Circuits Charles K Alexander Matthew N O SadikuMcGraw Hill 5th Edition,2013

Reference Books

1 Engineering Circuit Analysis J David Irwin et al Wiley India 10th Edition, 2014
2 Electric Circuits MahmoodNahviMcGraw Hill 5th Edition, 2009
3 Introduction to Electric Circuits Rich ard C Dorf and James A Svoboda Wiley 9th Edition, 2015
4 Circuit Analysis ; Theory and Practice Allan H Robbins Wilhelm C Miller Cengage 5th Edition, 2013
5 Basic Electrical Engineering V K Mehta, Rohit Mehta S Chand 6th Edition 2015

Course Title	**Network Analysis**		
Course Code		Credit	3
Core/ Elective	CEE	Semester	II
Prerequisite Knowledge	1. Basic Electrical Engineering 2. Mathematics-I		
Course Aim	To perform transient analysis of electrical networks applying Laplace transform, learn about coupling circuits and network synthesis, evaluate the various electrical parameters using two-port networks etc.		
Course Outcomes (COs)	At the end of the course students will be able to: CO1: to perform transient analysis applying Laplace transform. CO2: get the idea of 2-port networks and their applications. CO3: solve coupling electrical circuits. CO4: get the basic idea of network synthesis.		
Mapping of COs with POs			

	CO1	**CO2**	**CO3**	**CO4**
PO1	H	H	H	M
PO2	H	H	H	H
PO3	M	H	H	H
PO4	L	M	H	H
PO5	H	L	H	H
PO6	M	L	H	M
PO7	M	L	M	M
PO8	L	L	M	L
PO9	H	L	M	M
PO10	L	M	L	L
PO11	L	L	L	L
PO12	M	M	M	M

Mapping of COs with PSOs		CO1	CO2	CO3	CO4
	PSO1	H	H	H	H
	PSO2	H	H	H	H
	PSO3	M	M	M	M

Module 1: Laplace transform and transient analysis (9 Hours)

Representation of LTI system (Continuous time), Laplace transform: Revisited, Initial and Final value theorems, Standard test functions: step, ramp, Dirac delta.
Transient analysis using Laplace transform: 1st Order (RL, RC) and 2nd Order (RLC) Systems.

Module 2: Two-port Networks (8 Hours)

Interconnection of two-port networks, two-port network parameters (Z, Y, T, T^{-1}, h, g), Symmetrical & Reciprocal networks, Inter-conversion of two-port network parameters, Ladder networks, T-M transformation, Image & characteristic impedance. Network functions: Driving point and Transfer functions.

Module 3: Magnetically coupled Circuits (4 Hours)

Magnetic coupling, DOT conventions, Polarity of coils, Polarity of induced voltage, Concept of Self and Mutual inductance, Coefficient of coupling, Modeling of coupled circuits: Series, Parallel, & Parallel opposing.

Module 4:Positive Real Function (5 Hours)

Positive real functions and network synthesis, Definition and properties and testing, Synthesis of LC, RL & RC circuits using Cauer and Foster's first and second form, Passive filter synthesis.

Text / Reference books

1. M.E. Van Valkenberg, "Network Analysis," Prentice Hall of India, 3rd Edition, 2014.
2. D. Roy Choudhary, "Networks & Systems," New Age International, 2nd Edition, 2013.
3. W. H. Haytand J. E. Kemmerly, "Engineering circuit Analysis," Tata McGraw-Hill, 8th Edition, 2013.
4. A Chakrabarti& S. Bhadra, "Network Analysis and Synthesis," McGraw Hill education, 1st Edition, 2009.

Course Title	**Electrical Workshop**		
Course Code		Credit	2
Core/ Elective	CEE	Semester	II
Prerequisite Knowledge	NIL		

Course Aim	• To explain the various types of cables, connectors, switches, protective devices • To explain the house wiring with protection devices • To teach the various grounding techniques • To teach the modelling of inductors
Course Outcomes (COs)	At the end of the course students will be able to **CO1:**Understand the various types of cables, connectors and switches **CO2:**Understand the various protection devices, such as fuse, relays, MCB, MCCB and ELCB **CO3:**Provide wiring connections in houses **CO4:**Provide grounding/earthing **CO5:**Model the inductors and transformers

Mapping of COs with POs

	PO												PSO		
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**	**3**
CO1	H	H	H	H	H	H	M	L	H	L	L	L	H	L	L
CO2	H	H	H	H	H	H	M	L	H	L	L	L	H	L	L
CO3	H	H	H	H	H	H	M	L	H	L	L	L	H	L	L
CO4	H	H	H	H	H	H	M	L	H	L	L	L	H	L	L
CO5	H	H	H	H	H	H	M	L	H	L	L	L	H	L	L

UNIT 1 **[6 hours]**

CABLES: General specifications of cables- characteristic impedance, current carrying capacity, flexibility. Types of cables – SWG Single core, Multi core, Single strand, Multi strand and their types, Armoued cable, Shielded wires, Coaxial cables, Twisted pair, Flat ribbon cable' Teflon coated wires etc.

CONNECTORS: General specifications of connectors- contact resistance, breakdown voltage, insulation resistance, etc.

UNIT 2 **[3 hours]**

SWITCHES: Toggle switch- SPDT, DPDT,TPDT, Centre off, Without centre off, Rotary switch types depending on their poles and positions Rocker switch, Push button latch and non latch, Tactile switch, Micro switch, Limit switch, DIP switch, Thumb wheel switch- BCD, Decimal, Membrane switch, , Power electronic switches.

UNIT 3 **[8 hours]**

FUSES: Glass ,Ceramic fuse, Resettable fuse, Shunt fuse- MOV, HRC fuse

RELAYS: construction, working and application of General purpose relay, NO,NC contact, Difference between switch & relay

MCB, MCCB, ELCB: Construction working and applications.

UNIT 4 **[8 hours]**

WIRING: Wiring of simple light circuit for controlling light/ fan point (PVC conduit wiring), Wiring of power distribution arrangement using single phase MCB distribution board with ELCB, main switch and Energy meter,

STAR RATING: Energy saving and star rating of electrical appliances,

UNIT 5 **[7 hours]**

GROUNDING and INSULATION: Different types of grounding techniques, measure earth resistance, testing of insulation resistance, purpose of test lamp, Lightning and surge arrestors, substation equipments.

UNIT 6 **[6 hours]**

RATINGS: Ratings of Common Electrical Appliances: Transformer, Motors, Batteries, UPS, Inverters, Chargers, EVs etc.

Course Structure & Curriculum
For
B. Tech. Programme
NEP 2020

ELECTRONICS & COMMUNICATION ENGINEERING

Department of Electronics & Communication Engineering
Motilal Nehru National Institute of Technology Allahabad
Prayagraj-211004

Curriculum for
Bachelor of Technology in
(Electronics and Communication Engineering)

First Semester (Electronics and Communication Engineering)

Sl. No.	Course name	Cat	L	T	P	Credit	Contact Hours	Remarks
1	Physics/Chemistry	CEF	2	1	2	4	5	Branch Specific Physics and Chemistry Courses (Alternatively in each semester)
2	Mathematics-I	CEF	3	1	0	4	4	Common Course for all Branches
3	English Language and Technical Communication/Introduction to Artificial Intelligence and Machine Learning	PCE	2	0	2	3	4	Common Course for all Branches As per the clause 23.13 of the NEP 2020
4	Core Engineering Essential Course I (Flexible L-T-P) **Basic Electronics**	CEE	2	0	2	3	4	Branch Specific Course of that branch only here ECE
5	Core Engineering Essential Course II (Flexible L-T-P) **Digital Electronics**	CEE	2	0	2	3	4	Branch Specific Course of that branch only here ECE
6	Engineering Graphics/ **Electronics Workshop and Manufacturing Processes**	PCE/ CEE	1	0	2	2	3	Common Course (Alternatively in each semester) If any department does not want to adopt this/these course(s) for the specific branch, the department may float branch specific course(s) in that/those places here ECE
7	Environment and Climate Change	PCE	2	0	0	0	2	Common Course for all Branches (This is an Audit Course)
8	Extra Academic Activity-A/ Extra Academic Activity-B	EAA	0	0	4	2	4**	Common Course for all Branches (With different titles) *Engagement beyond Academic Activity Duration *Evaluation of Grading system to be worked on
	Total		14	2	14	21	26+4**	

Second Semester (Electronics and Communication Engineering)

Sl. No.	Course name	Cat	L	T	P	Credit	Contact Hours	Remarks
1	Chemistry/Physics	CEF	2	1	2	4	5	Branch Specific Physics and Chemistry Courses (Alternatively in each semester)
2	Mathematics-II	CEF	3	1	0	4	4	Branch Specific Mathematics Course
3	Introduction to Artificial Intelligence and Machine Learning/ English Language and Technical Communication	PCE	2	0	2	3	4	Common Course for all Branches As per the clause 23.13 of the NEP 2020
4	Core Engineering Supporting Course (Flexible L-T-P) Principle of Electronics Engineering	CES	2	0	2	3	4	Course to be floated by each department (here ECE) only for the students of other Branches
5	Core Engineering Essential Course III (Flexible L-T-P) Principle of Communication Engineering	CEE	2	0	2	3	4	Branch Specific Course of that branch only here ECE
6	Electronics Workshop and Manufacturing Processes/ Engineering Graphics	CEE/PCE	1	0	2	2	3	Common Course (Alternatively in each semester) If any department does not want to adopt this/these course(s) for the specific branch, the department may float branch specific course(s) in that/those places here ECE
7	Extra Academic Activity-A/ Extra Academic Activity-B	EAA	0	0	4	2	4**	Common Course for all Branches (With different titles) *Engagement beyond Academic Activity Duration *Evaluation of Grading system to be worked on
	Total		12	2	14	21	24+4**	

Courses offered by ECED in B Tech 1st Semester ECE

Course Code	Course name	L	T	P	Credit
EC-11101	Basic Electronics	2	0	2	3
EC-11102	Digital Electronics	2	0	2	3
EC-11103	Electronics Workshop and Manufacturing Process	1	0	2	3

BASIC ELECTRONICS (EC-11101)

Course Outcomes:

On successful completion of the course students will be able:

- To understand the basics of PN junction diode and its applications in electronic circuit design.
- To introduce different special purpose diode devices.
- To introduce the basics of transistor devices, characteristics, and its applications.
- To understand the operation of BJTs at low frequency.
- To introduce the basics of Field Effect Transistors.
- To acquire basic knowledge of operational amplifier and its applications as arithmetic circuits

UNIT 1: Transport Phenomenon in Semiconductor: Crystal Properties and charge Carriers in Semiconductors, Elemental and compound semiconductor materials, crystal lattice structure, Bonding forces, band theory, energy bands in solids, Intrinsic and Extrinsic semiconductors, charge carriers in semiconductors, carrier concentrations, drift of carriers in electric and magnetic fields.

5(L)

UNIT 2: Diodes- Introduction to *pn* diode and its applications as rectifier, rectifier as DC Power Supply,Clamper, Clipper, Voltage multiplier etc., Zener diode and its applications as regulator, Operation and characteristics of Varactor diode, Tunnel diode, LED, Photo diode, and Schottky diodes etc. 7(L)

UNIT 3: Bipolar Junction Transistors- Junction Transistor, transistor current components, Transistor as an amplifier, transistor construction, CB, CE, CC Configurations, analytical expressions for transistorcharacteristics, maximum voltage rating, phototransistor, biasing of bipolar junction transistors, small signal low frequency transistor hybrid model, simplified hybrid model, practical circuit of a transistor amplifier. 7(L)

UNIT 4: Field Effect Transistors- Basics of FET and MOSFET, construction, working, concept ofp i n c h -off, characteristics of JFET, MOSFET (Enhancement and Depletion), CG, CS, CD configuration, FET as a voltage variable resistor. 5(L)

UNIT 5: Operational Amplifier-Ideal & non-ideal characteristics, concept of summing junction and virtual ground. Application of operational amplifier as: Adder, Subtractor, Differentiator, Integrator, Multiplier, Unity gain amplifier & Logarithmic amplifier. 4(L)

Text/ Reference Books:

- Electronic devices and circuit theory by Robert Boylested and Louis Nashelsky
- Electronics Devices and Circuits by Millman & Halkias
- Digital design by Morris Mano
- Modern Digital Electronics by R. P. Jain

BASIC ELECTRONICS (LAB) (EC-11101)

Experiment 1: Familiarization to basic test and measuring instruments like Cathode Ray Oscilloscope(CRO), Function Generator, Power supply, Breadboard etc.
Experiment 2: To measure the frequency and amplitude of various waveforms using CRO.
Experiment 3: To verify the truth tables of different logic gates by using ICs and implement differentlogic gates using IC 7400.
Experiment 4: To study the *pn* junction diode characteristics under forward and reverse bias conditions.
Experiment 5: To study the application of a Zener diode as voltage regulator.
Experiment 6: To determine the ripple factor of Half-Wave and Full-wave (Bridge) rectifiers.
Experiment 7: To observe the clipping wave forms in different clipping configurations.
Experiment 8: To observe the clamping wave forms in different clamping configurations.
Experiment 9: To determine the CE (Common Emitter) characteristics of a given BJT.
Experiment 10: To plot the drain and transfer characteristics of a given FET and to find drain resistance.
Experiment 11: To verify the addition and subtraction operation using op-amp 741.

DIGITAL ELECTRONICS (EC-11102)
Course outcomes:
On successful completion of the course student will be able to:

- Have a basic understanding of the minimization techniques used in digital electronics.
- Have a thorough understanding of the concepts and design of different combinational logiccircuits.
- Understand, analyze and design various programmable logic devices.
- Understand and investigate the fundamental concepts of sequential logic circuits.
- Have a rigorous study of the various sequential logic circuits and to learn the design methods ofthe same.
- Acquire knowledge and analyze the design of different shift register circuits.
- Have a detailed understanding of design and working of multivibrators.
- Know about different characteristics of logic families and also analyze their design and working.

UNIT 1: A brief review of Minimization Techniques. 1(L)

UNIT 2: COMBINATIONAL LOGIC: Introduction, Design Procedure, Adders, Subtractors, Code Converters, Magnitude Comparator, BCD to Seven Segment decoder, Parity generator and Checker, Decoders, Encoders, Multiplexers, Demultiplexers, ROMs, Design of the circuits using Decoders,Multiplexers, ROMs. 6(L)

UNIT 3: PROGRAMMABLE LOGIC DEVICES: Programmable Logic Array (PLA), ProgrammableArray Logic (PAL), Design of the circuits using PLA and PAL, Field Programmable Gate Array (FPGA). 4(L)
UNIT 4: SEQUENTIAL LOGIC: Introduction, Flip-Flops, Flip-Flop Excitation Tables, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Race Around Condition, Master-Slave flip-flops, Conversion design of flip-flops, sequence detector. 4(L)

UNIT 5: Design of synchronous & ripple counters, Mod-k or Divide-by-k counters, Decade counter,BCD Counter, UP/DOWN Counters, Lock Out problem, Design with State Equations. 4(L)

UNIT 6: Shift register, Serial to Parallel Converter, Parallel to Serial Converter, Ring counters,Twisted-ring counter, Sequence Generator. 2(L)

UNIT 7: TIMING CIRCUITS: Multivibrators. 1(L)

UNIT 8: LOGIC FAMILIES: Characteristics of Digital ICs, DTL, TTL, ECL, MOS Logic & CMOSLogic, Calculation of noise margins and fan-out. 6(L)

Text/ Reference Books:

- M. Morris Mano: Digital Design, Third Edition, Prentice Hall
- R. P. Jain: Modern Digital Electronics, Third Edition, TMH
- Taub and Schilling: Digital Integrated Electronics, McGraw HILL
- Richard S. Sandige: Digital concept using standard ICs
- R. J. Tocci: Digital Systems: Principles and Applications, Fourth Edition, Prentice Hall

DIGITAL ELECTRONICS (LAB) (EC-14202)

Experiment 1: Verification of operation of Full Adder and Full Subtractor.
Experiment 2: Design & verification of 4-bit binary adder/subtractor using binary adder IC.
Experiment 3: Realization of operation of full adder and full subtractor using IC 74151/74153 MUX.
Experiment 4: Design & verification of full adder and full subtractor using an inverted output 3-to-8-linedecoder.
Experiment 5: Design and verification of operation of a BCD Adder using IC 7483.
Experiment 6: Realization of 4 X 1 MUX using basic gates.
Experiment 7: Verification of operation of BCD to Seven segment code conversion using IC 7447.
Experiment 8: Verification of Truth Tables of SR & D Flip flops.
Experiment 9: Verification of Truth Tables of Master Slave JK Flip-Flop.
Experiment 10: Design of MOD-8 UP/Down synchronous counter.
Experiment 11: Design of BCD ripple counter.
Experiment 12: Design of Universal Shift Register.
Experiment 13: Design of a sequential circuit from given state diagram.
Experiment 14: Design and verification of Astable Multivibrator using IC 555.
Experiment 15: Design and verification of Monostable Multivibrator using IC 555.
Experiment 16: Implementation of Basic Combinational and sequential circuits using VSM (VirtualSystem Modelling)
Experiment 17: Implementation of Basic Combinational and sequential circuits using VHDL

ELECTRONICS WORKSHOP AND MANUFACTURING PROCESS (EC-11103)

Course outcomes:

On successful completion of the course in theory and practical approach students will be able to:

- Have a basic understanding of the electronic components, ICs.
- Have an understanding of the use of electronic devices
- Understand, the process of soldering and securing the components on PCB
- Familiarize with 3-D printer and its uses
- Familiarize with the use spectrum analyzer and signal generator
- Familiarize with software tools used in circuit implementation
- Familiarize with semiconductor device manufacturing process

THEORY:

UNIT 1: Basics of CRO, DSO, Function Generator, Multimeter, Bread Board, Power Supply. [2]

UNIT 2: Active and Passive components, Types of ICs and their uses [2]

UNIT 3: Introduction to soldering process, types of soldering. [1]

UNIT 4: Regulated DC power supply and its uses. [1]

UNIT 5: Introduction to advanced electronic devices like Spectrum Analyzer, Signal Generator [2]

UNIT 6: Introduction to 3-D Printer and its uses [2]

UNIT 7: Introduction to semiconductor manufacturing process. [2]

LAB:

Experiment 1: Familiarization with Multimeter, Power Supply, Bread Board, Function Generator

Experiment 2: Use of DSO as measuring device and its functionalities

Experiment 3: Identification of Active and Passive components and their testing using Multimeter and DSO

Experiment 4: Soldering of components on PCB and their functionality testing on DSO

Experiment 5: Design and Implementation of Full wave Rectifier on PCB

Experiment 6: Design and Implementation of Regulated DC Power Supply on PCB

Experiment 7: Familiarization with Spectrum Analyzer and Signal Generator

Experiment 8: Study and familiarization of electronic 3-D Printer

Experiment 9: Familiarization with Verilog software for circuit implementation.

Experiment 10: Familiarization with Semiconductor Device Manufacturing Processes

Courses offered by ECED in B Tech 2nd Semester ECE

Course Code	Course name	L	T	P	Credit
EC-12101	Principle of Electronics Engineering	2	0	2	3
EC-12102	Principle of Communication Engineering	2	0	2	3
EC-12103	Electronics Workshop and Manufacturing Processes	1	0	2	3

N.B. EC-12101 is a supporting Course for students other than ECE students
EC-12103 is same syllabus as EC-11103, this Course is alternatively introduced in 1st and 2nd semesters

PRINCIPLE OF ELECTRONICS ENGINEERING (EC-12101)

Course Outcomes:

On successful completion of the course students will be able:

- To understand the basics of PN junction diode and its applications in electronic circuit design.
- To introduce different special purpose diode devices.
- To introduce the basics of transistor devices, characteristics, and its applications.
- To understand the operation of BJTs at low frequency.
- To have a thorough understanding of the concepts and design of different combinational logiccircuits.
- To understand and investigate the fundamental concepts of sequential logic circuits.

UNIT 1: Transport Phenomenon in Semiconductor: Crystal Properties and charge Carriers in Semiconductors, Elemental and compound semiconductor materials, crystal lattice structure, Bonding forces, band theory, energy bands in solids, Intrinsic and Extrinsic semiconductors, charge carriers in semiconductors, carrier concentrations, drift of carriers in electric and magnetic fields.

5(L)

UNIT 2: Diodes- Introduction to *pn* diode and its applications as rectifier, rectifier as DC Power Supply,Clamper, Clipper, Voltage multiplier etc., Zener diode and its applications as regulator, Operation and characteristics of Varactor diode, Tunnel diode, LED, Photo diode, and Schottky diodes etc. 7(L)

UNIT 3: Bipolar Junction Transistors- Junction Transistor, transistor current components, Transistor as an amplifier, transistor construction, CB, CE, CC Configurations, analytical expressions for transistorcharacteristics, maximum voltage rating, phototransistor, biasing of bipolar junction transistors, small signal low frequency transistor hybrid model, simplified hybrid model, practical circuit of a transistor amplifier. 7(L)

UNIT 4: Combinational Logic: Introduction, Design Procedure, Adders, Subtractors, Code Converters, Magnitude Comparator, BCD to Seven Segment decoder, Parity generator and Checker, Decoders, Encoders, Multiplexers, Demultiplexers, ROMs, Design of the circuits using Decoders,Multiplexers, ROMs. 6(L)

UNIT 5: Sequential Logic: Introduction, Flip-Flops, Flip-Flop Excitation Tables, Triggering of Flip-Flops, Analysis of Clocked Sequential Circuits, State Reduction and Assignment, Race Around Condition, Master-Slave flip-flops, Conversion design of flip-flops, sequence detector. 4(L)

Text/ Reference Books:

- Electronic devices and circuit theory by Robert Boylested and Louis Nashelsky
- Electronics Devices and Circuits by Millman & Halkias
- Digital design by Morris Mano
- Modern Digital Electronics by R. P. Jain
- Taub and Schilling: Digital Integrated Electronics, McGraw HILL
- Richard S. Sandige: Digital concept using standard ICs
- R. J. Tocci: Digital Systems: Principles and Applications, Fourth Edition, Prentice Hall

PRINCIPLE OF ELECTRONICS ENGINEERING (LAB) (EC-12101)

Experiment 1: Familiarization to basic test and measuring instruments like Cathode Ray Oscilloscope(CRO), Function Generator, Power supply, Breadboard etc.
Experiment 2: To measure the frequency and amplitude of various waveforms using CRO.
Experiment 3: To verify the truth tables of different logic gates by using ICs and implement differentlogic gates using IC 7400.
Experiment 4: To study the *pn* junction diode characteristics under forward and reverse bias conditions.
Experiment 5: To study the application of a Zener diode as voltage regulator.
Experiment 6: To determine the ripple factor of Half-Wave and Full-wave (Bridge) rectifiers.
Experiment 7: To observe the clipping wave forms in different clipping configurations.
Experiment 8: To observe the clamping wave forms in different clamping configurations.
Experiment 9: To determine the CE (Common Emitter) characteristics of a given BJT.
Experiment 10: Verification of operation of Full Adder and Full Subtractor.
Experiment11: Design & verification of 4-bit binary adder/subtractor using binary adder IC.
Experiment 12: Realization of operation of full adder and full subtractor using IC 74151/74153 MUX.
Experiment 13: Design & verification of full adder and full subtractor using an inverted output 3-to-8-linedecoder.

PRINCIPLE OF COMMUNICATION ENGINEERING (EC-12102)

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

- Understand the basic concepts of signals and random variables
- Understand the basic concepts of various AM modulators and demodulators.
- Understand the basic concepts of various FM and PM modulators and demodulators.
- Learn the working and application of Radio receivers.
- Understand the performance of Communication Systems in presence of Noise.
- Understand Sampling and various types of pulse modulation.

UNIT 1: Signal Representations, Frequency domain analysis of signals using Fourier Transforms, Random Variables, Random Processes, Auto-correlation function, PSD, PDF, CDF. Introduction to Communication systems, guided and unguided transmission media, radio frequency spectrum, Concept of bandwidth, Mathematical models for communication channels Linear filter channel,Linear time-invariant channel 6(L)

UNIT 2: Amplitude Modulation: Equation or AM wave, Modulation Index and Power relationships. AM Generation methods, AM demodulator: Square Low detector, Envelope detector and synchronous detector. DSB AM: Principle of nonlinear resistance, Balance modulator and Switching Modulator, DSB Demodulation through product modulator, Costas receiver. SSB AM: Time domain representation, Generation methods: Filter, Phase shift method using Hilbert Transformer, SSB demodulator. VSB-AMgeneration, Demodulation using sideband filters, Applications of AM, Quadrature Carrier multiplexing, FDM with Basic groups, Super groups, Master Groups. 8(L)

UNIT 3: Angle Modulation: Frequency and phase modulation, NBFM, WBFM, Generation ofFrequency Modulation: Reactance modulator and Indirect method. FM receiver: block diagram, FM discriminators: slope detector, balance slope detector and phase discriminator, Multiplexed Stereo FM system, Applications of FM. 6(L)

UNIT 4: Radio receivers: Tunned radio frequency receiver, Superheterodyne receiver Sensitivity and selectivity, selection of IF. Block diagram and features of Communication Receiver. 2(L)

UNIT 5: Noise in Communication Systems: Thermal noise, Shot noise, S/N ratio, noise Equivalentbandwidth, Noise performance of AM, DSB, SSB, FM systems under AWGN 3(L)

UNIT 6: Sampling Theorem, Different types of sampling, Analog Pulse modulation schemes PAM, PWM,and PPM. 3(L)

Text/ Reference Books:

- Communication System Engineering – John G Proakis
- Communication Systems- Simon Haykin
- Modern Digital and Analog Communication Systems- B.P. Lathi, 3rd edition, Oxford UniversityPress, 1998.
- Principles of Communication Systems - Toab & Schilling
- Digital & Analog communication systems-K. S. Shanmugam
- Contemporary Communication Systems using MATLAB- John G Proakis

PRINCIPLE OF COMMUNICATION ENGINEERING LAB (EC-12102)

Experiment1: To design and implement a Band Pass Filter for the range (400Hz-1KHz).
Experiment2: To implement Amplitude Modulation (AM), demodulation and calculate the modulationindex.
Experiment3: To implement Frequency Modulation (FM) using IC 2206 and demodulation using IC565.
Experiment4: To implement Pulse Amplitude Modulation (PAM) and Demodulation.
Experiment5: To implement Pulse Position Modulation (PPM).
Experiment6: To implement Pulse Width Modulation (PWM).
Experiment7: To implement Phase Locked Loop (PLL)and find out the lock range and capture range.
Experiment8: To design and test the circuit of Voltage to Frequency Converter (VCO) using IC 555.
Experiment9: To design and test a Mixer Circuit using PLL IC 565.
Experiment10: To study and implement Pre-emphasis and De-emphasis circuits.

Experiment11: To study and observe frequency response of Low-pass, High-pass, Band-pass and Notch filter using Spectrum Analyzer.

Experiment12: To determine the spectrum of AM using Spectrum Analyzer

Experiment13: To determine the spectrum of FM using spectrum analyzer.

Experiment14: To determine the performance of PCM.

Experiment15: To determine the performance TDM (PAM) and TDM (PCM).

MOTILAL NEHRU NATIONAL INSTITUTE OF TECHNOLOGY ALLAHABAD

B. Tech. in

MECHANICAL ENGINEERING

SCHEME OF INSTRUCTION AND SYLLABI

For B. Tech. Program

(Effective from 2022-23)

DEPARTMENT OF MECHANICAL ENGINEERING

Vision and Mission of the Institute

Motilal Nehru National Institute of Technology Allahabad

VISION

To attain a distinct identity for the Institute through innovation, knowledge creation and dissemination for the benefit of the society.

MISSION

- To nurture an eco-system for continuous enhancement of value-based teaching and learning process in the emerging areas of technology.
- To train quality human and knowledge resources in the service of society.
- To develop sustainable products and technologies.

Vision and Mission of the Department

VISION

To be a centre of excellence in Mechanical, Production and Industrial Engineering education and research for the benefits of society and humanity.

MISSION

- To educate and develop competent human resources for contemporary industry, academia and research.
- To promote interdisciplinary research and innovation skills in the graduates.
- To enhance the efforts to develop sustainable products, processes and technologies by developing competent entrepreneurs for the benefit of the society.

Department of Mechanical Engineering:

Brief about the Department:

The Department of Mechanical Engineering is one of the oldest department of the institute and was established in the year 1961. We are the largest community of excellent, energetic, and dynamic faculty, staff and students in the institute. The department is having highly qualified and experienced faculty (36 faculty members) in all streams of Mechanical Engineering. The department is broadly divided into three academic streams in which students receive outstanding education with a wide choice of specializations, electives and research areas. These three academic streams are: Design Engineering, Production and Industrial Engineering and Thermal Engineering.

The department offers eight semester (i.e. 4 year) Bachelor of Technology (B. Tech.) programmes in Mechanical Engineering and Production and Industrial Engineering. Every year 223 students are admitted through JEE (mains) and 15% of this intake is through Direct Admission to Students Abroad (DASA) scheme for the above two B. Tech. programmes. Some students are also through ICCR and MEA (Govt. of India) Schemes.

The department also offers four semester (i.e. 2 year) Master of Technology (M. Tech.) programmes in Computer Aided Design and Manufacturing, Design Engineering, Product Design and Development, Production Engineering and Thermal Engineering. Every year 125 students (25 in each specialization) are admitted through GATE in the above five M. Tech. programmes.

The department also offers Doctor of Philosophy (Ph.D.) programme in various areas of Mechanical Engineering as well as Production and Industrial Engineering. The strength of the department lies in its Ph.D. programme with more than 100 PhDs already been awarded till March, 2022. About 80 research scholars are presently pursuing their PhDs. Every year the department admits Ph.D. students equal to half of the number of faculty holding Ph.D. degree. The department is also a QIP centre for PhD and M. Tech programmes.

Today, the world of Mechanical Engineering changes under the influence of advanced computational tools, improved simulation and analysis, and entirely different manufacturing protocols. This has opened up new vistas of research in the department.

List of Programmes offered by the Department:

Program	Title of the Program
B. Tech.	Mechanical Engineering
	Production & Industrial Engineering
M. Tech.	Computer Aided Design and Manufacturing
	Design Engineering
	Product Design and Development
	Production Engineering
	Thermal Engineering
Ph.D.	Mechanical Engineering

B. Tech. – Mechanical Engineering

Program Educational Objective

PEO-1	To transform our students into employable technologists through education and training to contribute in the frontiers of Mechanical Engineering.
PEO-2	To groom the graduates for achieving team work capability and leadership qualities.
PEO-3	To impart multidisciplinary competence in the graduates for exploring ventures in Government, Public, Private, R&D and entrepreneurial sectors.
PEO-4	To imbibe ethical and human values in the graduates for the benefit of the society.

Program Articulation Matrix

PEO / Mission Statement	PEO1	PEO2	PEO3	PEO4
To educate and develop competent human resources for contemporary industry, academia and research.	3	3	2	3
To promote interdisciplinary research and innovation skills in the graduates.	2	3	2	2
To enhance the efforts to develop sustainable products, processes and technologies by developing competent entrepreneurs for the benefit of the society.	2	2	3	2

1-Slight; 2-Moderate; 3-Substantial

Program Outcomes

PO-01	Engineering Knowledge: Apply knowledge of mathematics, science and engineering fundamentals and Mechanical Engineering specialization to the solution of complex Engineering problems related to Mechanical Engineering.
PO-02	Problem Analysis: Identify, formulate, research literature and analyze complex Mechanical Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO-03	Design/ Development of Solutions: Design solutions for complex Mechanical Engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
PO-04	Conduct investigations: Conduct investigations of complex Mechanical Engineering problems using research-based knowledge and research methods including analysis, interpretation of data and synthesis of information to provide valid conclusions.
PO-05	Modern Tool Usage: To apply appropriate techniques, resources and engineering and IT tools for modeling of different Mechanical Engineering problems with an understanding of the limitations.
PO-06	The Engineer and Society: Apply contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO-07	Environment and Sustainability: Understand the impact of professional Engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO-08	Ethics: Apply ethical principles and commit to professional ethics responsibilities and norms of Engineering practice.
PO-09	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams as well as in multi disciplinary settings.
PO-10	Communication: Communicate effectively on complex Mechanical Engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PO-11	Project Management and Finance: Demonstrate knowledge and understanding of Mechanical Engineering and management principles and apply these to one's own work, as a member and leader of a team, to manage projects and in multidisciplinary environments.
PO-12	Life-long Learning: Recognize the need for the preparation and ability to engage in independent and life- long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO-01	Graduates will be able to apply fundamental knowledge of sciences and engineering to identify, comprehend, formulate, design and analyse real life problems in Mechanical Engineering and allied multidisciplinary fields.
PSO-02	Graduates will be able to apply the acquired computational, experimental and soft skills to solve Mechanical Engineering problems, interact and work coherently in a team environment, develop life-long learning, scientific skills and distinctive managerial traits.

SCHEME OF INSTRUCTION

B. Tech. Mechanical Engineering –Course Curriculum Structure

S. No.	Code	Course	Credit	L-T-P	Contact Hours
Semester-I					
1	CEF	Physics/Chemistry	4	2-1-2	5
2	CEF	Mathematics-I	4	3-1-0	4
3	PCE	English Language & Technical Communication/Introduction to Artificial Intelligence and Machine Learning	3	2-0-2	4
4	CEE	Materials Science and Engineering	3	3-0-0	3
5	CED	Engineering Thermodynamics	3	3-0-0	3
6	PCE	Workshop and Manufacturing Processes/Engineering Graphics	2	1-0-2	3
7	PCE	Environment and Climate Change	0	2-0-0	2
8	EAA	Extra Academic Activity-A/ Extra Academic Activity-B	2	0-0-4	4
		Total	**21**		**28**
Semester-II					
1	CEF	Chemistry/ Physics	4	2-1-2	5
2	CEF	Mathematics-II	4	3-1-0	4
3	PCE	Introduction to Artificial Intelligence and Machine Learning/English Language & Technical Communication	3	2-0-2	4
4	CEE	Computer based Numerical and Statistical Techniques	3	2-0-2	4
5	CES	Core Engineering Supportive Course (for other branches)(Engineering Mechanics by AMD for ME)	3	2-0-2	4
6	PSE	Workshop and Manufacturing Processes/Engineering Graphics	2	1-0-2	3
7	EAA	Extra Academic Activity-A/ Extra Academic Activity-B	2	0-0-4	4
		Total	**21**		**28**

List of Electives and Minors: B. Tech. (Mechanical Engineering)

II Semester: Core Engineering Supportive Course (for other branches)

S. No.	Code	Name
1.	ME*****	Basic Industrial Engineering
2	ME*****	Non-conventional Energy Recourses
3.	ME*****	Introduction to Engineering and Design
4.	ME*****	Engineering Innovation and Design

Minor 2: Sustainable Energy and Materials

S. No.	Details	Code	Name of the Electives
1.	Minor Essential course I	ME*****	Solar Energy and applications
2.	Minor Essential course II	ME*****	Energy Management
3.	Minor Essential course III	ME*****	Smart materials
4.	Minor Elective course I	ME*****	Green Hydrogen and Alternative fuels/Mechanics of Composite Materials/ Design against Fatigue and Fracture

Minor 3: Electric Vehicles and Automobiles

S. No.	Details	Code	Name of the Electives
1.	Minor Essential course I	ME*****	Electric Vehicle Technology
2.	Minor Essential course II	ME*****	Advanced Automobile Engineering
3.	Minor Essential course III	ME*****	Vehicle Management System
4.	Minor Elective course I	ME*****	Hybrid Electric and Fuel Cell Vehicles/ Vehicle Dynamics/Alternative Fuel Technology

Additional Minors

A student will earn an additional minor in the following disciplines if he/she successfully completes five elective subjects from each respective discipline in any semester

S. No.	Name of the Additional Minor	Eligible students
1.	Design Engineering	For students of ME
2.	Thermal Engineering	For students of ME
3.	Production Engineering	For students of ME

Additional Minor 1: Design Engineering If a student opts 05 subjects from following Electives:

S. No.	Code	Name of the Electives
1.	ME*****	Noise and Vibration
2.	ME*****	Finite Element Method in Engineering
3.	ME*****	Optimization Methods in Engineering
4.	ME*****	Industrial Tribology
5.	ME*****	Design of Robotic Systems
6.	ME*****	Mechanics of composite materials
7.	ME*****	Product life cycle management
8.	ME*****	Computational Fluid Dynamics
9.	ME*****	Design against Fatigue and Fracture
10.	ME*****	Product Design and Development
11.	ME*****	Design of Transmission Elements

Additional Minor 2: Thermal Engineering If a student opts 05 subjects from following Electives:

S. No.	Code	Name of the Electives
1.	ME*****	Computational Fluid Dynamics
2.	ME*****	Cryogenics
3.	ME*****	Design and Analysis of Experiments
4.	ME*****	Energy Management
5.	ME*****	Non-conventional Energy Resources
6.	ME*****	Solar Architecture
7.	ME*****	Alternative Fuel Technology
8.	ME*****	Gas Turbine and Jet Propulsion
9.	ME*****	Nuclear Power Science and Technology
10.	ME*****	Two phase flow

Additional Minor 3: Production Engineering If a student opts 05 subject from following Electives:

S. No.	Code	Name of the Electives
1.	ME*****	Design and Analysis of Experiments
2.	ME*****	Machine Tool Design
3.	ME*****	Micro and Nano Manufacturing
4.	ME*****	Concurrent Engineering
5.	ME*****	Precision Engineering
6.	ME*****	Design for Manufacturing and Assembly

7.	ME*****	Advanced Machining Processes
8.	ME*****	Product Life Cycle Management
9.	ME*****	Fracture Mechanics in Manufacturing
10.	ME*****	Condition Monitoring and Diagnostics
11.	ME*****	Surface Treatment and Characterization
12.	ME*****	Industrial safety and Reliability Engineering
13.	ME*****	Failure Mode and Effect Analysis
14.	ME*****	Total Quality Management
15.	ME*****	Mechanical Micromachining Technology

Semester-I

Course Code: AM*****	Materials Science and Engineering	Credits: 3-0-0:3

Prerequisites: NIL

Course Outcome

S.N.	Outcomes
CO1	Understand role of structure at different level on properties.
CO2	Apply concepts of Materials Science to analyze engineering problems.
CO3	Select materials for different engineering applications.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	-	1	1	1	-	1	-	2	2	2	3	3
CO2	3	3	2	2	3	1	-	1	2	2	1	2	3	3
CO3	3	3	3	3	3	2	2	2	2	2	1	2	3	3

Module	Content	Lectures
1.	**Introduction:** Historical perspective of Materials Science; Structure and properties relationship of Engineering Materials; Classification of materials; Introduction to Ceramics, Composites Materials: Processing and Applications; Advanced Materials.	**05**
2.	**Structure of Solids and Characterization of Materials:** Introduction to crystal structures and systems; Metallic structures; Ceramic crystal structures; Crystallographic directions and planes, Miller indices, Density computations, Crystallography, Diffraction methods, Electron microscopy, Metallography, Thermal characterization techniques.	**07**
3.	**Imperfections in Crystals:** Point defects, Dislocations, Interfacial Defects, Bulk defects.	**03**
4.	**Diffusion:** Diffusion mechanisms, steady and non-steady state diffusion, Factors that influence diffusion, Law's of diffusion, Applications of Diffusion.	**03**
5.	**Phase Diagrams and Phase Transformations:** Unary, Binary, Equilibrium phase diagrams, Eutectic, Eutectoid, Peritectic and peritectoid reactions, Transformation rate effects and TTT diagrams. Microstructure and property changes in iron-carbon system, Iron-Carbon (Fe-C or Fe-Fe3C) Diagram	**05**
6.	**Mechanical Behaviour of Materials:** Elastic and Plastic properties, Fatigue, Fracture, Creep.	**10**
7.	**Thermal, Electrical, Magnetic, Optical Properties:** Thermal behaviour of Materials; Electrical conduction, Semi conductivity, Super conductivity, Dielectric behaviour, Ferroelectricity, Piezoelectricity, Magnetic behaviour of Materials; Optical properties of materials and their applications.	**07**

Text and Reference Books:

1. "Materials Science and Engineering: An Introduction" by William D. Callister Jr., David G. Rethwisch.
2. "Materials Science and Engineering: A First Course" by Raghavan V.
3. "Mechanical Metallurgy" by George E. Dieter
4. "Elements of materials science and engineering" by Lawrence H. Van Vlack

##

Course Code: ME*****	Engineering Thermodynamics	Credits: 3-0-0:3

Prerequisites: NIL

Course Outcomes:

CO1	To understand the concept of thermodynamic system and its properties, work, power, heat and first law of thermodynamics.
CO2	To understand the concept of thermodynamic temperature scale, refrigerator, heat pump and feasibility of any process based on second law of thermodynamics.
CO3	To apply combined first and second law to evaluate entropy, Irreversibility and exergy.
CO4	To perform thermodynamic analysis of refrigeration, Gas and vapour power cycle.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	1	1	2	-	-	-	2	2	3
CO2	2	2	3	2	2	1	2	1	-	-	-	3	3	2
CO3	2	3	2	3	2	2	2	2	-	-	1	3	2	3
CO4	3	3	1	3	2	1	1	1	1	-	-	2	2	3

Unit	Details	No. Hrs
1	**Introduction to thermodynamics:** System, surroundings, boundaries, classification of systems. Unit and dimensions, conversion factors. Properties of systems, equilibrium, processes, heat and work interaction. The work interaction. Thermodynamic definition of work, characteristics of the work interaction. Evaluation of work. Adiabatic systems and processes.	**6**
2	**Zeroth law:** Diathermic boundary, Zeroth law, Isothermal states. Empirical temperature. Principles of thermometry. Scales of temperature. Gas thermometer. The ideal gas. Ideal gas temperature scale.	**4**
3	**The first law:** Basic form energy of a system, The heat interaction, Sign convention. First law for open systems, Steady-flow energy equation and its applications. Properties of gases. Properties of steam. Introduction to steam tables. Other equations of state.	**8**
4	**The second law**: Kelvin-Planck and Clausius statements. Equivalence of statements. Carnot theorem. Thermodynamic temperature. Kelvin scale. Carnot engine, refrigerator and heat pump. Definition of entropy. Combined first and second law, Evaluation of entropy. Principle of increase of entropy.	**7**
5	**Availability:** available energy, quality of energy, useful work, availability or exergy balance for open and closed systems, 2^{nd} law efficiency.	**5**
6	**Introduction to cycles**: Classifications of cycles. Gas power cycles- Otto, Diesel, Brayton. Vapour power cycle- Rankine cycle, vapour- compression refrigeration cycle.	**6**

Text Books:

1 Engineering Thermodynamics P.K. Nag McGraw Hill
2 Thermodynamics: An engineering Cengel & Boles, McGraw Hill

References:

1	Fundamentals of Engineering Thermodynamics	Moran M. J. & Shapiro H. N	Wiley
2	Fundamentals of Thermodynamics	Sonntag R.E., Borgnakke C. & Van Wylen C. J.	Wiley
3	Engineering Thermodynamics	Rogers G.F.C. & Mayhew Y.R	Longman

##

Course Code: ME*****	Workshop and Manufacturing Processes	Credits: 1-0-2:2

Prerequisites: NIL

Course Outcomes:

CO1	Students will be able to understand the importance of manufacturing which comprises materials, processes and systems.
CO2	Students will be able to understand the metal casting, metal working process and able to perform casting of metals, forging and sheet metal operations through practical classes.
CO3	Students will be able to understand the machining operations, permanent joining processes. They will be able to perform machining operations on Lathe machine and joining through arc and gas welding processes.
CO4	Students will be able to learn and perform operations related to carpentry, fitting, plastic molding, and Computer Numerical Control (CNC) machines.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	2	1	1	-	1	1	1	1
CO2	2	1	1	-	-	1	1	-	1	1	1	1
CO3	2	1	1	-	-	1	1	-	1	1	1	1
CO4	2	1	1	-	3	1	1	-	1	1	1	1
CO5	2	1	1	-	2	1	1	-	1	1	1	1

Correlation between ME11102 Workshop subject and the PSOs

Name of the B. Tech. Program	PSO1	PSO2	PSO3	PSO4
B. Tech. (Civil Engineering)	2	1	1	-
B. Tech (Mechanical Engineering)	3	3		
B. Tech (Production & Industrial Engineering)	3	3		
B. Tech (Electrical Engineering)	1	1	-	

Unit	Details	No. Hrs
1	**Concept of Manufacturing-** Manufacturing definition; Role of materials, processes and systems in manufacturing; Classification and brief introduction of engineering materials such as metals & alloys, Classification and brief introduction of manufacturing processes	4
2	**Sand Casting Process of Metals-** Elements of Green Sand Mould; Pattern design and making, Method of Preparation of Green Sand Mould; Casting Defects	2
3	**Metalworking Processes-** Classification of Metalworking Processes-brief introduction of bulk and sheet metal processes, Hot Vs Cold Working; Hot and Cold Rolling; Types of Rolling Mills, Forging, Extrusion, Drawing	3
4	**Machining Processes:** Classification of machining processes & machine tools; Construction, Specification, and operations on Lathe Machine and Drilling machine	2
5	**Fabrication Processes-** Classification of Welding Operations, Types of Joints & Welding Positions; Brief description of Arc, Resistance and Gas welding techniques. Brazing and Soldering	3

List of Practical

1. **Safety in Workshop (Demonstration)**
   Safety precautions and utilization of hand tools and machines of different shops with safe working habits. Introduction to measuring equipments and gauges of different shops.
2. **Carpentry**
   Study of wood works, types of hand tools and machine. Making of one job involving wood work joint
3. **Fitting**
   Study of different fits and hand tools. Making of one job involving fitting to size, male-female fitting with drilling and tapping
4. **Welding**
   Study of electric arc welding and gas welding, tools, types of weld joints and safety precaution during welding. Making of one joint using electric and gas welding. Students will be introduced to brazing and soldering (demonstration)
5. **Sheet Metal Work**
   Study of different hand tools, machine and sheet metal joints. Making of one utility job in sheet metal
6. **Foundry**
   Principles of molding, methods, core & core boxes, preparation of sand mould of given pattern and casting (demonstration)
7. **Black Smithy**
   Introduction to hot working and Study of forging hand tools, furnace and machine. Making a job on hot upset forging.
8. **Machining**
   Study of lathe machine, cutting tools and turning related operations. Making of one job on lathe machine including facing, step and taper turning, threading operations.
9. **Plastic Processing**
   Introduction to plastics and different plastic molding techniques. Study of injection molding process with demonstration.
10. **Computer Numerical Control (CNC)**
    Introduction to automation & CNC, Assembly of models of CNC, CNC wood router, engraving and exposure to part programming. Preparation of part program for simple profiles. Making a job on CNC (Demonstration).
11. **Mini Project**
    Team activity – Fabrication of prototype model based on above practical.

Text Books:

1 Principles of Modern Manufacturing: Materials, Processes and Systems — Mikell P. Groover — John Wiley

References:

1	Elements of Workshop Technology (Volume 1: Manufacturing Processes, Volume 2: Machine Tools)	S. K. Hajra Choudhury, A. K. Hajra Choudhury and N. Roy	Media Promoters & Publishers Pvt Ltd., 2010
2	Manufacturing Engineering and Technology	Serope Kalpakjian and Steven R. Schmid	Pearson, 2013
3	Machinery's Handbook	Erik Oberg, Franklin D. Jones, Holbrook L. Horton, Henry H. Ryffel, and Christopher J. McCauley Laura Brengelman	Industrial Press, Inc., 2020
4	Mechatronics	HMT	McGraw Hill Education, 2017
5	Manufacturing Processes I, https://nptel.ac.in/courses/112107144		NPTEL course
6	Fundamentals of manufacturing processes https://onlinecourses.nptel.ac.in/noc22_me71/preview		Swayam Course

##

Course Code: ME*****	Engineering Graphics	Credits: 1-0-2:2

Prerequisites: NIL

Course Outcomes:

CO1	Understand the importance and principles of engineering drawing by hand practice and using computer aided drafting software.
CO2	Understand the isometric and orthographic projections of different objects.
CO3	Create assembly drawing of simple machine components

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	-	3	-	-	2	1	2	-	2	2	3
CO2	2	2	2	1	3	-	-	2	1	2	-	1	2	2
CO3	3	3	3	2	3	-	-	2	1	2	-	1	3	3

Unit	Details	No. Hrs
1	Introduction to engineering drawing and its importance in real life design and manufacturing. Standards in drawing practice viz. types of lines, lettering, dimensioning, scales etc.	2L+2P
2	Introduction to isometric and orthographic projection. Orthographic projection of points, projection of lines, projection of planes, orthographic views of solids sketching of the same for conceptualization.	4L+8P
3	Introduction to computer aided drafting software and hands on practice of orthographic views of solid objects.	2L+6P
4	Sectional views of solid objects and hands on practice of sectional views of solid objects using computer aided drafting software.	2L+4P
5	Introduction to temporary fasteners (e.g. screwed fasteners, keys, cotters etc.) Details of screwed fasteners (e.g. bolt, nut, stud, screw etc), terminology of threads, types (e.g. V, square, acme, single/multi start, left/right handed etc). Assembly drawing of nut-bolt using computer aided drafting software.	1L+2P

Text Books:

1	Engineering Drawing	Jolhe D. A.	Tata McGraw Hill Education

References:

1	Engineering Drawing	Basant Agrawal, C. M. Agrawal	Tata McGraw Hill Education.
2	Machine Drawing	K L Narayana, P. Kannaiah, K. Venketa Reddy	New Age International publishers
3	Machine Drawing includes AutoCAD	Ajeet Singh	Tata McGraw Hill Publishing Company Ltd.
4	Elementary Engineering Drawing	Bhatt ND	Charotar Publishing.

##

Semester-II

Course Code: MA*****	Computer Based Numerical and Statistical Techniques	Credits: 2-0-2:3

Prerequisites: Mathematics I

Course Outcomes:

CO1	Students will be able to understand the concept of errors and will be able to find the roots of some algebraic and transcendental equations.
CO2	Students will be able to formulate the interpolating polynomial with the help of several interpolation formulas by analyzing and using the data points.
CO3	Students will be able to predict the value of the derivative at an intermediate point for a given set of data points. Also, they will be able to solve definite integrals using some numerical techniques and apply the knowledge in research and development activity for the betterment of society.
CO4	Students will be able to solve a system of linear equations arising in several engineering problems and find the eigen value and eigenvector of matrices.
CO5	Students will have basic knowledge of statistical techniques and will be able to derive the probability density function of random variables and calculate the expected value of a random variable. They will also be able to find several linear and nonlinear regression curves/planes for a set of data points.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	1	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	1	-	2	3	3
CO3	3	3	2	2	2	-	-	-	-	1	-	2	3	3
CO4	3	3	2	2	1	-	-	-	-	1	-	2	3	3
CO5	3	3	2	2	2	-	-	-	-	1	-	2	3	3

Unit	Details	No. Hrs
1	**Errors in Numerical Computation, Algebraic and Transcendental Equations** Errors in Numerical Computation and Their Analysis, Bisection Method, Method of False Position, Iteration Method, Newton-Raphson Method, Rate of Convergence, Method for complex root: Muller's Method, Quotient Difference Method	6
2	**Interpolation** Introduction, Errors in Polynomial Interpolation, Interpolation by Evenly Spaced Points: Finite Differences, Missing Terms Technique, Newton's Forward & Backward Interpolation Formula, Gauss, Sterling, Bessel's, Everett's Formula, Interpolation by Unevenly Spaced Points: Lagrange Interpolation Formula, Divided Difference, Newton's General Interpolation Formula.	7
3	**Numerical Differentiation and Integration** Numerical Differentiation, Numerical Integration, Trapezoidal Rule, Simpson's 1/3Rule, Simpson's 3/8 Rule, Boole's & Weddle's Rules.	4
4	**Numerical Linear Algebra** Numerical Techniques for Finding Solution of a System of Linear Equations: LU & LL* Decomposition Method, Gauss-Jacobi and Gauss-Seidel Iteration Methods, Power Method for Estimating Eigenvalues.	5

5	**Statistical Computations** Random Variables, Discrete and Continuous Random Variables and Their Probability Distribution, Poisson, Bernoulli and Normal Distribution, Frequency Chart, Regression Analysis, Least Square Fit, Linear and Non-linear Regression, Multiple Linear Regression	4

Text Books:

1	Introductory Methods for Numerical Analysis	S. S. Sastry	Prentice Hall (Fifth Edition-2012)
2	Numerical Methods for Scientific and Engineering Computations	M. K. Jain, S. R. K. Iyenger & R.K. Jain	Wiley Eastern Ltd. (Sixth Edition-2016)
3	Fundamental of mathematical Statistics	S. C. Gupta and V. K. Kapoor	S Chand Publication (Twelfth Edition - 2020)

Reference Books:

1	Applied Numerical Analysis	C. F. Gerald and P. O. Wheatley	Pearson Education
2	Numerical Methods for Science and Engineering	S. Rajashekharan	S. Chand Publication
3	Numerical Methods for Engineers	S. C. Chapra and R. P. Canale	McGraW-Hill Education
4	Statistical Techniques	W. George and G. William	IBH Publications

Computer Based Numerical Methods & Statistical Techniques (Lab)

Experiment 1: Make a program to find the derivative of a given polynomial f(x) for a given value of x.

Experiment 2: Make a program to find the roots of a given polynomial f(x) using the following methods.

(a) Bisection Method
(b) Method of False Position
(c) Iteration Method
(d) Newton-Raphson Method
(a) Muller's Method
(b) Quotient-Difference Method

Experiment 3: Make a program to create the following difference tables for a given set of data points:

(a) Forward Difference Table
(b) Backward Difference Table
(c) Central Difference Table
(d) Divided Difference Table

Experiment 4: Make a program to find the interpolation polynomial/interpolation value of f(x) at a specified value for evenly spaced data points using the following methods:

(a) Newton's Forward and Backward Difference Formulae.
(b) Gauss's, Stirling's, Bessel's, and Everett's interpolation Formulae.

Experiment 5: Make a program to find the interpolation polynomial/interpolation value of f(x) at a specified value for unevenly spaced data points using the following methods:

(a) Lagrange's Interpolation Formula.
(b) Newton's Divided Difference Formula.

Experiment 6: Make a program to find the nth (n=1,2 and 3) derivative of f(x) at a specified value of x for a given set of data points.

Experiment 7: Make a program to find the numerical integration of f(x) at a specified value of x for a given set of data points using the following rules.

(a) Trapezoidal Rule
(b) Simpson's 1/3 Rule
(c) Simpson's 3/8 Rule
(d) Boole's and Weddle's Rule.

Experiment 8: Make a program to find regression curves for a given set of data points using the following rules:

(a) Linear and Nonlinear Regression
(b) Multiple Linear Regression

##

Core Engineering Supportive Course (for other branches)

Course Code: ME*****	Basic Industrial Engineering	Credits: 2-0-0:2

Prerequisites: NIL

Course Outcome

S.N.	Outcomes
CO1	Students will be able to identify and use the elements of cost, methods of depreciation and investment techniques. Productivity, Productivity Measurements and develop entrepreneurial attitude.
CO2	Students will be able to describe the job evaluation and merit rating.
CO3	Students will be able to implement work study techniques for better productivity and learn to do work measurement and calculate the standard time for doing a job.
CO4	Students will be able to describe and use different material handling devices,

Course Articulation Matrix:

	Program Outcomes											
CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**
CO1	3	2	2	-	-	-	3	2	2	2	2	3
CO2	2	2	2	-	-	1	2	2	2	2	3	2
CO3	3	2	2	1	-	1	2	2	2	1	2	3
CO4	3	2	2	2	2	-	3	2	2	2	2	2

Unit	Details	No. Hrs
1	Introduction, Engineering Economy and Costing-Plant Location and Layouts, Production Systems, Cost Analysis, Break-even Analysis, Methods of Depreciation,	8
2	Concepts of Production and Productivity, Productivity Measurements.	
3	Job evaluation, Benefits of Job evaluation, Methods of Job evaluation, Merit Rating, Methods of Merit Rating, Requirements for success of Merit Rating System,	12
4	Work Measurement, Time Study, PMTS, Work Sampling, Method Study, Micro Motion Study, Principles of Motion Economy.	8
5	Material Handling System- principles, types, and devices.	6

Text/Reference Books

1	Introduction to Industrial and System Engineering	Turner, W.C, et. al	Prentice Hall, 1993
2	Operations and industrial management, Designing and managing for productivity	Del Mar, Donald	McGraw-Hill,2007
3	Motion and Time Study: Design and Measurement of Work	Ralph M. Barnes	Wiley Publishers
4	Human Factors Engineering	Chandler Allen Phillips	John Wiley and Sons, New York

##

Course Code: ME*****	Non-conventional Energy Resources	Credits: 3-0-0:3

Pre-requisites: NIL
Course Outcomes:

CO1	Understand the concept of energy crisis, non-conventional energy resources, availability and their importance.
CO2	Understand various methods to harness non-conventional energy resources.
CO3	Apply the methods for better harness, conversion techniques, and utilization of non-conventional energy resources.
CO4	Analyse various problems, limitations, complexities and performances of power plants based on non-conventional energy resources.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	3	3	3	2	2	2	3	3	2
CO2	3	3	2	2	2	3	3	3	2	2	2	3	3	2
CO3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Unit	Details	No. Hrs
1	Introduction: The energy crisis – causes and options, various conventional and non-conventional forms of energy and their characteristics, availability of non-conventional energy and land area requirements.	4
2	Solar energy: Introduction, Solar radiation, Sun-Earth angles, Measurement of solar radiation at the earth's surface, Types of collectors such as flat-plate and concentrating collectors, solar thermal power generation, solar ponds and energy storage. Principle of Solar photovoltaic, materials, mono-crystalline, polycrystalline and amorphous silicon cells and their production technology, I-V characteristics, parameters of performance, modules, array and PV plant configurations and power generation.	6
3	Biomass energy: Introduction, Incineration, Thermo-chemical and biochemical conversion to solid, liquid and gaseous fuels; Production technologies for bio-ethanol, biogas and producer gas, Urban waste to energy processes.	5
4	Ocean, Wave and Tidal energy: Introduction, Ocean thermal energy conversion (OTEC) – closed and open cycles and their limitations, Wave energy and its conversion processes, Tidal energy – nature of the tides and tidal barrages for power generation.	5
5	Wind energy: Fundamentals, power in the wind, site selection, maximum power coefficient, wind turbine and its types – horizontal axis and vertical axis machines, performance of wind machines, wind energy farms.	5
6	Geothermal energy: Introduction, Geothermal energy resources, Hot aquifers and hot dry rock systems, geothermal electric power plants.	4
7	Other Technologies: Magnetohydrodynamics (MHD) Energy conversion, Fuel Cells, Nuclear Energy, Hydrogen, Methanol, Energy Storage.	4

Text Books:

1	Renewable Energy Sources and Emerging Technologies	D.P. Kothari, K.C. Singal and R. Ranjan	PHI Learning Pvt. Ltd., New Delhi
2	Solar Energy-Fundamentals, Design, Modeling & Applications'	G.N. Tiwari	Narosa Publishing House, New Delhi, India

References:

1	Advanced Renewable Energy Sources	G.N. Tiwari and R.K. Mishra	RSC Publishing, Cambridge, U.K
2	Biogas Systems: Principles and Applications	K.M Mittal	New Age International Limited Publishers.
3	Wind Energy Come of Age	Gipe P	John Wiley and sons, New York.
4	Solar Energy Fundamentals	S. Kalogirou	Academic Press
5	Solar Photovoltaics: FundamentalsTechnologies and Applications	C.S. Solanki	PHI Learning Pvt. Ltd., New Delhi
6	Energy Technology (Non Conventional, Renewable And Conventional)	S. Rao, BB Parulekar	Khanna Publishers

##

Course Code: ME*****	Introduction to Engineering and Design	Credits: 2-1-0:3

Prerequisites: NIL

Course Outcomes:

CO1	Students will be able to develop an understanding of the engineering & Technology in general.
CO2	Students will be able to develop an understanding on how design differs in same category of products.
CO3	Students will be able to identify the needs that is to fulfilled by a product
CO4	Students will be able to understand how different approach leads to difference in cost and complexity.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	3	3	2	3	2	-	3	2	2
CO2	3	2	2	-	2	3	3	2	3	2	-	3	2	2
CO3	3	2	2	-	2	3	3	2	3	2	-	3	2	2
CO4	3	2	2	-	2	3	3	2	3	2	-	3	2	2

Unit	Details	No. Hrs
1	Introduction to General Engineering What is Engineering? Difference between Science, Engineering & Technology. History of Engineering. Engineering functions, Characteristics of engineers. Traits of engineers. Engineering Design; Engineering challenges; Ethics; Communication skills; Team work; Attitude. Creative thinking- Invention- innovation & inventiveness in a society.	7
2	Introduction of Engineering Design – needs assessment, problem formulation, concept selection modelling, abstraction, synthesis, economic analysis, materials selection and manufacturing processes. Case histories for illustrating the success and failure in engineering design.	7
3	Concepts of Manufacturing, Casting Processes, Plastics Processing, Metal working Processes, Machining Processes, Fabrication Processes, a glimpse of modern manufacturing processes through different case studies.	7
4	Simple hands on projects, Intellectual Property Rights.	7

Reference Books:

1	Engineering by Design	Gerard Voland	2nd Edition, Pearson, (2004).
2	Engineering Design	George E Dieter Linda C Schmidt	Design, Indian Edition (2016)
3	Product Design & Development	Karl T. Ulrich, Steven D Eppinger	McGraw Hill Publishers
4	Human Factors in Engineering Design	Mark S sanders & Ernst J	McGraw Hill Publishers.
5	Introduction to Engineering Technology	Robert J. Pond, Jeffrey L. Rankinen	7th Edition, Prentice Hall, 2009
6	Engineering Fundamentals: An Introduction to Engineering	Saeed Moaveni	4th Edition, Cengage Learning India Pvt. Ltd, (2011)

##

Course Code: ME*****	Engineering Innovation and Design	Credits: 2-0-1: 3

Prerequisites: NIL
Course Outcomes:

CO1	Students will be able to visualize the need for engineering for serving the society better
CO2	Students will be able to feel themselves more knowledgeable- at the end of the course.
CO3	Students will be able to identify needs and be able to suggest different alternative solutions considering cost constraints.
CO4	Students will be able to have a watchful eye on happenings in their surrounding for creative analyses. Possibility of taking up entrepreneurship activity, possibility of coming up with new ideas leading to IPR.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	2	2	-	-	-	2	2	2
CO2	3	3	3	2	2	2	2	2	-	-	-	2	2	2
CO3	3	3	3	2	2	2	2	2	-	-	-	2	2	2
CO4	3	3	3	2	2	2	2	2	-	-	-	2	2	2

Unit	Details	No. Hrs
1	Introduction Design & innovation, Who designs & develops products, Industrial & Practical examples. Projects.	8
2	Creative thinking- Invention- innovation & inventiveness in a society.	6
3	A Generic Development Process & Concept Development.	6
4	Identifying Customer Needs, Concept Generation, Concept Selection	6
5	Product Architecture, Industrial Design, Intellectual Property Rights	6

References:

1. Product Design & Development- Karl T. Ulrich, Steven D Eppinger, McGraw Hill Publishers.
2. Gerard Voland, Engineering by Design, Pearson,
3. Human Factors in Engineering Design- Mark S sanders & Ernst J. Mc Cornick McGraw Hill Publishers.
4. https://ocw.mit.edu/courses/esd-051j-engineering-innovation-and-design-fall-2012/video_galleries/lecture-notes-and-videos/

##

Course Code: ME*****	Workshop and Manufacturing Processes	Credits: 1-0-2:2

Prerequisites: NIL
Course Outcomes:

CO1	Students will be able to understand the importance of manufacturing which comprises materials, processes and systems.
CO2	Students will be able to understand the metal casting, metal working process and able to perform casting of metals, forging and sheet metal operations through practical classes.
CO3	Students will be able to understand the machining operations, permanent joining processes. They will be able to perform machining operations on Lathe machine and joining through arc and gas welding processes.
CO4	Students will be able to learn and perform operations related to carpentry, fitting, plastic molding, and Computer Numerical Control (CNC) machines.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	2	1	1	-	1	1	1	1
CO2	2	1	1	-	-	1	1	-	1	1	1	1
CO3	2	1	1	-	-	1	1	-	1	1	1	1
CO4	2	1	1	-	3	1	1	-	1	1	1	1
CO5	2	1	1	-	2	1	1	-	1	1	1	1

Correlation between ME11102 Workshop subject and the PSOs

Name of the B. Tech. Program	PSO1	PSO2	PSO3	PSO4
B. Tech. (Civil Engineering)	2	1	1	-
B. Tech (Mechanical Engineering)	3	3		
B. Tech (Production & Industrial Engineering)	3	3		

Unit	Details	No. Hrs
1	**Concept of Manufacturing-** Manufacturing definition; Role of materials, processes and systems in manufacturing; Classification and brief introduction of engineering materials such as metals & alloys, Classification and brief introduction of manufacturing processes	4
2	**Sand Casting Process of Metals-** Elements of Green Sand Mould; Pattern design and making, Method of Preparation of Green Sand Mould; Casting Defects	2
3	**Metalworking Processes-** Classification of Metalworking Processes-brief introduction of bulk and sheet metal processes, Hot Vs Cold Working; Hot and Cold Rolling; Types of Rolling Mills, Forging, Extrusion, Drawing	3
4	**Machining Processes:** Classification of machining processes & machine tools; Construction, Specification, and operations on Lathe Machine and Drilling machine	2
5	**Fabrication Processes-** Classification of Welding Operations, Types of Joints & Welding Positions; Brief description of Arc, Resistance and Gas welding techniques. Brazing and Soldering	3

List of Practical

1. **Safety in Workshop (Demonstration)**
   Safety precautions and utilization of hand tools and machines of different shops with safe working habits. Introduction to measuring equipments and gauges of different shops.
2. **Carpentry**
   Study of wood works, types of hand tools and machine. Making of one job involving wood work joint
3. **Fitting**
   Study of different fits and hand tools. Making of one job involving fitting to size, male-female fitting with drilling and tapping
4. **Welding**
   Study of electric arc welding and gas welding, tools, types of weld joints and safety precaution during welding. Making of one joint using electric and gas welding. Students will be introduced to brazing and soldering (demonstration)
5. **Sheet Metal Work**
   Study of different hand tools, machine and sheet metal joints. Making of one utility job in sheet metal
6. **Foundry**
   Principles of molding, methods, core & core boxes, preparation of sand mould of given pattern and casting (demonstration)
7. **Black Smithy**
   Introduction to hot working and Study of forging hand tools, furnace and machine. Making a job on hot upset forging.
8. **Machining**
   Study of lathe machine, cutting tools and turning related operations. Making of one job on lathe machine including facing, step and taper turning, threading operations.
9. **Plastic Processing**
   Introduction to plastics and different plastic molding techniques. Study of injection molding process with demonstration.
10. **Computer Numerical Control (CNC)**
    Introduction to automation & CNC, Assembly of models of CNC, CNC wood router, engraving and exposure to part programming. Preparation of part program for simple profiles. Making a job on CNC (Demonstration).
11. **Mini Project**
    Team activity – Fabrication of prototype model based on above practical.

Text Books:

1	Fundamental of Modern Manufacturing: Materials, Processes and Systems	Mikell P. Groover	John Wiley

References:

1	Elements of Workshop Technology (Volume 1: Manufacturing Processes,	S. K. Hajra Choudhury, A. K. Hajra Choudhury and N.	Media Promoters & Publishers Pvt Ltd., 2010

	Volume 2: Machine Tools)	Roy	
2	Manufacturing Engineering and Technology	Serope Kalpakjian and Steven R. Schmid	Pearson, 2013
3	Machinery's Handbook	Erik Oberg, Franklin D. Jones, Holbrook L. Horton, Henry H. Ryffel, and Christopher J. McCauley Laura Brengelman	Industrial Press, Inc., 2020
4	Mechatronics	HMT	McGraw Hill Education, 2017
5	Manufacturing Processes I, https://nptel.ac.in/courses/112107144		NPTEL course
6	Fundamentals of manufacturing processes https://onlinecourses.nptel.ac.in/noc22_me71/preview		Swayam Course

##

Course Code: ME*****	Engineering Graphics	Credits: 1-0-2:3

Prerequisites: NIL
Course Outcomes:

CO1	Understand the importance and principles of engineering drawing by hand practice and using computer aided drafting software.
CO2	Understand the isometric and orthographic projections of different objects.
CO3	Create assembly drawing of simple machine components

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	-	3	-	-	2	1	2	-	2	2	3
CO2	2	2	2	1	3	-	-	2	1	2	-	1	2	2
CO3	3	3	3	2	3	-	-	2	1	2	-	1	3	3

Unit	Details	No. Hrs
1	Introduction to engineering drawing and its importance in real life design and manufacturing. Standards in drawing practice viz. types of lines, lettering, dimensioning, scales etc.	2L+2P
2	Introduction to isometric and orthographic projection. Orthographic projection of points, projection of lines, projection of planes, orthographic views of solids sketching of the same for conceptualization.	4L+8P
3	Introduction to computer aided drafting software and hands on practice of orthographic views of solid objects.	2L+6P
4	Sectional views of solid objects and hands on practice of sectional views of solid objects using computer aided drafting software.	2L+4P
5	Introduction to temporary fasteners (e.g. screwed fasteners, keys, cotters etc.) Details of screwed fasteners (e.g. bolt, nut, stud, screw etc), terminology of threads, types (e.g. V, square, acme, single/multi start, left/right handed etc). Assembly drawing of nut-bolt using computer aided drafting software.	1L+2P

Text Books:

1	Engineering Drawing	Jolhe D. A.	Tata McGraw Hill Education

References:

1	Engineering Drawing	Basant Agrawal, C. M. Agrawal	Tata McGraw Hill Education.
2	Machine Drawing	K L Narayana, P. Kannaiah, K. Venketa Reddy	New Age International publishers
3	Machine Drawing includes AutoCAD	Ajeet Singh	Tata McGraw Hill Publishing Company Ltd.
4	Elementary Engineering Drawing	Bhatt ND	Charotar Publishing.

MOTILAL NEHRU NATIONAL INSTITUTE OF TECHNOLOGY ALLAHABAD

B. Tech. in

Production and Industrial Engineering

SCHEME OF INSTRUCTION AND SYLLABI

For B. Tech. Program

(Effective from 2022-23)

DEPARTMENT OF MECHANICAL ENGINEERING

Vision and Mission of the Institute

Motilal Nehru National Institute of Technology Allahabad

VISION

To attain a distinct identity for the Institute through innovation, knowledge creation and dissemination for the benefit of the society.

MISSION

- To nurture an eco-system for continuous enhancement of value-based teaching and learning process in the emerging areas of technology.
- To train quality human and knowledge resources in the service of society.
- To develop sustainable products and technologies.

Vision and Mission of the Department

VISION

To be a centre of excellence in Mechanical, Production and Industrial Engineering education and research for the benefits of society and humanity.

MISSION

- To educate and develop competent human resources for contemporary industry, academia and research.
- To promote interdisciplinary research and innovation skills in the graduates.
- To enhance the efforts to develop sustainable products, processes and technologies by developing competent entrepreneurs for the benefit of the society.

Department of Mechanical Engineering:

Brief about the Department:

The Department of Mechanical Engineering is one of the oldest department of the institute and was established in the year 1961. We are the largest community of excellent, energetic, and dynamic faculty, staff and students in the institute. The department is having highly qualified and experienced faculty (36 faculty members) in all streams of Mechanical Engineering. The department is broadly divided into three academic streams in which students receive outstanding education with a wide choice of specializations, electives and research areas. These three academic streams are: Design Engineering, Production and Industrial Engineering and Thermal Engineering.

The department offers eight semester (i.e. 4 year) Bachelor of Technology (B. Tech.) programmes in Mechanical Engineering and Production and Industrial Engineering. Every year 223 students are admitted through JEE (mains) and 15% of this intake is through Direct Admission to Students Abroad (DASA) scheme for the above two B. Tech. programmes. Some students are also through ICCR and MEA (Govt. of India) Schemes.

The department also offers four semester (i.e. 2 year) Master of Technology (M. Tech.) programmes in Computer Aided Design and Manufacturing, Design Engineering, Product Design and Development, Production Engineering and Thermal Engineering. Every year 125 students (25 in each specialization) are admitted through GATE in the above five M. Tech. programmes.

The department also offers Doctor of Philosophy (Ph.D.) programme in various areas of Mechanical Engineering as well as Production and Industrial Engineering. The strength of the department lies in its Ph.D. programme with more than 100 PhDs already been awarded till March, 2022. About 80 research scholars are presently pursuing their PhDs. Every year the department admits Ph.D. students equal to half of the number of faculty holding Ph.D. degree. The department is also a QIP centre for PhD and M. Tech programmes.

Today, the world of Mechanical Engineering changes under the influence of advanced computational tools, improved simulation and analysis, and entirely different manufacturing protocols. This has opened up new vistas of research in the department.

List of Programmes offered by the Department:

Program	Title of the Program
B. Tech.	Mechanical Engineering
	Production & Industrial Engineering
M. Tech.	Computer Aided Design and Manufacturing
	Design Engineering
	Product Design and Development
	Production Engineering
	Thermal Engineering
Ph.D.	Mechanical Engineering

B. Tech. – Production and Industrial Engineering

Program Educational Objective

PEO-1	To transform our students into employable technologists through education and training to contribute in the frontiers of Production and Industrial Engineering.
PEO-2	To groom the graduates for achieving team work capability and leadership qualities.
PEO-3	To impart multidisciplinary competence in the graduates for exploring ventures in Government, Public, Private, R&D and entrepreneurial sectors.
PEO-4	To imbibe ethical and human values in the graduates for the benefit of the society.

Program Articulation Matrix

PEO / Mission Statement	PEO1	PEO2	PEO3	PEO4
To educate and develop competent human resources for contemporary industry, academia and research.	3	3	2	3
To promote interdisciplinary research and innovation skills in the graduates.	2	3	2	2
To enhance the efforts to develop sustainable products, processes and technologies by developing competent entrepreneurs for the benefit of the society.	2	2	3	2

1-Slight; 2-Moderate; 3-Substantial

B. Tech. – Production and Industrial Engineering

Program Outcomes

PO-01	Engineering Knowledge: Apply knowledge of mathematics, science and engineering fundamentals and Production and Industrial Engineering specialization to the solution of complex Production and Industrial Engineering problems.
PO-02	Problem Analysis: Identify, formulate, research literature and analyze complex Production and Industrial Engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences.
PO-03	Design/ Development of Solutions: Design solutions for complex Mechanical Engineering problems and design system components or processes that meet specified needs with appropriate consideration for public health and safety, cultural, societal and environmental considerations.
PO-04	Conduct investigations of complex Production and Industrial Engineering problems using research-based knowledge and research methods including analysis, interpretation of data and synthesis of information to provide valid conclusions.
PO-05	Modern Tool Usage: To apply appropriate techniques, resources and engineering and IT tools for modeling of different Production and Industrial Engineering problems with an understanding of the limitations.
PO-06	The Engineer and Society: Apply contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to professional engineering practice.
PO-07	Environment and Sustainability: Understand the impact of professional Production and Industrial Engineering solutions in societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO-08	Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of Production and Industrial Engineering practice.
PO-09	Individual and Team Work: Function effectively as an individual, and as a member or leader in diverse teams as well as in multi disciplinary settings.
PO-10	Communication: Communicate effectively on complex Mechanical Engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PO-11	Project Management and Finance: Demonstrate knowledge and understanding of Mechanical Engineering and management principles and apply these to one's own work, as a member and leader of a team, to manage projects and in multidisciplinary environments.
PO-12	Life-long Learning: Recognize the need for the preparation and ability to engage in independent and life- long learning in the broadest context of technological change. Participate and succeed in competitive examinations for PG programs& Govt. services.

Program Specific Outcomes (PSOs)

PSO-01	Graduates will be able to apply fundamental knowledge of science and engineering to design, develop and/or improve the product, process or system with the help of acquired computational and experimental skills
PSO-02	Graduates will be able to solve the technical and managerial problems of an industry / organization using the acquired theoretical knowledge and soft skills in the Production and Industrial Engineering and allied multidisciplinary fields.

SCHEME OF INSTRUCTION

B. Tech. Production and Industrial Engineering –Course Curriculum Structure

S. No.	Code	Course	Credit	L-T-P	Contact Hours
Semester-I					
1	CEF	Physics/Chemistry	4	2-1-2	5
2	CEF	Mathematics-I	4	3-1-0	4
3	PCE	English Language & Technical Communication/Introduction to Artificial Intelligence and Machine Learning	3	2-0-2	4
4	CEE	Materials Science and Engineering	3	3-0-0	3
5	CEE	Fluid and Thermal Engineering	3	3-0-0	3
6	PCE	Workshop and Manufacturing Processes/Engineering Graphics	2	1-0-2	3
7	PCE	Environment and Climate Change	0	2-0-0	2
8	EAA	Extra Academic Activity-A/ Extra Academic Activity-B	2	0-0-4	4
		Total	**21**		**28**
Semester-II					
1	CEF	Physics/Chemistry	4	2-1-2	5
2	CEF	Mathematics-II	4	3-1-0	4
3	PCE	Introduction to Artificial Intelligence and Machine Learning*/English Language& Technical Communication	3	2-0-2	4
4	CEE	Computer based Numerical and Statistical Techniques	3	2-0-2	4
5	CES	Core Engineering Supportive Course (for other branches)(Engineering Mechanics by AMD for PIE)	3	2-0-2	4
6	PCE	Workshop and Manufacturing Processes/Engineering Graphics	2	1-0-2	3
7	EAA	Extra Academic Activity-A/ Extra Academic Activity-B	2	0-0-4	4
		Total	**21**		**28**

List of Electives and Minors: B.Tech. (Production and Industrial Engineering)

II Semester: Core Engineering Supportive Course (for other branches)

S. No	Course Code	Subject
1.	ME*****	Basic Industrial Engineering
2.	ME*****	Non-conventional Energy Recourses
3.	ME*****	Introduction to Engineering and Design
4.	ME*****	Engineering Innovation & Design

IV Semester: Core Elective Course - 1

S. No	Course Code	Subject
1.	PI*****	Optimization Methods in Engineering
2.	PI*****	Modelling and Simulation in Engineering
3.	PI*****	Design and Analysis of Experiments
4.	PI*****	Cryogenics
5.	PI*****	Manufacturing of Non-Metallic Product

V and VI Semester: Core Elective Courses – 2, 3, 4 and 5

S. No	Course Code	Subject
1.	PI*****	Refrigeration and Air Conditioning
2.	PI*****	Finite Element Method in Engineering
3.	PI*****	Industrial Safety and Reliability Engineering
4.	PI*****	Micro and Nano Manufacturing
5.	PI*****	Industrial Tribology
6.	PI*****	Energy Management
7.	PI*****	Concurrent Engineering
8.	PI*****	Precision Engineering
9.	PI*****	Design for Manufacturing and Assembly
10.	PI*****	Composite materials
11.	PI*****	Product Life Cycle Management
12.	PI*****	Noise and Vibration
13.	PI*****	Computational Fluid Dynamics
14.	PI*****	Fracture Mechanics in Manufacturing
15.	PI*****	Automobile Engineering
16.	PI*****	Condition Monitoring and Diagnostics
17.	PI*****	Non-Conventional Energy Sources
18.	PI*****	Failure Mode and Effect Analysis
19.	PI*****	Total Quality Management
20.	PI*****	Automatic Control
21.	PI*****	Mechanical Micromachining Technology
22.	PI*****	Surface Treatment and Characterization

VI Semester: Open Elective Course

S. No	Course Code	Subject
1.	ME*****	Non-Conventional Energy Sources
2.	ME*****	Energy Management
3.	ME*****	Product Design and Development
4.	ME*****	Electrical Vehicles Technology
5.	ME*****	Solar Photovoltaics

VII Semester:

Minors

S. No.	Name of the Minor	Eligible students
1	Mechatronics and Automation	For other students
2	Sustainable Energy and Materials	For all students
3	Electric Vehicles and Automobiles	For all students

Minor 1: Mechatronics and Automation

S. No.	Details	Code	Name of the Electives
1.	Minor Essential course I	ME*****	Mechatronics
2.	Minor Essential course II	ME*****	Robotics
3.	Minor Essential course III	ME*****	Automatic Control
4.	Minor Elective course I	ME*****	Machine Learning/Computer Integrated Manufacturing/Condition monitoring and diagnostics

Minor 2: Sustainable Energy and Materials

S. No.	Details	Code	Name of the Electives
1.	Minor Essential course I	ME*****	Solar Energy and applications
2.	Minor Essential course II	ME*****	Energy Management
3.	Minor Essential course III	ME*****	Smart materials
4	Minor Elective course I	ME*****	Green Hydrogen and Alternative fuels/ Mechanics of Composite Materials/ Design against Fatigue and Fracture

Minor 3: Electric Vehicles and Automobiles

S. No.	Details	Code	Name of the Electives
1.	Minor Essential course I	ME*****	Electric Vehicle Technology
2.	Minor Essential course II	ME*****	Advanced Automobile Engineering
3.	Minor Essential course III	ME*****	Vehicle Management System
4	Minor Elective course I	ME*****	Hybrid Electric and Fuel Cell Vehicles/Vehicle Dynamics/Alternative Fuel Technology

Additional Minors

A student will earn an additional minor in the following disciplines if he/she successfully completes five elective subjects from each respective discipline in any semester

S. No.	Name of the Additional Minor	Eligible students
1.	Design Engineering	For students of PIE
2.	Thermal Engineering	For students of PIE

Additional Minor 1: Design Engineering If a student opts 05 subjects from following Electives:

S. No.	Code	Name of the Electives
1.	ME*****	Noise and Vibration
2.	ME*****	Finite Element Method in Engineering
3.	ME*****	Optimization Methods in Engineering
4.	ME*****	Industrial Tribology
5.	ME*****	Design of Robotic Systems
6.	ME*****	Mechanics of composite materials
7.	ME*****	Product life cycle management
8.	ME*****	Computational Fluid Dynamics
9.	ME*****	Design against Fatigue and Fracture
10.	ME*****	Product Design and Development
11.	ME*****	Design of Transmission Elements

Additional Minor 2: Thermal Engineering If a student opts 05 subjects from following Electives:

S. No.	Code	Name of the Electives
1.	ME*****	Computational Fluid Dynamics
2.	ME*****	Cryogenics
3.	ME*****	Design and Analysis of Experiments
4.	ME*****	Energy Management
5.	ME*****	Non-conventional Energy Resources
6.	ME*****	Solar Architecture
7.	ME*****	Alternative Fuel Technology
8.	ME*****	Gas Turbine and Jet Propulsion
9.	ME*****	Nuclear Power Science and Technology
10.	ME*****	Two phase flow

Semester-I

Course Code: AM*****	Material Science and Engineering	Credits: 3-0-0:3

Prerequisites: NIL

Course Outcomes:

S.N.	Outcomes
CO1	Understand role of structure at different level on properties.
CO2	Apply concepts of Materials Science to analyze engineering problems.
CO3	Select materials for different engineering applications.

Course Articulation Matrix:

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
AM13103.1	2	1	-	1	1	1	-	1	-	2	2	2	3	3
AM13103.2	3	3	2	2	3	1	-	1	2	2	1	2	3	3
AM13103.3	3	3	3	3	3	2	2	2	2	2	1	2	3	3

Unit	Details	No. Hrs
1.	**Introduction:** Historical perspective of Materials Science; Structure and properties relationship of Engineering Materials; Classification of materials; Introduction to Ceramics, Composites Materials: Processing and Applications; Advanced Materials.	**05**
2.	**Structure of Solids and Characterization of Materials:** Introduction to crystal structures and systems; Metallic structures; Ceramic crystal structures; Crystallographic directions and planes, Miller indices, Density computations, Crystallography, Diffraction methods, Electron microscopy, Metallography, Thermal characterization techniques.	**07**
3.	**Imperfections in Crystals:** Point defects, Dislocations, Interfacial Defects, Bulk defects.	**04**
4.	**Diffusion:** Diffusion mechanisms, steady and non-steady state diffusion, Factors that influence diffusion, Law's of diffusion, Applications of Diffusion.	**04**
5.	**Phase Diagrams and Phase Transformations:** Unary, Binary, Equilibrium phase diagrams, Eutectic, Eutectoid, Peritectic and peritectoid reactions, Transformation rate effects and TTT diagrams. Microstructure and property changes in iron-carbon system, Iron-Carbon (Fe-C or Fe-Fe3C) Diagram	**05**
6.	**Mechanical Behaviour of Materials:** Elastic and Plastic properties, Fatigue, Fracture, Creep.	**10**
7.	**Thermal, Electrical, Magnetic, Optical Properties:** Thermal behaviour of Materials; Electrical conduction, Semi conductivity, Super conductivity, Dielectric behaviour, Ferroelectricity, Piezoelectricity, Magnetic behaviour of Materials; Optical properties of materials and their applications.	**05**

Text and Reference Books:

1. Materials Science and Engineering: An Introduction" by William D. Callister Jr., David G. Rethwisch.
2. Materials Science and Engineering: A First Course" by Raghavan V.
3. Mechanical Metallurgy" by George E. Dieter
4. Elements of materials science and engineering" by Lawrence H. Van Vlack

##

Course Code: ME*****	Fluid and Thermal Engineering	Credits: 3-0-0:3

Prerequisites: Physics, Basic Mathematics

Course Outcomes:

CO1	Students will be able to explain three thermodynamic laws and fundamental principles in fluid mechanics and heat transfer
CO2	Students will be able to solve problems related to thermal and fluid systems by applying thermodynamic laws and fluid principles and heat transfer
CO3	Students will be able to identify different power systems and fluid problems in thermal and fluid systems
CO4	Students will be able to report analyses and results of practical problems and experiments in a format that a technically competent person can follow and obtain the similar findings

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	1	1	1	1	1	-	-	2	1	1	3	1
CO2	3	2	2	1	-	-	1	-	-	2	-	-	2	1
CO3	2	3	2	3	1	-	2	-	-	3	-	-	2	2
CO4	3	3	1	3	1	1	3	1	1	2	1	2	3	3

Unit	Details	No. Hrs
1	Introduction: microscopic and macroscopic viewpoints in thermodynamics, basic concepts of system, control volume, state, extensive and intensive property, equilibrium, processes etc. Introduction to Laws of Thermodynamics (Zeroth, First and Second) and applications.	8
2	Introduction to thermodynamic cycles: Vapour Power and Gas Power Cycles.	5
3	Review of fluid properties: density, specific gravity, specific volume, viscosity, surface tension. Classification of fluid,	4
4	Hydrostatics: forces on plane surfaces and curved surfaces submerged in fluid, stability of submerged and floating bodies. Kinematics of fluid motion: methods of describing fluid motion, different types of fluid lines; concept of control volume & system; continuity equations (one dimension, two dimension & three dimension); Dynamics of fluid flow; Simple applications: different flow measuring instruments: venturimeter, orificemeter, Pitot tube etc;	8
5	Introduction: modes of heat transfer, heat exchanger applications; Phase change heat transfer	8

Text Books:

1	Engineering Thermodynamics	P.K. Nag	McGraw Hill
2	Fluid Mechanics	Cengel& Boles,	McGraw Hill
3	Heat and Mass Transfer (In SI units) A practical approach	Yunus A. Cengel,	McGraw Hill.

References:

1	Thermodynamics: An engineering	Cengel& Boles,	McGraw Hill
2	Introduction of Fluid Mechanics & Fluid Machines	Som, S.K., and Biswas G	TMH, New Delhi.
3	Heat Transfer	J.P. Holman	McGraw-Hill International edition

##

Course Code: ME*****	Workshop and Manufacturing Processes	Credits: 1-0-2:2

Prerequisites: NIL

Course Outcomes:

CO1	Students will be able to understand the importance of manufacturing which comprises materials, processes and systems.
CO2	Students will be able to understand the metal casting, metal working process and able to perform casting of metals, forging and sheet metal operations through practical classes.
CO3	Students will be able to understand the machining operations, permanent joining processes. They will be able to perform machining operations on Lathe machine and joining through arc and gas welding processes.
CO4	Students will be able to learn and perform operations related to carpentry, fitting, plastic molding, and Computer Numerical Control (CNC) machines.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	-	2	1	1	-	1	1	1	1
CO2	2	1	1	-	-	1	1	-	1	1	1	1
CO3	2	1	1	-	-	1	1	-	1	1	1	1
CO4	2	1	1	-	3	1	1	-	1	1	1	1
ME11102	2	1	1	-	2	1	1	-	1	1	1	1

Correlation between ME11102 Workshop subject and the PSOs

Name of the B. Tech. Program	PSO1	PSO2	PSO3	PSO4
B. Tech. (Civil Engineering)	2	1	1	-
B. Tech (Mechanical Engineering)	3	3		
B. Tech (Production & Industrial Engineering)	3	3		

Unit	Details	No. Hrs
1	**Concept of Manufacturing-** Manufacturing definition; Role of materials, processes and systems in manufacturing; Classification and brief introduction of engineering materials such as metals & alloys, Classification and brief introduction of manufacturing processes	4
2	**Sand Casting Process of Metals-** Elements of Green Sand Mould; Pattern design and making, Method of Preparation of Green Sand Mould; Casting Defects	2
3	**Metalworking Processes-** Classification of Metalworking Processes-brief introduction of bulk and sheet metal processes, Hot Vs Cold Working; Hot and Cold Rolling; Types of Rolling Mills, Forging, Extrusion, Drawing	3

4	**Machining Processes:** Classification of machining processes & machine tools; Construction, Specification, and operations on Lathe Machine and Drilling machine	2
5	**Fabrication Processes-** Classification of Welding Operations, Types of Joints & Welding Positions; Brief description of Arc, Resistance and Gas welding techniques. Brazing and Soldering	3

List of Practical

1. **Safety in Workshop (Demonstration)**
   Safety precautions and utilization of hand tools and machines of different shops with safe working habits. Introduction to measuring equipments and gauges of different shops.
2. **Carpentry**
   Study of wood works, types of hand tools and machine. Making of one job involving wood work joint
3. **Fitting**
   Study of different fits and hand tools. Making of one job involving fitting to size, male-female fitting with drilling and tapping
4. **Welding**
   Study of electric arc welding and gas welding, tools, types of weld joints and safety precaution during welding. Making of one joint using electric and gas welding. Students will be introduced to brazing and soldering (demonstration)
5. **Sheet Metal Work**
   Study of different hand tools, machine and sheet metal joints. Making of one utility job in sheet metal
6. **Foundry**
   Principles of molding, methods, core & core boxes, preparation of sand mould of given pattern and casting (demonstration)
7. **Black Smithy**
   Introduction to hot working and Study of forging hand tools, furnace and machine. Making a job on hot upset forging.
8. **Machining**
   Study of lathe machine, cutting tools and turning related operations. Making of one job on lathe machine including facing, step and taper turning, threading operations.
9. **Plastic Processing**
   Introduction to plastics and different plastic molding techniques. Study of injection molding process with demonstration.
10. **Computer Numerical Control (CNC)**
    Introduction to automation & CNC, Assembly of models of CNC, CNC wood router, engraving and exposure to part programming. Preparation of part program for simple profiles. Making a job on CNC (Demonstration).
11. **Mini Project**
    Team activity – Fabrication of prototype model based on above practical.

Text Books:

1 Fundamental of Modern Manufacturing: Materials, Processes and Systems — Mikell P. Groover — John Wiley

References:

1	Elements of Workshop Technology (Volume 1: Manufacturing Processes, Volume 2: Machine Tools)	S. K. Hajra Choudhury, A. K. Hajra Choudhury and N. Roy	Media Promoters & Publishers Pvt Ltd., 2010
2	Manufacturing Engineering and Technology	Serope Kalpakjian and Steven R. Schmid	Pearson, 2013
3	Machinery's Handbook	Erik Oberg, Franklin D. Jones, Holbrook L. Horton, Henry H. Ryffel, and Christopher J. McCauley Laura Brengelman	Industrial Press, Inc., 2020
4	Mechatronics	HMT	McGraw Hill Education, 2017
5	Manufacturing Processes I, https://nptel.ac.in/courses/112107144		NPTEL course
6	Fundamentals of manufacturing processes https://onlinecourses.nptel.ac.in/noc22_me71/preview		Swayam Course

##

Course Code: ME*****	Engineering Graphics	Credits: 2-0-2:4

Prerequisites: NIL

Course Outcomes:

CO1	Understand the importance and principles of engineering drawing by hand practice and using computer aided drafting software.
CO2	Understand the isometric and orthographic projections of different objects.
CO3	Create assembly drawing of simple machine components

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	-	3	-	-	2	1	2	-	2	2	1
CO2	2	2	2	1	3	-	-	2	1	2	-	1	2	2
CO3	3	3	3	2	3	-	-	2	1	2	-	1	2	3

Unit	Details	No. Hrs
1	Introduction to engineering drawing and its importance in real life design and manufacturing. Standards in drawing practice viz. types of lines, lettering, dimensioning, scales etc.	2L+2P
2	Introduction to isometric and orthographic projection. Orthographic projection of points, projection of lines, projection of planes, orthographic views of solids sketching of the same for conceptualization.	4L+8P
3	Introduction to computer aided drafting software and hands on practice of orthographic views of solid objects.	2L+6P
4	Sectional viewsof solid objects and hands on practice of sectional views of solid objects using computer aided drafting software.	2L+4P
5	Introduction to temporary fasteners (e.g. screwed fasteners, keys, cotters etc.) Details of screwed fasteners (e.g. bolt, nut, stud, screw etc), terminology of threads, types (e.g. V, square, acme, single/multi start, left/right handed etc). Assembly drawing of nut-bolt using computer aided drafting software.	1L+2P

Text Books:

1 Engineering Drawing Jolhe D. A. Tata McGraw Hill Education

References:

1 Engineering Drawing Basant Agrawal, C. M. Agrawal Tata McGraw Hill Education.

2 Machine Drawing K L Narayana, P. Kannaiah, K. Venketa Reddy New Age International publishers

3	Machine Drawing includes AutoCAD	Ajeet Singh	Tata McGraw Hill Publishing Company Ltd.
4	Elementary Engineering Drawing	Bhatt ND	Charotar Publishing.

##

Semester-II

Course Code: MA*****	**Computer Based Numerical Methods and Statistical Techniques**	**Credit:** 2-0-2:3

Prerequisites: Mathematics I

Course Outcomes:

CO1	Students will be able to understand the concept of errors and will be able to find the roots of some algebraic and transcendental equations.
CO2	Students will be able to formulate the interpolating polynomial with the help of several interpolation formulas by analyzing and using the data points.
CO3	Students will be able to predict the value of the derivative at an intermediate point for a given set of data points. Also, they will be able to solve definite integrals using some numerical techniques and apply the knowledge in research and development activity for the betterment of society.
CO4	Students will be able to solve a system of linear equations arising in several engineering problems and find the eigen value and eigenvector of matrices.
CO5	Students will have basic knowledge of statistical techniques and will be able to derive the probability density function of random variables and calculate the expected value of a random variable. They will also be able to find several linear and nonlinear regression curves/planes for a set of data points.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	2	2	1	-	-	-	-	1	-	2	3	3
CO2	3	3	2	2	1	-	-	-	-	1	-	2	3	3
CO3	3	3	2	2	2	-	-	-	-	1	-	2	3	3
CO4	3	3	2	2	1	-	-	-	-	1	-	2	3	3
CO5	3	3	2	2	2	-	-	-	-	1	-	2	3	3

Unit	Details	No. Hrs
1	**Unit-I Errors in Numerical Computation, Algebraic and Transcendental Equations** Errors in Numerical Computation and Their Analysis, Bisection Method, Method of False Position, Iteration Method, Newton-Raphson Method, Rate of Convergence, Method for complex root: Muller's Method, Quotient Difference Method.	6
2	**Unit-II Interpolation** Introduction, Errors in Polynomial Interpolation, Interpolation by Evenly Spaced Points::Finite Differences, Missing Terms Technique, Newton's Forward & Backward Interpolation Formula, Gauss, Sterling, Bessel's, Everett's Formula, Interpolation by Unevenly Spaced Points: Lagrange Interpolation Formula, Divided Difference, Newton's General Interpolation Formula.	7
3	**Unit III: Numerical Differentiation and Integration** Numerical Differentiation, Numerical Integration, Trapezoidal Rule, Simpson's 1/3Rule, Simpson's 3/8 Rule, Boole's & Weddle's Rules.	4

4	**Unit IV: Numerical Linear Algebra** Numerical Techniques for Finding Solution of a System of Linear Equations: LU & LL* Decomposition Method, Gauss-Jacobi and Gauss-Seidel Iteration Methods, Power Method For Estimating Eigenvalues.	5
5	**Unit V: Statistical Computations** Random Variables, Discrete and Continuous Random Variables and Their Probability Distribution, Poisson, Bernoulli and Normal Distribution, Frequency Chart, Regression Analysis, Least Square Fit, Linear and Non-linear Regression, Multiple Linear Regression.	4

Text Books:

1. S. S. Sastry, Introductory Methods for Numerical Analysis, Prentice Hall (Fifth Edition-2012)
2. M. K. Jain, S. R. K. Iyenger& R.K. Jain: Numerical Methods for Scientific and Engineering Computations, Wiley Eastern Ltd. (Sixth Edition-2016)
3. S. C. Gupta and V. K. Kapoor: Fundamental of mathematical Statistics, S Chand Publication (Twelfth Edition -2020)

Reference Books:

1. C. F. Gerald and P. O. Wheatley: Applied Numerical Analysis, Pearson Education
2. S. Rajashekharan: Numerical Methods for Science and Engineering, S. Chand Publication
3. S. C. Chapra and R. P. Canale: Numerical Methods for Engineers, McGraW-HillEducatio
4. W. George and G. William: Statistical Techniques, IBH Pulications

Computer Based Numerical Methods & Statistical Techniques (Lab)

Experiment 1: Make a program to find the derivative of a given polynomial f(x) for a given value of x.

Experiment 2: Make a program to find the roots of a given polynomial f(x) using the following methods.

(a) Bisection Method
(b) Method of False Position
(c) Iteration Method
(d) Newton-Raphson Method
(a) Muller's Method
(b) Quotient-Difference Method

Experiment 3: Make a program to create the following difference tables for a given set of data points:

(a) Forward Difference Table
(b) Backward Difference Table
(c) Central Difference Table
(d) Divided Difference Table

Experiment 4: Make a program to find the interpolation polynomial/interpolation value of f(x) at a specified value for evenly spaced data points using the following methods:

(a) Newton's Forward and Backward Difference Formulae.
(b) Gauss's, Stirling's, Bessel's, and Everett's interpolation Formulae.

Experiment 5: Make a program to find the interpolation polynomial/interpolation value of f(x) at a specified value for unevenly spaced data points using the following methods:

(a) Lagrange's Interpolation Formula.
(b) Newton's Divided Difference Formula.

Experiment 6: Make a program to find the nth (n=1,2 and 3) derivative of f(x) at a specified value of x for a given set of data points.

Experiment 7: Make a program to find the numerical integration of f(x) at a specified value of x for a given set of data points using the following rules.

(a) Trapezoidal Rule
(b) Simpson's 1/3 Rule
(c) Simpson's 3/8 Rule
(d) Boole's and Weddle's Rule.

Experiment 8: Make a program to find regression curves for a given set of data points using the following rules:

(a) Linear and Nonlinear Regression
(b) Multiple Linear Regression

Core Engineering Supportive Course (for other branches)

##

Core Engineering Supportive Course (for other branches)

Course Code: ME*****	**Basic Industrial Engineering**	Credits: 2-0-0-2

Prerequisites: NIL

Course Outcomes:

S.N.	Outcomes
CO1	Students will be able to identify and use the elements of cost, methods of depreciation and investment techniques. Productivity, Productivity Measurements and develop entrepreneurial attitude.
CO2	Students will be able to describe the job evaluation and merit rating.
CO3	Students will be able to implement work study techniques for better productivity and learn to do work measurement and calculate the standard time for doing a job.
CO4	Students will be able to describe and use different material handling devices,

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	-	-	3	2	2	2	2	3	3	2
CO2	2	2	2	-	-	1	2	2	2	2	3	2	2	2
CO3	3	2	2	1	-	1	2	2	2	1	2	3	3	2
CO4	3	2	2	2	2	-	3	2	2	2	2	2	3	2
CO5	2	2	2	-	2	1	3	2	2	2	3	3	2	2

Module	Details	No. Hrs
1.	Introduction, Engineering Economy and Costing-Plant Location and Layouts, Production Systems, Cost Analysis, Break-even Analysis, Methods of Depreciation,	8
2.	Concepts of Production and Productivity, Productivity Measurements.	
3.	Job evaluation, Benefits of Job evaluation, Methods of Job evaluation, Merit Rating, Methods of Merit Rating, Requirements for success of Merit Rating System,	12
4.	Work Measurement, Time Study, PMTS, Work Sampling, Method Study, Micro Motion Study, Principles of Motion Economy.	8
5.	Material Handling System- principles, types, and devices.	6

Text/Reference Books

1. Turner, W.C., et. al., 1993, "Introduction to Industrial and System Engineering", Prentice Hall.
2. Del Mar, Donald, "Operations and industrial management: designing and managing for productivity", McGraw-Hill,2007
3. Ralph M. Barnes, "Motion and Time Study: Design and Measurement of Work", Wiley Publishers
4. Chandler Allen Phillips, "Human Factors Engineering", John Wiley and Sons, New York,

##

Course Code: ME*****	Non-conventional Energy Resources	Credits: 3-0-0:3

Prerequisites: Basic knowledge of Heat Transfer, Thermodynamic.

Course Outcomes:

CO1	Understand the concept of energy crisis, non-conventional energy resources, availability and their importance.
CO2	Understand various methods to harness non-conventional energy resources.
CO3	Apply the methods for better harness, conversion techniques, and utilization of non-conventional energy resources.
CO4	Analyse various problems, limitations, complexities and performances of power plants based on non-conventional energy resources.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	2	2	3	3	3	2	2	2	3	3	2
CO2	3	3	2	2	2	3	3	3	2	2	2	3	3	2
CO3	3	3	3	3	3	3	3	3	3	3	2	3	3	3
CO4	3	3	3	3	3	3	3	3	3	3	3	3	3	3

Unit	Details	No. Hrs
1	Introduction: The energy crisis – causes and options, various conventional and non-conventional forms of energy and their characteristics, availability of non-conventional energy and land area requirements.	4
2	Solar energy: Introduction, Solar radiation, Sun-Earth angles, Measurement of solar radiation at the earth's surface, Types of collectors such as flat-plate and concentrating collectors, solar thermal power generation, solar ponds and energy storage. Principle of Solar photovoltaic, materials, mono-crystalline, polycrystalline and amorphous silicon cells and their production technology, I-V characteristics, parameters of performance, modules, array and PV plant configurations and power generation.	6
3	Biomass energy: Introduction, Incineration, Thermo-chemical and biochemical conversion to solid, liquid and gaseous fuels; Production technologies for bio-ethanol, biogas and producer gas, Urban waste to energy processes.	5
4	Ocean, Wave and Tidal energy: Introduction, Ocean thermal energy conversion (OTEC) – closed and open cycles and their limitations, Wave energy and its conversion processes, Tidal energy – nature of the tides and tidal barrages for power generation.	5
5	Wind energy: Fundamentals, power in the wind, site selection, maximum power coefficient, wind turbine and its types – horizontal axis and vertical axis machines, performance of wind machines, wind energy farms.	5
6	Geothermal energy: Introduction, Geothermal energy resources, Hot aquifers and hot dry rock systems, geothermal electric power plants.	4
7	Other Technologies: Magnetohydrodynamics (MHD) Energy conversion, Fuel Cells, Nuclear Energy, Hydrogen, Methanol, Energy Storage.	4

Text Books:

1	Renewable Energy Sources and Emerging Technologies	D.P. Kothari, K.C. Singal and R. Ranjan	PHI Learning Pvt. Ltd., New Delhi
2	Solar Energy-Fundamentals, Design, Modeling & Applications'	G.N. Tiwari	Narosa Publishing House, New Delhi, India

References:

1	Advanced Renewable Energy Sources	G.N. Tiwari and R.K. Mishra	RSC Publishing, Cambridge, U.K
2	Biogas Systems: Principles and Applications	K.M Mittal	New Age International Limited Publishers.
3	Wind Energy Come of Age	Gipe P	John Wiley and sons, New York.
4	Solar Energy Fundamentals	S. Kalogirou	Academic Press
5	Solar Photovoltaics: FundamentalsTechnologies and Applications	C.S. Solanki	PHI Learning Pvt. Ltd., New Delhi
6	Energy Technology (Non Conventional, Renewable And Conventional)	S. Rao, BB Parulekar	Khanna Publishers

##

Course Code: ME*****	Introduction to Engineering and Design	Credits: 2-1-0:3

Prerequisites: NIL

Course Outcomes:

CO1	Students will be able to develop an understanding of the engineering & Technology in general.
CO2	Students will be able to develop an understanding on how design differs in same category of products.
CO3	Students will be able to identify the needs that is to fulfilled by a product
CO4	Students will be able to understand how different approach leads to difference in cost and complexity.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2	2	-	2	3	3	2	3	2	-	3	2	2
CO2	3	2	2	-	2	3	3	2	3	2	-	3	2	2
CO3	3	2	2	-	2	3	3	2	3	2	-	3	2	2
CO4	3	2	2	-	2	3	3	2	3	2	-	3	2	2

Unit	Details	No. Hrs
1	Introduction to General Engineering What is Engineering? Difference between Science, Engineering & Technology. History of Engineering. Engineering functions, Characteristics of engineers. Traits of engineers. Engineering Design; Engineering challenges; Ethics; Communication skills; Team work; Attitude. Creative thinking- Invention- innovation & inventiveness in a society.	7
2	Introduction of Engineering Design – needs assessment, problem formulation, concept selection modelling, abstraction, synthesis, economic analysis, materials selection and manufacturing processes. Case histories for illustrating the success and failure in engineering design.	7
3	Concepts of Manufacturing, Casting Processes, Plastics Processing, Metal working Processes, Machining Processes, Fabrication Processes, a glimpse of modern manufacturing processes through different case studies.	7
4	Simple hands on projects, Intellectual Property Rights.	7

Reference Books:

1. Gerard Voland, *Engineering by Design*, 2nd Edition, Pearson, (2004).
2. George E Dieter Linda C Schmidt, Engineering Design, Indian Edition (2016)
3. Product Design & Development- Karl T. Ulrich, Steven D Eppinger, McGraw Hill Publishers.
4. Human Factors in Engineering Design- Mark S sanders & Ernst J. Mc Cornick McGraw Hill Publishers.
5. Robert J. Pond, Jeffrey L. Rankinen, *Introduction to Engineering Technology*: 7th Edition, Prentice Hall, 2009.

##

Course Code: ME*****	Engineering Innovation & Design	Credits: 2-0-1: 3

Prerequisites: NIL

Course Outcomes:

CO1	Students will be able to visualize the need for engineering for serving the society better
CO2	Students will be able to feel themselves more knowledgeable- at the end of the course.
CO3	Students will be able to identify needs and be able to suggest different alternative solutions considering cost constraints.
CO4	Students will be able to have a watchful eye on happenings in their surrounding for creative analyses. Possibility of taking up entrepreneurship activity, possibility of coming up with new ideas leading to IPR.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	3	3	2	2	2	2	2	-	-	-	2	2	2
CO2	3	3	3	2	2	2	2	2	-	-	-	2	2	2
CO3	3	3	3	2	2	2	2	2	-	-	-	2	2	2
CO4	3	3	3	2	2	2	2	2	-	-	-	2	2	2

Unit	Details	No. Hrs
1	Introduction Design & innovation, Who designs & develops products, Industrial & Practical examples. Projects.	8
2	Creative thinking- Invention- innovation & inventiveness in a society.	6
3	A Generic Development Process & Concept Development.	6
4	Identifying Customer Needs, Concept Generation, Concept Selection	6
5	Product Architecture, Industrial Design, Intellectual Property Rights	6

References:

1. Product Design & Development- Karl T. Ulrich, Steven D Eppinger, McGraw Hill Publishers.
2. Gerard Voland, Engineering by Design, Pearson,
3. Human Factors in Engineering Design- Mark S sanders & Ernst J. Mc Cornick McGraw Hill Publishers.
4. https://ocw.mit.edu/courses/esd-051j-engineering-innovation-and-design-fall-2012/video_galleries/lecture-notes-and-videos/

##

Course Code: ME*****	Workshop and Manufacturing Processes	Credits: 1-0-2:2

Prerequisites: NIL

Course Outcomes:

CO1	Students will be able to understand the importance of manufacturing which comprises materials, processes and systems.
CO2	Students will be able to understand the metal casting, metal working process and able to perform casting of metals, forging and sheet metal operations through practical classes.
CO3	Students will be able to understand the machining operations, permanent joining processes. They will be able to perform machining operations on Lathe machine and joining through arc and gas welding processes.
CO4	Students will be able to learn and perform operations related to carpentry, fitting, plastic molding, and Computer Numerical Control (CNC) machines.

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	1	1	-	2	1	1	-	1	1	1	1	2	1
CO2	2	1	1	-	-	1	1	-	1	1	1	1	2	1
CO3	2	1	1	-	-	1	1	-	1	1	1	1	2	1
CO4	2	1	1	-	3	1	1	-	1	1	1	1	2	1

Correlation between ME11102 Workshop subject and the PSOs

Name of the B. Tech. Program	PSO1	PSO2	PSO3	PSO4
B. Tech. (Civil Engineering)	2	1	1	-
B. Tech (Mechanical Engineering)	3	3		
B. Tech (Production & Industrial Engineering)	3	3		
B. Tech (Electrical Engineering)	1	1	-	

Unit	Details	No. Hrs
1	**Concept of Manufacturing-** Manufacturing definition; Role of materials, processes and systems in manufacturing; Classification and brief introduction of engineering materials such as metals & alloys, Classification and brief introduction of manufacturing processes	4
2	**Sand Casting Process of Metals-** Elements of Green Sand Mould; Pattern design and making, Method of Preparation of Green Sand Mould; Casting Defects	2
3	**Metalworking Processes-** Classification of Metalworking Processes-brief introduction of bulk and sheet metal processes, Hot Vs Cold Working; Hot and Cold Rolling; Types of Rolling Mills, Forging, Extrusion, Drawing	3

4	**Machining Processes:** Classification of machining processes & machine tools; Construction, Specification, and operations on Lathe Machine and Drilling machine	2
5	**Fabrication Processes-** Classification of Welding Operations, Types of Joints & Welding Positions; Brief description of Arc, Resistance and Gas welding techniques. Brazing and Soldering	3

List of Practical

1. **Safety in Workshop (Demonstration)**
   Safety precautions and utilization of hand tools and machines of different shops with safe working habits. Introduction to measuring equipments and gauges of different shops.
2. **Carpentry**
   Study of wood works, types of hand tools and machine. Making of one job involving wood work joint
3. **Fitting**
   Study of different fits and hand tools. Making of one job involving fitting to size, male-female fitting with drilling and tapping
4. **Welding**
   Study of electric arc welding and gas welding, tools, types of weld joints and safety precaution during welding. Making of one joint using electric and gas welding. Students will be introduced to brazing and soldering (demonstration)
5. **Sheet Metal Work**
   Study of different hand tools, machine and sheet metal joints. Making of one utility job in sheet metal
6. **Foundry**
   Principles of molding, methods, core & core boxes, preparation of sand mould of given pattern and casting (demonstration)
7. **Black Smithy**
   Introduction to hot working and Study of forging hand tools, furnace and machine. Making a job on hot upset forging.
8. **Machining**
   Study of lathe machine, cutting tools and turning related operations. Making of one job on lathe machine including facing, step and taper turning, threading operations.
9. **Plastic Processing**
   Introduction to plastics and different plastic molding techniques. Study of injection molding process with demonstration.
10. **Computer Numerical Control (CNC)**
    Introduction to automation & CNC, Assembly of models of CNC, CNC wood router, engraving and exposure to part programming. Preparation of part program for simple profiles. Making a job on CNC (Demonstration).
11. **Mini Project**
    Team activity – Fabrication of prototype model based on above practical.

Text Books:

1	Principles of Modern Manufacturing: Materials, Processes and Systems	Mikell P. Groover	John Wiley

References:

1	Elements of Workshop Technology (Volume 1: Manufacturing Processes, Volume 2: Machine Tools)	S. K. Hajra Choudhury, A. K. Hajra Choudhury and N. Roy	Media Promoters & Publishers Pvt Ltd., 2010
2	Manufacturing Engineering and Technology	Serope Kalpakjian and Steven R. Schmid	Pearson, 2013
3	Machinery's Handbook	Erik Oberg, Franklin D. Jones, Holbrook L. Horton, Henry H. Ryffel, and Christopher J. McCauley Laura Brengelman	Industrial Press, Inc., 2020
4	Mechatronics	HMT	McGraw Hill Education, 2017
5	Manufacturing Processes I, https://nptel.ac.in/courses/112107144		NPTEL course
6	Fundamentals of manufacturing processes https://onlinecourses.nptel.ac.in/noc22_me71/preview		Swayam Course

##

Course Code: ME*****	Engineering Graphics	Credits: 1-0-2: 2

Prerequisites: NIL

Course Outcomes:

CO1	Understand the importance and principles of engineering drawing by hand practice and using computer aided drafting software.
CO2	Understand the isometric and orthographic projections of different objects.
CO3	Create assembly drawing of simple machine components

Course Articulation Matrix:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	1	-	3	-	-	2	1	2	-	2	2	1
CO2	2	2	2	1	3	-	-	2	1	2	-	1	2	2
CO3	3	3	3	2	3	-	-	2	1	2	-	1	2	3

Unit	Details	No. Hrs
1	Introduction to engineering drawing and its importance in real life design and manufacturing. Standards in drawing practice viz. types of lines, lettering, dimensioning, scales etc.	2L+2P
2	Introduction to isometric and orthographic projection. Orthographic projection of points, projection of lines, projection of planes, orthographic views of solids sketching of the same for conceptualization.	4L+8P
3	Introduction to computer aided drafting software and hands on practice of orthographic views of solid objects.	2L+6P
4	Sectional viewsof solid objects and hands on practice of sectional views of solid objects using computer aided drafting software.	2L+4P
5	Introduction to temporary fasteners (e.g. screwed fasteners, keys, cotters etc.) Details of screwed fasteners (e.g. bolt, nut, stud, screw etc), terminology of threads, types (e.g. V, square, acme, single/multi start, left/right handed etc). Assembly drawing of nut-bolt using computer aided drafting software.	1L+2P

Text Books:

1	Engineering Drawing	Jolhe D. A.	Tata McGraw Hill Education

References:

1	Engineering Drawing	Basant Agrawal, C. M. Agrawal	Tata McGraw Hill Education.
2	Machine Drawing	K L Narayana, P. Kannaiah, K. Venketa Reddy	New Age International publishers
3	Machine Drawing includes AutoCAD	Ajeet Singh	Tata McGraw Hill Publishing Company Ltd.
4	Elementary Engineering Drawing	Bhatt ND	Charotar Publishing.

Department of Humanities and Social Sciences

Motilal Nehru National Institute of Technology Allahabad

Compiled Syllabi of EAA-A and EAA-B Courses

EAA-A Course

PROFESSIONAL ETHICS AND SOCIAL VALUES

Subject Code: HS* Credit: 2 (2L)**

Course Outcomes (COs):

1. To enable the students to create an awareness of ethics and human values.
2. To develop moral values, social values and loyalty in students.
3. To understand and appreciate the rights of others.
4. To apply professional ethics in organizations.
5. To apply integrity and honesty in their professionalism.

Course Objectives:

1. To enable the students to create an awareness of Professional Ethics and Social Values,
2. To instill Moral and Social Values and Loyalty and to appreciate the rights of others.

CO- PO Mapping

	CO1	CO2	CO3	CO4	CO5
PO1	✓	✓	✓	✓	✓
PO2					
PO3	✓	✓	✓	✓	✓
PO4					
PO5	✓	✓	✓	✓	✓
PO6	✓	✓	✓	✓	✓
PO7	✓	✓	✓	✓	✓
PO8	✓	✓	✓	✓	✓
PO9	✓	✓	✓	✓	✓
PO10					
PO11					
PO12	✓	✓	✓	✓	✓

UNIT I

Morals, social values and professional Ethics – Integrity – Work ethic – Service learning – Civic virtue – Respect for others – Living peacefully – Caring – Sharing – Honesty – Courage – Valuing time – Cooperation – Commitment – Empathy – Self-confidence – Character – Spirituality – Introduction to Yoga and meditation for professional excellence and stress Management. Social Work and Societal Expectation: Social work as experimentation – Social workers as responsible

experimenters on developing sustainable livelihood Models, Problem solving and rural development Models - Codes of ethics - a balanced outlook on natural law, Policies and Social Expectation

Unit - II

Ethical Decision Making, Business Ethics- The Changing Environment and Stakeholder Management, Relevance of Ethics and Values in Business, Spiritual Values Modern Business Ethics and Dilemmas, Overview of Corporate Social Responsibilities (CSR) and Sustainability

UNIT III

Senses of 'Social work Ethics' – Variety of moral issues – Types of inquiry – Moral dilemmas – Moral Autonomy – Kohlberg's theory – Gilligan's theory – Consensus and Controversy – Models of professional roles - Theories about right action – Self-interest –Customs and Religion –Uses of Ethical Theories, Life and professional ethics from the lessons of religious literature

UNIT IV

Safety and Risk – Assessment of Safety and Risk – Risk Benefit Analysis and Reducing Risk - Respect for Authority – Collective Bargaining – Confidentiality – Conflicts of Interest – Occupational Crime – Professional Rights – Employee Rights – Intellectual Property Rights (IPR) – Discrimination Multinational Corporations – Environmental Ethics – Computer Ethics – Weapons Development – Social Worker as Managers – Consulting Engineers – Engineers as Expert Witnesses and Advisors – Moral Leadership –Code of Conduct

UNIT V

Professional ethics of concerned engineering disciplines to be offered by the concerned engineering departments such as ethics in biotechnology, chemical engineering, computer science engineering ,civil engineering, electrical engineering, electronics and communication engineering, mechanical and production engineering

Suggested Readings:

- Mandal – Ethics in business and corporate governance, 2e, McGrawHill
- Agarwal, M. M. 1998 Ethics and Spirituality, Shimla: Indian Institute of Advanced Study
- Charles D. Fleddermann, "Engineering Ethics", Pearson Education / Prentice Hall, New
- Jersey, 2004 (Indian Reprint)

EAA-B Courses

Indian Traditional and Modern Performing Arts

Course Code: HS* ** **Credits: 2 (1L+2P)**

Course Outcomes:

1. Understand the concept of Indian Drama and its significance.
2. Understand the concept of Indian Theatre and its significance.
3. Understand the skills and methodology of direction and acting.
4. Enable them to perform various types of acts.
5. Develop the ability to conduct research and innovation in Drama and Theatre.

Course Objectives:

1. To gain understanding of Indian drama, Indian theatre, direction and acting.
2. To perform various types of Indian drama, theatre and modern art.
3. To develop students' creativity and aesthetic appreciation of the art world.

CO- PO Mapping

	CO1	CO2	CO3	CO4	CO5
PO1					
PO2					
PO3					
PO4					
PO5					
PO6	✓	✓	✓	✓	✓
PO7	✓	✓	✓	✓	✓
PO8	✓	✓	✓	✓	✓
PO9	✓	✓	✓	✓	✓
PO10					
PO11					
PO12	✓	✓	✓	✓	✓

Syllabus

Unit: I

Indian Drama and its theories:

Concept of drama- Indian

- Elements and structure of drama according to Indian scenario
- A brief study of different classifications of dramas – Tragedy, comedy, tragic
- Comedy, melodrama and farce: A brief introduction to various 'isms' in relation to drama including realism, naturalism,

- Symbolism, expressionism, absurd and epic Playwrights and their contribution:
- Sanskrit – Kalidasa, Bhasa, Sudraka, Bhavabhuti, Visakhadutta, Bhattanarayana;

Unit: II

Modern Indian Theatre:

Origin and development of modern Indian theatre with reference to region, state and personalities, A brief study of new trends in theatre since Independence movement both at national and regional level, such as, IPTA movement, Navanatya movement, Root Theatre movement, Third Theatre, Alternate theatre, Street theatre, Theatre of the Oppressed, Applied theatre, Forum Theatre, Site Specific theatre, An overview of major playwrights, directors and other contributing personalities of various regions, whose plays are widely performed at the national level. Popular Play Houses, Theatre Companies, Institutions and Groups in India and their contribution

Unit: III

Acting and Direction:

(A) Different schools of acting – Indian

Eastern – Sanskrit, Peking Opera, Noh, Kabuki

Role of Mime, Voice, Speech, Improvisation and Physical Theatre in actor's training

(B) Different directorial innovations and methods

Role of director in Theatre

Fundamentals of play direction: Balance, emphasis, composition, picturisation, movement, tempo and rhythm

Process of production: Script to performance

(C) Ideas on Production

1. Realistic:

2. Non-realistic: Impact of above ideas on post independent Indian Theatre movements

Unit: IV

Theatre Design and techniques

(A) Theatre architecture: Greek, Roman, Elizabethan, Thrust Stage, Proscenium, Arena, Open Stage. Sanskrit: Vikrishta – MadhyamNatyagruha,

(B) Stage craft: Fundamentals and functions of sets, lights, costumes, make-up, sound, props, other arts and theatre music in terms of various kinds of play production Aharya and Nepathyavidhi in classical Indian,

C) Theatre management and organization

(D) Children's theatre, applied theatre, community theatre, theatre in education, theatre of oppressed and feminist theatre

Unit: V

Theatre Education, Pedagogy and Research

Theatre as part of curriculum from primary education and in University system,

Relevance of traditional theatre training Movement analysis based on kinesthetics, Yoga, Theatre Game, Martial Arts, Folk,

Puppetry and other forms Eminent scholars and their works who contributed to the knowledge of Indian Theatre

Trends in Indian Theatre research and scholarship in India

Patronization to theatre- major institutions, organizations, Government, corporate, private bodies and personalities after independence Awareness of important theatre festivals, Awardees and current affairs in theatre

Indian Traditional Music (Vocal)

Course Code: HS* ** **Credits: 2 (1L+2P)**

Course Outcomes:

1. Enable to understand the various Indian traditional music.
2. Understand the differences and similarities between vocal and instrumental music.
3. Understand the difference between the northern and southern music system.
4. Understand the contribution of eminent artists of Indian classical music.
5. Understand the contribution eminent artists of Prayagraj to the Indian music.

Course Objectives:

1. To enhance the knowledge about Indian traditional music.
2. To understand the basics of vocal and instrumental music.
3. To enable students to perform vocal music.

CO- PO Mapping

	CO1	CO2	CO3	CO4	CO5
PO1					
PO2					
PO3					
PO4					
PO5					
PO6	✓	✓	✓	✓	✓
PO7	✓	✓	✓	✓	✓
PO8					
PO9	✓	✓	✓	✓	✓
PO10	✓	✓	✓	✓	✓
PO11					
PO12	✓	✓	✓	✓	✓

Syllabus

Unit I

Practical knowledge of Raagas with Drutkhyal/ Razakhani Gat-Kalyan, Bilawal Kafi Khamaj, Asawari, Bhairav, Bhairavi, Poorvi, Marwa, Todi

Unit II

FOR VOCAL

Practical knowledge of Bhajan, Geet, Gazal,Kajari, Chaiti, Dadra, Hori

FOR SITAR

Practical knowledge of Playing TWO DHUN in Kafi Raag and khamaj

Unit III

A-Brief study of northern and southern music system

B-Science of Music

Brief introduction of Indian music from ancient, medival and modern

Unit IV

Brief study of eminent artist of Indian classical music like Pt. Ravi Shankar, Utd. Bismillah Khan, Pt.Kisan Maharaj, Pt.Samta Prasad, Utd Jakir Husain, Pt. Rajan Sajan Mishra, Pt. Siyaram Tiwari, Utd. Bade Ghulam Ali Khan, Pt. Ramchatur Mallick, Pt. VidurMallick,Pt Bheemsen Joshi, Pt Jasraj, Utd. Rahim Fahimuddin Dagar, Utd Zia fariduddin Dagar, Vidushi Girija Devi Acharya Brihaspati, Vidushi Prem latasharm

Unit V

Contribution of eminent artist of Prayagraj to the Indian music: - Pt. Bhola Nath Bhatt, Pt. Bhola Nath Prasanna, Pt. Ramashray Jha, Vidushi Geeta Bannerji, Shri Lal Ji Srivastav, Shri Girish Chandra Srivastav, Pt. Nand Kumar Mishra, Shri Shailendra Mishra, Vidushi Kamla Bose, Shri Banwari Lal Srivastav.

Origin of Gharana and its development (Vocal/Sitar) with description of their artist.

Origin and development of Own Instruments: - Tanpura and Sitar.

Indian Traditional Music (Instrumental)

Course Code: HS* ** **Credits: 2 (1L+2P)**

Course Outcomes:

1. Understand basics of music.
2. Understand the Harmonium music instrument and its functioning.
3. Understand the Tabala music instrument and its functioning.
4. Understand the Synthesizer music instrument and its functioning.
5. Enable them to perform instrumental music- Harmonium, Tabala and Synthesizer.

Course Objectives:

1. To know and understand music vocal.
2. To gain understanding of various musical instruments.
3. To perform on various musical instruments.

CO- PO Mapping

	CO1	CO2	CO3	CO4	CO5
PO1					
PO2					
PO3					
PO4					
PO5					
PO6	✓	✓	✓	✓	✓
PO7	✓	✓	✓	✓	✓
PO8	✓	✓	✓	✓	✓
PO9	✓	✓	✓	✓	✓
PO10	✓	✓	✓	✓	✓
PO11					
PO12	✓	✓	✓	✓	✓

Syllabus

Unit I: INTRODUCTION

Basic knowledge of musical instruments like tabla, harmomium, synthesizer,

Unit II: HARMONIUM

Structural knowledge of Harmonium, Types of Harmoniums, Playing techniques of

Harmonium, Description of different Types of Harmonium, Definition of following terms – Sangeet. Naad, Swara, Shruti, Saptak,Alankar, Elementary knowledge of TeenTaal, Keherwa

Unit III: TABLA

Importance of Indian Culture & History of Music, Indian Music & Classification of Instruments, Origin of tabla its utility and importance, Study of tabla with well labelled diagram,Different technical terms of tabla and music, Various tals – teental, jhaptal, Kahwasadadra,Notation of Rayada, Mukhana, Tihai etc, Varnas of tabla- Technique, Teental-on tabla,dugun, Kayada, palta, tihai in teental, Kaharwa taal dugum, Prakars of kaharwa, Japtal, Dadra taal, Prakars of dadra, Roopak,dugum, Prakars of roopak, Bole of tot and tirkit etc, Chartal, Teevaratal, Mukhra, tukra in teental, Tabla accompaniment with light music, Padhant of all boles on hand.

Unit IV: SYNTHESIZER

Introduction to music, fundamental terms: Swara, Alankar, Chal, swar, Achal Swar, Komal, Shudh, TiwraSwar , Taal: Types of taals, their bits ,Types of ragas & their introduction: Bhupali, Bhimpalas, Vrundavani, Sarang, Durga, Des, Bageshri, Yaman, Kafi, Khamaj, Bhairav , Special features of each raag such as swar, Aroh, Awroh,Vadiswar, Timeetc, Types of musical instruments on key board ,Vande Mataram ,National Anthem , Special Features of various ragas such as Malkans, Darbari, Kalawati, Bibhas, Kedar, Tilak Kamod Vadi, Sanwadi Swar, Time of singing, Aroh, Awaroh, Chalan and Bandish ,

Unit V

Practical and practices of Harmonium and Tabla

Practical and practices of **SYNTHESIZER**

Suggested reading:

1. S.S. Paranjape - Bhartiya Sangeet Ka Itihasa
2. S.S. Paranjape - Sangeet Bodh
3. V.N. Bhatkhande - Bhatkhande Sangeet Shastra Part-I-II
4. Swami Prajnananda - History of Indian Music
5. Swami Prajnananda - Historical Study of Indian Music
6. Lalit Kishore Singh - Dhvani Aur Sangeet
7. Govind Rao Rajurkar - Sangeet Shastra Parag
8. Dr. Swatantra Sharma - Fundamentals of Indian Music
9. Dr. Pannalal Madan - Sangeet Shastra Vigyan

National Service Scheme

Course Code: **Credits 2 (1L+2P)**

Course Outcomes:

1.Understand the history of NSS, its organization, and benefits of NSS.
2.Understand the concept of national integration and nationalism.
3.Understand the concept of self-awareness and emotional intelligence.
4.Apply the concept of ethical & creative thinking and doing.
5.Analyze the process of decision making & problem solving.
6. Evaluate the concept of team building and its significance in life.

Course Objectives:

i. To know about the history of NSS, its organization, and benefits of NSS.
ii. To understand the concept of national integration and nationalism.
iii. To understand the concept of self-awareness and emotional intelligence.
iv. To understand the concept of ethical & creative thinking and doing.
v. To understand the process of decision making & problem solving.
vi. To understand the concept of team building and its significance in life.

CO- PO Mapping

	CO1	CO2	CO3	CO4	CO5
PO1					
PO2					
PO3					
PO4					
PO5					
PO6					
PO7	✓	✓	✓	✓	✓
PO8	✓	✓	✓	✓	✓
PO9	✓	✓	✓	✓	✓
PO10	✓	✓	✓	✓	✓
PO11					
PO12	✓	✓	✓	✓	✓

Syllabus

Semester I & II

Unit I: Preface to National Service Scheme& Basic Concepts Of NSS

Concern of National Service Scheme
NSS-Basic concepts

Basic concepts and components
NSS Program and activities

Unit II: Special Camp Program and Administrative Structure

Special camp program
Scheme and preparation of special camp program
Financial Methodology of expenses related to special camp program
Administrative structure at national level
Administrative structure at state level
Administrative structure at university level
Administrative structure
Advisory committees of NSS

Unit III: Scheme of program/activities and implementation of NSS programs

Scheme at state level
Scheme at university level
Scheme at institute level
Scheme of NSS programs
NSS at institute level-structure and administration of NSS unit
Program officer-appointment, duty and work

Unit IV: NSS Volunteers and their Role

National service scheme volunteer
At state, university
Administrative aid and implementation of NSS program

Unit V: Training, Customization, Research and Evaluation and Finance and Accounts
Training and customization center
Training of program officer and chief personnel
Methodology of financial expenditure
Methodology of financial expenditure
Methodology of financial expenditure at college level
Maintenance of accounts

Reference:

https://nss.gov.in/sites/default/files/manualNss2006.pdf

National Cadet Corps

Course Code: **Credits: 2 (1L+2P)**

Course Name: NCC-1

Semester: 1

Course Objectives:

To develop the following competencies in the cadets:

i. Know about the history of NCC, its organization, and incentives of NCC for their career prospects.
ii. Acquire knowledge of duties and conduct of NCC cadets.
iii. Understand about different NCC camps and their conducts.
iv. Understand the concept of national integration and its importance.
v. Understand the concept of self-awareness and emotional intelligence.
vi. Understand the concept of critical & creative thinking.
vii. Understand the process of decision making & problem solving.
viii. Understand the concept of team and its functioning.
ix. Understand the concept and importance of social service.
x. Understand that drill as the foundation for discipline and to command a group for common goal.
xi. Understand the importance of a weapon its detailed safety precautions necessary for prevention of accidents.
xii. Develop the concept of various markings on the map and how they are co-related to the ground features.

Learning Outcome

After completing this course, the cadets will be able to: -

I. Imbibe the conduct of NCC cadets.
II. Respect the diversity of different Indian culture.
III. Practice togetherness and empathy in all walks of their life.
IV. Do their own self-analysis and will work out to overcome their weakness for better performance in all aspects of life.
V. Understand creative thinking & its components.
VI. Think divergently and will try to break functional fixedness.
VII. Make a team and will work together for achieving the common goals.
VIII. Do the social services on different occasions.
IX. Perform foot drill and follow the different word of command.
X. Fire a weapon effectively with fair degree of marksmanship.
XI. Undertake point to point navigation and take part in route marches by day and night.

CO- PO Mapping

	CO1	CO2	CO3	CO4	CO5
PO1					
PO2					
PO3					

PO4					
PO5					
PO6					
PO7	✓	✓	✓	✓	✓
PO8	✓	✓	✓	✓	✓
PO9	✓	✓	✓	✓	✓
PO10	✓	✓	✓	✓	✓
PO11					
PO12	✓	✓	✓	✓	✓

Syllabus

Unit 1- NCC General (Contact Hrs. 06):
Introduction of NCC, History, Aims, Objective of NCC & NCC as Organization, Incentives of NCC, Duties of NCC Cadet. NCC Camps: Types & Conduct. Introduction to Weapons.

Unit 2- National Integration & Awareness (Contact Hrs. 04):
National Integration: Importance & Necessity, Factors Affecting National Integration, Unity in Diversity & Role of NCC in Nation Building, Threats to National Security.

Unit 3- Personality Development and Drill (Contact Hrs. 12):
Intra & Interpersonal skills - Self-Awareness- & Analysis, Empathy, Critical & creative thinking, Decision making and problem solving.
Foot Drill- Drill ki Aam Hidayaten, Word ki Command, Savdhan, Vishram, Aram Se, Murdna, Kadvar Sizing, Teen Line Banana, Khuli Line, Nikat Line, Khade Khade Salute Karna Parade Par, Visarjan, Line Tod, TejChal, Tham aur DhireChal, Tham.

Unit 4- Map Reading (Contact Hrs. 04).
Definition of Map, Conventional signs, Scale and Grid System, Topographical forms and technical terms, Relief, Contours and gradients, Cardinal points and types of North, Magnetic Variation and Grid Convergence.

Unit 5- Social Service and Community Development (Contact Hrs. 10).
Basics of social service and its need, Types of social service activities, Objectives of rural development programs and its importance, NGO's and their contribution in social welfare, contribution of youth and NCC in Social welfare. Cadets will participate in various activities throughout the semester e.g., Blood donation Camp, Swachhata Abhiyan, Beti Bachao Beti Padhao, Tree Plantation Drives, Anti-tobacco Rallies, Anti-Dowry Drive, Pandemic Mgmt. etc.

NCC Syllabus

Course Code: **Credits: 2 (1L+2P)**

Semester: 2

Course Name: NCC-2

Course Objectives:

To develop the following competencies in the cadets:

i. Understand the thinking & reasoning process.
ii. Understand the importance of improving communication skills.
iii. Understand about different NCC camps and their conducts.
iv. Identify the leadership traits.
v. Admire the qualities of great leaders.
vi. Understand & spread awareness about latest Government initiatives for welfare of citizens and contribute towards Nation building.
vii. Know about different legal provisions for children & women safety and protection.
viii. Understand the importance of a weapon, and detailed safety precautions necessary for prevention of accidents.
ix. Use terrain effectively for concealment, camouflage, indicate landmarks and give field signals.

Learning Outcome

After completing this course, the cadets will be able to: -

i. Define thinking, reasoning, critical thinking and creative thinking.
ii. To think critically about different life related issues.
iii. To think divergently and will try to break functional fixedness.
iv. Apply creative and critical thinking in their real-life problems.
v. Understand the organizations related to disaster management and their functioning.
vi. Respect and help women and children and feel connected with social problems
vii. Perform foot drill gracefully.
viii. Give and follow the different word of command.
ix. Fire a weapon effectively with fair degree of marksmanship.
x. Use of bearing and service protractor and locate the places and objects on the ground.

CO- PO Mapping

	CO1	CO2	CO3	CO4	CO5
PO1					
PO2					
PO3					
PO4					
PO5					
PO6					

PO7	✓	✓	✓	✓	✓
PO8	✓	✓	✓	✓	✓
PO9	✓	✓	✓	✓	✓
PO10	✓	✓	✓	✓	✓
PO11					
PO12	✓	✓	✓	✓	✓

Syllabus

Unit 1- Personality Development (Contact Hrs.5):
Thinking- Meaning and Concept of thinking, Reasoning, Process of thinking, Critical Thinking- Meaning & concept of critical thinking, Features of critical thinking, Process of critical thinking. Creative thinking- Meaning & concept of creative thinking, Features of creative thinking, Process of creative thinking, levels of Creativity, Characteristics of creative person.

Unit 2- Drill (Contact Hrs. 12):
Foot Drill Dahine, Baen, Aageaur Piche Kadam Lena. TejChal se Murdna, TejChal se Salute Karna, Tej Kadam Taal aur Tham, Tej Kadam Taal se Kadam Badalna. Teeno Teen se Ek File aur ek file se Teeno Teen Banana.

Unit 3- Leadership (Contact Hrs. 05):
Leadership capsule. Important Leadership traits, Indicators of leadership and evaluation. Motivation- Meaning & concept, Types of motivation. Factors affecting motivation. Ethics and Honor codes.

Unit 4- Map Reading (Contact Hrs. 04):
Protractor Bearing and its conversion methods. Service protractor and its uses. Prismatic compass and its uses and GPS. Navigation by compass and GPS.

Unit 5- Social Service and Community Development (Contact Hrs. 10)**:**
Cadets will participate in various activities throughout the semester e.g., Awareness regarding Protection of Children & Women Safety, Road/Rail Safety, New Government Initiatives, Cyber and mobile Security Awareness, Blood donation Camp, Swachhata Abhiyan, Constitution Day, Jan Jeevan Hariyali Abhiyan, Beti Bachao Beti Padhao etc. as per the requirement and similar announced days- National and state level.

Annexure No.: I

B.Tech. I Semester [Common to all branches]

Course Name: Mathematics-I Course Code: MA11101 L: T: P = 3: 1: 0 Credit: 4

Introduction:

This course is one of the basic course of mathematics for all branches of engineering students. The emphasis is on the fundamentals and theoretical concepts of mathematics which are needed to understand and solve engineering and scientific problems.

Course Objective:

Objective of this course is to make students proficient on the following contents of the syllabus so that they can use these concepts to understand and to solve engineering problem.

Unit-I: Continuity and Differentiability

Unit-II: Partial derivatives and Taylors Theorem

Unit-III: Integral Calculus

Unit-IV: Beta and Gamma Functions

Unit-V: Vector Calculus

Unit-VI: Ordinary Differential Equations

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B.Tech. I Semester [Common to all branches]

Course Name: Mathematics-I Course Code: MA11101 L: T: P= 3: 1: 0 Credit:4

Unit-I Continuity and Differentiability: (7 Lectures)

Limit and Continuity (ε–δ definition of one variable), Rolle's Theorem, Lagrange and Cauchy Mean Value Theorem, Limit and Continuity (ε–δ definition for several variables) and Differentiability for several variables.

Unit-II Partial derivatives and Taylors Theorem (5 Lectures)

Partial derivatives, Euler's homogeneous theorem, Implicit function, Change of variables, Jacobian, Taylor's theorem for functions of several variables. Extrema of functions of several variables, Lagrange method of undetermined multipliers.

Unit- III Integral Calculus: (7 Lectures)

Multiple integrals (Double & Triple Integral), Change of order of integration, Area of bounded region, Arc length of curve, Volume and Surface area of solid of revolution, Multiple integral by change of variables, Dirichlet integrals, Moment of inertia, Center of gravity.

Unit –IV Beta and Gamma Functions: (5 Lectures)

Improper integrals, Convergence of improper integral, Beta Function, Gamma functions, Improper Integrals involving a parameter.

Unit-V Vector Calculus: (8 Lectures)

Gradient, Directional derivatives, Divergence and Curl, line integral, Green's theorem, Surface and volume integrals, Gauss theorem, Stoke's theorems and their Applications.

Unit –VI Ordinary Differential Equation: (**8 Lectures**)

Existence and Uniqueness of solutions of First order ODE, Exact Differential Equation, Solution of Linear Differential Equation, Higher order Linear Differential Equation, Solutions of Homogeneous and Non-homogeneous ODE (CF+PI), Variation of parameters, Method of undetermined coefficients.

Text Books:

1. R. K. Jain and S. R. K. Iyenger, Advanced Engineering Mathematics, Edition: 5th, 2016 Narosa Pub. House
2. B.S. Grewal, Higher Engineering Mathematics, 44nd edition, 2018, Khanna Publishers.

Reference Books and Online Source:

1. Thomas and Finney, Calculus, 10th Edition, 2001, Addison Wesley
2. Erwin Kreyszig, Advanced Engineering Mathematics,10th Edition, 2015, John Wiley & Sons.
3. Online Source: NPTEL.

Course Outcomes (COs) of the Course

B.Tech. I Semester [Common to all branches]

Course Name: Mathematics-I Course Code: MA11101 L: T: P = 3: 1: 0 Credit: 4

CO	Statement
MA11101.1	The course provides a basic understanding of the limit, continuity, and differentiability of the function of single and several variables, which are fundamental for solving many engineering problems.
MA11101.2	Development of basic understating of partial derivatives, change of variables, Jacobins, maxima-minima of function of several variables to address some engineering based problems.
MA11101.3	This unit provides sufficient knowledge to apply double and triple integrals in calculating arc length, surface area, volume, the moment of inertia, and the center of gravity of surfaces to solve complex engineering problems.
MA11101.4	Make students familiar with the basic knowledge of beta, gamma, and error functions, which frequently appear in engineering problems.
MA11101.5	Students will learn basic concepts like gradient, directional derivative, divergence, curl, etc. They will also learn to calculate line, surface, and volume integrals and apply conversion techniques between them.
MA11101.6	Solution methods of the ordinary differential equation are fundamental concepts for engineers problems. This unit will help the students to have a clear understanding of differential equations. Also, students will be able to learn solution techniques for several kinds of first and higher-order ordinary differential equations.

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B.Tech. II Semester [Branch: Biotechnology] **Annexure No.: II**

Course Name: Mathematics-II Course Code: MA12101 L: T: P= 3: 1: 0 Credit: 4

Introduction:

This course is one of the basic course of mathematics for Biotechnology branch of engineering students. The emphasis is on the fundamentals and theoretical concepts of mathematics which are needed to understand and solve engineering and scientific problems.

Course Objective:

Objective of this course is to make students proficient on the following contents of the syllabus so that they can use these concepts to understand and to solve engineering problem.

Unit – I Linear Algebra

Unit -II Eigenvalues and Eigenvectors

Unit – III Partial Differential Equation

Unit- IV Laplace Transform

Unit- V Fourier Series& Fourier Transform

Unit- VI Probability and Statistics

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B.Tech. II Semester [Branch: Biotechnology]

Course Name: Mathematics-II Course Code: MA12101 L: T: P= 3: 1: 0 Credit:4

Unit –I Linear Algebra (6 Lectures)

Vector spaces, Subspaces, Linear dependence and independence, Basis and dimension, Dimension theorem. Linear Transformation, Rank–Nulity Theorem (Statement only), Computation of Rank and nullity of LT, Solution of linear simultaneous algebraic equations.

Unit –II Eigenvalues and Eigenvectors (6 Lectures)

Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Application of Eigenvalues and Eigenvectors, Quadratic form, Diagonalization, Canonical forms.

Unit– III Partial Differential Equation (7 Lectures)

First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non-Linear First Order PDE, Standard form -I, II, III, IV. Charpit's method, Higher Order Homogeneous linear PDE with constant coefficients:C. F. & P.I,, Non-homogeneous PDE with constant coefficients: C. F. & P. I., Classification of Linear PDE of second order, Method of separation of variables,

Unit- IV Laplace Transform: (7 Lectures)

Laplace transformation and its properties, Unit – step, Impulse and Periodic functions, Error Function. Inverse Laplace Transform, Convolution Theorem, Evaluation of Integral by Laplace Transform, Application of Laplace transform to solution of ODE & PDE.

Unit-V Fourier Series and Fourier Transform: (7 Lectures)

Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral. Fourier Transform, Fourier Sine and Cosine Transform, Finite sine and cosine transform, Convolution theorem.

Unit –VI Probability and Statistics (7 Lectures)

Definitions of probability, Conditional probability; Discrete and Continuous Random Variables, Probability distributions of random variable, Expectation, Descriptive Statistics-Mean, Median, Mode and standard deviation, Probability distributions: Binomial and Poisson Distributions, Normal Distribution.

Text Books:

1. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 5th **edition,** 2016, Narosa Pub.
2. B.S. Grewal, Higher Engineering Mathematics, **44nd edition, 2018,** Khanna Publishers.
3. S. C. Gupta & V. K. Kapoor, Probability and Statistics, **12th edition, 2020,** S Chand Publication.

Reference Books and Online Source:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, 2015, John Wiley & Sons.
2. George W. and William G, Statistical Methods, 10th Edition, 2014, IBH Publication.
3. Online Source: NPTEL.

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Course Outcomes (COs) of the Course

B.Tech. II Semester [Branch: Biotechnology]

Course Name: Mathematics-II Course Code: MA12101 L: T: P= 3: 1: 0 Credit: 4

CO	Statement
MA12101.1	This unit is designed to make students familiar with the basic concepts of linear algebra, such as vector spaces, basis, dimension, linear transformation, solvability of a system of linear equations, etc.
MA12101.2	Students will learn basic concepts like eigenvalues, eigenvector, quadratic form, and diagonalization, which are fundamental concepts in many engineering problems.
MA12101.3	Development of basic understanding and solution methods for the linear/nonlinear partial differential equations which arises in the modeling of engineering/physical problems. The student will be able to classify and solve the PDE's of second order which arises in the modeling of many engineering/physical problems. Also, the students will be able to apply the technique to solve wave and Laplace equations.
MA12101.4	The course provides a basic understanding of Laplace transformation to address the engineering problems governed by ordinary and partial differential equations.
MA12101.5	This unit provides fundamental knowledge about the Fourier series and Fourier transforms, which are fundamental concepts for solving boundary value problems and to study signal processing problem.
MA12101.6	Understanding of basic concepts of probability. Also, students will have basic knowledge of probability distributions.

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B.Tech. II Semester [Branch: Chemical Engineering]

Course Name: Mathematics-II Course Code: MA12102 L: T: P= 3: 1: 0 Credit:4

Introduction:

This course is one of the basic course of mathematics for Chemical Engineering students. The emphasis is on the fundamentals and theoretical concepts of mathematics which are needed to understand and solve engineering and scientific problems.

Course Objective:

Objective of this course is to make students proficient on the following contents of the syllabus so that they can use these concepts to understand and to solve engineering problem.

Unit – I Linear Algebra and Matrices

Unit- II Laplace Transform

Unit- III Fourier Series & Fourier Transform

Unit – IV Partial Differential Equation

Unit – V Application of Partial Differential Equation

Unit- VI Probability

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B.Tech. II Semester [Branch: Chemical Engineering]

Course Name: Mathematics-II Course Code: MA12102 L: T: P= 3: 1: 0 Credit: 4

Unit –I Linear Algebra and Matrices (7 Lectures)

Vector spaces, Subspaces, Linear dependence and independence, Basis and dimension, Dimension theorem. Linear Transformation, Rank–Nulity Theorem (Statement only), Computation of Rank and nullity of Linear Transformation, Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Application of Eigenvalues and Eigenvectors, Diagonalization.

Unit- II Laplace Transform: (7 Lectures)

Laplace transformation and its properties, Unit –step, Impulse and Periodic functions, Error Function. Inverse Laplace Transform, Convolution Theorem, Evaluation of Integral by Laplace Transform, Application of Laplace transform to solution of ODE & PDE.

Unit-III Fourier Series & Fourier Transform: (7 Lectures):

Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral. Fourier Transform, Fourier Sine and Cosine Transform, Finite sine and cosine transform, Convolution theorem, Application of Fourier Transform to boundary value problems.

Unit – IV Partial Differential Equation: (7 Lectures)

First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non-Linear First Order PDE, Some Standard form -I, II, III, IV. Charpit's method. Higher Order Homogeneous linear PDE with constant coefficients, C. F. & P.I, Non-homogeneous PDE with constant coefficients, C. F. & P. I.

Unit – V Application of Partial Differential Equation: (6 Lectures)

Classification of Linear PDE of second order: Elliptic, Parabolic and Hyperbolic, Solution of separation of variables. Interior and Exterior BVP: Heat and Wave equation, Laplace Equation

Unit –V Probability (6 Lectures)

Discrete and Continuous Random Variables, Probability distributions of random variable, Mathematical Expectation, Descriptive Statistics-Mean, Median, Mode and standard deviation, Probability distributions: Binomial and Poisson Distributions, Normal Distribution.

Text Books:

1.R.K. Jain& S.R.K. Iyenger, Advanced Engineering Mathematics, 5th **edition,** 2016, Narosa Pub.

2.B.S. Grewal, Higher Engineering Mathematics, **44nd edition, 2018,** Khanna Publishers.

3. S. C. Gupta & V. K. Kapoor, Probability and Statistics, 12th edition**, 2020,** S Chand Publication.

Reference Books and Online Source:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, 2015, John Wiley & Sons.

2. Qazi Zameeruddin & Surjeet Singh, Modern Algebra, 9th edition 2021, S Chand Publication

3. Online Source: NPTEL.

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Course Outcomes (COs) of the Course

B.Tech. II Semester [Branch: Chemical Engineering]

Course Name: Mathematics-II Course Code: MA12102 L: T: P= 3: 1: 0 Credit: 4

CO	Statement
MA12102.1	This unit is designed to make students familiar with the basic concepts of linear algebra, such as vector spaces, basis, dimension, linear transformation. Students will learn basic concepts like eigenvalues, eigenvector and its application, diagonalization, which are fundamental concepts in many engineering problems.
MA12102.2	The course provides a basic understanding of Laplace transformation to address the engineering problems governed by ordinary and partial differential equations.
MA12102.3	This unit provides fundamental knowledge about the Fourier series and Fourier transforms, which are fundamental concepts for solving boundary value problems and signal processing.
MA12102.4	Development of the basic understanding and solution methods for the linear/nonlinear partial differential equations which arises in the modeling of engineering/physical problems.
MA12102.5	The student will be able to classify and solve the PDE's of second order which arises in the modeling of many engineering/physical problems. Also, the students will be able to apply the technique to solve, heat, wave and Laplace equations.
MA12102.6	The students will have the basic knowledge of random variables, Probability distributions of random variable, Mathematical Expectation, Mean, Median, Mode and standard deviation, Probability distributions

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B.Tech. II Semester [Branch: Civil Engineering]

Course Name: Mathematics-II Course Code: MA12103 L: T: P= 3: 1: 0 Credit: 4

Introduction:

This course is one of the basic course of mathematics for Civil Engineering students. The emphasis is on the fundamentals and theoretical concepts of mathematics which are needed to understand and solve engineering and scientific problems.

Course Objective:

Objective of this course is to make students proficient on the following contents of the syllabus so that they can use these concepts to understand and to solve engineering problem.

Unit – I Linear Algebra and Matrices

Unit- II Laplace Transform

Unit- III Fourier Series & Fourier Transform

Unit – IV Partial Differential Equation

Unit- V Probability

Unit – VI Distribution and Sampling

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B.Tech. II Semester [Branch: Civil Engineering]

Course Name: Mathematics-II Course Code: MA12103 L: T: P= 3: 1: 0 Credit:4

Unit –I Linear Algebra and Matrices (7 Lectures)

Vector spaces, Subspaces, Linear dependence and independence, Basis and dimension, Dimension theorem. Linear Transformation, Rank–Nulity Theorem (Statement only), Computation of Rank and nullity of Linear Transformation, Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Application of Eigenvalues and Eigenvectors, Diagonalization.

Unit- II Laplace Transform: (6 Lectures)

Laplace transformation and its properties, Unit – step, Impulse and Periodic functions, Error Function. Inverse Laplace Transform, Convolution Theorem, Application of Laplace transform:Evaluation of Integral and solution of initial value problem.

Unit-III Fourier Series and Fourier Transform: (6 Lectures)

Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral. Fourier Transform, Fourier Sine and Cosine Transform, Finite sine and cosine transform, Convolution theorem.

Unit– VI Partial Differential Equation (7 Lectures)

First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non-Linear First Order PDE, Standard form -I, II, III, IV. Charpit's method, Higher Order Homogeneous linear PDE with constant coefficients:C. F. & P.I, Non-homogeneous PDE with constant coefficients: C. F. & P. I., Method of separation of variables.

Unit –V Probability (6Lectures)

Definitions of probability, Conditional probability; Discrete and Continuous Random Variables,Probability distributions of random variable, Mathematical Expectation, Descriptive Statistics-Mean, Median, Mode and standard deviation,

Unit –VI Distribution and Sampling (8 Lectures)

Probability distributions: Binomial and Poisson Distributions, Normal Distribution.Concept of population and sample, Random sample, Method of taking a random sample. Sample distribution of mean,Hypothesis testing.

Text Books:

1. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 5th edition**,** 2016, Narosa Pub.
2. B.S. Grewal, Higher Engineering Mathematics, 44nd edition**, 2018,** Khanna Publishers.
3. S. C. Gupta & V. K. Kapoor, Probability and Statistics, 12th edition**, 2020,** S Chand Publication.

Reference Books and Online Source:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, 2015, John Wiley & Sons.
2. George W. and William G, Statistical Methods, 10th Edition, 2014, IBH Publication.
3. Online Source: NPTEL.

Mathematics Department

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Course Outcomes (COs) of the Course

B.Tech. II Semester [Branch: Civil Engineering]

Course Name: Mathematics-II Course Code: MA12103 L: T: P= 3: 1: 0 Credit: 4

CO	Statement
MA12103.1	This unit is designed to make students familiar with the basic concepts of linear algebra, such as vector spaces, basis, dimension, linear transformation. Students will learn basic concepts like eigenvalues, eigenvector and its application, diagonalization, which are fundamental concepts in many engineering problems.
MA12103.2	The course provides a basic understanding of Laplace transformation to address the engineering problems. Student will learn about the application of Laplace transform to evaluate definite integral and to solve the initial value problem.
MA12103.3	This unit provides fundamental knowledge about the Fourier series and Fourier transforms, which are fundamental concepts for solving boundary value problems and to study signal processing problem.
MA12103.4	Development of basic understanding and solution methods for the linear/nonlinear partial differential equations which arises in the modeling of engineering/physical problems. Also, the students will be able to apply the technique to solve wave and Laplace equations.
MA12103.5	Understanding of basic concepts of probability, Random Variables, Probability distributions of random variable, Mathematical Expectation, Mean, Median, Mode and standard deviation.
MA12103.6	The students will have the basic knowledge of distribution and sampling, Method of taking a random sample. Sample distribution of mean, Hypothesis testing.

B.Tech. II Semester [Branch: CSE]

Course Name: Mathematics-II Course Code: MA12104 L: T: P= 3: 1: 0 Credit: 4

Introduction:

This course is one of the basic course of mathematics for Computer Science Engineering branch of engineering students. The emphasis is on the fundamentals and theoretical concepts of mathematics which are needed to understand and solve engineering and scientific problems.

Course Objective:

Objective of this course is to make students proficient on the following contents of the syllabus so that they can use these concepts to understand and to solve engineering problem.

Unit- I Laplace Transform

Unit- II Fourier Series & Fourier Transform

Unit – III Partial Differential Equation

Unit – IV Linear Algebra

Unit -V Eigenvalues and Eigenvectors

Unit- VI Statistics and Probability

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B.Tech. II Semester [Branch: CSE]

Course Name: Mathematics-II Course Code: MA12104 L: T: P= 3: 1: 0 Credit: 4

Unit- I Laplace Transform: (7 Lectures)

Laplace transformation and its properties, Unit – step, Impulse and Periodic functions, Error Function.Inverse Laplace Transform, Convolution Theorem, Evaluation of Integral by Laplace Transform, Application of Laplace transform: Evaluation of Integral and solution of initial value problem.

Unit-II Fourier Series & Fourier Transform: (7 Lectures):

Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral. Fourier Transform, Fourier Sine and Cosine Transform, Finite sine and cosine transform, Convolution theorem.

Unit – III Partial Differential Equation: (7Lectures)

First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non-Linear First Order PDE, Some Standard form -I, II, III, IV. Charpit's method.Higher Order Homogeneous linear PDE with constant coefficients, C. F. & P.I, Non-homogeneous PDE with constant coefficients, C. F. & P. I., Method of separation of variables.

Unit –IV Linear Algebra:(6 Lectures)

Group, Ring, Field, Vector spaces, Subspaces, Linear dependence and independence, Basis and dimension, Dimension theorem.

Unit –V Eigenvalues and Eigenvectors:(6 Lectures)

Linear Transformation, Rank – Nulity Theorem (Statement only), Computation of Rank and nullity of LT, Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Application of Eigenvalues and Eigenvectors: Quadratic form, Diagonalization, Canonical forms.

Unit –VI Statistics and Probability(7 Lectures)

Statistics: Frequency distribution, Measure of Central Tendency- Mean, Median, Mode, Geometric and Harmonic Mean; Mean Deviation, Standard Deviation; Definitions of probability, Conditional probability; Random Variable; Density Function; Discrete and Continuous Random Variables, Probability distributions of random variable; Mathematical Expectation of a Random Variable, Markov and ChebyshevInequality.

Text Books:

1. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 5th edition**,** 2016, Narosa Pub.
2. B.S. Grewal, Higher Engineering Mathematics, 44nd edition**, 2018,** Khanna Publishers.
3. S. C. Gupta & V. K. Kapoor, Probability and Statistics, 12th edition**, 2020,** S Chand Publication.

Reference Books and Online Source:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, 2015, John Wiley & Sons.
2. George W. and William G, Statistical Methods, 10th Edition, 2014, IBH Publication.
3. Qazi Zameeruddin & Surjeet Singh, Modern Algebra, 9th edition 2021, S Chand Publication
4. Online Source: NPTEL.

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Course Outcomes (COs) of the Course

B.Tech. II Semester [Branch: CSE]

Course Name: Mathematics-II Course Code: MA12104 L: T: P= 3: 1: 0 Credit: 4

CO	Statement
MA12104.1	The course provides a basic understanding of Laplace transformation to address the engineering problems. Students will able to apply Laplace transform to evaluate definite integral and to solve the initial value problem.
MA12104.2	This unit provides fundamental knowledge about the Fourier series and Fourier transforms, which are fundamental concepts for solving boundary value problems and to study signal processing problem.
MA12104.3	The course provides a basic understanding and solution methods for the linear/nonlinear partial differential equations which arises in the modeling of engineering/physical problems. The student will be able to solve the PDE's of second order which arises in the modeling of many engineering/physical problems.
MA12104.4	This unit is designed to make students familiar with the basic concepts of Group, Ring, Field, linear algebra such as vector spaces, basis, dimension, etc.
MA12104.5	Students will learn basic concept of linear transformation, eigenvalues, eigenvector, quadratic form, and diagonalization, which are fundamental concepts in many engineering problems.
MA12104.6	Student will be able to understand the basic concepts of statistics and probability theories. Also, students will have basic knowledge of discrete and continuous random variables and their probability distributions, Markov and Chebyshev Inequality.

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B.Tech. II Semester [Branch: EE, ECE]

Course Name: Mathematics-II Course Code: MA12105 L: T: P= 3: 1: 0 Credit: 4

Introduction:

This course is one of the basic course of mathematics for Electrical Engineering and Electronic Communication Engineering students. The emphasis is on the fundamentals and theoretical concepts of mathematics which are needed to understand and solve engineering and scientific problems.

Course Objective:

Objective of this course is to make students proficient on the following contents of the syllabus so that they can use these concepts to understand and to solve engineering problem.

Unit – I Linear Algebra

Unit -II Eigenvalues and Eigenvectors

Unit – III Partial Differential Equation

Unit- IV Laplace Transform

Unit- V Fourier Series

Unit- VI Fourier Transform

B.Tech. II Semester [Branch: EE, ECE]

Course Name: Mathematics-II Course Code: MA12105 L: T: P= 3: 1: 0 Credit: 4

Unit –I Linear Algebra:(6 Lectures)

Vector spaces, Subspaces, Linear dependence and independence, Basis and dimension, Dimension theorem. Linear Transformation, Rank–Nulity Theorem (Statement only), Computation of Rank and nullity of LT, Solution of linear simultaneous algebraic equations.

Unit –II Eigenvalues and Eigenvectors: (6 Lectures)

Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Application of Eigenvalues and Eigenvectors: Quadratic form, Diagonalization, Canonical forms and solving system of first order differential equations.

Unit – III Partial Differential Equation: (8 Lectures)

First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non-Linear First Order PDE, Some Standard form -I, II, III, IV. Charpit's method.Higher Order Homogeneous linear PDE with constant coefficients, C. F. & P.I, Non-homogeneous PDE with constant coefficients, C. F. & P. I., Method of separation of variables.

Unit- IV Laplace Transform: (7 Lectures)

Laplace transformation and its properties, Unit – step, Impulse and Periodic functions, Error Function.Inverse Laplace Transform, Convolution Theorem, Evaluation of Integral by Laplace Transform, Application of Laplace transform to solution of ODE& PDE.

Unit-V Fourier Series (6 Lectures):

Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral.

Unit-VI FourierTransform: (7 Lectures):

Fourier Transform, Fourier Sine and Cosine Transform, Finite sine and cosine transform, Convolution theorem, Application of Fourier Transform to solve boundary value problems (ODE & PDE).

Text Books:

1. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 5th edition**,** 2016, Narosa Pub.
2. B.S. Grewal, Higher Engineering Mathematics, 44nd edition**, 2018,** Khanna Publishers.

Reference Books and Online Source:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, 2015, John Wiley & Sons.
2. Qazi Zameeruddin & Surjeet Singh, Modern Algebra, 9th edition 2021, S Chand Publication
3. Online Source: NPTEL.

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Course Outcomes (COs) of the Course

B.Tech. II Semester [Branch: EE, ECE]

Course Name: Mathematics-II Course Code: MA12105 L: T: P= 3: 1: 0 Credit: 4

CO	Statement
MA12105.1	This unit is designed to make students familiar with the basic concepts of linear algebra, such as vector spaces, basis, dimension, linear transformation, solvability of a system of linear equations, etc.
MA12105.2	Students will learn basic concepts like eigenvalues, eigenvector, quadratic form, and diagonalization, which are fundamental concepts in many engineering problems.
MA12105.3	Development of the basic understanding and solution methods for the linear/nonlinear partial differential equations which arises in the modeling of engineering/physical problems.
MA12105.4	The course provides a basic understanding of Laplace transformation to address the engineering problems governed by ordinary and partial differential equations.
MA12105.5	This unit provides fundamental knowledge about the Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral.
MA12105.6	This unit provides fundamental knowledge about Fourier transforms, Application of Fourier Transform which is fundamental concepts for solving boundary value problems and signal processing.

B.Tech. II Semester [Branch: MED, PI]

Course Name: Mathematics-II Course Code: MA12106 L: T: P= 3: 1: 0 Credit: 4

Introduction:

This course is one of the basic course of mathematics for **MED and PI** branches of engineering students. The emphasis is on the fundamentals and theoretical concepts of mathematics which are needed to understand and solve engineering and scientific problems.

Course Objective:

Objective of this course is to make students proficient on the following contents of the syllabus so that they can use these concepts to understand and to solve engineering problem.

Unit- I Linear Algebra

Unit -II Eigenvalues and Eigenvectors

Unit- III Laplace Transform

Unit- IV Fourier Series& Fourier Transform

Unit – V Partial Differential Equation

Unit – VI Application of Partial Differential Equation

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B.Tech. II Semester [Branch: MED, PI]

Course Name: Mathematics-II Course Code: MA12106 L: T: P= 3: 1: 0 Credit: 4

Unit –I Linear Algebra:(6 Lectures)

Vector spaces, Subspaces, Linear dependence and independence, Basis and dimension, Dimension theorem. Linear Transformation, Rank – Nulity Theorem (Statement only), Computation of Rank and nullity of LT, Solution of linear simultaneous algebraic equations

Unit –II Eigenvalues and Eigenvectors:(6 Lectures)

Eigenvalues and Eigenvectors, Cayley-Hamilton theorem, Application of Eigenvalues and Eigen-vectors, Quadratic form, Diagonalization, Canonical forms.

Unit- III Laplace Transform: (7 Lectures)

Laplace transformation and its properties, Unit – step, Impulse and Periodic functions, Error Function.Inverse Laplace Transform, Convolution Theorem, Evaluation of Integral by Laplace Transform, Application of Laplace transform to solution of ODE& PDE.

Unit-VI Fourier Series & Fourier Transform: (7 Lectures):

Fourier series, Convergence of Fourier Series, Half range series. Fourier Integral, Fourier sine and Cosine Integral, Complex form of Fourier Integral. Fourier Transform, Fourier Sine and Cosine Transform, Finite sine and cosine transform,Convolution theorem, Application of Fourier Transform to boundary value problems.

Unit – V Partial Differential Equation: (8 Lectures)

First order PDE, Formation of PDE, Classification of solution: Complete, General and Particular solution, Lagrange's linear PDE, Non-Linear First Order PDE, Some Standard form -I, II, III, IV. Charpit's method.Higher Order Homogeneous linear PDE with constant coefficients, C. F. & P.I, Non-homogeneous PDE with constant coefficients, C. F. & P. I.

Unit – VI Application of Partial Differential Equation: (6 Lectures)

Classification of Linear PDE of second order: Elliptic, Parabolic and Hyperbolic, Solution of separation of variables. Interior and Exterior BVP : Heat and Wave equation, Laplace Equation

Text Books:

1. R.K. Jain & S.R.K. Iyenger, Advanced Engineering Mathematics, 5th edition, 2016, Narosa Pub.
2. B.S. Grewal, Higher Engineering Mathematics, 44nd edition, **2018,** Khanna Publishers.

Reference Books and Online Source:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, 2015, John Wiley & Sons.
2. Qazi Zameeruddin & Surjeet Singh, Modern Algebra, 9th edition 2021, S Chand Publication
3. Online Source: NPTEL.

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Course Outcomes (COs) of the Course

B.Tech. II Semester [Branch: MED, PI]

Course Name: Mathematics-II Course Code: MA12106 L: T: P= 3: 1: 0 Credit: 4

CO	Statement
MA12106.1	This unit is designed to make students familiar with the basic concepts of linear algebra, such as vector spaces, basis, dimension, linear transformation, solvability of a system of linear equations.
MA12106.2	Students will learn basic concepts like eigenvalues, eigenvector, quadratic form, and diagonalization, which are fundamental concepts in many engineering problems.
MA12106.3	The course provides a basic understanding of Laplace transformation to address the engineering problems governed by ordinary and partial differential equations.
MA12106.4	This unit provides fundamental knowledge about the Fourier series and Fourier transforms, which are fundamental concepts for solving boundary value problems and signal processing.
MA12106.5	Development of the basic understanding and solution methods for the linear/nonlinear partial differential equations which arises in the modeling of engineering/physical problems.
MA12106.6	The student will be able to classify and solve the PDE's of second order which arises in the modeling of many engineering/physical problems. Also, the students will be able to apply the technique to solve wave and Laplace equations.

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प्रयागराज -२११००४ (उ०प्र०), भारत
Department of Physics
Motilal Nehru National Institute of Technology Allahabad
Prayagraj-211004 (U.P.) India

May 13, 2022

Minutes of the meeting of Board of Academics of the Department of Physics held on May 13, 2022 at 10:15 AM in the conference room, Executive Development Centre of the Institute. Following members of BoAC attended the meeting:

1. **Prof. R. K. Singh** — Chairperson
   Dean Academic, MNNIT Allahabad
2. **Dr. Naresh Kumar** — Convener
   Associate Professor and Head
   Physics Department. MNNIT Allahabad
3. **Prof. Ravi Kant Soni,** Professor — External Member
   Physics Department, Indian Institute of Technology Delhi
   Hauz Khas, New Delhi-110016
4. **Prof. Ranjan Kumar Singh**, Professor — External Member
   Institute of Science (BHU)
   Department of Physics
   Banaras Hindu University (BHU), Varanasi -2211005
5. **Dr. Ajay Kumar Singh,** Senior Officer — External Member
   OCES PI Section, Human Resources Development, Division
   BARC Training School Complex, Anushkni Nagar Mumbai- 400094
   [Attended meeting online using MS Teams]
6. **Prof. P. P. Sahay** — Member
   Professor, Physics Department. MNNIT Allahabad
7. **Prof. S. N. Pandey** — Member
   Professor, Physics Department. MNNIT Allahabad
8. **Dr. Animesh K. Ojha** — Member
   Associate Professor, Physics Department. MNNIT Allahabad
9. **Dr. Ravi Prakash** — Member
   Assistant Professor, Physics Department. MNNIT Allahabad

The Chairperson extended a warm welcome to the members of BoAC and thanked them for attending the BoAC meeting. The recommendations of the BoAC on agenda items are as follows:

13.5.22 13/5/22 13.05.2022

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प्रयागराज -२११००४ (उ०प्र०), भारत
Department of Physics,
Motilal Nehru National Institute of Technology Allahabad
Prayagraj-211004 (U.P.) India

Agenda No 1: To discuss the syllabi of the proposed Master of Science (M.Sc.) in Physics, a two-year (four-semester) program by the Department of Physics, MNNIT Allahabad.

Recommendations: The syllabi recommended for Master of Science (M.Sc.) in Physics, a two-year (four-semester) program by the Department of Physics, MNNIT Allahabad is attached herewith as Annexure No. I.

Agenda No 2: Any other items with the permission of the Chair:

To discuss and revised syllabus for B. Tech. first in accordance with National Education Policy (NEP).

Recommendations: The BoAC considered the revised syllabus for B. Tech. first in accordance with National Education Policy (NEP) [letter no 1121/शैक्षिक/2022 dated 28.04.2022] and recommends the course contents of Physics courses to be offered branch wise in their B.Tech. First semester as per followings.

Sr.No	Branch	Course Name	Code	L:T:P	Credit	The detailed syllabus is as per Annexures
1.	Electrical Engineering	Engineering Physics-I	PH11101	2:1:2	4	II
2.	Electronics & Communication Engineering					
3.	Computer Science & Engineering					
4.	Mechanical Engineering	Engineering Physics-II	PH11102	2:1:2	4	III
5.	Production and Industrial Engineering					
6.	Chemical Engineering	Engineering Physics-III	PH11103	2:1:2	4	IV
7.	Biotechnology Engineering					
8.	Civil Engineering					

Meeting ended with the thanks to the Chair.

(R. K. Singh) * (Ajay Kumar Singh) 13/5/22 (Ranjan Kumar Singh) (Ravi Soni) 17/05/2022 (P P Sahay)

(S N Pandey) 13/05/21 (Animeshh K Ojha) 13.05.22 (Ravi Prakash) 13.5.22 (Naresh Kumar)

* Dr. Ajay Kumar Singh attended the meeting and his consent to the minutes annexed.

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Department of Physics
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Prayagraj-211004 (U.P.) India

ANNEXURE-II

B.Tech. Ist Semester [Branch: EE, ECE, CSE]

Course Name: Engineering Physics-I **Course Code:** PH11101 **L:T:P =** 2:1:2 **Credit:** 04

Electrodynamics
Gradient, divergence and curl operations. Spherical and Cylindrical Coordinates. Gauss divergence theorem and Stoke's theorem. Poisson's and Laplace equations. Working of Helmholtz galvanometer. Magnetic vector potential. Displacement current. Maxwell's equations (integral and differential forms) in free space, Propagation of electromagnetic waves in free space.

Quantum Mechanics
Wave particle duality. Wave packets. Phase and group velocity. Heisenberg's uncertainty principle and its applications. Wave function and its physical interpretation. Probabilities and Normalization. Time independent and dependent Schrödinger wave equation and its simple applications.

Solid State Physics
Crystal structure. Space lattice. Unit cell. Miller indices. Interplaner spacing. X-ray diffraction and Bragg's law. Diamagnetism, Paramagnetism and Ferromagnetism. Hysteresis curve. Curie-Weiss Law.

Practical: List of Experiments

1. To measure height of a building using Sextant.
2. To measure co-efficient of thermal conductivity of rubber by Lee's disc method.
3. To study variation of magnetic field along the axis of a current carrying coil.
4. Magnetic field distribution due to Helmholtz coil setup.
5. To determine resistivity by four probe method.
6. To study variation of magnetic field along axis of Helmholtz coil.
7. To measure surface tension using the "break-away" method.
8. To determine specific heat of copper, lead and glass.

Reference Books

1. D. J. Griffths, *Introduction to Electrodynamics*, Prentice Hall of India.
2. S. Gasiorowicz, *Quantum Physics*, John Wiley & Sons.
3. R. Eisberg and R. Resnik, *Quantum Physics*, John Wiley & Sons.
4. A. Beiser, *Concepts of Modern Physics*, Tata McGraw-Hill.
5. Charles Kittel, *Introduction to Solid State Physics*, Wiley India Edition.

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ANNEXURE-III

B.Tech. Ist Semester [Branch: ME, and PIE]

Course Name: Engineering Physics-II **Course Code:** PH11102 **L:T:P =** 2:1:2 **Credit:** 04

Physical Optics

Interference: Condition of observing interference. Fresnel's Biprism. Stoke's treatment. Interference in thin films. Newton's rings.

Diffraction: Fraunhofer's diffraction - Single slit, Double slit and N-slit or plane transmission grating. Rayleigh's criterion of resolution. Resolving power of grating and telescope.

Polarisation: Polarisation by reflection. Double refraction. Half wave and quarter wave plates. Production and analysis of plane. elliptical and circularly polarised light. Optical activity. Specific rotation. Laurent half-shade polarimeter.

Laser

Characteristics of Laser light, Stimulated and spontaneous emission. Population inversion. Einstein's coefficients. Laser emission, Nd-YAG and He-Ne lasers. Applications of laser in engineering.

Special Theory of Relativity

Frame of reference. Inertial and non-inertial frames. Postulates of special theory of relativity, Lorentz transformation of space and time, Length contraction, Time dilation, Addition of velocities. Energy Mass equivalence.

Practical: List of Experiments

1. To measure height of a building using Sextant.
2. Interference of light: Newton's ring.
3. Interference of light: Fresnel's Biprism .
4. Diffraction by a plane transmission grating.
5. Specific rotation of sugar using Polarimeter.
6. Resolving power of a telescope.
7. Surface tension measurement.
8. Variation of magnetic field along the axis of a current carrying coil.
9. Magnetic field distribution due to Helmholtz coil setup.

Reference Books

1. R. Resnik, *Introduction to Special Relativity*, John Wiley & Sons, Inc.
2. A. Ghatak, *Optics*, Tata McGraw-Hill.
3. E. Hecht, *Optics*, Addison-Wesley.
4. A. Beiser, Concepts of Modern Physics, Tata McGraw-Hill.
5. B. Laud, *Lasers and Non-Linear Optics*, Wiley.

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17/05/22

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प्रयागराज -२११००४ (उ०प्र०), भारत
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ANNEXURE-IV

B.Tech. Ist Semester [Branch: Civil Engineering, Chemical Engineering, Biotechnology]

Course Name: Engineering Physics-III **Course Code:** PH11103 **L:T:P =** 2:1:2 **Credit:** 04

Thermodynamics
Concept of heat. Laws of thermodynamics. Entropy. adiabatic isothermal and isobaric process. Carnot cycle and its efficiency. Refrigerator. Clausius-Clapeyron's equation. latent heat. specific heat of solids and gases. thermal conductivity. Maxwell's equations

Solid State Physics
Crystal structure. Space lattice. Unit cell. Miller indices. Interplaner spacing. Characteristic and Continuous. X-ray spectra. Mosley's law. X-ray diffraction and Bragg's law.

Diamagnetism. Paramagnetism. Ferromagnetism. Hysteresis curve. Curie-Weiss Law.

Semiconductors: intrinsic and exterinsic semiconductors, p-type and n-type semiconductors, p-n junction.

Acoustics
Production and detection of ultrasonic waves. Velocity of ultrasonics in liquids and gases. Applications of ultrasonic waves. Acoustics of buildings. Reverberation. Absorption coefficient. Sabines's formula for reverberation time.

Practical: List of Experiments

1. To measure height of a building using Sextant.
2. To measure Coefficient of thermal conductivity of rubber by Lee's disc method.
3. To study variation of magnetic field along the axis of a current carrying coil.
4. Magnetic field distribution due to Helmholtz coil setup.
5. To determine resistivity by four probe method.
6. To study variation of magnetic field along axis of Helmholtz coil.
7. To measure surface tension using the "break-away" method.
8. To determine specific heat of copper, lead and glass.

Reference Books

1. M. W. Zemansky, Richard Dittman, *Heat and Thermodynamics*, McGraw-Hill.
2. Brij Lal and Subramaniam, *Heat Thermodynamics & Statistical Physics*, S. Chand.
3. Charles Kittel, *Introduction to Solid State Physics*, Wiley India Edition.
4. B. Ghosh, *Principles of Acoustics*, Sreedhar Publishers.

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