NATIONAL ENGINEERING COLLEGE

(An Autonomous Institution Affiliated to Anna University Chennai)

K.R.NAGAR, KOVILPATTI

www.nec.edu.in

REGULATIONS – 2023

CURRICULUM & SYLLABUS

B. E. – MECHANICAL ENGINEERING

(Outcome Based Education & Choice Based Credit System)

DEPARTMENT OF MECHANICAL ENGINEERING

I. VISION

Producing globally competitive Mechanical Engineers with social responsibilities

II. MISSION

- Imparting quality education by providing excellent Teaching-Learning environment.
- Inculcating qualities of continuous learning, professionalism, team spirit, communication skill and leadership with social responsibilities.
- Promoting leading-edge research and development through collaboration with academia and industry.

III. PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

PEO 1: Graduates will have successful profession in Mechanical/allied Industries or Research /Academics or business enterprise.

PEO 2: Graduates will broaden their horizons beyond Mechanical Engineering to address the societal and environmental concerns.

PEO 3: Graduates will have the attitudes and abilities of leaders to adapt the changing global scenario.

IV. PROGRAM SPECIFIC OUTCOMES (PSOs)

PSO 1: Apply the concepts of Engineering Design to design, analyze and develop the Mechanical components and systems using the different analytical/CAD/experimental tools.

PSO 2: Apply the concepts of Thermal Engineering to design, analyze and develop the flow and energy systems using the different analytical/experimental/software tools.

PSO 3: Apply the concepts of Production and Industrial Engineering for analysis, optimization and development of mechanical systems.

V. PROGRAM OUTCOMES (POs)

PO 1: **Engineering knowledge:** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO 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.

PO 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.

PO 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.

PO 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.

PO 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.

PO 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.

PO 8: **Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO 9: **Individual and team work:** Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 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.

PO 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.

PO 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.

REGULATIONS 2023

Curriculum and Syllabus

SEMESTER – I

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Induction Programme – 2 weeks									**0**
Theory Courses									
1.	23SH11C	தமிழர்மரபு/ Heritage of Tamils	HSMC	1	0	0	0	1	1
2.	23SH12C	Mathematical Foundations for Engineers	BSC	3	1	0	0	4	4
3.	23SH13C	Introduction to Engineering	ESC	1	0	0	0	1	1
4.	23GN01C	Aptitude Essentials	EEC	1	0	0	0	1	1
Integrated Courses									
5.	23SH14C	Technical English	HSMC	1	0	2	0	3	2
6.	23SH15C	Engineering Physics	BSC	2	0	2	0	4	3
7.	23SH16C	Engineering Chemistry	BSC	2	0	2	0	4	3
8.	23ME11C	Engineering Graphics	ESC	2	0	4	0	6	4
			TOTAL	**13**	**1**	**10**	**0**	**24**	**19**

SEMESTER - II

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23SH21C	தமிழரும்தொழில்நுட்பமும் /Tamils and Technology	HSMC	1	0	0	0	1	1
2.	23GN05C	Professional Ethics and Human Values	HSMC	2	0	0	0	2	2
3.	23ME21C	Fourier Series, Complex Analysis and Calculus	BSC	3	1	0	0	4	4
4.	23ME22C	Materials Science	ESC	2	0	0	0	2	2
5.	23ME23C	Engineering Mechanics	ESC	3	1	0	0	4	4
Integrated Courses									
6.	23SH22C	Professional English	HSMC	1	0	2	0	3	2
7.	23CS11C	Problem Solving Techniques	ESC	3	0	2	0	5	4
8.	23EE13C	Fundamentals of Electrical and Electronics Engineering	ESC	3	0	2	0	5	4
Practical Courses									
9.	23GN02C	Innovation through Design Thinking	EEC	0	0	0	4	4	2
			TOTAL	**18**	**2**	**6**	**4**	**30**	**25**

SEMESTER – III

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23GN04C	Aptitude Excellence	EEC	1	0	0	0	1	1
2.	23ME31C	Engineering Thermodynamics	ESC	3	1	0	0	4	4
3.	23MC02C	Environmental Science and Engineering	MC	2	0	0	0	2	0
Integrated Courses									
4.	23ME32C	Statistics and Numerical Methods	BSC	3	0	0	2	5	4
5.	23ME33C	Basic Manufacturing Processes	PCC	3	0	2	0	5	4
6.	23ME34C	Fluid Mechanics and Hydraulic Machines	PCC	2	1	2	0	5	4
7.	23ME35C	Materials Engineering	PCC	2	0	2	0	4	3
8.	23ME36C	Kinematics of Machinery	PCC	3	0	0	2	5	4
Practical Course									
9.	23GN03C	Intellectual Property Rights Study	EEC	0	0	0	4	4	2
			TOTAL	**19**	**2**	**10**	**4**	**35**	**26**

SEMESTER – IV

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23GN06C	Project Management and Finance	HSMC	2	0	0	0	2	2
2.	23ME41C	Industrial Engineering	PCC V	3	0	0	0	3	3
3.	-	Elective – Science Stream	OEC	3	0	0	0	3	3
4.	23MC01C	Constitution of India	MC	2	0	0	0	2	0
Integrated Courses									
5.	23ME42C	Machining Processes	PCC	3	0	2	0	5	4
6.	23ME43C	Thermal Engineering	PCC	3	0	2	0	5	4
7.	23ME44C	Strength of Materials	PCC	3	0	2	0	5	4
8.	23ME45C	Machine Drawing	PCC	1	0	2	0	3	2
Practical Courses									
9.	23ME46C	System Modeling	EEC	0	0	2	2	4	2
			TOTAL	**20**	**0**	**10**	**2**	**32**	**24**

SEMESTER – V

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	-	Program Elective Course - I	PEC	3	0	0	0	3	3
Integrated Courses									
2.	23ME51C	Heat and Mass Transfer	PCC	2	1	2	0	5	4
3.	23ME52C	Dynamics of Machinery	PCC	2	1	2	0	5	4
4.	23ME53C	Mechatronics, Robotics & Control	PCC	2	0	0	2	4	3
5.	23ME54C	CAD/CAM	PCC	2	0	2	2	6	4
6.	-	Program Elective Course - II	PEC	2	0	0	2	4	3
Practical Courses									
7.	23ME55C	IoT Laboratory	PCC	0	0	2	0	2	1
8.	23ME56C	Simulation using Modern tool	EEC	0	0	2	2	4	2
			TOTAL	**13**	**2**	**10**	**8**	**33**	**24**

SEMESTER – VI

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	23ME61C	Design for Manufacturing & Assembly	PCC	3	0	0	0	3	3
2.	-	Open Elective Course - I	OEC	3	0	0	0	3	3
3.	-	Open Elective Course - II	OEC	3	0	0	0	3	3
Integrated Courses									
4.	23ME62C	Engineering Metrology and Measurements	PCC	2	0	2	0	4	3
5.	23ME63C	Machine Elements and system Design	PCC	3	1	0	2	6	5
6.	23ME64C	Computer Aided Analysis	PCC	2	0	2	2	6	4
7.	-	Program Elective Course - III	PEC	2	0	0	2	4	3
Practical Courses									
8.	23ME65C	Product Development Practice	EEC	0	0	2	2	4	2
			TOTAL	**18**	**1**	**6**	**8**	**33**	**26**

SEMESTER – VII

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Theory Courses									
1.	-	Open Elective Course - III	OEC	3	0	0	0	3	3
Integrated Courses									
2.	-	Program Elective Course - IV	PEC	3	0	0	0	3	3
3.	-	Program Elective Course - V	PEC	3	0	0	0	3	3
4.	-	Program Elective Course - VI	PEC	3	0	0	0	3	3
Practical Courses									
5.	23ME71C	Mini Project	EEC	0	0	0	6	6	3
6.	23ME72C	Internship	EEC	0	0	0	0	0	2
			TOTAL	**12**	**0**	**0**	**6**	**18**	**17**

SEMESTER – VIII

S. No	Course Code	Course Title	Category	Periods Per Week				Total Contact Periods	Credits
				L	T	P	E		
Practical Course									
1.	23ME81C	Capstone Project/Industry Practice	EEC	0	0	0	12	12	6
			TOTAL	**0**	**0**	**0**	**12**	**12**	**6**

TOTAL CREDITS: 167

Regulation 2023 - VERTICALS FOR HONOURS DEGREE / HONOURS DEGREE WITH SPECIALIZATION / MINOR DEGREE						
Department of Mechanical Engineering						
PROFESSIONAL ELECTIVE COURSES VERTICALS						
Sl No.	**Vertical 1**	**Vertical 2**	**Vertical 3**	**Vertical 4**	**Vertical 5**	**Vertical 6**
	CLEAN AND GREEN TECHNOLOGY	***MODERN MOBILITY SYSTEMS***	***ROBOTICS AND AUTOMATION***	***PRODUCT & PROCESS DEVELOPMENT***	***MATERIAS AND MODERN MANUFACTURING ENGINEERING***	***INDUSTRIAL MANAGEMENT***
1	Renewable Energy Sources	Automobile Engineering	Introduction to Robotics	Product Design and Development	Unconventional Machining Processes	Principles of Management
2	Solar Photovoltaic Energy Conversion	Automotive Electronics	Mechanics of Robots	New Product Development	Quality Control of Welded Structures	Total Quality Management
3	Cogeneration and Waste Heat Recovery	Hybrid Electrical Vehicles	Control of Robotic Systems	Design for Manufacture, Assembly and Environments	Non-Destructive Evaluation	Operations Research
4	Power Plant Engineering	Vehicle Systems Design	Electrical Drives and Control	Product Life Cycle Management	Additive Manufacturing	Marketing Management
5	Energy Conservation in Industries	Fundamentals of Digital Electronics	Mechatronics	Piping Design Engineering	Lean Manufacturing	Production Planning and Control
6	Energy Storage Systems	Thermal Management of Batteries and Fuel Cells	Hydraulics and Pneumatics	Computer Graphics and Virtual Reality	Machine Tool Control	Process Planning and Cost Estimation
7	Energy Efficient Buildings	Automotive Materials Components Design and Testing	MEMS Devices – Design and Fabrication	Modelling and Simulation	Computer Integrated Manufacturing	Engineering Economics and Cost Analysis
8	Fuel Cells&Hydrogen Energy	Automated Guided Vehicles	Industry 4.0	Advanced Modeling Techniques	Advanced Engineering Materials	Accounting for Engineers
9	Hybrid Electrical Vehicles		Microprocessor, Microcontroller and Applications	Advanced Engineering Materials		Industrial Safety Engineering

Course Code	தமிழர் மரபு(HERITAGE OF TAMILS)	L	T	P	E	C
23SH11C	(Common to all B.E. / B.Tech. Degree Programmes)	1	0	0	0	1

COURSE OUTCOMES

இப்பாடம் முடிந்ததும் மாணவர்களிடம் வளரும் திறன்

CO1:தமிழ் மொழியின் இலக்கிய வளம்,ஓவிய,சிற்பக் கலையின் பரிணாம வளர்ச்சி நாட்டுப்புறக் கலை மற்றும் வீர விளையாட்டுக்கள் பற்றிய அறிவு மற்றும் விளக்கும் திறன்

CO2:தமிழர்களின் திணைசார் கோட்பாடுகள் மற்றும் இந்திய பண்பாட்டில் தமிழர்களின் பங்கு பற்றிய அறிவு மற்றும் விளக்கும் திறன்

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: know and explain about Tamil literary resources, Dimensional growth of painting and sculpture arts, folk art and martial arts.

CO2: know and explain about Tamils Thinai concepts, contribution of Tamils in Indian National Movements and Indian Culture

CO1:தமிழ் மொழியின் இலக்கிய வளம், ஓவிய,சிற்பக் கலையின் பரிணாம வளர்ச்சி நாட்டுப் புறக் கலை மற்றும் வீரவிளையாட்டுக்கள் பற்றிய அறிவு மற்றும் விளக்கும் திறன் **L:9**

இந்திய மொழிக் குடும்பங்கள் - திராவிட மொழிகள் - தமிழ் ஒரு செம்மொழி –தமிழ் செவ்விலக்கியங்கள் - சங்க இலக்கியத்தின் சமயச் சார்பற்ற தன்மை – சங்க இலக்கியத்தில் பகிர்தல் அறம் - திருக்குறளில் மேலாண்மைக் கருத்துக்கள் - தமிழ்க் காப்பியங்கள், தமிழகத்தில் சமண பௌத்த சமயங்களின் தாக்கம் - பக்தி இலக்கியம், ஆழ்வார்கள் மற்றும் நாயன்மார்கள் - சிற்றிலக்கியங்கள் - தமிழில் நவீன இலக்கியத்தின் வளர்ச்சி - தமிழ் இலக்கிய வளர்ச்சியில் பாரதியார் மற்றும் பாரதிதாசன் ஆகியோரின் பங்களிப்பு - நடுகல் முதல் நவீன சிற்பங்கள் வரை – ஐம்பொன் சிலைகள் - பழங்குடியினர் மற்றும் அவர்கள் தயாரிக்கும் கைவினைப் பொருட்கள், பொம்மைகள் - தேர் செய்யும் கலை - சுடுமண் சிற்பங்கள் - நாட்டுப்புறத் தெய்வங்கள் - குமரிமுனையில் திருவள்ளுவர் சிலை - இசைக் கருவிகள் - மிருதங்கம், பறை, வீணை, யாழ், நாதஸ்வரம் - தமிழர்களின் சமூக பொருளாதார வாழ்வில் கோவில்களின் பங்கு - தெருக் கூத்து, கரகாட்டம், வில்லுப்பாட்டு, கணியான் கூத்து, ஒயிலாட்டம், தோல் பாவைக் கூத்து, சிலம்பாட்டம், வளரி, புலியாட்டம்,தமிழர்களின் விளையாட்டுகள்.

CO1: know andexplain about Tamil literary resources, Dimensional growth of painting and sculpture arts, folk art and martial arts.

Language Families in India - Dravidian Languages – Tamil as a Classical Language – Classical Literature in Tamil – Secular Nature of Sangam Literature – Distributive Justice in Sangam Literature- Management Principles in Thirukural - Tamil Epics and Impact of Buddhism & Jainism in Tamil Land- Bakthi Literature Azhwars and Nayanmars - Forms of minor Poetry - Development of Modernliterature in Tamil - Contribution of Bharathiyar and Bharathidhasan - Hero stone to modern sculpture - Bronze icons - Tribes and their handicrafts - Art of temple carmaking - - Massive Terracotta sculptures, Village deities, Thiruvalluvar Statue at Kanyakumari, Making of musical instruments - Mridhangam, Parai, Veenai, Yazh and Nadhaswaram - Role of Temples in Social and Economic Life of Tamils - Therukoothu, Karagattam, VilluPattu, Kaniyan Koothu, Oyillattam, Leather puppetry, Silambattam,Valari, Tiger dance - Sports and Games of Tamils.

CO2:தமிழர்களின் திணைசார் கோட்பாடுகள் மற்றும் இந்திய பண்பாட்டில் தமிழர்களின் பங்கு பற்றிய அறிவு மற்றும் விளக்கும் திறன் **L:6**

தமிழகத்தின் தாவரங்களும்,விலங்குகளும் - தொல்காப்பியம் மற்றும் சங்க இலக்கியத்தில் அகம் மற்றும் புறக் கோட்பாடுகள் - தமிழர்கள் போற்றிய அறக்கோட்பாடு–சங்ககாலத்தில் தமிழகத்தில் எழுத்தறிவும், கல்வியும் - சங்ககால நகரங்களும் துறைமுகங்களும் - சங்க காலத்தில் ஏற்றுமதி மற்றும் இறக்குமதி கடல் கடந்த நாடுகளில் சோழர்களின் வெற்றி - இந்திய விடுதலைப் போரில் தமிழர்களின் பங்கு - இந்தியாவின் பிறப்பகுதிகளில் தமிழ்ப் பண்பாட்டின் தாக்கம் - சுயமரியாதை இயக்கம் - இந்திய மருத்துவத்தில், சித்த மருத்துவத்தின் பங்கு – கல்வெட்டுகள், கையெழுத்துப் படிகள் - தமிழ்ப் புத்தகங்களின் அச்சு வரலாறு.

CO2: know andexplain about Tamils Thinaiconcepts, contribution of Tamils in Indian National Movements and Indian Culture

Flora and Fauna of Tamils &Aham and Puram Concept from Tholkappiyam and Sangam Literature -Aram Concept of Tamils - Education and Literacy during Sangam Age - Ancient Cities and Ports ofSangam Age - Export and Import during Sangam Age - Overseas Conquest of Cholas - Contribution of Tamils to Indian Freedom Struggle - The Cultural Influence of Tamils over the otherparts of India – Self-Respect Movement - Role of Siddha Medicine in Indigenous Systems ofMedicine – Inscriptions & Manuscripts – Print History of Tamil Books.

REFERENCES:

1. தமிழக வரலாறு–மக்களும் பண்பாடும் - கே.கே.பிள்ளை (வெளியீடு : தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர். இல.சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி–வைகை நதிக்கரையில் சங்ககால நகர நாகரீகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை–ஆற்றங்கரை நாகரீகம். (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils (Dr.K.K.Pillay) A joint publication of TNTB & ESC and RMRL (in print)
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International Institute of Tamil Studies.)
9. Keeladi - ‘Sangam City Civilization on the banks of river Vaigai’ (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to Tamil Nadu (Dr.K.K.Pillay) (Published by: The Author)
11. Porunai Civilization (Jointly Published by: Department of Archaeology & Tamil Nadu Text Book and Educational Services Corporation, Tamil Nadu)
12. Journey of Civilization Indus to Vaigai (R.Balakrishnan) (Published by: RMRL) – Reference Book.

L: 15; TOTAL: 15 PERIODS

Course Code	MATHEMATICAL FOUNDATIONS FOR ENGINEERS	L	T	P	E	C
23SH12C	(Common to all B.E. / B.Tech. Degree Programmes)	**3**	**1**	**0**	**0**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: interpretthe nature of quadratic form by orthogonal transformation.
CO2: identify the maxima and minima of functions.
CO3: solve ordinary differential equations.
CO4: find the solution of partial differential equations.
CO5: evaluate integrals of multivariate calculus.

Soft skill Component

CO6 : develop communication, problem solving and interpersonal skills

L:9, T:3

CO1: interpret the nature of quadratic form by orthogonal transformation.

Characteristic equation – Eigen values and Eigen vectors of a real matrix – Properties of Eigen values and Eigen vectors – Diagonalisation of a matrix by orthogonal transformation – Quadratic forms – Reduction of quadratic form to canonical form by orthogonal transformation and its nature; Cayley – Hamilton theorem (excluding proof) - Application: Stretching of a elastic membrane.

CO2: identify the maxima and minima of functions. **L:9, T:3**

Functions of two variables: Limit, continuity and partial derivatives; Total derivative, Jacobian, Taylor series- Application :Linearization of Non Linear systems using Taylor Series - Maxima and minima - Method of Lagrange multipliers.

CO3: solve ordinary differential equations. **L:9, T:3**

Solutions of first order ordinary differential equations - Equations solvable for ‘p’, equations solvable for ‘y’, equations solvable for ‘x’ - Solutions of higher order linear differential equations with constant coefficients – Cauchy’s and Legendre’s linear equations - Method of variation of parameters – Solution of simultaneous linear differential equation. Application RCL – circuit and Mass Spring System.

CO4: find the solution of partial differential equations. **L:9, T:3**

Formation of partial differential equations – Solutions of standard types of first order partial differential equations - Lagrange’s linear equations - Solutions of homogeneous and Non homogeneous linear partial differential equations of second and higher order with constant coefficient – Application - Shallow wave equations of first order PDE.

CO5 : evaluate integrals of multivariate calculus **L:9, T:3**

Double integration – Cartesian and polar coordinates - Change of order of integration - Change of variables - Cartesian to polar coordinates - Area as double integral - Triple integration - Cartesian and polar coordinates – Change of Variables- Cartesian to spherical and cylindrical coordinates. Application – Moments and centers of mass.

TEXT BOOKS:

1. Grewal.B.S., Higher Engineering Mathematics, Khanna Publications, 44th Edition, 2021.
2. James E. Gentle, Matrix Algebra, Springer International Publishing, 2nd Edition, 2017
3. ShankerRao.G., Linear Albebra, WileyIndia, 1st Edition , 2017

REFERENCES:

1. Bali.N.P. and Manish Goyal, A Textbook of Engineering Mathematics, Laxmi Publications Private Limited, 10th Edition, 2016.
2. Erwin Kreyszig, Advanced Engineering Mathematics, Wiley India, 10th Edition, 2017.
3. Kenneth B. Howell, Ordinary Differential Equations, CRC Press, 2020.
4. James Strewart, Daniel Clegg, Saleem Watson, Essential Calculus Early Trancendentals, Cengage Learning, 9th Edition, 2021.
5. Nanda Kumar A.K, P.S.Datti: Raju .K.George , Ordinary Differential Equations, Cambridge University press, 2017.

L: 45; T: 15; TOTAL: 60 PERIODS

Course Code	INTRODUCTION TO ENGINEERING	L	T	P	E	C
23SH13C	(Common to all B.E. / B.Tech. Degree Programmes)	**1**	**0**	**0**	**0**	**1**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: articulate the importance of Engineering and its role in society through OBE framework
CO2: identify and describe academic pathways towards career settlement

CO1: articulate the importance of Engineering and its role in society through OBE framework **L:9**

Engineering – An introduction, Classification of different Engineering Disciplines, Role of Engineers in Society. Graduate Attributes (GA), Program Specific Criteria (PSC)- Program Educational Objectives (PEO), Program Outcomes (PO), Course Outcomes (CO), Choice Based Credit System (CBCS), course categories, teaching and learning process, active and passive learning, project / problem based learning, different assessments process.

CO2: identify and describe academic pathways towards career settlement **L:6**

Curriculum, cafeteria curriculum and self learning big picture of the Program and the significance of each course in the undergraduate Engineering Program, Discuss the different career paths for an engineering graduate. Career objective, competency requirement.

Case study: Each student has to interact with alumni mentors/seniors/faculty members/surf the internet and present a career path that inspires him/her at the end of the course

REFERENCES:

1. Quamrul H. MazumderIntroduction to Engineering, An Assessment and Problem Solving Approach, CRC Press, 1st Edition, 2016.
2. Saeed Moaveni, "Engineering Fundamentals an Introduction to Engineering", Cengage Learning, USA, 4th Edition, 2011.

L: 15; TOTAL: 15 PERIODS

Course Code	APTITUDE ESSENTIALS	L	T	P	E	C
23GN01C	(Common to all B.E. / B.Tech. Degree Programmes)	**1**	**0**	**0**	**0**	**1**

COURSE OUTCOMES:

Upon the completion of the course the students will be able to

CO1: Recall the fundamentals in quantitative techniques and solve Number series problems quickly
CO2: Develop problem solving skills on Numbers and enhance arithmetic ability
CO3: Infer appropriate comparison and distribution methods using ratio and to form equations
CO4: Improve quantitative skills and solve problems on percentages and profit loss
CO5: Calculate data interpretation and data sufficiency in quantitative aptitude

CO1: Recall the fundamentals in quantitative techniques and solve Number series problems quickly **L : 3**

Numeric series – Finding missing numbers – Odd number out series - Letter series – Symbol series - Alphanumeric series

CO2: Develop problem solving skills on Numbers and enhance arithmetic ability **L : 3**

Number Types - HCF & LCM – Square root- Cubic root - divisibility criteria- Unit digit calculation- Prime factors

CO3: Infer appropriate comparison and distribution methods using ratio and to form equations **L : 3**

Ratio & Proportion: Comparison of Ratios - Variations: Direct and indirect proportionAges: Present Age, Past Age & Future calculation

CO4: Improve quantitative skills and solve problems on percentage and profit loss **L : 3**

Concept of Percentage – Percentage calculation - Calculation of Percentage on Population Results on Depreciation .Profit and Loss –Percentage of Profit and Loss – Discount

CO5: Calculate data interpretation and data sufficiency in quantitative aptitude **L : 3**

Data Interpretation – Pie Chart – Bar Chart – Table Chart .Data Sufficiency in Logical Reasoning : Numbers, Ratio, Ages, Percentage and Profit Loss

REFERENCES:

1. Dr.R.Aggarwal, " Quantitative Aptitude", S Chand Publishing, Revised Edition 2017
2. R.V.Praveen, "Quantitative Aptitude and Reasoning" , 3rd Edition , Eastern Economy Edition, PHI Learning 2016

Video Materials
Profit Loss
https://youtu.be/PpVO7I8dx6U
https://youtu.be/_cW7_BUDYcw
Number series
https://youtu.be/_4ZJFkFE2XU
https://youtu.be/83nJmniFmNk
Numbers
https://youtu.be/81pwuMJ8OIU
https://youtu.be/VT_N9cacgl4
Square root and Cube root
https://youtu.be/nJSqsaT0AgU
https://youtu.be/_HyhwS8P9KY
Problems on Ages
https://youtu.be/6PCTRVmu-ek
https://youtu.be/eAl3BvO_Ipw
Data Interpretation
https://youtu.be/s99rda8e0vc

L: 15; TOTAL: 15 PERIODS

Course Code	TECHNICAL ENGLISH	L	T	P	E	C
23SH14C	(Common to all B.E. / B.Tech. Degree Programmes)	**1**	**0**	**2**	**0**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: apply the fundamental grammar rules in writing
CO2: utilizing phonetic transcription for pronunciation

Practical Component

CO3: apply the basic language skills in various aspects of communication
CO4: utilize technical terms and phrases in specific contexts
CO5: develop the pronunciation skill through various language components
CO6: distinguish different writing forms and interpret text through divergent thinking
CO7: develop effective reports with grammatical and language components

Soft skill Component

CO8: develop communication, team spirit, creativity and time management

CO1: apply the fundamental grammar rules in writing **L:13, P:26**

Parts of Speech - Word Formation using Prefix and Suffix - Sentence formation (Kinds of Sentences) - Tenses (Present, Past & Future tense) – Concord

CO3: apply the basic language skills in various aspects of communication

Diary Writing - Greeting and Self Introduction

CO4: utilize technical terms and phrases in specific contexts

Technical terms and extended definition - Essay Writing (Argumentative Essay and Analytical Essay) - Situational phrases & Conversation - Formal Letter Writing (Permission & Requisition letters)

CO6: distinguish different writing forms and interpret text through divergent thinking

Picture Description, Introduction to Reading Techniques (Skimming, scanning, inferring, predicting, Reading and Reviewing a book (Sci – Fi), E Mail Writing

CO7: develop effective reports with grammatical and language components
Listening and responding to general information (Business context) - Report Writing (Types, Structure, and Stages of report writing) - Checklist

CO2:utilizing phonetic transcription for pronunciation **L:2, P:4**

Phonetics (Vowels & Consonants)

CO5: develop the pronunciation skill through various language components

Word Transformation from one form to another - Letter Writing (Informal) - Listening and responding to general information (General context)

TEXT BOOKS:

1. Paul V. Anderson, Technical Communication: A Reader - Centered Approach, Cengage Learning, 9th Edition, 2017.
2. RavindraNath Tiwari, Technical English-II, Shashwat Publication, 1st Edition, 2020.
3. Stephen D. Krashen, Principles and Practice in Second LanguageAcquisition. Pergamon, 1987.
4. Lester Kaufman and Jane Straus, The Blue Book of Grammar and Punctuation: An Easy-to Use Guide with Clear Rules, Real-World Examples, and Reproducible Quizzes, Wiley, 2021.
5. Wells H. G., The Time Machine, Penguin Classics, 2012.

REFERENCES:

1. Michael McCarthy, English Grammar: The Basics, Taylor & Francis, 2021.
2. Peter Lucantoni and Lydia Kellas, Cambridge IGCSE(TM) English as a Second Language Workbook, Cambridge University Press, 6th Edition, 2022.

L: 15; P: 30; TOTAL: 45 PERIODS

Course Code	ENGINEERING PHYSICS	L	T	P	E	C
23SH15C	(Common to all B.E. / B.Tech. Degree Programmes)	**2**	**0**	**2**	**0**	**3**

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

Theory Components:

CO1: identify the structural properties of crystalline materials

CO2: comprehend and apply the concepts of centre of mass and elasticity

CO3: explain thermodynamic parameters and fundamental laws and their application in various processes

CO4: illustrate the applications of different lasers and optical fibers

CO5:interpret the quantum concepts, to illustrate the quantization of energy, and computation

Practical Components:

CO6: compare the mechanical properties of the materials due to bending and torsion

CO7: analyze thermal conductivity of different bad conducting materials

CO8: explore the light-matter interaction by the phenomenon of interference and diffraction and photoelectric effect

Soft skill Component:

CO9: develop the team spirit and communication skill through group activities

CO1: identify the structural properties of crystalline materials **L:10**

Crystalline and amorphous materials - unit cell - primitive cell - crystal systems, Bravais lattices - Miller indices – interplanar distance – Characteristics of SC, BCC, FCC, HCP structures - Bragg's law - X-ray diffraction and its applications - Synthesis of crystalline materials

CO2: comprehend and apply the concepts of centre of mass and elasticity **L:6,**

CO6: compare the mechanical properties of the materials due to bending and torsion **P:10**

Multi-particle dynamics - Introduction - Center of mass (CM) – CM of continuous bodies - Introduction to rigid bodies - translation - rotation – moment of inertia – theorems of moment of inertia – Torsional pendulum.

Elasticity – Stress - strain diagram and its applications - Moduli of elasticity and its relation - bending of beams - Bending moment – cantilever - theory and experiment - Uniform bending - theory and experiment – Non Uniform bending - I-shaped girders

CO3: explain thermodynamic parameters and fundamental laws and their application in various processes **L:6, P:8**

CO7: analyse thermal conductivity of different bad conducting materials.

Laws of thermodynamics –Thermo dynamical processes – Introduction to heat transfer – conduction - convection and radiation – thermal conductivity of good conductor –Radial flow of heat - Spherical shell method and cylindrical shell method – Thermal conductivity of poor conductor - Lee's disc method– Applications - heat exchangers - refrigerators and ovens

CO4: illustrate the applications of different lasers and optical fibers **L:6,**

CO8: explore the light-matter interaction by the phenomenon of Interference and diffraction and photoelectric effect **P:6**

Lasers: Interaction of light with matter - Einstein coefficients and their relations – characteristics of laser - components of laser – Lasing action – Pumping methods – Types of Laser - Nd-YAG laser -semiconductor laser- Applications

Fiber optics: principle and classification of optical fibers – propagation of light in optical fiber - Numerical aperture and Acceptance angle – losses associated with optical fibers (Qualitative) – Fiber optic communication system - Applications - Displacement and pressure sensors – Endoscopy

CO5: interpret the quantum concepts, to illustrate the quantization of energy, and computation **L:6, P:2**

CO8: explore the light-matter interaction by the phenomenon of interference and diffraction and photoelectric effect

Planck's radiation law - de-Broglie hypothesis – Matter waves - Heisenberg's uncertainty principle – elementary proof – applications – Schrödinger's time-dependent and time-independent wave equation – physical significance of wave function – Introduction to quantum tunneling - applications - particle in a one-dimensional box – tunneling microscope – quantum confinement in 0D, 1D, 2D systems - quantum computation

TEXT BOOKS:

1. AvadhanuluM. N., KshirsagarP.G and Arun MurthyT.V.S, A Text book of Engineering Physics, S.Chand& Co, 11th Edition, 2018.
2. Kleppner D and Kolenkow R. An Introduction to Mechanics. McGraw Hill Education (Indian Edition), 2017.
3. Kenneth S Krane, Modern Physics, Wiley, 4th Edition, 2021.

REFERENCES:

1. WolfsonR., Essential University Physics, Volume 1 & 2, Pearson Education, 2ndIndian Edition, 2009.
2. Hitendra K. Malik, A.K. Singh, Engineering Physics, McGraw Hill Education, 2nd Edition, 2017.
3. Kyungwon An, Fundamentals of Laser Physics, World Scientific Publishing Company, 2023
4. HallidayD, Resnick R andWalker J, Principles of Physics, Wiley, 12th Edition, 2021.

L: 30; P: 30; TOTAL: 60 PERIODS

Course Code	ENGINEERING CHEMISTRY	L	T	P	E	C
23SH16C	(Common to all B.E. / B.Tech. Degree Programmes)	2	0	2	0	3

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

Theory Component:

CO1: explain the suitable water treatment technologies for domestic and industrial applications

CO2: apply the knowledge of corrosion to solve the industrial problems

CO3: describe the preparation, properties and their applications of smart materials in various sectors

CO4: describe the basic components and performance analysis of batteries

CO5: predict the mechanical, electrical and electronics properties of materials using various instrumentation techniques

Practical Component:

CO6: estimate the amount of Ca^{2+}/ Mg^{2+}, alkalinity and Chloride ion present in the water sample.

CO7: quantify the amount of acid and metal ion in the given samples by different analytical techniques

Soft skill Component:

CO8: develop interpersonal, work ethics and communications skills for career settlement

CO1: explain the suitable water treatment technologies for domestic and industrial applications

CO6: estimate the amount of Ca^{2+}/ Mg^{2+}, alkalinity and Chloride ion present in the water sample.

Introduction, sources and impurities in water, potable water specifications (as per WHO and BIS) - hardness-types-estimation of $Ca^{2+}$and Mg^{2+} ion in water by EDTA method. Alkalinity-types-determination of alkalinity of water -chronic daily intake - incremental life time risk - hazard quotient, hazard index, contamination factor - determination of chloride ion in water using Argentometric method-municipal water treatment- physical **L:6, P:12**

methods and chemical methods. Disinfection-internal conditioning - calgon and carbonate conditioning. Desalination-types-Reverse Osmosis (RO) process- Forward osmosis (FO) - electro dialysis - demineralization.

CO2: apply the knowledge of corrosion to solve the industrial problems.

CO7: quantify the amount of acid and metal ion in the given samples by different analytical techniques

Corrosion – mechanism of dry and wet corrosion-forms of corrosion– galvanic corrosion and differential aeration corrosion, crevice corrosion, pitting corrosion, microbial corrosion-stress corrosion, intergranular corrosion - determination of rate of corrosion by weight loss method. **L:6, P:6**

Protection: cathodic protection, surface coatings, corrosion inhibitors. Corrosion of industrial components: corrosion and its control in power industries, automotive industries, chemical processing industries and marine industries.

CO3: describe the preparation, properties and their applications of smart materials in various sectors

Polymers: introduction - classification - functional polymers: electroluminescence polymer, biodegradable polymers, fire retardant polymer, thermo responsive polymer - piezo, ferro and pyroelectric polymer - nanocomposites: introduction, synthesis, properties & applications- synthesis of nanocomposites using sol -gel process **L:6**

CO4: describe the basic components and performance analysis of batteries

Introduction - components - operation principle - Lead acid – Nickel metal hydride batteries- Lithium ions batteries: Lithium polymer battery, Lithium sulphur battery - fabrication and performance evaluation- safety issues - battery management system - recycling of lithium batteries. **L:6**

CO5: predict the mechanical, electrical and electronics properties of materials using various instrumentation techniques

CO7: quantify the amount of acid and metal ion in the given samples by different analytical techniques.

Spectroscopy methods: Beer-Lambert's law and its limitations– UV-visible spectroscopy and IR spectroscopy – principle - instrumentation– applications. Estimation of copper. Electro analytical methods: potentiometric titration - Estimation of Fe^{2+} ion by potentiotometric method. Conductometric method- estimation of HCl by conductometric titration- pH metric method-Estimation of HCl by pH metric titration-applications. Thermal analytical methods: Thermal Gravimetric Analysis (TGA) and Differential Thermal Analysis (DTA)- Thermo Mechanical Analysis (TMA) –principle - instrumentation - Thermo gravimetric analysis of $CuSO_4.5H_2O$- applications. **L:6, P:12**

TEXT BOOKS:

1. Jain P.C. and Jain M, Engineering Chemistry, DhanpatRai Publishing Company, New Delhi, 17th Edition, 2021.
2. Dara S.S and Umare S.S, A Text Book of Engineering Chemistry, S.Chand& Company Limited, 20th Edition, 2018.
3. Agarwal S, Engineering Chemistry, Cambridge Publishing Company, 2nd Edition, 2019

REFERENCES:

1. Benjamin M. M, Water Chemistry, Waveland Press, 2nd Edition, 2019.
2. Cicek V, Corrosion Engineering, Springer Publishing, 1st Edition, 2021.
3. Shahinpoor. M, Fundamentals of Smart Materials, Publisher: Royal Society of Chemistry, 1st Edition, 2020.

4. Berg H, Bernhardsson S, and Johansson P, Electric Vehicle Batteries: Moving from Research towards Innovation, Publisher: Springer, 1st Edition, 2019.
5. Crouch S, Skoog D, Holler F, Principles of Instrumental Analysis, 2017.

L: 30; P: 30; TOTAL: 60 PERIODS

Course Code	PROBLEM SOLVING TECHNIQUES	L	T	P	E	C
23CS11C	(Common to all B.E. / B.Tech. Degree Programmes)	3	0	2	0	4

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to

Theroy Component:

CO1: apply fundamentals of problem solving techniques to develop simple algorithms for arithmetic and logical problems

CO2: apply fundamental, sequential, conditional logic statements and arrays for solving basic problems

CO3: implement modular programming concept using user defined functions

CO4: inscribe programs using pointers and to allocate memory for user defined data types using dynamic memory management functions

CO5: develop file processing application programs

Practical Component:

CO6: develop programs for simple algorithms using sequential and Control structures

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

CO8: develop application programs using structures and files concept.

CO1: apply fundamentals of problem solving techniques to develop simple algorithms for arithmetic and logical problems **L:6**

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Algorithms - Building blocks of algorithms (statements, control flow, functions) - Notation (pseudo code, flow chart) – Problem solving aspect – Top down design – Implementation of algorithms – Program Verification – Efficiency of algorithms – Analysis of algorithm.

CO2: apply fundamental, sequential, conditional logic statements and arrays for solving basic problems **L:12, P:10**

Data Types - Constants – Variables - Keywords – Operators– Problem Solving using fundamental algorithms. Control Statements: Branching and Looping - Algorithms Using Selection and Repetition - Summation of a set of numbers, Reversing Digits of an Integer - Implementation of fundamental algorithms and factoring methods - Array Techniques - Array order reversal, Array Counting, Finding maximum and the minimum value in a set

CO6: develop programs for simple algorithms using sequential and Control structures

Solve problems using control statements (Decision making and Looping)

CO7: inscribe programs using arrays, functions and pointers to work with

multiple data items.

Problem solving based on Array Handling(1D and 2D, Multi-dimensional arrays, traversal, rotation) - Solve problems to handle strings

CO3: implement modular programming concept using user defined functions **L:10, P:8**

Modular Programming approach: Modularization and recursion - Bubble Sort, Selection Sort, Linear Search, Binary Search, Implementation of sorting and searching

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Solve problems by using modular approach (Functions and Recursion)

CO4: inscribe programs using pointers and to allocate memory for user defined data types using dynamic memory management functions **L:12, P:10**

Pointer Concept – add numbers using call by reference – finding maximum number from list of numbers - permutations of a given string using pointers – Implementation of function returns a pointer;

Structures &Union - finding the largest element of an array using Dynamic Memory Allocation – Implementation of Student database in structure using Dynamic Memory Allocation;

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Build efficient solutions to manage memory efficiently through Pointers.

CO8: develop application programs using structures and files concept.

Develop appliactions using Structures

CO5: Develop file processing application programs **L:5, P:2**

File Handling: Files - Introduction, Types of file processing: Sequential access, Random access – Implementation of word count, copy file, Voter's age validation, Marks range validation

CO8: Develop application programs using structures and files concept.

Develop applications using Files

TEXT BOOKS:

1. Maureen Sprankle and Jim Hubbard, Problem Solving and Programming Concepts, Prentice Hall, 9th Edition, 2012.
2. R.G Dromey, How to solve it by Compute, Pearson education, Delhi, 2nd Edition, 2021.

REFERENCES:

1. Behrouz A. Forouzan, Richard F.Gilberg, P.GoldaJeyasheeli, G.Priyanka, S.T.Veena , Problem solving Using C A Structured Programming Approach, Volume I & II, 1st Edition, Cengage Publication, 2022
2. Karl Beecher, Computational Thinking: A Beginner's Guide to Problem Solving and Programming, BCS Learning & Development Limited, 1st Edition, 2017.
3. Byron S. Gottfried, Jitendar Kumar Chhabra, Programming with C, Tata McGraw Hill Publishing Company, New Delhi, 4th Edition, 2018.
4. Kernighan B.W., Ritchie D.M., C Programming Language (ANSI C), Prentice Hall of India Private Limited., New Delhi, 2nd Edition, 2010.

5. PradipDey and Manas Ghosh, Programming in C, Oxford University Press, New Delhi, 2018.
6. Yashavant P. Kanetkar, Let Us C, BPB Publications,16th Edition, 2020
7. H. M.Deitel, P. J. Deitel, C How to Program, Pearson Education., New Delhi, 7th Edition, 2016.

L: 45; P: 30; TOTAL: 75 PERIODS

Course Code	ENGINEERING GRAPHICS	L	T	P	E	C
23ME11C	(Common to MECH, CIVIL, AIDS, EEE, IT)	2	0	4	0	4

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to
CO1: Construct the Engineering Curves and Perform Freehand Sketching.
CO2: Construct the Orthographic Projections of Points, Straight Lines and Lamina
CO3: Draw the Projections of Simple Solids in Different Positions.
CO4: Visualize the Sectional Views and Surface of Various Solids.
CO5: Draw the Isometric and Perspective Projections of Various Solids.

CO1: Construct the Engineering Curves and Perform Freehand Sketching. L:6, P:12

Principles of Engineering Graphics – significance. Usage of Drawing Instruments. Lettering and dimensioning exercise Construction of ellipse, parabola and hyperbola using eccentricity method– Construction of cycloids, Epi and Hypo-cycloids. Orthographic views of simple components by Free hand drawing - Transferring measurement from the given object to the free hand sketches.

CO2: Construct the Orthographic Projections of Points, Straight Lines and Lamina L:6, P:12

Principle of orthographic projections – Conventions - First angle and third angle projections. Projections of points placed in all quadrants – projections of straight lines – inclined to both reference planes - determination of true length and inclinations. Projections of regular polygonal surfaces and circular lamina inclined to both reference planes.

CO3: Draw the Projections of Simple Solids in Different Positions. L:6, P:12

Projections of simple solids like prisms, pyramids, cylinder and cone - axis inclined to one reference plane - change of position method.

CO4: Visualize the Sectional Views and Surface of Various Solids. L:6, P:12

Sectioning of simple solids – Axis perpendicular to horizontal plane- Drawing sectional views with true shape of the section. Development of lateral surfaces of truncated solids – Prisms, pyramids, cylinder and cone.

CO5: Draw the Isometric and Perspective Projections of Various Solids. L:6, P:12

Principles of isometric projection – Isometric scale – Isometric projections of simple solids like prism, pyramid, cone and cylinder – Combination of solids. Perspective projections of simple solids by visual-ray method

TEXT BOOKS:

1. Bhatt N.D, "Engineering Drawing", 54th Edition, Charotar Publishing House, 2023.
2. Shah M.B and Rana B.C, "Engineering Drawing", Pearson Education, 2nd Edition, 2009.

REFERENCES:

1. Natrajan K.V., "A text book of Engineering Graphics", Dhanalakshmi Publishers, Chennai, 2009.
2. Agrawal B. & Agrawal C.M., "Engineering Graphics", TMH Publication,2nd Edition, 2013
3. Narayana K.L. &Kannaiah P, "Text book on Engineering Drawing", Scitech Publishers, 2011.
4. Gopalakrishna K.R, "Engineering Drawing", Subhas Publications, 32nd Edition, 2017.

L: 30; P: 60; TOTAL: 90 PERIODS

Course Code	தமிழரும் தொழில்நுட்பமும் (TAMILS AND TECHNOLOGY)	L	T	P	E	C
23SH21C	(Common to all B.E. / B.Tech. Degree Programmes)	1	0	0	0	1

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

CO1: தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் தொழில்நுட்பம், உற்பத்தித் தொழில்நுட்பம் பற்றிய அறிவு மற்றும் விளக்கும் திறன்.

CO2: தமிழர்களின் வேளாண்மை மற்றும் நீர்ப்பாசனத் தொழில்நுட்பம், அறிவியல் தமிழ் மற்றும் கணினித் தொழில்நுட்பம் பற்றிய அறிவு மற்றும் விளக்கும் திறன்.

Upon the successful completion of the course, the student will be able to

CO1: Know and explain about Tamils weaving and Pottery technology, Design and construction Technology and Manufacturing Technology.

CO2: Know and explain about Tamils Agriculture and irrigation technology, Scientific Tamil and Tamil computing

CO1: தமிழர்களின் நெசவு மற்றும் பானைத் தொழில்நுட்பம், வடிவமைப்பு மற்றும் கட்டிடத் தொழில்நுட்பம் மற்றும் உற்பத்தித் தொழில்நுட்பம் பற்றிய அறிவு மற்றும் விளக்கும் திறன் **L:9**

சங்க காலத்தில் நெசவுத் தொழில் - பானைத் தொழில்நுட்பம் - கருப்பு சிகப்பு பாண்டங்கள் - பாண்டங்களில் கீறல் குறியீடுகள்- சங்க காலத்தில் வடிவமைப்பு மற்றும் கட்டுமானங்கள் & சங்க காலத்தில் வீட்டுப் பொருட்களில் வடிவமைப்பு - சங்க காலத்தில் கட்டுமான பொருட்களும் நடுகல்லும் - சிலப்பதிகாரத்தில் மேடை அமைப்பு பற்றிய விவரங்கள் - மாமல்லபுரச் சிற்பங்களும் கோவில்களும் - மாதிரி கட்டமைப்புகள் பற்றி அறிதல், மீனாட்சி அம்மன் ஆலயம் மற்றும் திருமலை நாயக்கர் மஹால் - செட்டி நாடு வீடுகள் - பிரிட்டிஷ் காலத்தில் சென்னையில் இந்தோ-சாரோசெனிக் கட்டிடக்கலை- கப்பல் கட்டும் கலை - உலோகவியல் - இரும்புத் தொழிற்சாலை - இரும்பை உருக்குதல், எஃகு - வரலாற்றுச் சான்றுகளாக செம்பு மற்றும் தங்க நாணயங்கள் - நாணயங்கள் அச்சடித்தல் - மணி உருவாக்கும் தொழிற்சாலைகள் - கல் மணிகள், கண்ணாடி மணிகள் - சுடுமண் மணிகள் - சங்கு மணிகள் - எலும்புத் துண்டுகள் - தொல்லியல் சான்றுகள் - சிலப்பதிகாரத்தில் மணிகளின் வகைகள்.

CO1: KNOW AND EXPLAIN ABOUT WEAVING AND CERAMIC TECHNOLOGY, DESIGN AND CONSTRUCTION TECHNOLOGY, MANUFACTURING TECHNOLOGY

Weaving Industry during Sangam Age – Ceramic technology – Black and Red Ware Potteries (BRW)– Graffiti on Potteries- Designing and Structural construction House & Designs in household materials duringSangam Age - Building materials and Hero stones of Sangam age — Details of Stage Constructions in Silappathikaram- Sculptures and Temples of Mamallapuram- Great Temples of Cholas and other worship places - Temples of Nayaka Period - Type study (Madurai Meenakshi Temple)- ThirumalaiNayakarMahal - Chetti Nadu Houses, Indo –Saracenic architecture at Madras during British Period- Art of Ship Building - Metallurgical studies - Iron industry - Iron smelting, steel -Copper and gold Coins as source of history - Minting of Coins — Beads making-industries Stone beads -Glass beads - Terracotta beads -Shell beads/ bone beats - Archeological evidences – Gemstone types described in Silappathikaram.

CO2: தமிழர்களின் வேளாண்மை, நீர்ப்பாசனத் தொழில்நுட்பம், அறிவியல் தமிழ் மற்றும் கணினித் தமிழ் பற்றிய அறிவு மற்றும் விளக்கும் திறன். **L:6**

அணை, ஏரி, குளங்கள், மதகு - சோழர்காலக் குமுழித் தூம்பின் முக்கியத்துவம் - கால்நடை பராமரிப்பு - கால்நடைகளுக்காக வடிவமைக்கப்பட்ட கிணறுகள் - வேளாண்மை மற்றும் வேளாண்மைச் சார்ந்த செயல்பாடுகள் - கடல்சார் அறிவு - மீன்வளம் - முத்து மற்றும் முத்துக்குளித்தல் - பெருங்கடல் குறித்த பண்டைய அறிவு - அறிவுசார் சமூகம்- அறிவியல் தமிழின் வளர்ச்சி - கணினித்தமிழ் வளர்ச்சி - தமிழ் நூல்களை மின்பதிப்பு செய்தல் - தமிழ் மென்பொருட்கள் உருவாக்கம் - தமிழ் இணையக் கல்விக் கழகம் - தமிழ் மின் நூலகம் - இணையத்தில் தமிழ் அகராதிகள் - சொற்குவைத் திட்டம்.

CO2: KNOW AND EXPLAIN ABOUT AGRICULTURE TECHNOLOGY, IRRIGATION TECHNOLOGY, SCIENTIFIC TAMIL & TAMIL COMPUTING

Dam, Tank, ponds, Sluice, Significance of Kumizhi Thoompu of Chola Period, Animal Husbandry - Wells designed for cattle use - Agriculture and Agro Processing – Knowledge of Sea - Fisheries — Pearl - Conche diving - Ancient Knowledge of Ocean – Knowledge Specific Society- Development of Scientific Tamil - Tamil computing – Digitalization of Tamil Books –Development of Tamil Software – Tamil Virtual Academy – Tamil Digital Library – Online Tamil Dictionaries– Sorkuvai Project.

REFERENCE BOOKS:

1. தமிழக வரலாறு–மக்களும் பண்பாடும் - கே. கே. பிள்ளை (வெளியீடு: தமிழ்நாடு பாடநூல் மற்றும் கல்வியியல் பணிகள் கழகம்)
2. கணினித் தமிழ் - முனைவர் இல. சுந்தரம் (விகடன் பிரசுரம்)
3. கீழடி – வைகை நதிக்கரையில் சங்ககால நகர நாகரிகம் (தொல்லியல் துறை வெளியீடு)
4. பொருநை – ஆற்றங்கரை நாகரிகம் (தொல்லியல் துறை வெளியீடு)
5. Social Life of Tamils(Dr.K.K.Pillay)A joint publication of TNTB & ESC and RMRL
6. Social Life of the Tamils - The Classical Period (Dr.S.Singaravelu) (Published by: International Institute of Tamil Studies.
7. Historical Heritage of the Tamils (Dr.S.V.Subatamanian, Dr.K.D. Thirunavukkarasu) (Published by: International Institute of Tamil Studies).
8. The Contributions of the Tamils to Indian Culture (Dr.M.Valarmathi) (Published by: International InstituteofTamilStudies.)
9. Keeladi-Sangam City Civilization on the banks of river Vaigai (JointlyPublishedby:Department of Archaeology &Tamil NaduText Book and Educational Services Corporation, Tamil Nadu)
10. Studies in the History of India with Special Reference to TamilNadu (Dr.K.K.Pillay) (Published by: The Author)

L: 15; TOTAL: 15 PERIODS

23GN05C	**PROFESSIONAL ETHICS AND HUMAN VALUES**	**L**	**T**	**P**	**E**	**C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**2**	**0**	**0**	**0**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

CO1: Recognize and practice the core human values and theories related to ethical behavior.

CO2: Analyze the engineering ethical breach from past study.

CO3: Distinguish and apply safety, responsibility and rights in workplaces.

CO1: Recognize and practice the core human values and theories related to ethical behavior **L: 10**

Moral dilemmas and moral autonomy - Kohlberg's theory - Gilligan's theory - Consensus and controversy –Case studies: Vigil mechanism, Whistle blowing - Protected disclosures - Personal ethics, work ethics and human values - Governing Regulation.

CO2 : Analyze the engineering ethical breach from past study **L: 10**

Engineering as experimentation - engineers as responsible experimenters - codes of ethics - a balanced outlook on law - Case study: The challenger disaster

CO3 : Distinguish and apply safety, responsibility and rights in workplaces **L: 10**

Safety and risk - assessment of safety and risk - risk benefit analysis and reducing risk - Collegiality and loyalty - respect for authority – confidentiality; Collective bargaining, Conflicts of interest - Case study; Occupational crime - professional rights - employee rights - Intellectual Property Rights (IPR) - discrimination. Case studies: The Three mile island and Chernobyl disaster

TEXT BOOK

1. Mike W Martin and Roland Schinzinger, "Ethics in Engineering", McGraw Hill, New York, 5th Edition, 2022

REFERENCES

1. Behnam Taebi, "Ethics and Engineering: An Introduction", Cambridge University Press, 2021
2. Ajesh Faizal, Aswathy S U, Roy V I, "Professional Ethics in Engineering: an Industry Perspective", Noor Publishing, 2021
3. R.S.Naagarazan, "A Textbook on Professional Ethics and Human Values", New age International Pvt. Ltd; 3rd Edition, 2022
4. Dr.P.Elamurugan, "Professional Ethics in Engineering", Notion Press, 2021

L:30; TOTAL:30 PERIODS

Course Code	**FOURIER SERIES, COMPLEX ANALYSIS AND**	**L**	**T**	**P**	**E**	**C**
23ME21C	**CALCULUS**	**3**	**1**	**0**	**0**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: perform Fourier series expansion of the functions.
CO2: calculate the Fourier series solution of Wave and Heat equation.
CO3: interpret analytic function in transformations.
CO4: evaluate complex integration over contour.
CO5: analyze the concepts related to vector field.

CO 1 : perform Fourier series expansion of functions

Dirichlet's conditions – General Fourier series – Half range series – Complex form of Fourier series – Parseval's identity – Harmonic analysis – Identification of frequencies. **L:9,T:3**

CO2 : calculate Fourier series solution of Wave and Heat equation

Fundamentals of Fourier series - Half range Fourier series - Classification of Partial Differential Equations - Fourier series solutions of one dimensional wave equation - One dimensional heat equation - Steady state solution of two dimensional heat equation (Insulated edges excluded). **L:9,T:3**

CO3 : interpret analytic function in transformations

Analytic functions - Necessary and Sufficient conditions (excluding proofs) - Harmonic and orthogonal properties of analytic functions - Harmonic conjugate - Construction of analytic functions- fluid flow problems-Conformal mapping: w= z+c, cz, 1/z and bilinear transformation. **L:9,T:3**

CO4 : evaluate complex integration over contour

Statement and applications of Cauchy's integral theorem and Cauchy's integral formula (excluding proofs) – Taylor's and Laurent's expansions - Singular points - Residues - Residue theorem (excluding proof) - Application of residue theorem to evaluate real integrals - Unit circle and semi - circular contour (excluding poles on boundaries). **L:9,T:3**

CO5 : analyze the concepts of calculus in vector fields

Differentiation of vectors : Gradient, Divergence, Curl and Directional derivatives – Line, Surface and Volume Integrals - Statement of Green's, Gauss divergence and Stokes' theorem - Simple applications involving rectangular parallelepiped and cubes. **L:9,T:3**

TEXT BOOKS:

1. Grewal.B.S., Higher Engineering Mathematics, 44th Edition, Khanna Publications, Delhi, 2021.
2. Erwin Kreyszig, "Advanced Engineering Mathematics", 10th Edition, Wiley India, 2017.

REFERENCE BOOKS:

1. Bali.N.P. and Manish Goyal, A Textbook of Engineering Mathematics, 10th Edition, Laxmi Publications Private Limited, 2016.
2. Jain.R.K. and Iyengar.S.R.K., Advanced Engineering Mathematics, 5th Edition, Narosa Publishing House Private Limited, 2016
3. Ramana B.V, Higher Engineering Mathematics, Tata Mc-Graw Hill Publishing Company, New Delhi, 2017.
4. Michael D .Greenberg, Advanced Engineering Mathematics, 2nd Edition, Pearson Education, 2021.

L: 45; T: 15; TOTAL: 60 PERIODS

Course Code	**MATERIALS SCIENCE**	**L**	**T**	**P**	**E**	**C**
23ME22C		**2**	**0**	**0**	**0**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: describe the preparation, properties, and applications of glass, ceramics and nanomaterials.

CO2: qualitatively analyze different materials based on their magnetic properties and explain the applications of magnetic materials in various sectors.

CO3: interpret the properties of the various solar materials and their role in the energy production.

CO1: describe the preparation, properties, and applications of glass, ceramics and nanomaterials.

Glass: Introduction - classifications - manufacturing process – commercial and Industrial applications. Glass durability: controlling factors, Improvement of durability, durability measurements, and mechanism of reactions of solutions with glass surfaces. Effect of temperature and composition on the physical properties. Colours in glasses: role of transition metal ions in glass manufacturing - application of redox reactions. Decolorization and refining of glasses, methods of testing of glass quality. **L:18**

Engineering Ceramics: Introduction - Classification – Preparation, properties and applications of Boron carbide, Silicon carbide, Nitrides: Boron, Silicon and aluminium nitrides. Refractories: Introduction - types; acidic, basic and neutral refractories. properties, manufacturing process and applications.

Nanomaterials: Introduction - size dependence of properties –classification. Synthesis; laser ablation method and hydrothermal methods. Characterization techniques: Scanning and Transmission Electron Microscopy – Principle-Instrumentation (Block diagramme only).

CO2: qualitatively analyze different materials based on their magnetic properties and explain the applications of magnetic materials in various sectors. **L-6**

Magnetic materials: Introduction - types - Soft, hard and Ferrite magnetic materials: properties, and applications. Applications of magnetic materials in spintronics, magnetic information storage, magneto resistance in thin film structures, sensors, and memory elements in computers.

CO3: interpret the properties of the various solar materials and their role in the energy production. **L-6**

Solar collector materials – Glazing materials – Absorber materials - Insulation materials - Reflecting materials – Phase change materials. Photovoltaic materials: Direct and indirect band-gap materials. Solar grade silicon: Mono and multi crystalline silicon solar cells. CIGS – Dye sensitised solar cells-Pervoskite solar cells

REFERENCES:

1. William J Callister, Introduction to Materials Science and Engineering, John Wiley & Sons, Inc. 12th Edition, Reprint 2021.
2. Vijayamohanan K Pillai, Meera Parthasarathy, Functional Materials: A Chemist's Perspective,

Universities Press, 2013.
3. Smith, Foundations for material science and engineering McGraw-Hill, 4th Edition, 2019.
4. Master, IES, Basics of material science & engineering, 7th Edition, Ies Master Publication, 2022.
5. David Kingery.W, Introduction to Ceramics, Wiley & Sons, 2013.
6. Duffie, J.A., and Beckman, W.A. Solar Energy Thermal Process, John Wiley and Sons, NewYork, Jui Sheng Hsieh, Solar Energy Engineering, Prentice Hall, 2017.
7. Barry Carter.C, Grant Norton. M., Ceramic Materials: Science and Engineering, Springer Verlag New York Inc., 5th Edition 2021.

L : 30; TOTAL : 30 PERIODS

Course Code	ENGINEERING MECHANICS	L	T	P	E	C
23ME23C		3	1	0	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Apply laws of mechanics to analyze the system of forces acting on particles and rigid bodies.
CO2: Evaluate the reactions in supports and perform force analysis on structures.
CO3: Compute the centroid and moment of inertia of lamina.
CO4: Apply the concepts of dry friction and compute the frictional forces for bodies in contact
CO5: Apply the fundamental principles of kinematics and kinetics of particles

CO1 Apply laws of mechanics to analyze the system of forces acting on particles and rigid bodies. **12**

Particles: Forces on a particle, Laws of Mechanics - transmissibility, resultant of two forces and several concurrent forces - resolution of a force, equilibrium of a particle, free body diagram, force in space - equilibrium of a particle in space; Rigid Bodies: Moment of a force – Varignon's theorem – Force Couple System –Reduction of system of forces into one force and couple – Equilibrium of rigid bodies in 2D.
Experimentation – Solving of forces in equilibrium of particles using pulley-hanging mass setup

CO2 Evaluate the reactions in supports and perform force analysis on structures. **12**

Types of supports, Types of Loading and determination of reactions. Structures: Simple trusses: Assumptions and Analysis of Plane Truss - Method of joints, method of sections, joints underspecial loading conditions, Failure of Joints, Analysis of frames.
Demonstration – Estimation of support reactions using a simply supported beam setup

CO3 Compute the centroid and moment of inertia of lamina. **12**

Centroids of areas, composite areas, Pappus and Guldinus theorems - determination ofmoment of inertia of plane figures, Parallel and perpendicular axis theorem - radius of gyration - polar moment of inertia
Demonstration – Centre of gravity of composite lamina, Significance of area moment of inertia in deflection of simply supported beams

CO4 Apply the concepts of dry friction and compute the frictional forces for bodies in contact **12**

Role of frictional force – Types of friction – Limiting friction – coefficientof static and kinetic friction - angle of friction – Coulomb's law of friction – Angle of Repose – Cone of friction –Problems in ladder friction, belt friction and wedge friction.
Experimentation – Estimate the coefficient of static and kinetic friction for various surfaces

CO5 Apply the fundamental principles of kinematics and kinetics of particles **12**

Kinematics: Rectilinear Motion – Uniform and Variable acceleration – Motion of particle under gravity – Relative motion. Curvilinearmotion; Kinetics: Newton's Second Law of motion – D'Alembertz Principle, Work energy principle. Impulse-Momentum principle – Motion of singular body and connected bodies.
Demonstration – Kinetics of connected bodies using pulley-mass system

TEXT BOOKS

1. Hibbeler R C, "Engineering Mechanics: Statics & Dynamics", Pearson India Education Services Private Limited, 14th Edition, 2018.
2. Irving H Shames and G.Krishna Mohana Rao, "Engineering Mechanics-Statics and Dynamics", Pearson Education, 4th Edition, 2016.
3. Timoshenko, DH Young, J V Rao, S Pati, "Engineering Mechanics", Mcgraw Hill Education Pvt. Ltd., 5th Edition, 2013.

REFERENCES

1. Beer FP, Mazurek DF, Sanghi S, Eisenberg ER, Johnston ER and Cornwell PJ, "Vector Mechanics for Engineers: Statics and Dynamics", Tata McGraw Hill Education Private Limited, 12th Edition, 2019.
2. Meriam J.L and Kraig L.G, "Engineering Mechanics-Statics and Dynamics", John Wiley & sons, New York, 9th Edition, 2021.
3. N.H.Dubey, "Engineering Mechanics – Statics and Dynamics", Tata McGraw-Hill Publishing Company, New Delhi, 2017.
4. Rajasekaran S and Sankarasubramanian G, "Fundamentals of Engineering Mechanics", Vikas Publishing House Private Limited, 3rdEdition, 2017.
5. Bansal RK, "A Textbook of Engineering Mechanics", Laxmi Publications (P) Ltd., 8th Edition New Delhi, 2017.
6. Nelson A, "Engineering Mechanics-Statics and Dynamics", Tata McGraw-Hill Publishing Company, New Delhi, 1st Edition 2019.

L:45; T:15; TOTAL:60 PERIODS

Course Code	PROFESSIONAL ENGLISH	L	T	P	E	C
23SH22C	(Common to all B.E. / B.Tech. Degree Programmes)	**2**	**0**	**2**	**0**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: extend the primary language skills to develop critical thinking

CO2: build the secondary language skillsfor professional competence

Practical Component

CO3: apply the vital sub-functions of listening in particular context
CO4: take part in propagating ideas through effective oral communication
CO5: inferring information using various reading techniques
CO6: construct professional content via distinct methods of writing

Soft skill Component

CO7: develop interpersonal, communicational and behavioral attributes

CO1:extend the primary language skills to develop critical thinking
CO3: apply the vital sub-functions of listening in particular context L:6,P:16
CO4: take part in propagating ideas through effective oral communication

If Conditionals – Standard Abbreviations –Types of Listening (Comprehensive, Informational, Critical Listening) –One Word Substitution, Components of Speaking

Listening for Specific Information –Listening to Speech (Oxford Union Society) – Listening to Science Talks or Theories

Product Description – Chart Description – Process Description – Group Discussion (Uses – Structure – Strategies – Team Work – Positive & Negative Body Languages – Samples – Demo)

CO2:build the secondary language skills for professional competence L:5,P:18
CO5: inferring information using various reading techniques
CO6: construct professional content via distinct methods of writing

Synonyms – Intensive and Extensive Reading –Error Spotting (Based on Concord, Pronoun, Articles & Adverb Placement)– Writing Style (Persuasive, Expository & Descriptive)

Newspaper Reading – Reading Comprehension (Fiction & NonFiction)

Business Letters for Quotations and Clarification, Placing Orders and Making Complaints – Proposal Writing – Job Application Letter & Resume Preparation – Paragraph Writing – Content Writing

TEXT BOOKS

1. Lucantoni, Peter& Lydia Kellas. “English as a Second Language Workbook”, 6th Edition, Cambridge University Press, 2022.
2. Twain, Mark. “The Adventures of Tom Sawyer”, 1st Edition, Pegasus, 2012.
3. Clear, James. “Atomic Habits”, 1st Edition, Dreamliners, 2022.
4. Garcia, Hector & Francesc Miralles. Ikigai: The Japanese Secret to a long and Happy Life. 1st Edition, Tuttle Publishing, 2021.
5. Elbow, Peter, “Writing with Power”, 2nd Edition, Oxford University Press, 1998.

REFERENCES

1. Butterfield, Jeff. “Soft Skills for Everyone”, 2nd Edition, Cengage, 2020
2. Raman, Meenashi & Sangeetha Sharma. Professional English, 1st Edition, Oxford University Press, 2018

L: 11; P: 34; TOTAL: 45 PERIODS

Course Code	PROBLEM SOLVING TECHNIQUES	L	T	P	E	C
23CS11C	(Common to all B.E. / B.Tech. Degree Programmes)	3	0	2	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theroy Component

CO1: apply fundamentals of problem solving techniques to develop simple algorithms for arithmetic and logical problems

CO2: apply fundamental, sequential, conditional logic statements and arrays for solving basic problems

CO3: implement modular programming concept using user defined functions

CO4: inscribe programs using pointers and to allocate memory for user defined data types using dynamic memory management functions

CO5: develop file processing application programs

Practical Component

CO6: develop programs for simple algorithms using sequential and Control structures

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

CO8: develop application programs using structures and files concept.

CO1: apply fundamentals of problem solving techniques to develop simple algorithms for arithmetic and logical problems **L:6**

Overview of programming: Problem Solving in Everyday Life, Types of Problem, Computer-based problem solving, Algorithms - Building blocks of algorithms (statements, control flow, functions) - Notation (pseudo code, flow chart) – Problem solving aspect – Top down design – Implementation of algorithms – Program Verification – Efficiency of algorithms – Analysis of algorithm.

CO2: apply fundamental, sequential, conditional logic statements and arrays for solving basic problems **L:12, P:10**

Data Types - Constants – Variables - Keywords – Operators– Problem Solving using fundamental algorithms. Control Statements: Branching and Looping - Algorithms Using Selection and Repetition - Summation of a set of numbers, Reversing Digits of an Integer - Implementation of fundamental algorithms and factoring methods - Array Techniques - Array order reversal, Array Counting, Finding maximum and the minimum value in a set

CO6: develop programs for simple algorithms using sequential and Control structures

Solve problems using control statements (Decision making and Looping)

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Problem solving based on Array Handling (1D and 2D, Multi-dimensional arrays, traversal, rotation) - Solve problems to handle strings

CO3: implement modular programming concept using user defined functions **L:10, P:8**

Modular Programming approach: Modularization and recursion - Bubble Sort,

Selection Sort, Linear Search, Binary Search, Implementation of sorting and searching

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Solve problems by using modular approach (Functions and Recursion)

CO4: inscribe programs using pointers and to allocate memory for user defined data types using dynamic memory management functions **L:12, P:10**

Pointer Concept – add numbers using call by reference – finding maximum number from list of numbers - permutations of a given string using pointers – Implementation of function returns a pointer;

Structures & Union - finding the largest element of an array using Dynamic Memory Allocation – Implementation of Student database in structure using Dynamic Memory Allocation;

CO7: inscribe programs using arrays, functions and pointers to work with multiple data items.

Build efficient solutions to manage memory efficiently through Pointers.

CO8: develop application programs using structures and files concept.

Develop applications using Structures

CO5: Develop file processing application programs **L:5, P:2**

File Handling: Files - Introduction, Types of file processing: Sequential access, Random access – Implementation of word count, copy file, Voter's age validation, Marks range validation

CO8: Develop application programs using structures and files concept.

Develop applications using Files

TEXT BOOKS:

1. Maureen Sprankle and Jim Hubbard, Problem Solving and Programming Concepts, Prentice Hall, 9th Edition, 2012.
2. R.G Dromey, How to solve it by Compute, Pearson education, Delhi, 2nd Edition, 2021.

REFERENCES:

1. Behrouz A. Forouzan, Richard F.Gilberg, P.Golda Jeyasheeli, G.Priyanka, S.T.Veena , Problem solving Using C A Structured Programming Approach, Volume I & II, 1st Edition, Cengage Publication, 2022
2. Karl Beecher, Computational Thinking: A Beginner's Guide to Problem Solving and Programming, BCS Learning & Development Limited, 1st Edition, 2017.
3. Byron S. Gottfried, Jitendar Kumar Chhabra, Programming with C, Tata McGraw Hill Publishing Company, New Delhi, 4th Edition, 2018.
4. Kernighan B.W., Ritchie D.M., C Programming Language (ANSI C), Prentice Hall of India Private Limited, New Delhi, 2nd Edition, 2010.
5. PradipDey and Manas Ghosh, Programming in C, Oxford University Press, New Delhi, 2018.
6. Yashavant P. Kanetkar, Let Us C, BPB Publications,16th Edition, 2020

7. H. M.Deitel, P. J. Deitel, C How to Program, Pearson Education., New Delhi, 7th Edition, 2016.

L: 45; P: 30; TOTAL: 75 PERIODS

Course Code	FUNDAMENTALS OF ELECTRICAL AND	L	T	P	E	C
23EE13C	ELECTRONICS ENGINEERING	3	0	2	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Demonstrate the characteristic parameters of DC and AC circuits.

CO2: Explain the working of AC and DC machines.

CO3: Describe the analog and digital instruments for monitoring and control.

CO4: Demonstrate the operation of electronic and digital devices for applications.

CO5: Infer the purpose of wiring and safety.

Practical Component

CO6: Analyze basic electric circuits and characteristics of electrical machines.

CO7: Demonstrate the functionality of instruments and characteristics of electronics devices.

CO8: Perform residential wiring and measure earth resistance.

CO1: Demonstrate the characteristic parameters of DC and AC circuits. **L:9, P:6**

Sources - Passive Elements – Electrical Quantities: Voltage, Current, Power and Energy – DC circuits: Ohms Law – Kirchhoff's Laws – Mesh analysis - AC Circuits: Waveforms, RMS, Peak, real power, reactive power and apparent power, power factor.

CO6: Analyze basic electric circuits and characteristics of electrical machines

1. Verification of Ohms Law and Kirchhoff law.
2. Measurement of AC signal parameter (Peak-Peak, RMS, Period and Frequency)

CO2: Explain the working of AC and DC machines. **L:9, P:8**

Construction, Types of DC motors – Working Principles – Need for Starters - AC Motors: Construction and Working of Single Phase and Three Phase Induction Motor– Servomotor -Stepper motor.

CO6: Analyze basic electric circuits and characteristics of electrical machines.

1. Analyse the characteristics of DC Shunt Motor and DC series motor
2. Load test on single phase and three phase induction motor

CO3: Describe the analog and digital instruments for monitoring and control. **L:9, P:2**

Analog instruments: Functional Elements, Principles: PMMC, MI, And Electrodynamometer wattmeter – Digital voltmeter – energy meter - multimeter – DSO – Multifunction meter.

CO7: Demonstrate the functionality of instruments and characteristics of electronics devices.

1. Calibration of single phase energy meter using wattmeter

CO4: Demonstrate the operation of electronic and digital devices for applications. **L:9, P:6**

Characteristics and applications: Diode – Rectifiers, Zener Diode – Regulators, BJT - LEDs – Photo Diodes, Opto-Isolators- Binary Number System – Logic Gates: Basic gates, Universal gates – Boolean Algebra –ADC and DAC.

CO7: Demonstrate the functionality of instruments and characteristics of electronics devices.

1. Experimental Verification of PN Junction diode as rectifiers.
2. Experimental Verification of Zener Diode as Voltage Regulators.
3. Verify the truth table of logic gates.

CO5: Infer the purpose of wiring and safety. **L:9, P:8**

Diagrams & Symbols used in basic Electrical wiring -Electric shock -Protection: PPE, Switches, Plug and Socket, Fuse, MCB, ELCB, MCCB and Earthing- Wiring & installations- Inverters – UPS- Energy Consumptions –Electrical safety and standards– Schematic Electrical Layout for building.

CO8: Perform residential wiring and measure earth resistance.

1. Measurement of Earth Resistance using Electrical Equipment.
2. Residential house wiring, Staircase wiring and selection of fuse.

TEXT BOOKS:

1. D.P. Kothari and I J Nagrath, "Basic Electrical and Electronics Engineering", Tata McGraw Hill, 4th Edition, 2019.
2. R.K.Rajput, "Basic Electrical and Electronics Engineering", University Science Press, 2017.

REFERENCES:

1. Lionel Warnes, "Electrical and electronics engineering: Principles and practice, Palgrave Macmillan publication, 3rdEdition, 2003.
2. D.C. Kulshreshtha, "Basic Electrical Engineering", Tata McGraw Hill, Revision 1stEdition, 2011.
3. David Bell, "Electronic Devices and Circuits", Oxford university press, 5th Edition, 2008.
4. Mohamed A. El-Sharkawi, "Electric Safety Practice and Standards", Taylor & Francis, 2013.

L: 45; P: 30; TOTAL: 75 PERIODS

Course Code	**INNOVATION THROUGH DESIGN THINKING**	**L**	**T**	**P**	**E**	**C**
23GN02C	(Common to all B.E. / B.Tech. Degree Programmes)	**0**	**0**	**0**	**4**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Experiential Component

CO1: Analyse the impact of design thinking process.

CO2: Practice design thinking process through real world problems.

Soft skill Component

CO3: Present survey conclusions on selected real-world problems.

CO1: Analyse the impact of design thinking process **30**

Design thinking process: history and phases -Ideation tools: brainstorming, mind mapping, scrambler method, six thinking hats - case studies.

CO2: Practice design thinking process through real world problems **30**

Real world problem selection-Practicing the preliminary stages of design thinking process - work presentation.

TEXT BOOKS

1. Falk Uebernickel, Li Jiang, Walter Brenner, Britta Pukall, Therese Naef, "Design Thinking: The Handbook", WS Professional, 2020
2. PavanSoni, "Design Your Thinking: The Mindsets, Toolsets and Skill Sets for Creative Problem solving", Penguin Random House, 2020

REFERENCES

1. Michael Lewrick, "The Design Thinking Playbook", Wiley, 2019
2. Kathryn Christopher, "Design Thinking in Engineering", Kendall Hunt Publishing Company,2019
3. Robert Curedale, "Design Thinking Process & Methods", Design Community College Inc, 5th Edition, 2019
4. David Lee, "Design Thinking in the Classroom", Ulysses Press, 2018
5. Jimmy Jain, "Design Thinking for Startups", Notion Press, 2018
6. Monika Hestad Silvia Rigoni Anders Grnli, "The Little Booklet on Design Thinking: An Introduction", Zaccheus Entertainment, 2nd Edition, 2017
7. Scott Swan, Michael G.Luchs and Abbie Griffin, "Design Thinking: New Product Development Essentials", Wiley-Blackwell, 2016
8. D.M. Arvind Mallik, "Design Thinking for Educators", Notion Press, 2019

E:60; TOTAL:60 PERIODS

Course Code	**APTITUDE EXCELLENCE**	**L**	**T**	**P**	**E**	**C**
23GN04C		**1**	**0**	**0**	**0**	**1**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

CO1: Infer appropriate methods to simplify computation

CO2: Develop problem solving skills on Time and Work

CO3: Interpret fundamentals in quantitative techniques and solve problems quickly

CO4: Improve quantitative skills and solve problems on permutation and Combination

CO5: Acquire the knowledge of Cognitive ability and solve puzzles effectively

CO1: Infer appropriate methods to simplify computation **3**

Simplification: BODMAS rule –Simplification algebraic expressions, techniques for mental calculation, approximation methods and quick estimation strategies

CO2: Develop problem solving skills on Time and Work

Time and Work: Chain rule- Units method – efficiency ratio technique-work and wages – pipes and cisterns **3**

CO3: Interpret fundamentals in quantitative techniques and solve problems quickly

Time Speed Distance: Relation between speed and time –Speed ratio-Average speed-Effective speed - Data Sufficiency **3**

CO4: Improve quantitative skills and solve problems on permutation and Combination

Probability Permutation Combination: Fundamental Counting Principle – Computing Permutation – Circular Permutation – Computing Combinations - Data Sufficiency-Percentile **3**

CO5: Acquire the knowledge of Cognitive ability and solve puzzles effectively

Abstract reasoning: Mirror and water image – Figure Matrix – Pattern Completion-Graphing of Data - Logical puzzles – Dot situation - Ranking ordering. **Cognitive ability:** Blood Relation - Direction Sense Test-Data Sufficiency **3**

REFERENCES:

1. R.V.Praveen, "Quantitative Aptitude and Reasoning" , 3rd Edition , Eastern Economy Edition, PHI Learning, 2016
2. Arun Sharma," Quantitative Aptitude for CAT", McGraw Hill Edge, 10th Edition 2022
3. Dr.R.Aggarwal, " Quantitative Aptitude", S Chand Publishing, Revised Edition 2017

L:15; TOTAL : 15 PERIODS

Course code	**ENGINEERING THERMODYNAMICS**	**L**	**T**	**P**	**E**	**C**
23ME31C		**3**	**1**	**0**	**0**	**4**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

CO1: Apply concepts of energy conservation to analyze open and closed systems.
CO2: Arrive benchmark performances of heat engines and refrigerator / heat pump and compute entropy changes.
CO3: Apply exergy balance to evaluate the second law efficiency of closed systems and control volumes at steady state.
CO4: Estimate properties of ideal gases, real gases and pure substances
CO5: Derive various thermodynamic relation for different systems

CO1 Apply concepts of energy conservation to analyze open and closed systems. 12

Introduction - system and their behavior - Properties of the system - Thermodynamic Equilibrium - Zeroth law of thermodynamics - temperature scale - mechanical concept of energy - Heat and Work - Quasi static process - First law of Thermodynamics - Mass and Energy Analysis: Closed system and open system - Transient systems - Applications.

CO2 Arrive benchmark performances of heat engine, refrigerator and heat pump and compute entropy changes. **12**

Introduction- Heat engine, heat pump and Refrigerator - Second Law of Thermodynamics - Carnot Cycle - Carnot theorem and its corollaries - Absolute Temperature scale - Irreversible and Reversible Processes - Clausius Inequality.

Entropy: Principle of increase of entropy - Tds relations - Entropy balance for closed systems - Entropy rate balance for control volumes at steady state.

CO3 Apply exergy balance to evaluate the second law efficiency of closed systems and control volumes at steady state **12**

Exergy of a system - Closed system exergy balance - Exergy rate balance for control volumes at steady state - First and second law efficiency - Case studies.

CO4 Estimate properties of ideal gases, real gases and pure substances **12**

Ideal gas equation of state – Compressibility factor – Vander Waals equation of state for real gases –Ideal Gas Mixtures–Properties of Ideal Gas mixture.

Pure Substances– phases of pure substances – property diagrams – Property tables – evaluation of properties of pure substance for different applications- Simple applications.

CO5 Derive various thermodynamic relation for different systems **12**

Thermodynamics Relations - Gibbs and Helmholtz Functions, Maxwell Relations, specific heat ratio, Joule Kelvin effect, ClausiusClapeyron equation - Multi component system.

TEXT BOOKS

1. YunusA.Cengel, "Thermodynamics - An Engineering Approach", McGraw Hill publications, 9th Edition, 2019.
2. Mahesh M Rathore, "Thermal Engineering", McGraw Hill publications, 2010.

REFERENCES

1. Claus Borgnakke, Richard E. Sonntag, "Fundamentals of Thermodynamics", John Wiley & Sons, 10th Edition, 2020
2. Kalliat T.Valsaraj, "Principles of Environmental Thermodynamics and Kinetics", CRC press, 4th Edition, 2020.
3. P.K.Nag, "Engineering Thermodynamics", Mc Graw-Hill publications, 6th Edition, 2017
4. R.K. Rajput, "Thermal Engineering", Laxmi Publications, 10th Edition, 2017
5. De Didier Fontaine, "Principles of classical Thermodynamics: Applied to Material Science", World Scientific Publications, 2022
6. Moran, Shapiro, Boettner, Bailey, "Principles of Engineering Thermodynamics", Wiley publications, 8th Edition, 2015.

L:45; T:15; TOTAL:60 PERIODS

COURSE CODE	ENVIRONMENTAL SCIENCE AND ENGINEERING	L	T	P	C
23MC02C		2	0	0	--

COURSE OUTCOMES:

Upon the successful completion of the course, the student will be able to
CO1: explain the structure and functions of an ecosystem and the importance of biodiversity.
CO2: interpret the causes, effects of air and water pollution.
CO3: comprehend the causes, impacts and management of e-waste and municipal waste.
CO4: apply the knowledge of sustainability practices in the environment.

CO1: explain the structure and functions of an ecosystem and the importance of biodiversity. **L-6**

Introduction to Environment**,** scope and importance of environment – need for public awareness. Eco-system: structure and function. Biodiversity: Introduction - types – values of biodiversity – threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – endangered and endemic species of India. Conservation of biodiversity: In-situ and ex-situ - Biodiversity index calculation (Simpson and Shannon diversity Index, Sorenson coefficient)

CO2: interpret the causes, effects of air and water pollution. **L-6**

Air pollution - Classification of air pollutants – sources – Effects - Measurements: dust monitor – gas analyzer, particle size analyzer. Water pollution – Classification – health hazards – sampling and analysis of water. Waste water treatment – different industrial effluents and their treatment – Measurement: BOD and COD – atomic absorption spectrometer. Case study (Okhla sewage water treatment plant)

CO3: comprehend the causes, impacts and management of e-waste and municipal waste. **L-12**

Integrated Waste Management: Introduction – Generation and types of solid waste – Swachh Bharat Mission – Solid waste management: collection, transportation, segregation and processing – Disposal: landfill – biochemical processes and energy recovery - Municipal solid waste management rules 2016.

e-Waste Management: Introduction – Composition - Types – Generation – Environmental and health hazards of e-waste – Recycling - Recovery of metals: pyrometallurgical, hydrometallurgical, and biometallurgical process – e-waste management and handling rules 2016 – e-waste management companies in India.

CO4: apply the knowledge of sustainability practices in the environment. **L-6**

Sustainability and Management**:** Introduction - concept, needs and challenges – economic and social aspects of sustainability – unsustainability to sustainability – millennium development goals and protocols – Sustainable Development Goals-targets, indicators and intervention areas – Climate change – Global, Regional and local environmental issues and possible solutions – case studies. Concept of Carbon Credit – Carbon Footprint – Environmental management in industry – A case study – Zero waste and R concept – Circular economy – ISO 14000 Series – Material Life cycle assessment.

TEXT BOOKS:

1. Miller. G.T and Spoolman.S, 'Environmental Science', 16th Edition, Brooks / Cole Publishing Co., 2018.
2. Peavy. H.S, Rowe. D.R and Tchobanoglous. G, 'Environmental Engineering', 2nd Edition, McGraw Hill Education, 2020.

3. Benny Joseph, 'Environmental Engineering', Tata-Mc-Graw Hill, New Delhi, 2016.
4. Gilbert M.Masters, 'Introduction to Environmental Science and Engineering', 2nd Edition, Pearson Education, 2016.

REFERENCE BOOKS:

1. Kaushik. A and Kaushik. C.P, 'Environmental Science and Engineering', 6th Edition, New Age International Publishers, 2018.
2. Weller. K, 'Environmental Science and Biological Engineering', 1st Edition, WIT Press, 2015.

L:30; TOTAL : 30 PERIODS

Course Code	STATISTICS AND NUMERICAL METHODS	L	T	P	E	C
23ME32C		3	1	0	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: calculate the various measures of dispersion.
CO2: apply the principles of hypothesis testing in small and large samples.
CO3: analyze the variances in design of experiments.
CO4:apply numerical techniques to solve algebraic equation and calculate derivatives andintegrals.
CO5: compute numerical solution of differential equations.

CO1 : calculate the various measures of dispersion

Central tendencies - Mean, median, mode - Measures of Dispersion: Mean deviation, and Quartile Deviation - Carry out performance study on measures of central tendencies: Case Study through software– Moments–Skewness–Kurtosis-Correlation and Regression. **L:9, T:3**

CO2 : apply the principles of hypothesis testing in small and large samples

Sampling distributions - Estimation of parameters - Statistical hypothesis – Central limit theorem - Large sample tests based on Normal distribution for single mean and difference of means - Confidence interval for mean - Chi-square distribution-Contingency table for independent of attributes – Goodness of fit. **L:9,T:3**

CO3 : analyze the variances in design of experiments

Tests based on t and F distributions for mean, variance and proportion - ANOVA - One way and two way classifications - Completely randomized design – Randomizedblock design – Latin square design – 2^2 factorial design. **L:9,T:3**

CO4: apply numerical techniques to solve algebraic equation and calculate derivatives and integrals

Solution of Algebraic and transcendental linear equations - Newton - Raphson Method-Solution of simultaneous equations – Gauss Elimination method – Gauss Jacobi's method- Gauss Seidel method – Interpolation – Lagrange's Method - Numerical **L:9,T:3**

Differentiation – Newton's forward difference and backward difference formula – Numerical integration - Single integration using Trapezoidal and Simpson's 1/3 rd and 3/8 th rules.

CO5 : compute numerical solution of differential equations

Taylor's Series Method – Euler's Method – RungeKutta fourth order Method – Predictor - corrector Methods – Milne's Method - Solution of one dimensional heat equation by explicit and implicit methods - Two dimensional Laplace and Poisson equations – Liebman's iteration Process.- Determine numerical solution of ordinary differential equations and partial differential equations: Activity through software. **L:9,T:3**

TEXT BOOKS:

1. Richard A. Johnson, Irwin Miller, John Freund, Miller & Freund's, Probability and Statistics for Engineers, 9th Edition, Pearson Education Limited, Global Edition, 2017.
2. Grewal, B.S., Numerical Methods in Engineering & Science: With Programs in C, C++ & MATLAB, 10th Edition, Khanna Publishers, New Delhi, 2014.
3. Erwin Kreyszig, Advanced Engineering Mathematics, 10th Edition, Wiley India, 2017.

REFERENCES:

1. R.E. Walpole, R.H. Myers, S.L. Myers, and K Ye, Probability and Statistics for Engineers and Scientists, Pearson Education, Asia, 9th Edition, 2016.
2. M.R.Spiegel, J.Schiller and R.A. Srinivasan, Schaum Outlines, Probability and Statistics, Tata McGraw Hill Edition, 2017.
3. Chapra, S.C and Canale, R.P. Numerical Methods for Engineers, 7th Edition, Tata Mc Graw Hill, New Delhi, 2016.

L: 45; T:15; TOTAL: 60 PERIODS

Course Code	BASIC MANUFACTURING PROCESSES	L	T	P	E	C
23ME33C		3	0	2	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Select appropriate casting method for an industrial component and design the Gating and riser systems.

CO2: Identify the suitable metal joining process for an application.

CO3: Recognize suitable metal forming process for making an industrial component and evaluate the load Requirement in forming processes.

CO4: Analyze various polymer processing methods and identify suitable fabrication method for polymer product

CO5: Describe the need and process of additive manufacturing.

Practical Component

CO6: Demonstrate the green sand and stir casting process and prepare green sand mould for an industrial component.

CO7: Practice arc welding for making simple weld joints.

CO8: Prepare simple components using forging techniques and sheet metal Process.

CO9:Generate prototype for the real time component using 3D printing

CO1	**Select appropriate casting method for an industrial component and design the Gating and riser systems.**	**9**
CO6	**Demonstrate the green sand casting and stir casting process and prepare green sand mould for an industrial component.**	**8**

Sand casting- Moulding sand: types, properties and testing methods- Patterns: materials and allowances – Core making process - Solidification in casting-Riser and gating design– Fettling and Finishing Process - *Preparation of green sand mould using solid and split pattern in Laboratory.*
Working principle of special casting processes – *Demonstration of the stir casting process in Laboratory* -Recent developments in casting– Casting defects.

CO2	**Identify the suitable metal joining process for an application.**	**9**
CO7	**Practice arc welding for making simple weld joints.**	**8**

Fusion and solid-state welding processes–*Practicing with TIG and Electric arc welding for making simple weld joints in laboratory* –Brazing, soldering and adhesive bonding processes–Recent developments in welding-*Demonstration of the Automatic Welding in Laboratory - Construction and working principle*–Weld defects.

CO3	**Recognizesuitable metal forming process for making an industrial component and evaluate the load Requirement in forming processes.**	**9**
CO8	**Prepare simple components using forging techniques and sheet metal Process.**	**8**

Hot working and cold working of metals – forging, rolling, drawing and extrusion processes-principles and applications- Sheet metal forming processes- principles and applications-Load estimation for bulk (forging, rolling, extrusion, drawing) and sheet (shearing, deep drawing, bending) metal forming processes - *Preparation of simple objects through hot forging and simple sheet metal parts in laboratory*-Recent developments in forming.

CO4	**Analyze various polymer processing methods and identify suitable fabrication method for polymer product**	**9**

Types of plastics- plastic processing techniques: Blow moulding, Injection moulding (screw and plunger type machines), Rotational moulding, Transfer moulding and compression moulding- Recycling and Eco-friendly Processing-Recent developments and Industrial applications.

CO5	**Describe the need and process of additive manufacturing**	**9**
CO9	**Generate prototype for the real time component using 3D printing**	**6**

Need and Development of additive manufacturing systems- Classification of additive manufacturing processes - Benefits – Applications - Generation of prototype for the given real time product using 3D printing in laboratory.

TEXT BOOKS

1. Hajra Choudhury, "Elements of Workshop Technology, Vol.I Manufacturing Processes", Media Promotors Private Limited, Mumbai, 15th Reprint, 2016.
2. S.Gowri, P.Hariharan and A.SureshBabu, "Manufacturing Technology I", Pearson Education, 2017.

REFERENCES

1. Mikell P Groover, "Fundamentals of Modern Manufacturing", John Wiley & Sons, 7th

Edition, 2019.
2. Rajput R.K, "A text book of Manufacturing Technology", Lakshmi Publications, 2016.
3. P.N.Rao, "Manufacturing Technology", 2nd Edition, Tata McGraw-Hill Publishing Limited, 2015.
4. P.C.Sharma, "A Text book of Production Technology", 11th Edition, S.Chand and Company, 2013.
5. Begman, "Manufacturing Process", 8th Edition, John Wiley & Sons, 2018.
6. Larry Jeffus, "Welding and Metal Fabrication", Cengage Learning, 2012.
7. Serope Kalpajian, Steven R.Schmid, "Manufacturing Engineering and Technology", Pearson Education, Inc., 2nd Indian Reprint, 2018.

L:45; P:30; TOTAL:75 PERIODS

Course Code	FLUID MECHANICS AND HYDRAULIC MACHINES	L	T	P	E	C
23ME34C		2	1	2	0	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Explain the fundamental properties of fluids and applications of Bernoulli's Equation.

CO2: Apply dimensional analysis techniques and dimensionless parameters in fluid Mechanics.

CO3: Determine flow rates and head losses in laminar and turbulent flows.

CO4: Apply principles of fluid mechanics to design and select hydraulics turbines.

CO5: Apply principles of fluid mechanics to design and select pumps.

Practical Component

CO6: Apply Bernoulli's equations to determine the coefficient of discharge in flow measuring devices.

CO7: Determine frictional and minor head losses in flow through pipes.

CO8: Evaluate the performance of different types of turbines.

CO9: Evaluate the performance of different types of pumps.

CO1	**Explain the fundamental properties of fluids and applications of Bernoulli's Equation.**	**9**
CO6	**Apply Bernoulli's equations to determine the coefficient of discharge in flow measuring devices.**	**12**

Units and dimensions- Properties of fluids- mass density, specific weight, specific volume, Specific gravity, viscosity, compressibility, vapor pressure, surface tension and capillarity. Flow characteristics – concept of control volume - application of continuity equation, energy equation and momentum equation – E*xperimental determination of Coefficient of Discharge (Cd) – Venturimeter – Orificemeter – Rotameter*

CO2 Apply dimensional analysis techniques and dimensionless parameters in fluid Mechanics. 9

Dimension and units - dimensionless parameters - Buckingham‘s π theorem - Models andsimilitude - Applications of dimensionless parameters, scaling factors and law.

CO3 Determine flow rates and head losses in laminar and turbulent flows. 9

CO7 Determine frictional and minor head losses in flow through pipes. 6

Boundary layer concepts – Flow over Cylinders- Laminar flow though circular conduits and circular annuli -Darcy-Weisbach's equation - Flow through pipes in series and in parallel, friction factor –Moody diagram- Losses in pipes.

Experimental Evaluation of Friction Coefficient – Frictional Loss – Coefficients of pipe fittings – Minor Losses – Bend – Elbow – Sudden expansion - Sudden Contraction

CO4 Apply principles of fluid mechanics to design and select hydraulics turbines. 9

CO8 Evaluate the performance of different types of turbines. 6

Hydro turbines: definition and classifications - working principles - velocity triangles – workdone - specific speed - efficiencies - performance curves*with experimental verification.*

CO5 Apply principles of fluid mechanics to design and select pumps. 9

CO9 Evaluate the performance of different types of pumps. 6

Pump: Classification and working principles - Centrifugal pump velocity triangles, specific speed, efficiency and performance curves*with experimental verification* - Reciprocating pump: slip, discharge, work done - cavitation.

TEXT BOOKS

1. YunusA. Cengel and John M. Cimbala, “Fluid Mechanics: Fundamentals and Applications”, McGraw-Hill Ltd, New Delhi, 4th Edition, 2017.
2. Bansal RK, “Fluid Mechanics and Hydraulics Machines”, Laxmi publications (P) Ltd, New Delhi, 10th Edition, 2019.

REFERENCES:

1. Munson, Young and Okiishi, “Fundamentals of Fluid Mechanics”, John Wiley & Sons, 10th Edition, 2021.
2. White FM, “Fluid Mechanics”, Tata McGraw-Hill, New Delhi, 8thEdition, 2017.
3. Streeter VL and Wylie EB, “Fluid Mechanics”, McGraw-Hill Ltd, Asia,8thEdition, 2017
4. Modi PN and Seth SM, “Hydraulics and Fluid Mechanics Including Hydraulics Machines”, Standard Book House, 22nd Edition, 2019
5. Kumar KL, “Engineering Fluid Mechanics”, Eurasia Publishing HousePrivate Limited, 15thEdition, New Delhi, 2016.
6. Shiv Kumar, “Fluid Mechanics & Fluid Machines: Basic Concepts & Principles”,Ane Books Pvt. Ltd., New Delhi, 3rdEdition, 2018
7. https://nptel.ac.in/courses/112105171

L:45; P:30; TOTAL:75 PERIODS

Course Code	MATERIALS ENGINEERING	L	T	P	E	C
23ME35C		2	0	2	0	3

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Describe the structure and properties of materials referring suitable phase diagrams.

CO2: Choose appropriate heat-treatment techniques to impart desired properties in materials / alloys.

CO3: Identify the suitable ferrous and non-ferrous alloys for engineering applications.

CO4: Select suitable polymers, ceramics and composites for specific engineering applications.

CO5: Explain different damage mechanisms and testing of metals.

Practical Component

CO6: Prepare the specimens and characterize the microstructures of different ferrous and non-ferrous metals.

CO7: Evaluate the effect of heat treatment on properties of steel.

CO8: Measure the hardness of ferrous and non-ferrous materials

CO1 Describe the structure and properties of materials referring suitable phase diagrams. 6

Constitution of alloys–Solid solutions, substitutional and interstitial–phase diagrams, Isomorphous, eutectic, eutectoid, peritectic, and peritectoid reactions, Iron–Iron carbide phase diagram. Classification of Steel and cast Iron - microstructure, properties and application. Study of metallurgical microscope and sample preparation.

CO2 Choose appropriate heat treatment techniques to impart desired properties in materials / alloys. 6

CO6 Prepare the specimens and characterize the microstructures of different ferrous and non-ferrous metals. 12

CO7 Evaluate the effect of heat treatment on properties of steel. 8

Definition– Introduction to furnace, Full annealing, stress relief, recrystallisation and spheroidising–normalising, hardening and Tempering of steel. Isothermal transformation diagrams–cooling curves superimposed on I.T. Diagram -Continuous Cooling Transformation (CCT) diagram- Austempering, Martempering –hardening methods-case hardening, carburizing, Nitriding, cyaniding, carbonitriding–Flame and Induction hardening–Vacuum and Plasma hardening - Thermo-mechanical treatments-elementary ideas on sintering.

Preparation and study of the microstructure of low carbon steel, mild steel, high speed steel and stainless steel. Evaluate the effect of heat treatment on properties of steel. Measurement of hardness of various heat treated and untreated plain carbon steels.

CO3 Identify the suitable ferrous and non-ferrous alloys for engineering applications 6

Effect of alloying additions on steel (Mn, Si, Cr, Mo, V, Ti& W) -α and β stabilizers –stainless and tool steels–HSLA, Maraging steels–Cast Iron-Grey, white, malleable, spheroidal–alloy cast irons, Copper and copper alloys–Brass, Bronze and Cupronickel–Aluminum and its alloys - Al-Cu–precipitation strengthening treatment– Titanium alloys, Mg-alloys, Ni-based super alloys –

Properties and Applications.

CO4 Select suitable polymers, ceramics and composites for specific engineering applications. 6

Polymers–types of polymer, commodity and engineering polymers–Properties and applications of various thermosetting and thermoplastic polymers (PP, PS, PVC, PMMA, PET,PC, PA, ABS, PI, PAI, PPO, PPS, PEEK, PTFE, PETG, Polymers–Urea and Phenol formaldehydes)-Engineering Ceramics–Properties and applications of Al2O3, SiC, Si3N4, PSZ and SIALON–Composites-Classifications-Metal Matrix and FRP-Applications of Composites.

CO5 Explain different damage mechanisms and testing of metals 6

CO8 Measure the hardness of ferrous and non-ferrous materials 10

Mechanisms of plastic deformation, slip and twinning–Types of fracture–Testing of materials under tension, compression and shear loads–Hardness tests (Brinell, Vickers and Rockwell), hardness tests, Micro and Nano-hardness tests, Impact test Izod and Charpy, fatigue and creep failure mechanisms.

Perform Brinnell hardness test on metals, Perform Rockwell hardness test on metals.

TEXT BOOKS

1. Avner, S.H., "Introduction to Physical Metallurgy", McGraw Hill Education; 2nd Edition, 2017.
2. Williams D Callister, "Material Science and Engineering" Wiley India Private Limited, 10th Edition, 2020.

REFERENCES

1. Raghavan.V, "Materials Science and Engineering", Prentice Hall of India Pvt. Ltd., 6th Edition, 2015.
2. Kenneth G.Budinski and Michael K. Budinski, "Engineering Materials", Prentice Hall of India Private Limited, 9th Indian Reprint, 2016.
3. Upadhyay.G.S. and Anish Upadhyay, "Materials Science and Engineering", Viva Books Pvt. Ltd., New Delhi, 2015.
4. U.C.Jindal: Material Science and Metallurgy, "Engineering Materials and Metallurgy", 1st Edition, Dorling Kindersley, 2012.

L:30; P:30; TOTAL:60 PERIODS

Course Code	KINEMATICS OF MACHINERY	L	T	P	E	C
23ME36C		3	0	0	2	4

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Theory Component

CO1: Discuss the fundamental concepts of the simple mechanisms.
CO2: Determine velocity and acceleration of any point on a link in simple mechanisms.
CO3: Draw the cam profile for different types of follower and motion requirements.
CO4: Apply gear and gear train fundamentals to select suitable components for specific

applications.

CO5: Apply friction concepts to design clutches and brakes.

Experiential Component

CO6: Design a mechanism for a specific engineering application.

CO7: Analyse and Validate the mechanisms through kinematic principles.

CO8: Implement theoretical designs into tangible prototypes.

CO9: Collaborate and communicate effectively as a member of a team for proficient problem-solving.

CO1 Discuss the fundamental concepts of the simple mechanisms 9

Definitions – Link, Kinematic pair, Kinematic chain, Mechanism and Machine – Degrees of Freedom – Mobility – Kutzbach criterion (Gruebler‘s equation) – Grashoff‘s law- Kinematic inversions of four-bar chain and single slider crank chain.

Description of common mechanisms – Quick return mechanisms, Double slider mechanism, pantograph, straight line generators (Peaucellier and Watt mechanisms).

CO6 Design a mechanism for a specific engineering application. 10

Identification of an application, selection and design of suitable mechanism for the application.

CO2 Determine velocity and acceleration of any point on a link in simple mechanisms 9

Analysis of velocity and acceleration in simple mechanisms – Graphical Methods for relative velocity and acceleration polygons – Coriolis acceleration.

CO3 Draw the cam profile for different types of follower and motion requirements 9

Introduction – Terminology, Classifications, Types of follower motion – Uniform velocity Motion, Simple Harmonic Motion, Uniform Acceleration and Retardation Motion and Cycloidal Motion. Graphical layouts of cam profile – Knife edge follower, Roller and flat faced follower.

CO4 Apply gear and gear train fundamentals to select suitable components for specific applications. 9

Types of Gears – Spur gear terminology and definitions – Law of toothed gearing – Involute and cycloidal gear profiles- Contact ratio – Interference and undercutting. Gear trains – Simple, compound and Epicyclic gear trains–speed calculation.

CO5 Apply friction concepts to design clutches and brakes. 9

Dry friction, Friction clutch – single and multi-plateclutch. Brakes – Single and Double Block brakes. Conditions for self-locking and self energizing.

CO7 Analyse and Validate the mechanisms through kinematic principles. 10

Performing kinematic analysis of Mechanism.

CO8 Implement theoretical designs into tangible prototypes. 10

Developing a prototype, and testing.

TEXT BOOKS

1. Rattan SS, “Theory of Machines”, Tata McGraw Hill Publishers, New Delhi, 2017.
2. Robert L Norton, “Design of Machinery”, McGraw Hill Higher Education, 5th Edition, 2013.

REFERENCES

1. Uicker J J, Pennock G R and Shigley J E, "Theory of Machines and Mechanisms",Oxford University Press, 5th Edition, 2017.
2. Ambekar A G, "Mechanism and Machine Theory", Prentice Hall of India, New Delhi, 1st Edition, 2011.

L:45; P:30; TOTAL:75 PERIODS

23GN03C	**INTELLECTUAL PROPERTY RIGHTS STUDY**	**L**	**T**	**P**	**E**	**C**
	(Common to all B.E. / B.Tech. Degree Programmes)	**0**	**0**	**0**	**4**	**2**

COURSE OUTCOMES

Upon the successful completion of the course, the student will be able to

Experiential Component

CO1: Survey and practice the basic elements of existing patents.

CO2: Investigate and present the state of art technologies through effectual IP search.

Soft Skill Component

CO3: Present patent survey conclusions

CO1 Survey and practice basic elements of existing patents **30**

Basic elements of IPR – claims – infringements – Patent examination and Report - Case studies: patent survey.

CO2 Investigate and present the state of art technologies through effectual IP search **30**

Importance of IP search-factors to be considered for effective IP search-Hands-on Practice

REFERENCES

1. D.P. Mittal, "Indian Patents Law and Procedure", Taxman Publication, 2002
2. B.L. Wadera, "Patents, trademarks, copyright, Designs and Geographical Judications", 2010
3. P. Narayanan, "Intellectual Property Law", Eastern Law House, 2022
4. N.S.Gopalakrishnan & T.G.Agitha, "Principles of Intellectual Property", Eastern Book Company, Lucknow, 2009.

E:60 TOTAL:60 PERIODS