ST JOSEPH ENGINEERING COLLEGE

An Autonomous Institution
Vamanjoor, Mangaluru - 575028

Affiliated to VTU – Belagavi & Recognized by AICTE New Delhi
NBA – Accredited: B.E.(CSE,ECE,EEE, ME and CIV) & MBA
NAAC – Accredited with A+

B.E. SCHEME & SYLLABUS
(With effect from 2021-22)

MECHANICAL ENGINEERING

SECOND YEAR
(III and IV Semester)

2022 - 2023

III Semester (B.E. - Mechanical Engineering)														
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	BSC	21MAM301	Complex Analysis, Linear Algebra and Numerical Methods	MAT	MAT	2	2	-	03	50	50	100	3
2	PCC	21MEC302	Metal casting, Forming and Joining Processes (Integrated Course)	ME	ME	3	-	2	03	50	50	100	4
3	PCC	21MEC303	Material Science and Engineering (Integrated Course)	ME	ME	3	-	2	03	50	50	100	4
4	PCC	21MEC304	Engineering Thermodynamics	ME	ME	2	2	-	03	50	50	100	3
5	PCC	21MEL305	Machine Drawing	ME	ME	-	-	2	03	50	50	100	1
6	HSMC	21UHV306	Universal Human Values - II	COM		2	-	-	02	50	50	100	2
		21BFE306	Biology for Engineers	COM									
7	HSMC	21KBK307	Balake Kannada (Kannada for communication)			--	2	--	02	50	50	100	1
		21KSK307	Saamskrutika Kannada (Kannada for Administration)										
		21CPC307	Constitution of India, Professional Ethics and Cyber Law			1	--	--					
8	SDC	21IEP308	IoT Enabled Prototyping	COM		-	-	2	03	50	50	100	1
9	SDC	21IOT309	Industry Oriented Training - Business Etiquettes	COM		-	-	2	02	50	-	50	-
Total						12 **OR** **13**	6 **OR** **4**	10	24	**450**	**400**	**850**	**19**
10	HSMC	21ENG310	Business Communication	ENG	-	-	2	-	02	50	50	100	-
11	MNCC	21MAL301	Additional Mathematics- I	MAT	MAT	2	1	-	03	50	50	100	-

IV Semester (B.E. - Mechanical Engineering)													
SI. No.	**Course and Course Code**		**Course Title**	**Teaching Department**	**Paper Setting Board**	**Teaching Hours/Week**			**Examination**				**Credits**
						Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Duration in hours**	**CIE Marks**	**SEE Marks**	**Total Marks**	
						L	**T**	**P**					
1	BSC	21MAM401	Vector Integration, Curve Fitting and Statistical Methods	MAT	MAT	2	2	-	03	50	50	100	3
2	PCC	21MEC402	Machine Tool Technology (Integrated Course)	ME	ME	3	-	2	03	50	50	100	4
3	PCC	21MEC403	Fluid Mechanics (Integrated Course)	ME	ME	3	-	2	03	50	50	100	4
4	PCC	21MEC404	Mechanics of Materials	ME	ME	2	2	-	03	50	50	100	3
5	PCC	21MEL405	Mechanical Measurements and Metrology Lab	ME	ME	-	-	2	03	50	50	100	1
6	UHV	21UHV406	Universal Human Values – II	COM		2	-	-	02	50	50	100	2
	HSMC	21BFE406	Biology for Engineers	COM									
7	HSMC	21KBK407	Balake Kannada (Kannada for communication)/			--	2	--	02	50	50	100	1
		21KSK407	Saamskrutika Kannada (Kannada for Administration)										
		21CPC407	Constitution of India, Professional Ethics and Cyber Law			1	--	--					
8	SDC	21CTE408	Computational Tools for Engineers	COM		-	-	2	03	50	50	100	1
9	SDC	21IOT409	Industry Oriented Training - Computing Skills	COM		-	-	2	02	50	-	50	-
10	INT	21INT410	Summer Internship - I						03	50	50	100	2
Total						12 OR **13**	6 OR **4**	10	19	**500**	**450**	**950**	**21**
11	MNCC	21MAL401	Additional Mathematics- II	MAT	MAT	2	1	-	03	50	50	100	-

Note: BSC: Basic Science Courses; ESC: Engineering Science Courses; HSMC: Humanity, Social Science and Management Courses; MNCC = Mandatory Non-Credit Course. INT: Internship, PCC: Professional Core Course; PEC = Professional Elective Course; OEC = Open Elective Course; UHV: Universal Human Values SDC: Ability Enhancement (Skill Development) Course.

One-hour Lecture (L) per week per semester = 1 Credit Two-hour Tutorial (T) per week per semester = 1 Credit Two-hour Practical/Laboratory/Drawing (P) per week per semester = 1 Credit Four hours of Self-study = 1 Credit.

Summer Internship-II: All the students admitted shall have to undergo mandatory internship of minimum 04 weeks during the IV and V semester vacation. Summer Internship shall be Carried Out – based on industrial/ Govt./NGO /MSME/ Rural Internship /Innovation/Entrepreneurship, Credited in V Semester. Internship shall be considered as a head of passing and shall be considered for the award of degree. Those, who do not take up/complete the internship shall be declared fail and shall have to complete during subsequent examination after satisfying the internship requirements.

21KBK307/407 Balake Kannada (Kannada for communication) is prescribed for students who have not studied Kannada at any level of schooling (State/Central-CBSC/ICSE) and are not able to speak, write, read and understand Kannada.
21KSK307/407 Saamskrutika Kannada (Kannada for Administration) is prescribed for students who satisfy any one of the following. i. Studied 1 – 10th standard in Kannada medium ii. Studied Kannada as first or second language during high school and cleared SSLC examination iii. Studied Kannada at any level of schooling and are able to speak, write and read Kannada. iv. Passed diploma or certificate course in Kannada conducted by a university established by law in India v. Passed Kava, Jana and Rathna examinations conducted by Kannada Sahithya Parishat vi. Passed the SSLC examination or any other examination declared as equivalent thereto by the state government or any examinations higher than SSLC examination a) in which the question papers on different subjects are answered in Kannada language or b) in which Kannada was the main or second language or an optional subject but not one of the subjects in a composite paper.

Course prescribed to lateral entry Diploma holders admitted to III semester of Engineering programs:
(a)The mandatory non – credit courses Additional Mathematics I and Business Communication prescribed for III semester and Additional Mathematics II prescribed for IV semester, to the lateral entry Diploma holders admitted to III semester of BE/B.Tech programs, shall attend the classes during the respective semesters to complete all the formalities of the course and appear for the University examination. In case, any student fails to register for the said course/ fails to secure the minimum 40% of the prescribed CIE marks, he/she shall be deemed to have secured F grade. In such a case, the students have to fulfil the requirements during subsequent semester/s to appear for SEE. (b) These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

Courses prescribed to lateral entry B. Sc degree holders admitted to III semester of Engineering programs:
Lateral entrant students from B.Sc. Stream, shall clear the Mandatory non-credit courses Engineering Graphics and Elements of Civil Engineering and Mechanics of the First Year Engineering Programme. These Courses shall not be considered for vertical progression, but completion of the courses shall be mandatory for the award of degree.

AICTE Activity Points to be earned by students admitted to BE/B.Tech Day College Programs:
Over and above the academic grades, every student admitted to the 4 years Degree programme and every student entering 4 years Degree programme through lateral entry, shall earn 100 and 75 Activity Points respectively for the award of degree through AICTE Activity Point Programme. Students transferred from other Universities to fifth semester are required to earn 50 Activity Points from the year of entry. The Activity Points earned shall be reflected on the student's eighth semester Grade Card. The activities can be spread over the years, anytime during the semester weekends and holidays, as per the liking and convenience of the student from the year of entry to the programme. However, minimum hours' requirement should be fulfilled. Activity Points (non-credit) have no effect on SGPA/CGPA and shall not be considered for vertical progression. In case students fail to earn the prescribed activity Points, Eighth Semester Grade Card shall be issued only after earning the required Activity Points. Students shall be admitted for the award of degree only after the release of the Eighth semester Grade Card.

III SEMESTER

Complex Analysis, Linear Algebra and Numerical Methods (Common to **CIV & MECH**)			
Course Code	21MAM301	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. To provide an insight into applications of complex variables and conformal mapping arising in potential theory.
2. To apply the knowledge of numerical methods in solving engineering problems.
3. To gain proficiency in solving system of equations using Linear Algebra.

Module-1

Complex Variables: Function of a complex variable, Analytic function, Cauchy - Riemann equations in Cartesian and Polar forms, properties of analytic functions (no proof). Construction of analytic functions – Milne Thompson method -Problems. **8 Hours**

Module-2

Transformations: Introduction. Discussion of conformal transformations: $w = z^2$, $w = e^z, w = z + \frac{1}{z}, z \neq 0$**,** Bilinear transformations- Problems.

Complex integration: Line integral of a complex function-Cauchy's theorem and Cauchy's integral formula and problems. **8 Hours**

Module-3

Numerical Methods-1: Finite differences - Interpolation/ extrapolation using Newton's forward and backward difference formula, Lagrange's formula and inverse interpolation formula

Numerical integration - Trapezoidal rule and Simpson's 1/3rd and Simpson's 3/8 rule. **8 Hours**

Module-4

Numerical Methods-2: Numerical solutions to partial differential equations – Finite difference approximation to derivatives, solution of Laplace equation in two dimensions, heat and wave equations in one dimension (explicit methods). **8 Hours**

Module-5

Linear Algebra: Gauss Jordan method to find inverse, Matrix Inversion Method, Solution of a system of linear equations – LU Factorization method, partition method, Relaxation method, Cholesky method. (All problems restricted to matrices of order 3). **8 Hours**

Course Outcomes:

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

21MAM301.1	To Construct the analytic function and apply the concepts of complex potentials to solve the problems arising in electromagnetic field theory.
21MAM301.2	Utilize conformal transformation arising in aero foil theory, fluid flow visualization and image processing.
21MAM301.3	Use Cauchy's integral theorem and formula to compute line integrals.
21MAM301.4	Apply the knowledge of numerical methods in the models of various physical and engineering phenomena.

21MAM301.5	Examine a variety of partial differential equations and solution by numerical methods.
21MAM301.6	Apply the knowledge of various methods used in solving the system of linear equations.

Question paper pattern:

Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2015
2	Numerical methods for Engineering problems	N Krishna Raju and K U Muthu	Macmillan India Limited	2nd Edition, 2008
Reference Books				
1	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	11th Edition,, 2010
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th Edition,, 2016
3	Numerical methods for Engineers	Steven C Chapra and Raymond P Canale	McGraw Hill Education	6th Edition,, 2012
4	Numerical methods for scientific and engineering computation.	M.K.Jain, S.R.K. Iyenger and R.K. Jain	New Age International Publishers	5th Edition,, 2007

Web links/Video Lectures/MOOCs:

https://youtu.be/41pu051ZJAo

https://youtu.be/otTLkuh4dNU

https://www.youtube.com/watch?v=1QjTzwEZ3pE

https://youtu.be/LPMcjyxZ7eM

https://youtu.be/H_L57dJqdM4

https://youtu.be/BFYFkn-eOQk

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAM301.1		3	1									
21MAM301.2	3	1										
21MAM301.3	2	2										
21MAM301.4		3	1									
21MAM301.5		3	1									
21MAM301.6	1		3									

1: Low 2: Medium 3: High

METAL CASTING, FORMING AND JOINING PROCESSES			
Course Code	21MEC302	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. Outline different casting processes and their steps.
2. Categorize and prioritize furnaces and casting techniques.
3. Explain metallurgical aspects during the solidification of metal and alloys.
4. Assess various joining processes used in manufacturing.
5. Investigate the metallurgical aspects of welding and different NDT testing methods.

Module-1

Introduction & basic materials used in the foundry:

Introduction: Definition, Classification of manufacturing processes. Metals casting classification, factors that determine the selection of a casting alloy.

Patterns: Definition, classification, materials used for the pattern, various pattern allowances and their importance.

Sand moulding: Types of base sand, requirement of base sand, Binder, Additives, preparation of sand moulds. Moulding machines- Jolt type, squeeze type and Sand slinger. Sands and moulds- Green sand, core sand, dry sand, sweep mould, CO_2 mould, shell mould, investment mould, plaster mould, cement bonded mould.

Cores and gating: Definition, need, types. Method of making cores, Concept of gating (top, bottom, parting line, horn gate) and risers (open, blind) - Functions and types.

Fettling and cleaning of castings: Basic steps involved, Sand Casting defects- causes, features and remedies, advantages & limitations of the casting process. **08 Hours**

Module-2

Melting & metal mould casting methods:

Melting furnaces: Classification of furnaces, Gas fired pit furnace, Resistance furnace, Coreless induction furnace, electric arc furnace, constructional features & working principle of cupola furnace.

Casting using metal moulds: Gravity die casting, pressure die casting, centrifugal casting, squeeze casting, slush casting, thixocasting, and continuous casting processes. **08 hours**

Module-3

Metal Forming Processes: Introduction to metal forming process: Mechanical behaviour of metals in elastic and plastic deformation, stress-strain relationships, Yield criteria, Application to tensile testing, strain rate and temperature in metal working; Hot deformation, Cold working and annealing.

Metal Working Processes: Fundamentals of metal working, Analysis of bulk forming processes like forging, rolling, extrusion, wire drawing by slab method.

Sheet metal processes: Sheet metal forming process (Die and punch assembly, Blanking, piercing, bending etc., Dies: Compound and Progressive die), High Energy rate forming processes. **08 hours**

Module-4

Welding process: Definition, Principles, classification, application, advantages & limitations of welding. Arc welding: Metal arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding (AHW). Gas Welding: Principle, Oxy-Acetylene welding, oxy-hydrogen welding, air-acetylene welding, Gas cutting, powder cutting.

Special types of welding: Resistance welding, Seam welding, Butt welding, Spot welding, Projection welding, Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.

Soldering and brazing: Definition, Principle and applications. **08 hours**

Module-5

Metallurgical aspects in welding

Structure of welds, Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ. Effect of carbon content on structure and properties of steel, Shrinkage in welds & Residual stresses. Concept of electrodes, filler rod and fluxes. Welding defects- causes & remedy.

Non-Destructive Testing Methods: Methods used for inspection of casting and welding: Visual, magnetic particle, dye penetrant test, ultrasonic, radiography and eddy current. **08 hours**

List of Practice Experiments: 2 hours each

1. Testing of moulding sand and core sand: Compression, Shear and Tensile tests on Universal Sand Testing Machine.
2. To determine the permeability number of green sand, core sand and raw sand.
3. To determine the Grain Fineness Number (GFN) of Base Sand.
4. Mould preparation using two moulding boxes (hand cut moulds) and using patterns (Single piece pattern and Split pattern).
6. Welding Practice: Preparation of L-Joint, T-Joint, Butt joint, V-Joint and Lap joints on M.S. flats using Arc Welding Equipment.
7. To study the effect of heat affected zone on the microstructure of steel weldments.
8. Preparing forged models involving upsetting, drawing and bending operations.
9. Sheet metal punch/die design and layout optimization

Demonstration Experiments for CIE

10. To study the defects of Cast and Welded components using Non-destructive tests like: a) Ultrasonic flaw detection b) Magnetic crack detection c) Dye penetration testing
11. To analyse the material flow and solidification simulation using Auto-Cast software

Open-ended experiment covering the concept of entire syllabus

1. Mounding and casting of pulley or spur gear.

Course Outcomes:

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

21MEC302.1	Classify and categorize sands, patterns, cores and gating systems for developing sand moulds.
21MEC302.2	Compare and assess different types of melting furnaces and casting methods.
21MEC302.3	Demonstrate skills in preparation of forging models involving upsetting, drawing and bending operations.
21MEC302.4	Assess the various joining processes used in manufacturing based on applications.
21MEC302.5	Investigate the metallurgical aspects of welding.
21MEC302.6	Assess the applications of various NDT Testing Methods.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Manufacturing Science	Ghosh, A. and Mallik, A. K	East-West Press	2017
2.	Welding Processes and Technology	Parmar R. S	Khanna Publishers	2007

3	Manufacturing Technology- Foundry, Forming and Welding	P.N.Rao	Tata McGraw Hill	3, 2022
Reference Books				
1	Principles of metal casting	Rechard W. Heine, Carl R. Loper Jr., Philip C. Rosenthal	Tata McGraw Hill Education Private Limited	2009
2	Manufacturing Process-I	Dr. K. Radhakrishna	Sapna Book House	5, 2009
3	Process and Materials of Manufacturing	Roy A	Lindberg Pearson Edu	4, 2006
4	Manufacturing Engineering and Technology	Serope Kalpakjian Steuen. R Sechmid	Pearson Education Asia	7, 2018

Web links/Video Lectures/MOOCs

1. https://nptel.ac.in/courses/112107083/
2. https://nptel.ac.in/courses/112107090/
3. https://www.coursera.org/lecture/circular-economy/aluminium-from-mine-to-metal-casting-OgzTQ

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEC302.1	-	**2**	-	-	-	**2**	-	-	-	-	-	**2**	-	-
21MEC302.2	-	-	-	-	-	-	**2**	-	-	-	-	**2**	-	-
21MEC302.3	-	**3**	-	-	-	-	-	-	-	-	-	**2**	-	**2**
21MEC302.4	-	-	-	-	-	**2**	**2**	-	-	-	-	-	-	**2**
21MEC302.5	-	-	-	**3**	-	-	**2**	-	-	-	-	-	-	-
21MEC302.6	-	-	-	**3**	-	-	**2**	-	-	-	-	-	-	-

1: Low 2: Medium 3: High

MATERIAL SCIENCE AND ENGINEERING			
Course Code	**21MEC303**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. To relate and compare the structure and behaviour of materials common for mechanical engineering applications.
2. To explore the mechanical properties of metals and their alloys, polymers, ceramics, smart materials and composites.
3. To interpret the effect of heat treatment on material properties by heat treatment.
4. To relate the selection of materials for different applications.
5. To study and interpret various failure modes of materials.

Module-1

Structure of Materials

Introduction: Classification of materials, crystalline and non-crystalline solids, atomic bonding

Crystal Structure: Crystal Lattice, Unit Cell, Planes and directions in a lattice, Planar Atomic Density, packing of atoms and packing fraction, Classification and Coordination of voids, Bragg's Law.

Imperfections in Solids: Types of imperfections, Point defects: vacancies, interstitials, line defects, 2-D and 3D-defects, Concept of free volume in amorphous solids.

Plastic deformation of single crystal by slip and twinning, Mechanisms of strengthening in metals.

Creep: Description of the phenomenon with examples, three stages of creep, creep properties, Stress relaxation. Concept of fracture toughness, numerical on diffusion, strain and stress relaxation. **08 Hours**

Module-2

Alloy Systems

Concept of formation of alloys: Types of alloys, solid solutions, factors affecting solid solubility (Hume Rothery rules).

Phase diagrams: Eutectic, and Eutectoid systems, Lever rule (Numerical), Intermediate phases, Gibb's phase rule, Effect of non-equilibrium cooling, Coring and Homogenization.

Iron-Carbon (Cementite) diagram, Common alloy steels, Stainless steel, Tool steel, Specifications of steels. Mechanism of solidification, Homogeneous and Heterogeneous nucleation, Crystal growth, cast metal structures, Solidification of Steels and Cast irons. **08 Hours**

Module-3

Heat Treatment, Ferrous and Non-Ferrous Alloys: Heat treating of metals: Time-Temperature-Transformation (TTT) curves, Continuous Cooling Transformation (CCT) curves, Annealing: Recovery, Recrystallization and Grain growth, Types of annealing, Normalizing, Hardening, Tempering, Martempering & Austempering.

Surface hardening methods: Concept of hardenability, Factors affecting hardenability. Carburizing, cyaniding, nitriding, flame hardening and induction hardening, age hardening of aluminium-copper alloys and PH steels. Ferrous materials: Properties, Compositions and uses of Grey cast iron and steel. **08 Hours**

Module-4

Ceramics, Plastics and Composite Materials: Types, fundamentals, processing and applications.

Powder Metallurgy: Introduction, Powder Production Techniques: Different Mechanical and Chemical methods, Characterization of powders (Particle Size & Shape Distribution), Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process, Sintering and Application of Powder Metallurgy. **08 Hours**

Module-5

Materials Selection: The need for material selection in design, and the evolution of Engineering materials.

The Design Process and Materials Data: Types of design, design tools and materials data, processes of obtaining materials data, materials databases.

Engineering Materials and Their Properties: The classes of engineering materials and their structure, material properties: mechanical properties, functional properties.

Material Selection Charts: Selection criteria for materials, material property Charts, deriving property limits and material indices.

08 Hours

List of Practice Experiments: 2 hours each

1. Performing various mechanical testing like Tension, Compression, Shear and Bending tests using Universal Testing Machine (UTM).
2. Performing Rockwell, Brinell and Vickers's hardness Tests on different materials.
3. Performing impact test study using Izod and Charpy Impact tests.
4. To study the effect of Heat treatment on the behavior of materials.
5. Specimen preparation for macro and micro structural examinations and study of the macrostructure and microstructure of a sample metal/ alloys.
6. To study the crystal structure of a given Cast Iron, Mild steel, Aluminium and Copper/Brass specimens and study the crystal imperfections in a given Cast Iron, Mild steel and Aluminium specimens.
7. To conduct a wear test on Mild steel/ Cast Iron/Aluminium/ Copper to find the volumetric wear rate and coefficient of friction.

Demo Experiments

8. Demonstration of a Fatigue Test.
9. Study the properties of various types of plastics.

Open-ended experiment covering the concept of entire syllabus

1. Study the change in hardness of mild steel after going through the oil quenching and annealing process.

Course Outcomes:

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

21MEC303.1	Interpret the relationship between structure and properties of commonly applicable engineering materials.
21MEC303.2	Evaluate the importance of phase diagrams and phase transformations.
21MEC303.3	Inspect the effect of heat treatment and surface treatment processes on the properties of materials.
21MEC303.4	Analyze the properties of composites, ceramics and plastics in the context of society, environment and sustainability.
21MEC303.5	Discuss the importance of the design process and material data in material selection.
21MEC303.6	Summarize environment-friendly emerging materials for engineering applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Material science and Engineering: An Introduction	William D. Callister	Wiley	3, 2006
2	Materials Selection in Mechanical Design	Ashby, M.F	Elsevier	2022
3	Materials Science and Engineering	V. Raghavan	Prentice Hall India	2, 2002

Reference Books				
1	Mechanical Metallurgy	George Ellwood Dieter	McGraw-Hill	3, 2007
2	Materials Science and Engineering	V. Raghavan	Prentice Hall India	2, 2002
3	Powder Metallurgy- Science, Technology and Applications	P. C. Angelo and R. Subramanian	Prentice Hall India	2009

Web links/Video Lectures/MOOCs

1. msmsjec.blogspot.in (Accessed on 19/10/2022)
2. https://swayam.gov.in/nd1_noc20_mm13(Accessed on 19/10/2022)
3. https://onlinecourses.nptel.ac.in/noc19_mm02/(Accessed on 19/10/2022)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEC303.1	-	-	-	**3**	-	-	-	-	-	-	-	-	-	**2**
21MEC303.2	-	-	-	-	-	-	**2**	-	-	-	-	**2**	-	-
21MEC303.3	-	-	-	**3**	-	-	-	-	-	-	-	**2**	-	**2**
21MEC303.4	-	-	-	-	-	**2**	**3**	-	-	-	-	-	-	-
21MEC303.5	-	-	-	-	-	**3**	**2**	-	-	-	-	-	-	-
21MEC303.6	-	-	-	-	-	**2**	**3**	-	-	-	-	**1**	-	-

1: Low 2: Medium 3: High

Engineering Thermodynamics

Course Code	21MEC304	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. To understand the thermodynamic system, its equilibrium, and various forms of energy - Heat transfer and Work.
2. To study the fundamental laws of thermodynamics, including zeroth Law, first Law, and second Law
3. To Interpret the behavior of pure substances and their application in practical problems.
4. To study Ideal and real gases and evaluation of thermodynamic properties.
5. To understand the fundamentals of Vapor Power Cycles and Gas power cycles.
6. To Study the concept of gas turbine cycle and jet propulsion.

Module-1

Introduction and Review of fundamental concepts: Thermodynamic definition and scope, Microscopic and Macroscopic approaches, Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface, examples. Thermodynamic properties; definition and units, intensive, extensive properties, specific properties, pressure, specific volume Thermodynamic state, state point, state diagram, path and process, quasi-static process, cyclic and non-cyclic; processes; Thermodynamic equilibrium; definition, mechanical equilibrium; diathermic wall, thermal equilibrium, chemical equilibrium, (Only for Self-study)

Zeroth law of thermodynamics. Temperature; scales, thermometry, Importance of temperature measuring instruments. Design of Thermometers.

Work and Heat: Thermodynamic definition of work; examples, sign convention, Displacement work, Heat; definition, units and sign convention, Expressions for displacement work and heat in various processes through p-v diagrams. Shaft work, Electrical work. Numerical on displacement work only.

First Law of Thermodynamics: Statement of the first law of thermodynamics, extension of the First law to non - cyclic processes, energy, energy as a property, Steady Flow Energy Equation (SFEE) and engineering applications. Numerical on SFEE
10 Hours

Module-2

Second Law of Thermodynamics and Entropy

Limitations of the first law of thermodynamics. Devices converting heat to work; (a) In a thermodynamic cycle, (b) In a mechanical cycle. Thermal reservoir, direct heat engine; schematic representation and efficiency. Kelvin - Planck statement of the Second law of Thermodynamics; PMM I and PMM II, Clausius statement of Second law of Thermodynamics, Carnot cycle, Clausius inequality, Statement-proof, Entropy- definition, a property, change of entropy, entropy as a quantitative test for irreversibility, entropy as a coordinate. Related numerical.

Available energy

Available energy, Maximum work in a reversible process; useful work; Dead state; availability; Second law efficiency.

10 Hours

Module-3
Introduction and Review of Ideal and Real gases Ideal gas mixtures, Daltons law of partial pressures, Amagats law of additive volumes, Evaluation of properties of ideal gases. Real gases: introduction, Van-Der Waal's equation, Van-Der Waal's constants in terms of critical properties. (Only for self-study) Compressibility factor, compressibility chart and applications. **Thermodynamic relations** Maxwell's equations, TdS equation**.** Ratio of Heat capacities and Energy equation, Joule-Kelvin effect, Clausius-Clapeyron equation. **Combustion thermodynamics** Theoretical (Stoichiometric) air for combustion of fuels, excess air, actual combustion. Exhaust gas analysis. A/F ratio, energy balance for a chemical reaction, enthalpy of formation, enthalpy and internal energy of combustion, adiabatic flame temperature, combustion efficiency. **10 Hours**
Module-4
Pure Substances P-T and P-V diagrams, triple point and critical points, sub-cooled liquid, saturated liquid, mixture of saturated liquid and vapour, saturated vapour and superheated vapour states of pure substance with water as an example. Enthalpy of change of phase (Latent heat), Dryness fraction (quality) representation of various processes on T-S & H-S diagrams. Usage of the Steam table, Related numerical. **Vapour Power Cycles** Carnot vapour power cycle, simple Rankine cycle, actual vapour power cycles, ideal and practical regenerative Rankine cycles, open and closed feed water heaters, Reheat Rankine cycle and characteristics of an Ideal working fluid in vapour power cycles. Related Numerical. **10 Hours**
Module-5
Gas power cycles Ericson Cycle, Stirling Cycle, Air standard cycles-Otto cycle, Diesel cycle and Dual cycle, computation of thermal efficiency and mean effective pressure, comparison of Otto, Diesel & Dual cycles. Related numerical. **Gas turbine Cycles** Introduction and classification of gas turbine, gas turbine (Brayton) cycle; description and thermal analysis and methods to improve the thermal efficiency of gas turbines, Related numerical. Jet Propulsion. **10 Hours**

Course Outcomes:	
At the end of the course the student will be able to:	
21MEC304.1	Illustrate the fundamentals of thermodynamics and energy interactions across the boundary of thermodynamic systems
21MEC 304.2	Apply the laws of thermodynamics to solve engineering problems.
21MEC304.3	Calculate the optimum air-fuel ratio for a given fuel to achieve complete combustion.
21MEC304.4	Evaluate thermodynamic properties of pure substance, ideal and real gas mixtures using various relations
21MEC304.5	Evaluate the performance of vapour power cycles.
21MEC304.6	Investigate the performance of Gas power cycles and gas turbine cycles

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Basic and Applied Thermodynamics	P. K. Nag	Tata McGraw Hill	6th Edition, 2017
2	Thermodynamics: An Engineering approach	Michael A Boles and Yunus Cengel	McGraw Hill Education	6th Edition, 2011
Reference Books				
1	Applications of Thermodynamics	Kadambi V, T.R. Seetharaman, K.B. Subramanya Kumar	Wiley	1st edition, 2019
2	A Text Book of Engineering Thermodynamics	Rajput R.K	Laxmi Publications Ltd.	6th Edition, 2016

Web links/Video Lectures/MOOCs/papers

1.https://www.digimat.in/nptel/courses/video/112105266/L01.html (Accessed on 17/10/2022)

2. https://nptel.ac.in/courses/112105123(Accessed on 17/10/2022)

3. https://nptel.ac.in/courses/127106135 (Accessed on 17/10/2022)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21MEC304.1	-	3	-	-	-	-	-	-	-	-	-	-	2	-
21MEC304.2	-	3	-	-	-	-	-	-	-	-	-	3	-	2
21MEC304.3	-	-	3	-	-	-	-	-	-	-	-	-	-	2
21MEC304.4	-	-	-	3	2	-	-	-	-	-	-	-	-	-
21MEC304.5	-	-	3	-	-	-	-	-	-	-	-	-	2	-
21MEC304.6	-	-	-	3	2	-	-	-	-	-	-	2	-	-

1: Low 2: Medium 3: High

MACHINE DRAWING			
Course Code	**21MEL305**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	03

Course Learning Objectives:

This Course will enable students to:

- To acquire the knowledge of limits, tolerance and fits and indicate them on machine drawings.
- To make drawings using orthographic projections and sectional views
- To impart knowledge of thread forms, fasteners, keys, joints, couplings and clutches.
- To understand and interpret drawings of machine components leading to the preparation of assembly drawings manually and using CAD packages.

Module 1 - (Only for CIE)

Introduction to Computer-Aided Design Software:

Review the graphic user interface of the software. Review the basic sketching commands and navigational commands. Practice Extrude, Revolve, Cut-out, Revolve Cut-out, Hole, Sweep, Loft, and Helix commands. Generate 2D views of the 3D modelled parts and extract the sectional views.

Limits, Fits & Tolerances:

Introduction, Fundamental tolerances, Deviations, Methods of placing limit dimensions, machining symbols, types of fits with symbols and applications, geometrical tolerances on drawings. Standards followed in the industry. **1 Hour**

Module 2 - (Only for CIE)

Sections of Simple and hollow solids: True shape of sections **2 Hours**

Module 3 – (only for CIE)

Thread forms: Terminology of thread forms. Sectional views of threads: ISO Metric (Internal & External), BSW (Internal and External), Square, ACME and Sellers thread, and American Standard thread.

Fasteners: Hexagonal headed bolt and nut with washer (assembly), square-headed bolt and nut with washer (assembly).

Rivets: Terminologies of rivets. Modelling Single and double riveted lap joints, Butt joints with single/double cover straps (Chain and zigzag using snap head rivets). **3 Hours**

Module 4

Assembly of Joints and couplings (with GD&T) using a 2D environment

Joints: Like Cotter joint (socket and spigot), knuckle joint (pin joint).

Couplings: Like flanged coupling, universal coupling **03 Hours**

Module 5

Assembly Drawings: Using a 3D environment

(Part drawings shall be given)

Model and assemble the following machine elements.

1. Plummer block (Pedestal Bearing)
2. Rams Bottom Safety Valve
3. I.C. Engine connecting rod
4. Screw jack (Bottle type)
5. Machine vice **5 Hours**

Course Outcomes: At the end of the course the student will be able to:	
21MEL305.1	Describe the concepts of limits, fits, and tolerances, to model machine components.
21MEL305.2	Illustrate sectional views of part and assembled models.
21MEL305.3	Compare the various thread forms, fasteners & rivets used for machine components and develop a 2D model drawing.
21MEL305.4	Sketch the drawings of joints and couplings used in the machine members using 2D environment.
21MEL305.5	Create the parts of machine component and assembled them appropriately using modern modelling software with 3D environment.
21MEL305.6	Create drafting of the assembled machine components as per the conventions and requirements.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Machine Drawing	N.D.Bhat & V.M.Panchal	Charotar Publishing House,	51st edition, 2022
2	Machine Drawing	N.Siddeshwar, P.Kannaih, V.V.S. Sastri	Tata Mc.Grawhill	2017
Reference Books				
1	A Textbook of Computer Aided Machine Drawing	S. Trymbakaa Murthy,	CBS Publishers, New Delhi, 2007	2007
2	Machine Drawing	K.R. Gopala Krishna	Subhash Publication	2011

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21MEL305.1	**2**	**2**												
21MEL305.2	**2**	**2**			**3**									
21MEL305.3	**2**	**2**			**3**									
21MEL305.4	**2**	**2**			**3**									
21MEL305.5		**2**			**3**					**2**				
21MEL305.6		**2**			**3**					**2**				

1: Low 2: Medium 3: High

Universal Human Values- II			
Course Code	**21UHV306/406**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives:

This introductory course input is intended:

1. To help the students appreciate the essential complementarily between 'VALUES' and 'SKILLS' to ensure sustained happiness and prosperity which are the core aspirations of all human beings.
2. To facilitate the development of a Holistic perspective among students towards life and profession as well as towards happiness and prosperity based on a correct understanding of Human reality and the rest of existence. Such a holistic perspective forms the basis of Universal Human Values and movement toward value-based living in a natural way.
3. To highlight plausible implications of such a Holistic understanding in terms of ethical human conduct, trustful and mutually fulfilling human behavior and mutually enriching interaction with Nature.

Module-1

Introduction to Value Education

Right Understanding, Relationship and Physical Facility (Holistic Development and the Role of Education), Understanding Value Education, Self-exploration as the Process for Value Education, Continuous Happiness and Prosperity – the Basic Human Aspirations, Happiness and Prosperity – Current Scenario, Method to Fulfill the Basic Human Aspirations.

Activities: Sharing about Oneself, Exploring Human Consciousness and Exploring Natural Acceptance. **5 Hours**

Module-2

Harmony in the Human Being

Understanding Human beings as the Co-existence of the Self and the Body, Distinguishing between the Needs of the Self and the Body, The Body as an Instrument of the Self Understanding Harmony in the Self, Harmony of the Self with the Body, Programme to ensure self-regulation and Health.

Activities: Exploring Sources of Imagination in the Self, Exploring Harmony of Self with the Body and Exploring the difference of Needs of Self and Body. **5 hours**

Module 3

Harmony in the Family and Society

Harmony in the Family – the Basic Unit of Human Interaction, 'Trust' – the Foundational Value in Relationship, 'Respect' – as the Right Evaluation, Other Feelings, Justice in Human-to-Human Relationship, Understanding Harmony in the Society, Vision for the Universal Human Order.

Activities: Exploring the Feeling of Trust, Exploring the Feeling of Respect and Exploring the Feeling systems to fulfil Human Goal. **5 hours**

Module-4
Harmony in the Nature/Existence Understanding Harmony in the Nature, Interconnectedness, self-regulation and Mutual Fulfilment among the Four Orders of Nature, Realizing Existence as Co-existence at All Levels, The Holistic Perception of Harmony in Existence Activities: Exploring the Four Orders of Nature and Co-existence in Existence **3 hours**
Module-5
Implications of the Holistic Understanding – a Look at Professional Ethics Natural Acceptance of Human Values, Definitiveness of (Ethical) Human Conduct, A Basis for Humanistic Education, Humanistic Constitution and Universal Human Order, Competence in Professional Ethics, Holistic Technologies, Production Systems and Management Models-Typical Case Studies, Strategies for Transition towards Value-based Life and Profession Activities: Exploring Ethical Human Conduct**,** Humanistic Models in Education and steps of Transition towards Universal Human Order **5 hours**

Course Outcomes: At the end of the course the student will be able to:	
21UHV306.1	Practice the method of self-exploration to understand the basic human aspiration.
21UHV306.2	Distinguish between needs of self and body.
21UHV306.3	Evolve a program for self-regulation and health.
21UHV306.4	Differentiate between the characteristics and activities of different orders and study the mutual fulfilment among them
21UHV306.5	Realize sustainable solutions to the problems in society and nature
21UHV306.6	Develop competence in professional ethics and strategies for the transition towards a value-based life/profession

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Text Books				
1	Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi	2, 2019
2	Teachers' Manual for A Foundation Course in Human Values and Professional Ethics	R R Gaur, R Asthana, G P Bagaria	Excel Books, New Delhi	2, 2019
Reference Books				
1	Jeevan Vidya: Ek Parichaya	A Nagaraj	Jeevan Vidya Prakashan, Amarkantak	1999
2	Human Values	A.N. Tripathi	New Age Intl. Publishers, New Delhi	2004

Web links/Video Lectures/MOOCs/papers

1. The Story of Stuff (Book).
2. The Story of My Experiments with Truth - by Mohandas Karamchand Gandhi
3. Small is Beautiful - E. F Schumacher.
4. Slow is Beautiful - Cecile Andrews
4. Economy of Permanence - J C Kumarappa
5. Bharat Mein Angreji Raj – Pandit Sunderlal
6. Rediscovering India - by Dharampal
7. Hind Swaraj or Indian Home Rule - by Mohandas K. Gandhi
8. India Wins Freedom - Maulana Abdul Kalam Azad
9. Vivekananda - Romain Rolland (English)
10. Gandhi - Romain Rolland (English)

11. UHV-I Teaching material (Presentations, Pre & Post Surveys etc.)
https://fdp-si.aicte-india.org/AicteSipUHV_download.php

12. Details of UHV-II: Universal Human Values – Understanding Harmony and Ethical Human Conduct
https://drive.google.com/file/d/1cznDaqDwKy__EKWmqJLWF94MeY4AXcsU/view?usp=sharing

13. Recorded FDP (Refresher 1 Part 1: Preparing to teach UHV-I in SIP)
https://www.youtube.com/watch?v=kejuD4faDDE&list=PLWDeKF97v9SOjS4RanhaYj4YLiImqm5pj&index=1

14. Resources, including the class notes and presentations
https://drive.google.com/drive/folders/1nh9m5ibEtvMyqekeiexAJtfbdNtmtt6-?usp=sharing

15. Hindi Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SMRfe5PK1HPYnEcrrJOL6K7

16. English Recording of 5-day UHV FDP
https://www.youtube.com/playlist?list=PLWDeKF97v9SP7wSlapZcQRrT7OH0ZlGC4

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21UHV306.1						2			3	2				
21UHV306.2						3	3							
21UHV306.3	2								3			2		
21UHV306.4						3	3	3						
21UHV306.5	2					2			3					
21UHV306.6						3	3			2				

1: Low 2: Medium 3: High

Biology for Engineers			
Course Code	**21BFE306/406**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:0:0)	SEE Marks	50
Credits	**02**	Exam Hours	02

Course Learning Objectives:

1. To bring awareness of biological concepts to engineering students
2. To introduce the building blocks of life and their complexity
3. To encourage interdisciplinary studies and projects
4. To appreciate the discoveries that mimic nature and its working
5. To inculcate nature-inspired design and operational principles

Module-1

Basic Cell Biology: Introduction to Biology, The cell: the basic unit of life, Expression of genetic information-protein structure and function, Cell metabolism; Cells respond to their external environments, Cells grow and reproduce, Cellular differentiation. **5 Hours**

Module-2

Biochemistry and Molecular Aspects of Life: Biodiversity-Chemical bonds in Biochemistry; Biochemistry and Human biology, Protein synthesis -DNA; RNA, Transcription and translation factors play key roles in protein synthesis, Differences between eukaryotic and prokaryotic protein synthesis, Stem cells and their applications. **5 Hours**

Module-3

Bioinspired Engineering based on human physiology: Circulatory system (artificial heart, pacemaker, stents), Nervous system (Artificial neural network), Respiratory system, sensory system (electronic nose, electronic tongue), Visual and auditory prosthesis (Bionic eye and cochlear implant).

5 Hours

Module-4

Relevance of Biology as an interdisciplinary approach: Biological observation that led to major discoveries, Echolocation (ultrasonography, sonars), Photosynthesis (photovoltaic cells, bionic leaf), Bird flying (aircraft), Lotus leaf effect (Super hydrophobic and self-cleaning surfaces), Plant burrs (Velcro). **5 Hours**

Module-5

Bioinspired Algorithms and Applications: Genetic algorithm, Gene expression modelling, Parallel Genetic Programming: Methodology, History, and Application to Real-Life Problems, Dynamic Updating DNA Computing Algorithms, Bee-Hive: New Ideas for Developing Routing Algorithms Inspired by Honey Bee Behaviour. **5 Hours**

Course Outcomes:

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

21BFE306.1	Discuss how the cell forms the basic building block of life
21BFE306.2	Distinguish between transcription and translation
21BFE306.3	Describe the role played by proteins within the cell
21BFE306.4	Analyze the role of bioinspired design in novel applications
21BFE306.5	Apply bioinspired design principles to other domains
21BFE306.6	Implement a simple genetic algorithm

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Biology for Engineers	Thyagarajan.S., Selvamurugan. N., Rajesh.MP, Nazeer RA, Richard W. Thilagaraj, Barathi.S., and Jaganthan.M.K	Tata McGraw Hill	2012
2	Molecular Biology	Robert Weaver	McGraw-Hill	5, 2012
Reference books				
1	Lewin's Genes XII	Jocelyn E. Krebs, Elliott S. Goldstein, Stephen T. Kilpatrick	Jones and Bartlett Learning	2017
2	Bioinspired Engineering	Jenkins, C.H.	Momentum Press	2012
3	Bio mimetics: Nature-Based Innovation	Yoseph Bar-Cohen	CRC Press	1, 2016
4	A Practical Guide to Bio-inspired Design	Hashemi Farzaneh, Helena, Lindemann, Udo,	Springer	2019

Web links/Video Lectures/MOOCs/papers

1. https://books.google.co.in/books?id=-2LNBQAAQBAJ&printsec=frontcover#v=onepage&q&f=false
2. https://www.aminotes.com/2017/02/biology-for-engineers-module-1-cocepts.html

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21BFE306.1	2					1								
21BFE306.2		1				1								
21BFE306.3	2					2								
21BFE306.4		2										2		
21BFE306.5	2											2		
21BFE306.6		2										2		

1: Low 2: Medium 3: High

Balake Kannada			
Course Code	**21KBK307/407**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives:

1. To enable the students to understand, speak, read and write the Kannada language.
2. To communicate in the Kannada language in their daily life with Kannada speakers
3. To give the overall information about the Kannada language and Karnataka state

Module- 1	
Kannada Aksharamaale haagu Uchchaarane (Kannada Alphabets and Pronunciation)	**3 hours**
Module-2	
Sambhashanegaagi Kannada Padagalu (Usage of Kannada Words in General Communication and Vocabulary)	**3 hours**
Module-3	
Sambhashaneyalli Kannada (Usage of Kannada in the proper manner - in Kannada Conversation)	**3 hours**
Module-4	
Kannadadalli Chatuvatikegalu (Activities related to the Kannada Language - Development of Skill vocabulary)	**3 hours**
Module-5	
Karnataka raajya, Kannada Bhashe, Saahithyada bagege Maahithi (Information about the Karnataka State, Kannada Language and Literature)	**3 hours**

Course Outcomes:

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

21KBK307.1	Write and read the Kannada alphabet
21KBK307.2	Communicate Kannada fluently
21KBK307.3	Communicate in Kannada in his day-to-day life
21KBK307.4	Build confidence to address large gatherings
21KBK307.5	Develop skills, vocabulary and fluency
21KBK307.6	Make use of state language and literature

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Balake Kannada	Dr L Thimmesha	Prasaranga VTU Belagavi	1st Edition. 2020
2	Vyavaharika Kannada	Dr L Thimmesha, Prof V Keshavamoorthy	Prasaranga VTU Belagavi	1st Edition. 2020
Reference Books				
1	Kannada Kali	Lingadevaru Halemane	Kannada University Hampi	Fourth Edition 2016
2	Spoken Kannada	N. D Krishnamurthy, Dr S. M. Rameshchandra Swamy, Abdul Rehman Pasha	Kannada Sahithya Parishat	2018

Web links/Video Lectures/MOOCs/papers

1. https://youtu.be/daY6TRvHFB4
2. https://youtu.be/RuRmq7VyCaQ

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21KBK307.1	2									2				
21KBK307.2	2									2				
21KBK307.3	2									2				
21KBK307.4	2									2				
21KBK307.5	2									2				
21KBK307.6	2									2				

1: Low 2: Medium 3: High

Saamskruthika Kannada			
Course Code	**21KSK307/407**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives:

1. ಕನ್ನಡ ಸಾಹಿತ್ಯ , ಸಂಸ್ಕೃತಿ ಮತ್ತು ನಾಡು ನುಡಿಯ ಪರಿಚಯ
2. ಕನ್ನಡದಲ್ಲಿ ತಾಂತ್ರಿಕ ವಿಜ್ಞಾನಗಳ ವಿಷಯಕ್ಕೆ ಸಂಬಂಧಿಸಿದ ವಿಷಯಗಳ ಪರಿಚಯ
3. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ , ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತದ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ
4. ಕನ್ನಡ ಭಾಷೆಯ ವ್ಯಾಕರಣದ ಬಗ್ಗೆ ಅರಿವು
5. ಕನ್ನಡ ಭಾಷಾ ಬರಹದಲ್ಲಿ ಕಂಡುಬರುವ ದೋಷಗಳು ಹಾಗೂ ಅವುಗಳ ನಿವಾರಣೆ ಮತ್ತು ಲೇಖನ ಚಿಹ್ನೆಗಳ ಪರಿಚಯ
6. ಸಾಮಾನ್ಯ ಅರ್ಜಿಗಳು, ಸರ್ಕಾರಿ ಮತ್ತು ಅರೆ ಸರ್ಕಾರಿ ಪತ್ರ ವ್ಯವಹಾರದ ಬಗ್ಗೆ ಅರಿವು

Module-1

1. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ ; ಹಂಪ ನಾಗರಾಜಯ್ಯ
2.ಕನ್ನಡ ನಾಡು ನುಡಿ
3.ಕನ್ನಡ ಭಾಷೆ – ಸಂಕ್ಷಿಪ್ತ ವಿವರಣೆ **3 Hours**

Module-2

4.ಕಾವ್ಯ ಭಾಗ- ಆಧುನಿಕ ಪೂರ್ವ
(ವಚನಗಳು, ಕೀರ್ತನೆಗಳು, ತತ್ವಪದಗಳು,ಜನಪದ ಗೀತೆ)
5. ಕಾವ್ಯ ಭಾಗ – ಆಧುನಿಕ
(ಡಿ ವಿ ಜಿ, ದ.ರಾ.ಬೇಂದ್ರೆ, ಕುವೆಂಪು, ಕೆ.ಎಸ್. ಎನ್, ಜಿ.ಎಸ್.ಶಿವರುದ್ರಪ್ಪ, ಚಂದ್ರಶೇಖರ ಕಂಬಾರ, ಸಿದ್ಧಲಿಂಗಯ್ಯ) **3 Hours**

Module-3

6.ಭಾಷಾ ಪ್ರಯೋಗದಲ್ಲಾಗುವ ಲೋಪದೋಷಗಳು ಮತ್ತು ಅವುಗಳ ನಿವಾರಣೆ
7. ಲೇಖನ ಚಿಹ್ನೆಗಳು ಮತ್ತು ಅವುಗಳ ಉಪಯೋಗ
8. ಪತ್ರವ್ಯವಹಾರ - ಆಡಳಿತ ಪತ್ರಗಳು; ಸಾಮಾನ್ಯ, ಸಾರ್ಕಾರಿ ಪತ್ರಗಳು, ಅರೆಸರ್ಕಾರಿ ಪತ್ರಗಳು **3 Hours**

Module-4

9. ಡಾ.ಸರ್ ಎಂ ವಿಶ್ವೇಶ್ವರಯ್ಯ –ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ ; ಎ ಎನ್ ಮೂರ್ತಿರಾವ್
10. ಯುಗಾದಿ; - ವಸುಧೇಂದ್ರ **3 Hours**

Module-5

ವಿಜ್ಞಾನ ಮತ್ತು ತಂತ್ರಜ್ಞಾನ
11. “ಕ” ಮತ್ತು “ಬ” ಬರಹ ತಂತ್ರಾಂಶಗಳು ಮತ್ತು ಕನ್ನಡ ಟೈಪಿಂಗ್
12. ಕನ್ನಡ – ಕಂಪ್ಯೂಟರ್ ಶಬ್ದಕೋಶ
13. ತಾಂತ್ರಿಕ ಪದಕೋಶ –ತಾಂತ್ರಿಕ ಹಾಗೂ ಪಾರಿಭಾಷಿಕ ಕನ್ನಡ ಪದಗಳು **3 Hours**

Course Outcomes:
At the end of the course the student will be able to:

21KSK307.1	**ಕನ್ನಡ ನಾಡು ನುಡಿಯ ಅರಿವು ಹಾಗೂ ಸಂಸ್ಕೃತಿಯ ಹರಿವು**
21KSK307.2	**ಕವಿ ಕಾವ್ಯಗಳ ಪರಿಚಯ- ಕವಿತೆಗಳ ಮೂಲಕ ಬದುಕಿನ ನೈಜತೆಯ ಚಿತ್ರಣ**
21KSK307.3	**ಶುದ್ಧ ಕನ್ನಡದ ಬಳಕೆ, ಪತ್ರಗಳತ್ತ ಒಲವು, ಸುಲಭ ವ್ಯಾಕರಣ**
21KSK307.4	**ಕನ್ನಡ ಸಾಹಿತ್ಯದ ವಿವಿಧ ಪ್ರಕಾರಗಳು- ವ್ಯಕ್ತಿ ಪರಿಚಯ ಹಾಗೂ ಕತೆಯ ತಂತ್ರಗಾರಿಕೆ**
21KSK307.5	**ತಂತ್ರಾಂಶಗಳ ಬಳಕೆ, ಪಾರಿಭಾಷಿಕ ಪದಗಳ ಪರಿಚಯ**
21KSK307.6	**ಕನ್ನಡ ಭಾಷಾಜ್ಞಾನ, ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯ**

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	**ಆಡಳಿತ ಕನ್ನಡ**	**ಡಾ.ಎಲ್ .ತಿಮ್ಮೇಶ್ ಪ್ರೊ.ವಿ. ಕೇಶವಮೂರ್ತಿ**	**ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ**	2019
2	**ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ**	**ಡಾ .ಹಿ. ಚಿ. ಬೋರಲಿಂಗಯ್ಯ , ಡಾ.ಎಲ್ .ತಿಮ್ಮೇಶ್**	**ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ**	2020
Reference Books				
1	**ಕನ್ನಡ ಸಾಹಿತ್ಯಕೋಶ & ವ್ಯಾಕರಣ ಪುಸ್ತಕ**	**ರಾಜಪ್ಪ ದಳವಾಯಿ ———**	**ದಳವಾಯಿ ಪ್ರಕಾಶನ, ಬೆಂಗಳೂರು.**	2008
2	**ಕನ್ನಡ ಕ್ಲಿಷ್ಟಪದ ಕೋಶ (ಶಬ್ದದ ವ್ಯುತ್ಪತ್ತಿ ಸಹಿತ)**	**ಪ್ರೊ. ಜಿ. ವೆಂಕಟ ಸುಬ್ಬಯ್ಯ ಹಾಗೂ ರಾಜ್ಯಶ್ರೀ ಸತೀಶ್**	**ಪ್ರಿಸಮ್ ಬುಕ್ಸ್ ಪ್ರೈ.ಲಿ.**	2006

Web links/Video Lectures/MOOCs/papers

1. https://youtu.be/HS8InQR36E4
2. https://youtu.be/C_SF24_ygxQ
3. https://youtu.be/wuT7UED7yuQ
4. https://youtu.be/pxLwNWXhbnQ
5. https://youtu.be/H6FXRSBNO4c

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21KSK307.1		2										2		
21KSK307.2		2										2		
21KSK307.3		2								2				
21KSK307.4		2										2		
21KSK307.5		2				2								
21KSK307.6						2				2				

1: Low 2: Medium 3: High

Constitution of India, Professional Ethics and Cyber Law			
Course Code	**21CPC307/407**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(1:0:0)	SEE Marks	50
Credits	**01**	Exam Hours	02

Course Learning Objectives: To

1. Know the fundamental political codes, structure, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and *the* duties of citizens
2. Understand engineering ethics and their responsibilities; identify their individual roles and ethical responsibilities towards society.
3. Know about cybercrimes and cyber laws for cyber safety measures.

Module-1

Introduction to Indian Constitution:

The Necessity of the Constitution, The Societies before and after the Constitution adoption. Introduction to the Indian constitution, The Making of the Constitution, The Role of the Constituent Assembly - Preamble and Salient features of the Constitution of India. Fundamental Rights and its Restriction and limitations in different Complex Situations. Directive Principles of State Policy (DPSP) and its present relevance in our society with examples. Fundamental Duties and its Scope and significance in Nation building. **3 Hours**

Module-2

Union Executive and State Executive:

Parliamentary System, Federal System, Centre-State Relations. Union Executive - President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Court of India, Judicial Reviews and Judicial Activism. State Executives - Governor, Chief Minister, State Cabinet, State Legislature, High Court and Subordinate Courts, Special Provisions (Articles 370.371,37JJ) for some States. **3 Hours**

Module-3

Elections, Amendments and Emergency Provisions:

Elections, Electoral Process, and Election Commission of India, Election Laws. Amendments - Methods in Constitutional Amendments (How and Why) and Important Constitutional Amendments. Amendments - 7,9, 10,12,42,44,61,73,74,75,86, and 91,94,95,100,101,118 and some important Case Studies. Emergency Provisions, types of Emergencies and their consequences.

Constitutional special provisions:

Special Provisions for SC and ST, OBC, Women, Children and Backward Classes.

3 Hours

Module-4

Professional/ Engineering Ethics:

Scope & Aims of Engineering & Professional Ethics - Business Ethics, Corporate Ethics, Personal Ethics. Engineering and Professionalism, Positive and Negative Faces of Engineering Ethics, Code of Ethics as defined in the website of Institution of Engineers (India): Profession, Professionalism, and Professional Responsibility. Clash of Ethics, Conflicts of Interest. Responsibilities **in** Engineering Responsibilities in Engineering and Engineering Standards, the impediments to Responsibility. Trust and Reliability in Engineering, TPRs (Intellectual Property Rights), Risks, Safety and liability in Engineering. **3 Hours**

Module-5
Internet Laws, Cyber Crimes and Cyber Laws: Internet and Need for Cyber Laws, Modes of Regulation of Internet, Types of cyber terror capability, Net neutrality, Types of Cyber Crimes, India and cyber law, Cyber Crimes and the information Technology Act 2000, Internet Censorship. Cybercrimes and enforcement agencies. **3 Hours**

Course Outcomes: At the end of the course the student will be able to:	
21CPC307.1	Discuss the constitutional knowledge and legal literacy
21CPC307.2	Review the Indian constitution
21CPC307.3	Analyze the role and functions of Union and state executives
21CPC307.4	Review the Electoral Process, the System of Election Commission and its functions
21CPC307.5	Discuss professional ethics and responsibilities of engineers
21CPC307.6	Analyze the cybercrimes and cyber laws for cyber safety measures

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Constitution of India, Professional Ethics and Human Rights	Shubham Singles, Charles E. Haries, et al	Cengage Learning India	2018
2	Cyber Security and Cyber Laws	Alfred Basta and et al	Cengage Learning India	2018
Reference Books				
1	Introduction to the Constitution of India	Durga Das Basu	Prentice -Hall	2008
2	Engineering Ethics	M. Govindarajan, S. Natarajan, V. S. Senthilkumar	Prentice -Hall	2004

Web links/Video Lectures/MOOCs/papers

1.https://www.constitutionofindia.net/constitution_of_india

2. https://infosecawareness.in/cyber-laws-of-india

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CPC307.1						2		2						
21CPC307.2								2				2		
21CPC307.3						2		2				2		
21CPC307.4						2		2						
21CPC307.5						2		2						
21CPC307.6								2				2		

1: Low 2: Medium 3: High

IOT ENABLED PROTOTYPING			
Course Code:	**21IEP308**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	03

Course Learning Objectives:

1. Understand the IoT concepts such as sensing, actuation, and communication.
2. Development of Internet of Things (IoT) prototypes—including devices for sensing, actuation, processing, and communication and Protocols
3. Understand the significance of Project Management and the different techniques of planning
4. To introduce fundamental aspects of intellectual property rights, Govt. policies on IPR, and patentability search techniques.

Module 1

Internet of Things – Hardware / System Design

Introduction to IoT fundamentals, Introduction to sensors, Difference between analog and Digital sensors, Interfacing Temperature, Light and Humidity sensor with Arduino, Interfacing Motors with Arduino, A simple program to control actuator based on the analog sensor. **6 Hours**

Module 2

Internet of Things

Networking in IoT:

Introduction to wireless communication, Wifi Module ESP8266 interface with Arduino, Machine to Machine (M2M) communication using WiFi module. A simple demonstration of sensing temperature from one device and control actuator on a second device (M2M)

IoT in Web/ Cloud Platform:

Introduction to a web server - XAMPP(windows), A simple interactive web page using HTML5, Bootstrap (or CSS), and Javascript. Interfacing ESP8266 with webserver, ThingSpeak API, and MQTT protocol, A simple project to demonstrate the status of two IoT devices communicating with a Web Server. **6 Hours**

Module 3

Project Planning and Management

Project initiation, Project charter, Project planning, and implementation, Scheduling and costing, Project monitoring and control, Project closure and reports. **6 Hours**

Module 4

Intellectual Property Rights

Introduction and the need for intellectual property right (IPR) – Kinds of Intellectual Property Rights, Elements of Patentability: Novelty, Non-Obviousness (Inventive Steps), Industrial Application, Non - Patentable Subject Matter, Registration Procedure, Patentability search methods, Patent landscape, Freedom-to-market, National IPR Policy, Govt. initiatives and scheme in promoting IPR. **6 Hours**

Course Project

Develop IoT-based prototypes (solutions) to solve any industrial or societal problems. The prototype building is teamwork of 3-5 students. The goals should be clearly defined and should use robust technologies and rigorous testing. **6 Hours**

Course Outcomes: At the end of the course, the student will be able to:	
21IEP308.1	Analyze the basics of IoT and protocols
21IEP308.2	Develop IoT-based prototypes to solve industrial and societal problems
21IEP308.3	Apply appropriate approaches to plan a new project and develop a project schedule.
21IEP308.4	Discuss the ethical aspects in IPR, Govt. policies on IPR, and conducting patentability searches
21IEP308.5	Inculcate the teamwork and communication skills

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Reference Books				
1	Internet of Things (A Hands-on-Approach)	Vijay Madisetti and Arshdeep Bahga	Orient Blackswan Private Limited	1st Edition, 2015
2	Fundamentals of Intellectual Property	Dr. Kalyan C. Kankanala	Asia Law House	1st Edition, 2012
3	Project Management Absolute Beginner's Guide	Greg Horine	Pearson Education (US)	4th Edition, 2017

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**	**PO 7**	**PO 8**	**PO 9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO 2**
21IEP308.1			**2**		**2**				**2**	**2**				
21IEP308.2			**2**								**3**			
21IEP308.3					**2**						**2**			
21IEP308.4								**1**		**2**				
21IEP308.5								**1**	**2**	**2**				

1: Low 2: Medium 3: High

Industry Oriented Training - Business Etiquettes			
Course Code	**21IOT309**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	2

Course Learning Objectives:

6. Know the components of self-introduction
7. Develop a resume with the inclusion of core competencies
8. Involve and contribute to group discussions
9. Develop effective communication to succeed in the professional career
10. Know the etiquettes of digital communication

Module-1

Self Introduction &Essentials of grooming

Self Introduction: Learn the secret to introducing Yourself, Things to avoid when introducing yourself. Activity: Video record the self-introduction. **Essentials of grooming:** Creating the first impression, what does the well-dressed man wear? What does the well-dressed woman wear? Personal hygiene and habits

4 Hours

Module-2

Resume Writing

Purpose, Identifying Relevant Competencies, Understanding Applicant Tracking Systems, Lists of Competencies, Writing Accomplishment/ Objective Statements, Finding the Right Words-Action verbs, The Most Popular Resume Format, Other Popular Resume Formats, Do's and Don'ts. Activity: Students have to submit a copy of their resume

4 Hours

Module-3

Group Discussion

Types, process, Evaluation criteria, Do's and Don'ts Activity: Group discussions have to be held during the training sessions **4 Hours**

Module-4

Communicate effectively

Build a Story, Just a Minute, Group Activities, Team building activities, Role Play, Presentation Skills

4 Hours

Module-5

Digital right and wrong

Virtual Communication: Agenda, being prepared, Dressing appropriately, background, Use Microphone and camera the right way, restraining from off tasks during virtual meetings, protecting confidential data during online presentations, time management

4 Hours

Course Outcomes:	
At the end of the course the student will be able to:	
21IOT309.1	Articulate the essential components required for self-introduction in any business or a networking event and also recognize the need to dress appropriately for a successful career in the corporate
21IOT309.2	Develop a resume inclusive of core competencies, and action verbs which are compatible with Applicant Tracking Systems
21IOT309.3	Demonstrate the types, process and evaluation process of Group Discussion and carry out effective group discussions
21IOT309.4	Develop skills required for effective communication
21IOT309.5	Associate and be accustomed to the etiquette to be followed during online meetings

Sources

1. English for Common Interactions in the Workplace: Basic Level: Coursera: https://www.coursera.org/learn/english-common-interactions-workplace-basic-level
2. Personal Communication-Introduce Yourself With Confidence: https://www.udemy.com/course/how-to-introduce-yourself/
3. Professionalism, Grooming and Etiquette: https://www.edx.org/course/professionalism-grooming-and-etiquette
4. How to Write a Resume: https://www.coursera.org/learn/how-to-write-a-resume#syllabus
5. Group Discussion Strategies: https://www.udemy.com/course/group-discussion-strategies/
6. Communication Strategies for a Virtual Age: https://www.coursera.org/learn/communication-strategies-virtual-age#syllabus

References

1. https://simplifytraining.com/course/personal-hygiene-and-good-grooming/
2. https://www.udemy.com/course/group-discussion-strategies/
3. https://www.educba.com/course/group-discussion/
4. https://getrafiki.ai/meetings/rules-of-virtual-meeting-etiquette-every-sales-professional-should-follow/
5. https://thedigitalworkplace.com/articles/online-meeting-etiquette-for-attendees/
6. https://rigorousthemes.com/blog/virtual-meeting-etiquette-guidelines-ground-rules/

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21IOT309.1									2	3		1		
21IOT309.2										3		1		
21IOT309.3									2	3	1	1		
21IOT309.4									2	3	1	1		
21IOT309.5									2	3	1	1		

1: Low 2: Medium 3: High

Additional Mathematics - I

(A Bridge Course for Lateral Entry Students of BE Programmes)

(Common to all Programmes)

Course Code	**21MAL301**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	50
Credits	-	Exam Hours	03

Course Learning Objectives:

1. To familiarize concepts of Mathematics required for engineering study
2. To equip the students with standard concepts and tools to solve problems in their discipline of engineering.

Module-1

Complex Trigonometry: Complex Numbers, Definitions and properties. Modulus and amplitude of a complex number, De Moivre's Theorem, Argand diagram,
Vector Algebra: Scalars and vectors. Addition and subtraction and multiplication of vectors- Dot and Cross products, problems.

8 Hours

Module-2

Trigonometry: Trigonometric ratios, quadrant rule, trigonometric ratios of standard angles, compound angles, Sum and product formula and Hyperbolic functions
Partial fraction: Type 1- Denominator is a product of non repeated linear factors, Type 2 -repeated linear factors and Type 3: Quadratic factors. **8 Hours**

Module-3

Differentiation: Derivative of a function, Derivative of a composite function, Differentiation of Implicit function, Differentiation of inverse trigonometric function, product formula, Quotient formula, Chain rule, nth derivative, Leibnizs Rule, angle between radius vector and tangent (only formula), angle between polar curves. **8 Hours**

Module-4

Integration: Definition, standard formulae, Integration by substitution, , Integration by partial fraction method, Integration by parts, Bernoulli's rule ,$\int e^{ax}\ sin\ bx\ dx$ and $\int e^{ax} \cos bx\ dx$
Definite Integrals and properties of definite integrals. Application- Definite integral as an area. **8 Hours**

Module-5

Linear Algebra: Rank of matrices - Rank of a matrix by Echelon form, consistency of system of linear equations - homogeneous and non-homogeneous equations, Gauss – Elimination and Gauss - Seidel methods. Eigen values and Eigenvectors-properties, largest Eigenvalue by Rayleigh's power method. Diagonalization of a square matrix of order two. **8 Hours**

Course Outcomes:

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

21MAL301.1	Apply complex numbers and vectors in Engineering Applications
21MAL301.2	Apply trigonometry in real life applications
21MAL301.3	Resolve the Rational fraction into partial fractions.
21MAL301.4	Compute derivative of different functions

21MAL301.5	Compare and different methods integration and select appropriate method to solve given problem
21MAL301.6	Analyze given problem and use appropriate method of solving given set of equations

Question paper pattern:
Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Sl No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2017
2	NCERT Text Book for Mathematics I PUC and II PUC	NCERT	NCERT	Reprint 2007
3	Higher Engineering Mathematics	H.K Dass and R Verma	C. Chand and Company	First Edition, 2011
Reference Books				
1	Advanced Engineering Mathematics – Volume I	E. Kreyszig John Wiley & Sons	Wiley Precise Textbook Series	10th Edition 2010
2	"Higher Engineering Mathematics"	B.V.Ramana	Tata McGraw-Hill Publications	11th Edition,2010

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAL301.1	3	1										
21MAL301.2	3	1										
21MAL301.3	3		1									
21MAL301.4	3		1									
21MAL301.5	3		1									
21MAL301.6	3		1									

1: Low 2: Medium 3: High

Business Communication

(A Bridge Course for Lateral Entry Students BE programmes)

Course Code	**21ENG310/410**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:2:0)	SEE Marks	50
Credits	**00**	Exam Hours	02

Course Learning Objectives:

1. To enable the learner to communicate effectively in real-life situations.
2. To review English grammar effectively for study purposes across the curriculum.
3. To enhance English vocabulary and language proficiency.
4. To achieve better writing and presentation skills.

Module-1	**2 Hours**
Subject Verb Agreement, Sequences of tenses, Active and Passive, Reported speech, Articles, Preposition.	
Module-2	**2 Hours**
Vocabulary, One word substitutes, Confused words, Phrasal Verbs, Idioms and Phrases, Analogies.	
Module-3	**2 Hours**
Technical vocabulary, Homophones, Homographs, Homonyms, Synonyms and Antonyms, Common errors in the English language, and Phrasal verbs.	
Module-4	**2 Hours**
Formal letter writing, Covering letter with Resume, Email Etiquette Cloze passage.	
Module-5	**2 Hours**
Communication skills: Group discussion, Etiquette of the job interview, Dialogues in various situations, Telephonic conversation.	

Course Outcomes:

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

21ENG310.1	Analyze the concepts of grammar and its usage
21ENG310.2	Identify the nuances of phonetics, intonation and flawless pronunciation
21ENG310.3	Implement English vocabulary and language proficiency.
21ENG310.4	Apply the forms of writing skills at the professional level.
21ENG310.5	Demonstrate speaking ability in terms of fluency and comprehensibility.
21ENG310.6	Demonstrate competence in the four modes of literacy: Writing, Reading, Speaking and listening.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Textbooks				
1	Communication skills	Sanjay Kumar and Pushp Lata	Oxford University Press	Second Edition, 2015

2	High School English Grammar and Composition	Wren and Martin	S Chand and Company Ltd	2015
Reference Books				
1	Practical English Usage	Michael Swan	Oxford University Press	2016
2	English Grammar in Use	Raymond Murphy	Cambridge University Press	Second Edition, 1994

Web links/Video Lectures/MOOCs

1.https://englishforeveryone.org
2.https://owl.purdue.edu
3.http://guidetogrammar.org

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21ENG310.1	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.2	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.3	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.4	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.5	2	-	-	-	-	-	-	-	-	3	-	-	-	-
21ENG310.6	2	-	-	-	-	-	-	-	-	3	-	-	-	-

1: Low 2: Medium 3: High

IV SEMESTER

Vector Integration, Curve Fitting and Statistical Methods (Common to **CIV&MECH**)			
Course Code	21MAM401	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

1. To provide an insight into applications of vector integration and apply the least square method numerically to find the curve of best fit.
2. To acquire the proficiency in variational calculus and solving ODEs arising in engineering applications using numerical method.
3. To develop probability distribution of discrete, continuous random variables and joint probability distribution occurring in design engineering and microwave engineering.

Module-1

Vector Integration: Line integrals, Applications to work done by a force, Theorems of Green, Gauss and Stokes (Without Proof) **8 Hours**

Module-2

Curve fitting: Curve fitting by the method of least squares: straight line, parabola and exponential curve of the type $y = ax^b$.

Calculus of Variations: Variation of function and Functional, variational problems, Euler's equation, Geodesics, Hanging chain problem. **8 Hours**

Module-3

Statistical Methods: Correlation and regression-Karl Pearson's coefficient of correlation and rank correlation -problems. Regression analysis- lines of regression –problems.

Probability: Introduction, Conditional probability and Baye's theorem – problems. **8 Hours**

Module-4

Probability Distributions: Random variables – discrete and continuous. Probability distribution function, cumulative distribution function. Binomial, Poisson, Exponential and Normal distribution – Problems. **8 Hours**

Module-5

Joint Probability Distribution: Joint distribution of random variables – Expectation, covariance and correlation.

Markov chain: Stochastic matrices, higher transition probabilities, regular stochastic matrices, probability vector. **8 Hours**

Course Outcomes:

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

21MAM401.1	Analyze the concepts of Gradient, Divergence, Curl and apply Green's, Stokes, Divergence theorem in various engineering problems.
21MAM401.2	Apply the method of least squares to fit a curve for the given data.
21MAM401.3	Apply the concept of extremals of functional using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.
21MAM401.4	Make use of the probability, correlation and regression analysis to fit a suitable mathematical model for the statistical data.

21MAM401.5	Apply discrete and continuous probability distributions in analyzing the probability models arising in engineering field.
21MAM401.6	Construct joint probability distributions and apply the knowledge in attempting Engineering problems for feasible random events.

Question paper pattern:

Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module. Students will have to answer 5 full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2017
2	Advanced Engineering Mathematics	E. Kreyszig	John Wiley & Sons	10th edition, 2016
3	Introductory Probability And Statistical Applications	B L Mayer	Wiley Eastern Limited	2nd Edition,2010
Reference Books				
1	Higher Engineering Mathematics	B.V. Ramana	Tata McGraw-Hill	11th Edition, 2010

Web links/Video Lectures/MOOCs

1. https://www.youtube.com/watch?v=AIxiYG-gZ00&list=PLHXZ9OQGMqxfW0GMqeUE1bLKaYor6kbHa
2. https://www.youtube.com/watch?v=1RdWluX3XGc
3. https://www.youtube.com/watch?v=6HeQc7CSkZs
4. https://youtu.be/Ih0GJMzg0yg
5. https://youtu.be/XQoLVl31ZfQ
6. https://youtu.be/LzWHQgRLge0
7. https://youtu.be/vv-l0vOayKM
8. https://youtu.be/aztcS-3MwH0
9. https://youtu.be/E4wyYQhcN_Y
10. https://youtu.be/i3AkTO9HLXo

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAM401.1		3	1									
21MAM401.2	1		3									
21MAM401.3	3	1										
21MAM401.4		1		3								
21MAM401.5		2	2									
21MAM401.6	2		2									

1: Low 2: Medium 3: High

MACHINE TOOL TECHNOLOGY			
Course Code	**21MEC402**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. Calculate the values of various forces involved in the machining operations and study the factors affecting the surface finish.
2. Enumerate various types of lathes, drilling, shaping, milling, grinding and CNC machines along with various operations involved in it.
3. Select the appropriate machining process depending on the geometry of the component required.
4. Comprehend appropriate jigs and fixtures for various machining processes.

Module-1

Introduction to Machining Processes and Machine Tools: Subtractive manufacturing processes and classifications.

Construction, specification operations of machine tools: Lathe, Shaping, Milling, Drilling, **Grinding Machine. Introduction to CNC machines:** CNC Lathe, Milling, Drilling, Machining Centre. **8 Hours**

Module-2

Mechanics of Metal Cutting: Single point turning tool geometry (SPTT) influences the chip formation mechanisms of the Orthogonal and Oblique cutting process.

Cutting Force Analysis (Orthogonal Cutting): Analysis of machining forces and power requirement, 'Merchant's model of Orthogonal Cutting and Theory of Lee & Shaffer' Chip Velocity, Velocity relationships (simple numerical); the influence of cutting temperature on machinability.

Cutting Fluids: Characteristics of Cutting fluids, Selections, and applying methods of cutting fluids. **7 Hours**

Module-3

Machinability and Tool Life: Process of cutting tool failure wears and time relationship, tool wear index, feed marks, the effect of tool wear on the machined surface, surface finish, machinability, machinability index/rating, tool life & variables affecting tool life, tool materials.

Finishing Process: Importance of surface finishing processes, Grinding, Abrasive Flow Machining, Honing. Sanding, Abrasive blasting, Polishing, Lapping.

Surface Finishing and Protection: Powder Coating, Liquid Coating, Electroplating, Galvanizing, Anodizing. **7 Hours**

Module-4

Advanced Machining Process; Importance and classification of advanced machining process; Process principle, process parameters, and application of: - Abrasive Jet Machining (AJW), Water Jet Machining (WJM), Abrasive Water Jet Machining (AWJM); Ultrasonic Machining (USM); Electrical Discharge Machining (EDM); Wire Electrical Discharge Machining (WEDM); Electro Chemical Machining (ECM). Laser Beam Machining (LBM), Electron Beam Machining (EBM), and Plasma Arc Machining (PAM).

Hybrid Machining Process: Importance of hybrid machining process; Process principal, process parameters, and application of: - Electrochemical Discharge Machining (ECDM), Ultrasonic Assisted Electric Discharge Machining (UAEDM), Electrochemical Discharge Grinding (EDG), Powder Assisted Electric Discharge Machining (PAEDM). **7 Hours**

Module-5:

Jigs and Fixtures: Importance of jigs and fixtures; the difference between jigs and fixtures; types of jigs and fixtures; essential features of jigs and fixtures, Materials used. Factors to be considered for the design of Jigs and Fixtures.

Jigs: Template, Plate, Channel, Diameter, Leaf, Rung, Box.

Fixtures: Turning, Milling, Broaching, Grinding, Boring, Indexing, Tapping, Duplex, Welding, and Assembly fixtures. **7 Hours**

List of Laboratory Experiments related to the above modules – 4 hours each

1. One Job on Lathe machine with simple operations (turning, facing, Thread cutting and tapering) on low carbon steel and/or heat-treated low carbon steel, and Demonstration of tungsten carbide cutting tool inserts.
2. Operations and One Job each on shaping/milling machine
3. Simple operations and One Job on the drilling and grinding machine.
4. Demonstration/Experimentation of simple programming of CNC machine operations.
5. To study the tool geometry of a single point turning tool (SPTT) in the American Standards Association (ASA) system.
6. Cutting force measurement with dynamometers (Demonstration) for turning, drilling, and grinding operations.
7. Application of cutting fluids in turning operations and case study on optimizing process parameters on turning operation.
8. Analysis of chip formation and chip reduction coefficient in turning of mild steel by HSS tool with different depth of cut, speed, and feed rate.
9. Experiment on tool wears and tool life on anyone conventional machining process.
10. Experiment on anyone advanced machining process
11. Design of Jigs and Fixture for any one application using any software tool.
12. Experiment using Drill/template Jig and Demonstration on turning and grinding fixtures.
13. Experiment using milling Indexing fixtures.

Open-ended experiment covering the concept of entire syllabus

14. Preparation of model with Shaft and gear with key lock.

Course Outcomes:

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

21MEC402.1	Discuss the Conventional CNC machines operations.
21MEC402.2	Demonstrate the advanced manufacturing process operations.
21MEC402.3	Determine tool life, cutting force, and economy of the machining process.
21MEC402.4	Analyse the influence of various parameters on machine tools' performance.
21MEC402.5	Select the appropriate machine tools and processes for various applications.
21MEC402.6	Select the appropriate Jigs and fixtures for various applications.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Metal Cutting Principles	Shaw, M C	Oxford University Press	2016
2	Advanced Methods of Machining	McGeough, J A	Springer	2011
3	Fundamentals of Machining and Machine Tools	Boothroyd, G., and Knight, W. A.	Taylor and Francis	2011
4	Machining and Machine Tools	Chattopadhyay, A B	Wiley India	2013
Reference Books				
1	Fundamentals of Modern Manufacturing: Materials, Processes, and Systems	Mikell P. Groover	Wiley Publications	2019
2	Manufacturing Technology II	Rao P. N.	Tata McGraw Hill	2002

Web links/Video Lectures/MOOCs/papers

1. V. K. Jain, Advanced Machining Processes, NPTEL Course Department of Mechanical Engineering, IIT Kanpur, Link: http://nptel.ac.in/courses/112104028/.
2. U. S. Dixit, Mechanics of Machining, NPTEL Course Department of Mechanical Engineering Guwahati, Link: http://nptel.ac.in/courses/112103248/.
3. A. B. Chattopadhyay, Manufacturing Processes II, NPTEL Course of Department of Mechanical Engineering, IIT Kharagpur, https://nptel.ac.in/courses/112/105/112105126/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO 11	PO 12	PSO1	PSO 2
21MEC402.1	3	-	-		3								2	2
21MEC402.2	3				3							2	2	2
21MEC402.3			3		2									
21MEC402.4			3									3		
21MEC402.5						2					2		2	
21MEC402.6						2					2		2	

1: Low 2: Medium 3: High

Fluid Mechanics			
Course Code	**21MEC403**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(3:0:2)	SEE Marks	50
Credits	**04**	Exam Hours	03

Course Learning Objectives:

1. To understand the basic properties of fluids and understand the continuum approximation.
2. To calculate the forces exerted by a fluid at rest on submerged surfaces and understand the force of buoyancy.
3. To understand the flow characteristic and dynamics of the flow field for various engineering applications.
4. To know how velocity changes and energy transfers in fluid flows are related to forces and torques and to understand why designing for minimum loss of energy in fluid flows is so important.
5. To discuss laminar and turbulent flow and appreciate their differences and the concept of boundary layer theory.
6. To understand the concept of dynamic similarity and how to apply it to experimental modelling.

Module-1

Introduction

Fluid Properties, Types of fluids, Fluid Pressure, and its Measurements: Concept of continuum, Newton's law of viscosity, Pascal's law, hydrostatic Law, manometry (simple, differential, inverted and inclined manometers), numerical.

Fluid Statics

Hydrostatic Forces on a horizontal plane, vertical plane, and inclined plane submerged in static fluid, Buoyancy, floatation and stability, numerical.

8 Hours

Module-2

Fluid Kinematics and Dynamics

Types of flows, Eulerian representation, Continuity equation in 3D (Cartesian coordinate only), velocity and acceleration fields, streamlines, streak lines, timeline and path lines, material derivative, linear motion and deformation, angular deformation, vorticity, Laplace's equation in velocity potential and Poisson's equation in stream function, flow net, numerical.

Newton's second law along a streamline and normal to streamline, Euler equation of motion and reduction to Bernoulli equation, Navier Stokes equation, numerical.

8 Hours

Module-3

Laminar and turbulent flow

Flow-through circular pipe, between parallel plates, Power absorbed in viscous flow in bearings, Poiseuille equation – velocity profile loss of head due to friction in viscous flow. Reynolds's experiment, frictional loss in pipe flow.

Introduction to turbulence, characteristics of turbulent flow, laminar-turbulent transition major and minor losses. Hagen Poiseuille equation, numerical.

8 Hours

Module-4

Dimensional analysis

Introduction, derived quantities, dimensions of physical quantities, dimensional homogeneity, Rayleigh's method, Buckingham Pi-theorem, dimensionless numbers and their significance, similitude, types of similitude, Unit and specific quantities, model studies and its numerical.

Flow over bodies

Development of boundary layer, Lift and Drag, Flow around circular cylinders, spheres, aerofoils and flat plates, Streamlined and bluff bodies, boundary layer separation and its control. **8 Hours**

Module-5

Compressible Flows

Introduction, thermodynamic relations of perfect gases, internal energy and enthalpy, speed of sound, pressure field due to a moving source, basic Equations for one-dimensional flow, stagnation and sonic properties, normal and oblique shocks.

CFD

Introduction, necessity, limitations, the philosophy behind CFD, applications. **8 Hours**

List of Laboratory Experiments related to the above modules – 2 hours each

1. Determine the viscosity of oil using Red wood viscometer and Say-bolt viscometer.
2. Measurement of pressure using different Manometers for high and low pressure measurements (manometers using different manometric fluids).
3. Working principle of different flow meters and their calibration (orifice plate, venture meter, Rotameter)
4. Working principle of different flow meters for open channel and their calibration
5. Determination of head loss in pipes and pipe fittings having different diameters, different materials and different roughness
6. Reynolds apparatus to measure critical Reynolds number for pipe flows
7. Effect of change in cross section and application of the Bernoulli equation
8. Impact of jet on flat and curved plates
9. Wind tunnel calibration using Pitot static tube
10. Determination of drag and lift coefficient of standard objects using a wind tunnel.

Demonstrate the use of any CFD package to study the flow over aerofoil/cylinder (For CIE only)

Course Outcomes:

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

21MEC403.1	Describe the key fluid properties used in the analysis of fluid behaviour.
21MEC403.2	Apply the principles of pressure, buoyancy, and floatation to solve numerical problems.
21MEC403.3	Apply the knowledge of fluid statics, kinematics and dynamics while addressing problems of engineering applications.
21MEC403.4	Examine the principles of dimensional analysis to study fluid flow problems
21MEC403.5	Evaluate the basic concept of compressible flow problems using CFD software.
21MEC403.6	Measure various properties of fluid with the help of experimental investigation in the laboratory.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Fundamentals of Fluid Mechanics	Munson, Young, Okiishi, Huebsch	Wiley publications	7, 2017
2	Fluid Mechanics-Fundamentals & Applications	Yunus A Cengel and John A Cimbala	Tata McGraw Hill.	4, 2019
Reference Books				
1	A textbook of Fluid Mechanics and Hydraulic Machines	Dr. R K Bansal	Laxmi Publications (P) Ltd	10, 2019
2	Fluid Mechanics, Hydraulics and Fluid Machines	S Ramamrutham	Dhanpat Rai Publications.	9,2014
3	Introduction to Fluid Mechanics	Fox and MacDonald	Wiley India.	9, 2015

Web links/Video Lectures/MOOCs/papers

1. https://. http://nptel.ac.in/courses/112104118/
2. http://www.mooc-list.com/course/fluid-mechanics-saylororg
3. https://legacy.saylor.org/me201/Unit01/

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21MEC403.1	-	**3**	-	-	-	-	-	-	**2**	**2**	-	-	**2**	-
21MEC403.2	-	**3**	**2**	-	-	-	-	-	-	-	-	-	-	-
21MEC403.3	-	-	**3**	-	**2**	-	-	-	-	-	-	-	**3**	-
21MEC403.4	-	-	**3**	-	-	-	-	-	-	-	-	**2**	-	-
21MEC403.5	-	-	-	**1**	**3**	-	-	-	-	-	-	-	-	**3**
21MEC403.6	-	-	-	**3**	-	--	-	-	**2**	**2**	-	2	-	2

1: Low 2: Medium 3: High

MECHANICS OF MATERIALS			
Course Code	**21MEC404**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:2:0)	SEE Marks	50
Credits	**03**	Exam Hours	03

Course Learning Objectives:

This Course will enable students to:

1. Compute different types of stresses, strain, strain energy developed in the member subjected to axial, bending, shear, torsion & thermal loads.
2. Compute and analyze the stress distributions in thick & thin cylinders.
3. Analyze the shear stresses and bending stresses developed in beams having different cross sections by developing the shear force and bending moment diagrams.
4. Evaluate the shear stresses induced in shafts subjected to torque while transmitting rotational power.
5. Utilize the equation of crippling load using Euler's theory for analysing columns subjected to buckling load.

Module-1

Stresses and Strains: Introduction, Hooke's stress-strain concepts, Factor of safety, Calculation of stresses in straight, Stepped, and tapered sections, Composite sections, Thermal Stresses, Shear stress and shear strain, Lateral strain, and Poisson's ratio.

Self-Study: Elastic constants and relations between them.

8 Hours

Module-2

Analysis of Stress and Strain: Generalized state of stress, Principal stresses and maximum shear stresses, and its inclinations, Mohr's circle, Theories of Failures (Principal Stress Theory, Shear Stress Theory)

Cylinders: Thin cylinder: Hoop's stress, maximum shear stress, circumferential and longitudinal strains, Thick cylinders: Lames equations.

10 Hours

Module-3

Shear Force and Bending Moment: Introduction to shear force and bending moment diagram, point of contraflexure and point of maximum bending moment, Relationship between loads, shear forces and bending moments, Shear force and bending moments of cantilever beams, simply supported, and over hanging beams subjected to concentrated loads, moment, uniformly distributed / varying loads.

Deflection of Beams Differential equation for deflection, equation for deflection, slope, moment, double integration method for point loads on cantilever and simply support beams, UDL, Macaulay's method

10 Hours

Module-4

Bending and Shear Stresses in Beams: Introduction, theory of simple bending, assumptions in simple bending, bending equation. shearing stresses in beams, shear stress across rectangular, circular, and symmetrical I and T sections.

Torsion: Introduction, derivation of torsion equation for circular shafts, torsional rigidity and polar modulus Power transmitted by a Circular solid and hollow shaft.

8 Hours

Module-5
Columns: Introduction, short and long columns. Euler's theory; Assumptions, Derivation for Euler's Buckling load for different end conditions, Limitations of Euler's theory **Strain Energy:** Strain energy due to normal stresses, Shear stresses, Modulus of resilience, Strain energy due to bending and torsion, Von Misses theory of failure. **8 Hours**

Course Outcomes: At the end of the course the student will be able to:	
21MEC404.1	Design simple mechanical structures such as bars, shafts and beams subjected to static loads with considerations of allowable stresses and factor of safety.
21MEC404.2	Apply the concepts to evaluate the designs of existing structures such as columns, beams, shafts, and cylinders to assess the stresses induced and deflections suffered.
21MEC404.3	Apply the shear stresses and bending stresses developed in beams having different cross sections, draw the shear force and bending moment diagrams.
21MEC404.4	Choose an appropriate theories of failure to design simple components regarding dimensions, stresses, and factor of safety.
21MEC404.5	Conduct the Tensile test and determine the Young's modulus of mild steel through stress strain curve using virtual lab platform.
21MEC404.6	Apply the fundamentals of Mechanics of Materials to answer GATE exam questions.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Text Books				
1	Mechanics of Materials	James M. Gere	Cengage	9, 2014
3	Fundamentals of Strength of Materials	P N Chandramouli	PHI Learning Pvt. Ltd	2013
2	Strength of Materials	R. Subramanian	Oxford	3,2016
3	Strength of Material	R K Rajput	S Chand & Company Pvt. Ltd	6,2015
Reference Books				
1	Strength of Materials	S. S. Rattan	McGraw Hill	3, 2017
2	Mechanics of Materials	Ferdinand Beer, Russell Johnston	McGraw Hill	2014
3	Mechanics of Material	R. C. Hibbeler	Pearson	9,2018
4	Strength of Materials	S. S. Bhavikatti	Vikas Publications	2021

Web links/Video Lectures/MOOCs

1. http://nptel.ac.in/courses/112107147/ (accessed on 17/10/2022)
2. https://ocw.mit.edu/courses/mechanical-engineering/2-001-mechanics-materials-i-fall-2006/ (accessed on 31/05/2021)

3. https://www.coursera.org/learn/mechanics-1 (accessed on 17/10/2022)

Virtual Lab Link to do self-study: http://sm-nitk.vlabs.ac.in/# (accessed on 31/05/2021)

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO11	PO 12	PSO 1	PSO2
21MEC404.1	-	-	**3**	-	2	-	-	-	-	-	-	2	-	-
21MEC404.2	**3**	-	-	-	-	**2**	-	-	-	-	-	-	2	-
21MEC404.3	**2**	-	-	-	**2**	-	2	-	-	-	-	-	-	-
21MEC404.4	-	-	2	-	-	-	2	**2**	-	-	-	-	-	-
21MEC404.5	-	-	3	-	2	-	-	2	-	-	-	-	-	-
21MEC404.6	-	--	-	-	-	-	-	-	-	-	-	2	3	-

1: Low 2: Medium 3: High

MECHANICAL MEASUREMENTS AND METROLOGY LAB			
Course Code	**21MEL405**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	03

Course Learning Objectives:

1. To illustrate the theoretical concepts through experiments.
2. To demonstrate calibration techniques of various measuring devices.
3. To illustrate the use of various measuring tools & measuring techniques.

Experiments

1. Study of instruments for Linear measurement and angular measurements: Slip gauges-Measurement of angle-sine bar, Sine centre, Angle gauges, Optical instruments for angular measurements.
2. Study of Autocollimator-Applications for measuring straightness and squareness.
3. Study of different Comparators and calibration of Dial indicator, Electrical comparators, LVDT, Pneumatic comparators.
4. Study of Terminology of screw threads and Measurement of major diameter, Minor diameter, Pitch, Angle and Effective diameter of screw threads by 2- wire and 3-wire methods
5. Gear tooth measurement using Gear tooth Vernier and Parkinson Gear Tester.
6. Various parameter measurements using computerized profile projector.
7. Surface topology measurement using Surface Roughness Tester.
8. Calibration of Pressure gauge, Thermocouple and Load cell
9. Determination of modulus of elasticity and modulus of rigidity of a mild steel specimen using strain gauges.
10. Calibration of Micrometer and Vernier caliper using slip gauges.
11. Circularity measurement using Electronic and Mechanical comparator.
12. Demonstration of Measurement using Coordinate Measuring Machine (CMM) / Laser Scanner
13. Choose any product used in the day-to-day life based on his/her choice, prepare a measurement plan and implement the measurement with existing tools)

Course Outcomes:

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

21MEL405.1	Demonstrate calibration of pressure gauge, thermocouple, LVDT, load cell, Micrometre and Strain gauge
21MEL405.2	Apply concepts of angular measurement using Sine bar / Sine centre / Bevel Protractor and alignment using Autocollimator/ Roller set.
21MEL405.3	Demonstrate linear measurements using Optical Projector/Tool maker microscope, Mechanical comparator/ Tally surf and Optical flats.

21MEL405.4	Analyse cutting tool forces using Lathe and Drill tool dynamometers
21MEL405.5	Apply concepts of screw thread measurements using floating carriage micrometre and gear teeth measurements using gear tooth Vernier/Gear tooth micrometre.
21MEL405.6	Design of inspection gauges and apply the concepts to inspect the components.

Sl. No.	**Title of the Book**	**Name of the Author/s**	**Name of the Publisher**	**Edition and Year**
Text Books				
1	Engineering Metrology	R.K. Jain	Khanna Publishers	2009
2	Engineering Metrology	I.C Gupta	Dhanpat Rai Publications	2002
Reference Books				
1	Mechanical Measurements	Beckwith Marangoni and Lienhard	Pearson Education publisher	6., 2006
2	Engineering Metrology and Measurements	N.V.Raghavendra and L. Krishnamurthy	Oxford University Press	2019

Web links/Video Lectures/MOOCs

1. http://www.nitttrc.edu.in/nptel/courses/video/112104250/L52.html (Accessed on 17-10-2022)
2. https://nptel.ac.in/courses/112/104/112104250/ (Accessed on 17-10-2022)
3. http://bit.ly/MMMsjec(Accessed on 17-10-2022)

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21MEL405.1	-	-	-	3	-	-	-	2	-	2	-	-	-	-
21MEL405.2	-	-	-	3	-	-	-	-	-	2	-	-	-	-
21MEL405.3	-	-	-	3	-	-	-	-	-	2	-	-	-	-
21MEL405.4	-	-	-	3	-	-	-	-	-	2	-	-	-	-
21MEL405.5	-	-	-	3	-	-	-	-	-	2	-	-	-	-
21MEL405.6	-	-	-	3	-	-	-	2	-	3	-	-	-	-

1: Low 2: Medium 3: High

COMPUTATIONAL TOOLS FOR ENGINEERS			
Course Code:	**21CTE408**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	50
Credits	**01**	Exam Hours	03

Course Learning Objectives:

1. Apply modeling and simulation tools for a wide range of engineering problems.
2. Understand the analysis of data in Excel with statistics.
3. Use MATLAB and Simulink to perform engineering system analysis.

The engineering design process heavily relies on modeling and simulation. Modern simulation techniques enable the development of multi-physical, holistic system models that account for all system interactions. These digital models speed up the design and testing processes, saving time and money.

Module 1

Engineering Design Analysis

Need for engineering design analysis. Product and system design. Introduction to analysis parameters – stress, deformation, acceleration, internal force and stability. Static structural analysis of engineering design using finite element method (case studies). Heat transfer and fluid dynamics modeling and simulation using CFD software (case studies). **10** Hours

Module 2

Data Analysis with EXCEL

Calculate Mean, Median, Mode, Minimum, Maximum, Quartiles, Variance and Standard Deviation from some numbers. Analyze a population using data samples. Group data, build XY charts, apply Logarithmic Scale and Trend Line on a chart, forecast from some data, and calculate running averages. Normal Distribution, Exponential Distribution, Uniform Probabilities, Binomial Distribution, and Poisson Distribution. **4** Hours

Module 3

MATLAB and Simulink for Engineers

Applications of MATLAB and Simulink in electrical engineering, electrical machines and power system projects, simulation of rectifiers, inverters, choppers, and cycloconverters **10** Hours

Course Project

Solve complex engineering problems via modeling and simulation. The project work is teamwork of 3-5 students. The goals should be clearly defined, use any software tool, and rigorous validation of the mathematical model should be done (experimental or theoretical).

Course Outcomes:

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

21CTE408.1	Apply the Finite Element Method to solve engineering problems
21CTE408.2	Solve statistical problems using Excel
21CTE408.3	Perform system-level analysis using MATLAB and Simulink
21CTE408.4	Build mathematical models for any given engineering problem.
21CTE408.5	Demonstrate teamwork and communication skills

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Reference Books				
1	MATLAB and Simulink for Engineers	Agam Kumar Tyagi	Oxford University Press	2012
2	Practical Finite Element Analysis	Nitin S.Gokhale	Finite to Infinite	2020
3	Excel Crash Course for Engineers	Eklas Hossain	Springer	2021

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)													
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
21CTE408.1	1				1	1								
21CTE408.2		1			2				2					
21CTE408.3		1			2									
21CTE408.4					2	2								
21CTE408.5	1								2					

1: Low 2: Medium 3: High

Industry Oriented Training - Computing Skills			
Course Code	**21IOT409**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(0:0:2)	SEE Marks	-
Credits	-	Exam Hours	02

Course Learning Objectives:

1. Use logical conditions for problem-solving and also introduce the concepts of arrays
2. Know functions, function calls, and parameter passing
3. Introduce algorithms and appreciate their importance in problem-solving
4. Introduce the core concepts of OOP's
5. Differentiate between front-end & back-end development and recognize the use of database management

Module-1

Introduction to computing constructs

Logical conditions: For Loops, Nested For Loops, While Loops, Do-While Loops, Nesting and Boxes, and combine/negate several logical conditions using logic operations AND, OR, and NOT.

Arrays & strings: Create arrays of characters (strings), use the null terminator, and manipulate strings

4 Hours

Module-2

Functions & Pointers

Introduction to Functions, Returning Data From a Function, Passing Data Into a Function, Getting Valid User Input, Changing Parameter Values, Pointer Basics, Changing the Pointed to Value, Walking an Array with Pointers, Dynamic Memory Allocation, Getting More Memory, Pointers to Structure

4 Hours

Module-3

Algorithm analysis

Introduction to Algorithm Analysis, Big-O, Big-O Examples, Dynamic Array Operations, Bubble Sort, Selection Sort, Insertion Sort, Recursion, Recursive Binary Search, Merge Sort

4 Hours

Module-4

Object-oriented programming

Designing for Object-Oriented Programming, Core Concepts of OO Programming: Classes and objects, data abstraction, encapsulation, inheritance, benefits of inheritance, polymorphism, procedural and object-oriented programming paradigm.

4 Hours

Module-5

Frontend and backend development

UI, Database management: DBMS overview, Relational Data Model and the CREATE TABLE Statement, Basic Query Formulation with SQL

4 Hours

Course Outcomes: At the end of the course the student will be able to:	
21IOT409.1	Illustrate the use of logical conditions, declare and manipulate data into arrays
21IOT409.2	Implement functions, function calls, and parameter passing
21IOT409.3	Design, implement, and evaluate an algorithm to meet desired needs
21IOT409.4	Describe the core concepts of OOP's
21IOT409.5	Recognize the concepts of front-end development and database management

Sources

1. Computational Thinking with Beginning C Programming Specialization: https://www.coursera.org/learn/simulation-algorithm-analysis-pointers?specialization=computational-thinking-c-programming#syllabus
2. Simulation, Algorithm Analysis, and Pointers: https://www.coursera.org/lecture/simulation-algorithm-analysis-pointers/big-o-examples-pdCan
3. Programming Fundamentals: https://www.coursera.org/learn/programming-fundamentals?specialization=c-programming#syllabus
4. Object-Oriented Programming Concepts: https://www.coursera.org/learn/concepts-of-object-oriented-programming#syllabus
5. Introduction to Back-End Development: https://www.coursera.org/learn/introduction-to-back-end-development

Course Articulation Matrix

Course Outcomes (COs)	**Program Outcomes (POs)**													
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**	**PO10**	**PO11**	**PO12**	**PSO1**	**PSO2**
21IOT409.1	2	1	1											
21IOT409.2	2	1	1											
21IOT409.3	1	1	2											
21IOT409.4	2		1											
21IOT409.5	2	1	1											

1: Low 2: Medium 3: High

Additional Mathematics - II

(A Bridge Course for Lateral Entry Students BE Programmes)

(Common to all Programmes)

Course Code	**21MAL401**	CIE Marks	50
Teaching Hours/Week (L:T:P)	(2:1:0)	SEE Marks	50
Credits	**00**	Exam Hours	03

Course Learning Objectives:

1. To familiarize the techniques of differential equations, vector analysis and linear algebra to engineering students.
2. To equip the students with standard concepts and tools that will help them in solving problems in their discipline of engineering.

Module-1

Partial Differentiation: Partial derivatives, Problems on Euler's theorem. Total derivative

Partial differential equations: Introduction, Formation of PDE, Solution of PDE by direct integration method. **8 Hours**

Module-2

First order ordinary differential equations: Introduction**,** Variable Separable, Homogeneous, Linear Exact and reducible to exact, Bernoulli's equations, Orthogonal Trajectories in polar form. **8 Hours**

Module-3

Linear Ordinary Differential Equations of Higher Order: Standard form of higher order linear differential equation with constant coefficients, Concept of different types of solutions. Solution of homogeneous equations. Non homogeneous equations- Concept of Inverse differential operator (P.I restricted to R(x) = $e^{ax}, sinax \text{ or } cosax \text{ for } f(D)y = R(x)$.) **8 Hours**

Module-4

Vector differentiation: Vector functions of a single variable, derivative of a vector function, velocity and acceleration, unit tangent. Scalar and vector functions, gradient of a scalar field, directional derivative, divergence of a vector field, solenoidal vector, curl of a vector field, irrotational vector **8 Hours**

Module-5

Numerical Methods: Finite differences. Interpolation using Newton‟s forward and backward difference formulae (Statements only)-problems. Solution of polynomial and transcendental equations – Newton-Raphson and Regula-Falsi methods (only formulae, Numerical integration: Simpson‟s one third rule and three eighth rule (without proof) Problems. **8 Hours**

Course Outcomes:

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

21MAL401.1	Apply Euler's theorem for partial differentiation
21MAL401.2	Compare different methods of forming partial differential equations
21MAL401.3	Classify the given first order differential equations
21MAL401.4	Solve higher order differential equations
21MAL401.5	Differentiate between solenoidal and irrotational vectors.
21MAL401.6	Find root of a transcendental equation

Question paper pattern:

Note: The SEE question paper will be set for 100 marks and the marks will be proportionately reduced to 50

- The question paper will have Part A and Part B. Part A is Mandatory
- Part A has 10 short answer type questions of two mark each
- Part B has 10 Full questions. Each full question carries 16 marks.
- There will be 2 full questions (with a maximum of four sub questions) from each module.
- Each full question will have sub questions covering all the topics under a module.

Students will have to answer 5 full questions, selecting one full question from each module.

Sl. No.	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
Textbooks				
1	Higher Engineering Mathematics	B.S. Grewal	Khanna Publishers	44th Edition, 2017
3	Higher Engineering Mathematics	H.K Dass and R Verma	C. Chand and Company	First Edition 2011
Reference Books				
1	Advanced Engineering Mathematics – Volume I	E. Kreyszig John Wiley & Sons	Wiley Precise Textbook Series	10th Edition 2015
2	Advanced Engineering Mathematics – Volume II	E. Kreyszig John Wiley & Sons	Wiley Precise Textbook Series	First Edition,2014
3	"Higher Engineering Mathematics"	B.V.Ramana 11th Edition	Tata McGraw-Hill Publication	First Edition 2017

Course Articulation Matrix

Course Outcomes (COs)	Program Outcomes (POs)											
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
21MAL401.1		3	1									
21MAL401.2		3	1									
21MAL401.3	3	1										
21MAL401.4	3		1									
21MAL401.5		3	1									
21MAL401.6		3	1									

1: Low 2: Medium 3: High