SYLLABUS

(With effect from 2022 -23)

ಪಠ್ಯಕ್ರಮ

(ಶೈಕ್ಷಣಿಕ ವರ್ಷ 2022-23)

Bachelor Degree
In
Automobile Engineering

III & IV Semester

Out Come Based Education
With
Choice Based Credit System

[National Education Policy Scheme]

P.E.S. College of Engineering, Mandya - 571 401, Karnataka
[An Autonomous Institution affiliated to VTU, Belagavi,
Grant – in – Aid Institution (Government of Karnataka),
Accredited by NBA (All UG Programs), NAAC and Approved by AICTE, New Delhi]

ಪಿ.ಇ.ಎಸ್. ತಾಂತ್ರಿಕ ಮಹಾವಿದ್ಯಾಲಯ
ಮಂಡ್ಯ–571 401, ಕರ್ನಾಟಕ
(ವಿ.ಟಿ.ಯು, ಬೆಳಗಾವಿ ಅಡಿಯಲ್ಲಿನ ಸ್ವಾಯತ್ತ ಸಂಸ್ಥೆ)
Ph : 08232- 220043, Fax : 08232 – 222075,Web : www.pescemandya.org

VISION

"PESCE shall be a leading institution imparting quality Engineering and Management education developing creative and socially responsible professionals."

MISSION

- *Provide state of the art infrastructure, motivate the faculty to be proficient in their field of specialization and adopt best teaching-learning practices.*
- *Impart engineering and managerial skills through competent and committed faculty using outcome based educational curriculum.*
- *Inculcate professional ethics, leadership qualities and entrepreneurial skills to meet the societal needs.*
- *Promote research, product development and industry-institution interaction.*

QUALITY POLICY

Highly committed in providing quality, concurrent technical education and continuously striving to meet expectations of stake holders.

CORE VALUES

***P**rofessionalism*
***E**mpathy*
***S**ynergy*
***C**ommitment*
***E**thics*

Department of Automobile Engineering

The discipline Automobile Engineering was established in the year 1980, and has gained expertise and contributing vitally to the Automobile Engineering community. The focus is to consistently pursue in providing innovative and quality training to the talented and dedicated students, to empower them in engineering for the development of national economy, specialized in transport sector. We the lead the way in Karnataka to introduce the Department of Automobile Engineering to impart sound automotive knowledge to the students with a passion towards Automobiles. We take the honor in being recognized as a 'research centre' in Karnataka by VTU and Mysore University. In addition to these regular programmes, this department is also actively involved in conducting Faculty Development Programmes, Technical talks, Training programmes and technical visits to various industries & regular industrial trainings for the benefit of students. The department has well qualified and well experienced faculty members to meet the present day curriculum requirements both in theory as well as practical aspects.

The vision and mission of Department of Automobile Engineering is as mentioned below

VISION

To be a distinguished centre for imparting quality education in automobile engineering to develop competent and socially responsible engineers and carryout research on continuous basis for the betterment of the society.

MISSION

AUM1: To give best learning experience through innovative teaching practices supported by excellent laboratory infrastructure and exposure to recent trends in the automotive industry.

AUM2: Provide in-depth knowledge in automobile engineering with equal emphasis on theoretical and practical aspects and interdisciplinary problem solving skills.

AUM3: Inculcate societal responsibility and ethical values through personality development programs.

AUM4: Focus on Industry-institute interaction, for better understanding of the state of the art technologies, Promoting research and also to build the spirit of entrepreneurship.

The departments of Automobile Engineering's vision and mission statements are aligned with PESCE's vision and mission statements. The vision of the department is derived based on the vision of the institute in consultation with internal/external stakeholders.

1.1 State the Program Educational Objectives (PEOs) (5)

Program Educational Objectives (PEOs) are broad statements that describe the career and professional accomplishments that the program is preparing the graduates to achieve. The PEOs for the program describe accomplishments that graduates are expected to achieve within three to five years after graduation

PEO1: To prepare Graduates to pursue a successful career in automotive and allied industries and/or to pursue higher education and/or to become entrepreneur.

PEO2: To develop expertise in the core area of automobile engineering such as design, manufacturing, and servicing with a focus on research and innovation for the benefit of the society.

PEO3: To enable graduates to apply interdisciplinary engineering knowledge to solve practical automobile engineering problems.

PEO4: To prepare graduates to demonstrate professionalism, team work, communication skills, ethical conduct, and societal responsibility and adapt to current trends by engaging in lifelong learning.

The PEOs should be consistent with the vision and mission of the institution and program. The PEOs were revised with a view to prepare graduates to work in creative and socially responsible manner.

Programme Specific Outcomes (PSOs)

Specific skills enhanced in this programme can enable the Graduates to

PSO1. Apply the basic and advanced knowledge of automobile, manufacturing, materials and thermal engineering to analyze and solve a realistic/practical **problem**.

PSO2. Design basic **automotive** systems and make use of advanced automotive systems to improve the performance, safety, maintenance and management of automobiles.

PSO3. Use modern tools and carry out research in automotive domain for providing solutions to automotive and societal issues.

Programme Outcomes (Pos)

Engineering program must demonstrate that their students attain the following outcomes:

PO1. Engineering Knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialisation to the solution of complex engineering problems.

PO2. Problem analysis: Identify, formulate, research literature, and analyse complex engineering

problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern Tool Usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO6. **The Engineer and Society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal, and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and Sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and Team Work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication:** Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project Management and Finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. **Life-long learning** :Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change

Bachelor of Engineering (III –Semester)										
Sl. No.	**Course Code**	**Course Title**	**Teaching Department**	**Hrs / Week**			**Credits**	**Examination Marks**		
				L	**T**	**P**		**CIE**	**SEE**	**Total**
1	P21MA301	Transform and Numerical Analysis	MA	2	2	-	3	50	50	100
2	P21AU302	Engineering Thermodynamics	AU	3	-	-	3	50	50	100
3	P21AU303	Fluid Mechanics & Machinery	AU	3	-	-	3	50	50	100
4	P21AU304	Manufacturing Process – I	AU	3	-	2	4	50	50	100
5	P21AU305	Material Science & Metallurgy	AU	3	-	2	4	50	50	100
6	P21AUL306	Computer Aided Machine Drawing (CAMD) Professional Core Course Laboratory	AU	-	-	2	1	50	50	100
7	P21KSK307	Samskrutika Kannada /	HSMC	-	2	-	1	50	50	100
	P21KBK307	Balake Kannada								
	OR									
	P21CIP307	Constitution of India and Professional Ethics	HSMC	-	2	-	1	50	50	100
8	P21HSMC308	Employability Enhancement Skills - III	HSMC	-	2	-	1	50	50	100
9.	P21AEC309	Innovation and Design Thinking	AU	-	2	-	1	50	50	100
Total							**21**			

10	P21MDIP301	Basic Engineering Mathematics - I	MA	2	2	-	0	100	-	100
11	P21HDIP308	Employability Enhancement Skills - I	HSMC	-	2	-	0	100	-	100

Bachelor of Engineering (IV –Semester)										
Sl. No.	**Course Code**	**Course Title**	**Teaching Department**	**Hrs / Week**			**Credits**	**Examination Marks**		
				L	**T**	**P**		**CIE**	**SEE**	**Total**
1	P21MA401	Applied Mathematical Methods	MA	2	2	-	3	50	50	100
2	P21AU402	Theory of machines	AU	3	-	-	3	50	50	100
3	P21AU403	Mechanics of Materials (MOM)	AU	3	-	-	3	50	50	100
4	P21AU404	Manufacturing Process – II	AU	3	-	2	4	50	50	100
5	P21AU405	Mechanical Measurements and Metrology (MMM)	AU	3	-	2	4	50	50	100
6	P21AUL406	Fluid Mechanics and Machinery Professional Core Course Laboratory	AU	-	-	2	1	50	50	100
7	P21KSK407	Samskrutika Kannada /	HSMC	-	2	-	1	50	50	100
	P21KBK407	Balake Kannada								
	OR									
	P21CIP407	Constitution of India and Professional Ethics	HSMC	-	2	-	1	50	50	100
8	P21HSMC408	Employability Enhancement Skills - IV	HSMC	-	2	-	1	50	50	100
9.	P21INT409	Internship – I	AU	-	-	-	1	-	100	100
Total							**21**			

10	P21MDIP401	Basic Engineering Mathematics - II	MA	2	2	-	0	100	-	100
11	P21HDIP408	Employability Enhancement Skills - II	HSMC	-	2	-	0	100	-	100

TRANSFORM AND NUMERICAL ANALYSIS
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – III

Course Code:	**P21MA301**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

- Adequate exposure to basics of engineering mathematics so as to enable them to visualize the applications to engineering problems
- Analyze periodic phenomena using concept of Fourier series, series solution of Engineering problems
- Understand Fourier transforms of functions and use it to solve initial value, boundary value problems.
- Apply Z-Transform technique to Solve difference equations and Numerical Technique to estimate interpolation, Extrapolation and area - (All formulae without proof)-problems only
- Use mathematical IT tools to analyze and visualize the above concepts.

UNIT – I	**8 Hours**

Fourier Series: Introduction, periodic function, even and odd functions, properties. Special waveforms - square wave, half wave rectifier, saw-toothwave and triangular wave. Dirichlet's conditions, Euler's formula for Fourier series (no proof). F urier series for functions of period 2L (all particular cases) – problems, Half Range Fourier series- Construction of Half range cosine and sine series and problems Practical harmonic analysis-Illustrative examples from engineering field.

Self-study component:	Derive Euler's formula, Fourier series in complex form.

UNIT – II	**8 Hours**

Partial differential equations (PDE's):
Formation of PDE's. Solution of non-homogeneous PDE by direct integration. Solutions of homogeneous PDE involving derivative with respect to one independent variable only, Method of separation of variables(first and second order equations).

Applications of PDE's: Various Possible solution of PDE's
Classification of second order PDE, various possible solutions for One- dimensional wave and heat equations, by the method of separation ofvariables. Solution of all these equations with specified boundary conditions(Boundary value problems). Illustrative examples from engineering field.

Self-study component:	Charpit's Method -simple problem. Various possible solutions of Two dimensional Laplace equation.

UNIT – III	**8 Hours**

Finite Differences and Interpolation: Forward and backward differences, Interpolation, Newton-Gregory forward and backward interpolation formulae, Lagrange's interpolation formula and Newton's divided differenceinterpolation formula (All formulae without proof)-problems only.

Numerical Differentiation: Derivatives using Newton-Gregory forward and backward interpolation formulae, Applications to Maxima and Minima of atabulated function. **Numerical Integration:** Newton-Cotes quadrature formula, Simpson's 1/3rd rule and Simpson's 3/8th rule. Weddle's rule (All rules without proof)-	
Self-study component:	Inverse Lagrange's Interpolation formula, Central differences.
UNIT – IV	**8 Hours**
Fourier Transforms: Infinite Fourier transforms. Properties- linearity, scaling, shifting and modulation (no proof), Fourier sine and cosine transforms. Inverse Fourier Transforms, Inverse Fourier cosine and sine transforms. Problems. Convolution theorem and Parseval's Identity (noproof)-problems.	
Self-study component:	Finite Fourier transform, Fourier transform of derivatives of functions
UNIT – V	**8 Hours**
Z - Transforms: Definition. Z-transforms of basic sequences and standard functions. Properties-linearity, scaling, Damping rule, first and second shifting, multiplication by *n*, initial and final value theorem (statement only)-problems. Inverse Z- transforms- problems. **Difference Equations:** Definition. Formation of Difference equations, Linear & simultaneous linear difference equations with constant coefficients-problems, Solutions of difference equations using Z- transforms.	
Self-study component:	Convolution theorem and problems, Application to deflection of a loaded string.
Course Outcomes: On completion of the course, student should be able to:	
CO1	**Analyze** engineering problems using the fundamental concepts in Fourier series, FourierTransforms and Basics ideas of PDE's.
CO2	**Explain** various methods to find the Fourier constants, solution of PDE's, Estimation of interpolationand find the area, solution of difference equations.
CO3	**Apply** the acquired knowledge to construct the Half- range Fourier series, Finding Fourier transformsand Inverse Laplace transforms for some standard functions.
CO4	**Evaluate** Z-transform of various functions, solutions of differential equations with initial and boundaryconditions.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International PublishingHouse Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. https://ocw.mit.edu/courses/18-085-computational-science-and-engineering-i-fall-2008/resources/lecture-28- fourier-series-part-1/
4. https://www.thefouriertransform.com/
5. http://mcatutorials.com/mca-tutorials-numerical-methods-tutorial.php

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**2**										
CO2	**2**	**3**										
CO3	**3**	**2**										
CO4	**2**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

ENGINEERING THERMODYNAMICS

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code: P21AU302	**Semester: III**	**L-T-P: 3-0-0**	**Credits: 03**
Contact Period-Lecture: 40Hrs.	**Exam: 3Hrs.**	**Weightage: CIE:50 %;**	**SEE: 50%**

Course Objectives:

Prerequisites: The students should have undergone the course Engineering Physics, Engineering Mathematics-1

Course Learning Objectives:

The objectives of this course are to,

- Understand the fundamental concepts and laws of thermodynamics to analyze the performance of thermal systems. L2
- Analyze the principle and process of energy interaction for different thermodynamics processes.L4
- Interpret the fundamental concepts and laws of thermodynamics to analyse the performance of thermal systems.L5
- Understand the basic concepts of thermodynamics and able to apply for the different thermodynamic cycles. L2
- Make use of mathematical expressions to analyse the performance of different thermal systems.L3

Course Content

UNIT-I

Fundamental Concepts & Definitions: Definition of Thermodynamics, Microscopic and Macroscopic approaches to the study of thermodynamics, Definitions of System (closed system) and Control Volume (open system) with examples. Definition of thermodynamic property, Intensive and extensive properties thermodynamic state, process, quasi-static process, thermodynamic cycle. Thermodynamic equilibrium, definitions of thermal, chemical and mechanical equilibrium. Zeroth law of thermodynamics. Thermodynamic definition of work, sign convention and examples to illustrate the definition of work. Work done at the system boundary, process equation and expressions for work done in different processes. Definition of beat and sign convention. Comparison of work and heat

9Hrs

Self-study component: Different temperature measuring instruments, Concept of Temperature, types of commonly used temperature scales and relation between them.

UNIT-II

First Law of Thermodynamics Statement of the First law of thermodynamics for a closed system undergoing a cyclic process First law thermodynamics for a change of state of the system and concept of energy. Energy as a property of the system and its significance. Internal Energy, Enthalpy and Specific heats. Simple numerical problems on systems undergoing closed process Steady flow process, First law applied to steady flow process, derivation of steady flow energy equation and its applications to steady flow process. Simple numerical problems on systems undergoing steady flow process

8Hrs

Self-study component: Entropy- Clausius inequality, showing cyclic integral of $\delta Q/T$ is independent of path.

UNIT-III

Second Law of Thermodynamics: Thermal reservoir, Source and sink. Heat engine, heat pump and refrigerator and their schematic representation, efficiency and coefficient of performance Kelvin - Planck and Clausius statement of the Second law of thermodynamics and equivalence of the two Statements of second law. Definition of perpetual motion machines of II kind with example. Reversible and Irreversible processes, factors that make a process irreversible. Reversible heat engine-Carnot Cycle and expression for efficiency of Carnot cycle Simple numerical problems on heat engines

7 Hrs

Self-study component: Violation of II law leads PMMK-II proof.

UNIT-IV

Air Standard Cycles Carnot Cycle, Otto Cycle, and Diesel Cycle, their P-V and T-S diagrams, description, expression for efficiencies and definition of mean effective pressures. Comparison of Otto and Diesel cycles

Reciprocating Air Compressors: Operation of a single stage reciprocating air compressors. Work input using P-V diagram and steady state flow analysis. Effect of clearance and volumetric efficiency, Adiabatic, isothermal and mechanical efficiencies. Multistage compressors, saving in work, expression for optimum intermediate pressure Imperfect inter cooling.

8 Hrs

Self-study component: Study of actual otto cycle & diesel cycle

UNIT-V

Refrigeration and Psychometry: Introduction, pressure enthalpy diagram. Vapor compression refrigeration systems, description, analysis, refrigerating effect, capacity, power required, Units of refrigeration and COP. Properties of atmospheric air Dry Air, Relative Humidity, Specific humidity, degree of saturation, dry bulb and wet bulb temperature Psychometric Chart and Psychometric Process: Sensible heating or cooling, cooling and dehumidification, heating and humidification and adiabatic mixing of two streams**.**

8 Hrs

Self-study component: Different make of Refrigerator; at least three

Text Books

1. P.K. Nag. Basic and Applied Thermodynamics, Tata McGraw Hill, 2009
2. RK Rajput, Engineering Thermodynamics by Laxmi Publications Pvt Ltd 2011. ISBN-10: 9380298404 ISBN-13 978-9380298405

Reference Books

1. Yunus A, Thermodynamics - An engineering approach. Cengal Tata McGraw Hill
2. R K Hegde & Nirangan Murthy Applied Thermodynamics, Publisher - Sapna 2006.
3. Dr. MK Murulidhar - Applied Thermodynamics, Subham stores, 2008

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

1. Understand the fundamental concepts and laws of thermodynamics to analyze the performance of thermal systems. L2
2. Analyze the principle and process of energy interaction for different thermodynamics processes.L4
3. Interpret the fundamental concepts and laws of thermodynamics to analyse the performance of thermal systems.L5
4. Understand the basic concepts of thermodynamics and able to apply for the different thermodynamic cycles. L2
5. Make use of mathematical expressions to analyse the performance of different thermal systems.L3

Course Articulation Matrix														
Course Outcomes		Program Outcomes												PSO
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	Interpret the fundamental concepts and laws of thermodynamics to analyze the performance of thermal systems. **L2**	2	1												
CO2	Analyze the principle and process of energy interaction for different thermodynamics processes. **L4**	1	2												
CO3	Interpret the fundamental concepts and laws of thermodynamics to analyse the performance of thermal systems. **L5**	3	3	1											
CO4	Interpret the basic concepts of thermodynamics and able to apply for the different thermodynamic cycles. **L2**	2	1	2											
CO5	Make use of mathematical expressions to analyse the performance of different thermal systems. **L3**	2	2	2											

Fluid Mechanics and Machinery

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code: P21AU303	**Semester: III**	**L-T-P: 3-0-0**	**Credits: 03**
Contact Period-Lecture: 40Hrs.	**Exam: 3Hrs.**	**Weightage: CIE:50 %;**	**SEE: 50%**

Course Objectives:

Prerequisites: The students should have undergone the course on Elements of Mechanical Engineering.

Course Learning Objectives (CLOs):

This course aims to:

- Understand fluid properties and concepts of fluid statics, kinematics & dynamics. L2
- Apply the first principles, laws to formulate relations between variables/parameters of static, kinematic & dynamic behavior fluids. L3
- Analyze the effect of various parameters of fluid statics, kinematics and dynamics by solving practical problems using derived relations and losses. L4
- Develop knowledge about energy conversion in Turbo machines. L3
- Comprehend the functioning of Centrifugal and Reciprocating pumps. L2

Relevance of the Course

Fluid Mechanics course is an introductory for Undergraduate program in Engineering. The subject has a wide scope and is of prime importance in several fields of engineering and science. Present course emphasizes the fundamental underlying fluid mechanical principles of fluid statics, kinematics, dynamics, turbo machinery and application of those principles to solve real life problems. Special attention is given towards deriving all the governing equations starting from the fundamental principle. There is a well-balanced coverage of physical concepts, mathematical operations along with examples and exercise problems of practical importance. After completion of the course, the students will have a strong fundamental understanding of the basic principles of Fluid Mechanics & Machinery and will be able to apply the basic principles to analyze fluid mechanical systems.

Course Content

UNIT-I

Properties of Fluids: Introduction, properties of fluids, classifications, viscosity, thermodynamic properties, Surface tension and Capillarity, Vapour pressure and Cavitation

Fluid Statics - Pressure and its Measurement: Fluid pressure at a point, Pascal's law, pressure variation in a static fluid, Absolute, gauge, atmospheric and vacuum pressures, simple manometers, and differential manometers**.**

8Hrs

Self-study component: Thermodynamic properties, Relationship between compressibility for a gas.

UNIT-II

Fluid Statics - Hydrostatic forces on surfaces: Total pressure and center of pressure, vertical plane surface submerged in liquid, horizontal plane surface submerged in liquid, inclined plane surface submerged in liquid, and curved surface submerged in liquid.

Buoyancy and Floatation: Buoyancy center of buoyancy, meta-center and meta-centric height, conditions of equilibrium of floating and submerged bodies.

8Hrs

Self-study component: Moment of inertia & other geometric properties of important plane surfaces.

UNIT-III

Fluid Kinematics: Introduction, Types of fluid flow, continuity equation in one and three Dimension (Cartesian co-ordinate system only), velocity and acceleration.

Fluid Dynamics: Introduction, equations of motion, Euler's equation of motion, Bernoulli's equation from Euler's equation, Bernoulli's equation for real fluids.

Fluid flow measurements - Venturimeter, Orifice meter, Pitot tube.

8 Hrs

Self-study component: continuity equation in cylindrical polar coordinates, velocity potential Function and stream function for 2D flow and types of motion.

UNIT-IV

Flow through pipes: Introduction, loss of energy in pipes, Major Energy Losses, Darcy-Weisbach equation for loss of head due to friction in pipes, Chezy's equation for loss of head due to friction in pipes, Minor Energy Losses.

Fundamentals of Turbo machines: Parts of turbo machine, classification of turbo machines, Degree of reaction, Velocity triangles for different values of degree of reaction (no numerical)

8 Hrs

Self-study component: Hydraulic gradient and total energy line**.**

UNIT-V

Centrifugal Pumps: Centrifugal pump: Working of C/F pump, work done by the impeller, losses & efficiency, specific speed, multistage pump.

Reciprocating pumps: Types, work done by reciprocating pump, single acting and double acting, coefficient of discharge, Percentage slip, effect of acceleration on piston, Air vessels

8 Hrs

Self-study component: Advantages of centrifugal pump over Reciprocating pump, Types of reciprocating pump.

Text Books

1. K. W. Bedford, Victor Streeter, E. Benjamin Wylie "Fluid Mechanics" Tata Mcgraw Hill Education Private Limited, 9th edition, 1997, ISBN: 9780070625372
2. Dr. R.K.Bansal, "Fluid mechanics and hydraulic machines" Laxmi publications Ltd., New Delhi. 9th edition, 2015, ISBN: 9788131808153.
3. Dr. M S Govindegowda& Dr. A M Nagaraja "Turbomachines," PHI Learning Pvt Limited, 2009, ISBN: 978-8120337756.

Reference Books

1. Dr. JagadishLal "Fluid Mechanics and Hydraulics" Metropolitan Book Co. Pvt. Ltd, New Delhi, 2002, ISBN: 9788120002722
2. Dr. K.L.Kumar, "Engineering Fluid Mechanics" S Chand Ltd., 2010, ISBN: 9788121901000
3. Frank M.White "Fluid Mechanics" Tata Mcgraw Hill Education Private Limited, 7th edition, 2011, ISBN: 9780071333122
4. V. Ganesan, "Gas Turbines," Tata McGraw Hill Education Limited 3rd Edition, 2010, ISBN: 978-0070681927.

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

1. Understand fluid properties and concepts of fluid statics, kinematics & dynamics. L2
2. Apply the first principles, laws to formulate relations between variables/parameters of static, kinematic & dynamic behavior fluids. L3
3. Analyze the effect of various parameters of fluid statics, kinematics and dynamics by solving practical problems using derived relations and losses. L4
4. Develop knowledge about energy conversion in Turbo machines. L3
5. Comprehend the functioning of Centrifugal and Reciprocating pumps. L2

Course Articulation Matrix															
Course Outcomes		**Program Outcomes**												**PSO**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**1**	**2**
CO1	Understand fluid properties and concepts of fluid statics, kinematics & dynamics. L2	2	2	1											
CO2	Apply the first principles, laws to formulate relations between variables/parameters of static, kinematic & dynamic behavior fluids. L3	2	2	1											
CO3	Analyze the effect of various parameters of fluid statics, kinematics and dynamics by solving practical problems using derived relations and losses. L4	2	2	1											
CO4	Develop knowledge about energy conversion in Turbo machines. L3	1	2	1											
CO5	Comprehend the functioning of Centrifugal and Reciprocating pumps. L2	1	1	1											

MANUFACTURING PROCESS – I

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code: P21AU304	**Semester: III**	**L-T-P: 3-0-2**	**Credits: 04**
Total Theory Teaching Hours: 40 **Total Laboratory Hours: 24**	**Exam: 3Hrs.**	**Weightage: CIE: 50%; SEE: 50%**	

Course Learning Objectives:

The objectives of this course are to,

- Acquire basic knowledge about casting, welding and metal cutting theory which are relevant to manufacturing of engineering components.
- Give comprehensive insight regarding the mechanical equipment and operations involved to fulfill various applications.

Course Content

UNIT-I

Introduction to Casting: Concept of Manufacturing process, Casting process- Steps involved, advantages, limitations and applications of casting process. Patterns: Definition, Pattern materials, classification of patterns, Pattern allowances. Binder: Definition and types. Casting defects, causes and remedies.

8 Hrs

Self study component: Melting furnace classification.

UNIT-II

Sand Moulding: Types of sand moulds, Ingredients of moulding sand and properties, core making, principles of gating: Elements of gating system, types of gates, gating ratio, Risers: types and functions. Special Moulding Process: CO_2 moulding, Shell moulding, permanent mould casting, Pressure die casting, Squeeze Casting.

8 Hrs

Self study component: stir casting and centrifugal casting.

UNIT-III

Special types of welding: Resistance welding-principle, working principle, advantages, disadvantages and applications of the following types-Seam welding, Spot welding, Friction welding, Explosive welding. Metallurgical aspect in welding: Formation of different zones during welding, Heat Affected Zone (HAZ), Parameters affecting HAZ, Welding defects.

8 Hrs

Self study component: weldability and friction stir welding.

UNIT-IV

Theory of Metal Cutting: Introduction, Single point cutting tool nomenclature, geometry, orthogonal and oblique cutting, Mechanism of chip formation, Types of chips Cutting tool materials: HSS, Carbides, Coated carbides, CBN and Ceramics. Heat generation in metal cutting, factors affecting heat generation. Tool Wear: Causes and types, effects of cutting parameters on tool life, tool failure criteria, Taylor's tool life equation, simple problems on tool life evaluation.

8 Hrs

Self study component: Cutting Fluids: Desired properties, types and selection.

UNIT-V

Machine Tools and Mechanisms: Constructional feature of turret lathe, Turret lathe indexing mechanism, Shaping Machine-classification of shaping machine, Shaper mechanism - Crank and slotted lever quick return mechanism and hydraulic driving mechanism, Planing Machine-classification of planer - Planer mechanism -open and cross belt drive mechanism.

8 Hrs

Self study component: Milling machine and grinding machine.

Practical Content

24 Hrs

Testing of molding sand and core sand:

1. Compression, shear and permeability tests on green sand specimen.
2. Sieve analysis to find grain fineness number of base sand.

Foundry and casting:

3. Use of foundry tools and other equipments.
4. Preparation of moulds using two moulding boxes with and without Patterns (Split pattern, Core boxes).
5. Production of metal component using sand casting.

Machining processes:

6. Preparation of one model on lathe involving plain turning, facing, knurling and eccentric turning.
7. External threads cutting, V-thread and square thread.
8. Taper turning by different methods.
9. Cutting of V-groove using a shaper.
10. Surface grinding.

Text Books

1. Serope Kalpak Jain and Steven R Schmid, **"Manufacturing Engineering and Technology"**, Pearson Education Asia, 4th Edition, 2002, ISBN: 97881775817062.
2. Dr. K. Radhakrishna, **"Manufacturing Process-I"**, 5th Edition, Sapna Book House, 2006, ISBN: 8128002074.

Reference Books

1. P. N. Rao, **"Manufacturing and Technology: Foundry Forming and Welding"**, Tata McGraw Hill, 2nd Edition, 2013, ISBN: 97893832866143.
2. Roy A Lindberg, **"Process and Materials of Manufacturing"**, Prentice Hall, 4th Edition, 1998, ISBN: 9780205118175.

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

1. **Apply** the concept of primary manufacturing processes such as casting, welding and machining.
2. **Identify** real-time applications of special casting, welding and Machining processes.
3. **Examine** the defects in casting and welding by **analysing** the microstructure.
4. **Analyse** various cutting parameters in metal cutting.
5. **Prepare** a report as an **individual** or **as a team** member to **communicate** effectively.

Web Resources

1. http://efoundry.iitb.ac.in/Academy/index.jsp
2. http://nptel.ac.in/courses/112107145/
3. http://www.elcoweld.com/files/editor/downloads/elmi/AWP1.pdf
4. https://books.google.co.in/books?id=NOotk64Grx0Candprintsec=frontcoverandsource=gbs_ge_summary_randcad=0#v=onepageandqandf=false
5. https://youtu.be/YtksJ12suFM
6. https://youtu.be/yPpyyABaqcw
7. https://youtu.be/MD-PDz4EQAg
8. http://nptel.ac.in/courses/112105126/

Course Articulation Matrix															
Course Outcomes		**Program Outcomes**												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	**Apply** the concept of primary manufacturing processes such as casting, welding and machining.	3													
CO2	**Identify** real-time applications of special casting, welding and Machining processes.	3													
CO3	**Examine** the defects in casting and welding by **analysing** the microstructure.		3												
CO4	**Analyse** various cutting parameters in metal cutting.		3												
CO5	**Prepare** a report as an **individual** or **as a team** member to **communicate** effectively.									3	3				1

SEE- Course Assessment Plan

COs	**Marks Distribution**					**Total Marks**	**Weightage (%)**
	Unit I	**Unit II**	**Unit III**	**Unit IV**	**Unit V**		
CO1	2+9			2+9		22	22%
CO2		2+9	2+9		2+9	33	33%
CO3	9	9	9	9		36	36%
CO4					9	9	9%
CO5	**Note: Assessment only in CIE**						
	20	20	20	20	20	100	100%
Application =55% Analysis = 45%							

MATERIAL SCIENCE AND METALLURGY

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code: P21AU305	**Semester: III**	**L-T-P: 3-0-2**	**Credits: 04**
Total Theory Teaching Hours: 40 **Total Laboratory Hours: 24**	**Exam: 3 Hrs.**	**Weightage: CIE:50%; SEE:50%**	

Course Learning Objectives:

The objectives of this course are to,

- Material science and Metallurgy perceives materials behavior and atomic characterization, interpret with the selection of materials for suitable applications.
- The course introduces basic knowledge over phase diagrams and also deals with behaviors, transformation of metals expose to different environment and heat treatment.
- Course also exposed to inculcate the knowledge over advanced materials and composite materials.

Course Content

UNIT-I

Structure of Crystalline Solids: Atomic bonding in solids, Fundamental concepts of unit cell, space lattice, Bravaias lattice, Unit cells for cubic structure and HCP, study of stacking of layers of atoms in cubic structures and HCP, Calculation of atomic radius, co-ordination number and atomic packing factors for different cubic structures. Crystal imperfections - point, line, surface and volume defects. Diffusion Mechanisms and Fick's laws of diffusion.

8 Hrs

Self-study component: Crystal planes and Direction

UNIT-II

Mechanical characteristics of metals: Tensile properties, true stress and true strain, Hardness, Rockwell, Vickers and Brinell hardness testing, plastic deformation - slip and twinning. Fracture type, stages in Cup and Cone fracture, fracture toughness, Griffith's criterion. Fatigue test, S-N curves, factors affecting fatigue life and protection methods. The creep curves, Mechanism of creep.

8 Hrs

Self-study component: ASTM standards for different mechanical tests.

UNIT-III

Phase Diagrams and Solid Solution: Solid solutions, Rules governing formation of solid solutions, Phase diagram- Basic terms, phase rule, cooling curves, construction of Phase diagrams, interpretation of equilibrium diagrams, Types of Phase diagrams, Lever rule. Iron Carbon Equilibrium Diagram: Phases in the Fe-C system, invariant reactions, critical temperatures, Microstructures of slowly cooled steels, effect of alloying elements on the Fe-C diagram. Construction of TTT diagram, TTT diagram for hypo and hyper eutectoid steels.

8 Hrs

Self-study component: Continuous Cooling Transformation (CCT) diagram.

UNIT-IV

Heat Treatment and Strengthening Method: Annealing and its types, normalizing, hardening, tempering, martempering, austempering, surface hardening: case hardening, carburizing, cyaniding, nitriding, Induction hardening, hardenabilty, Jominy end-quench test.

8 Hrs

Self-study component: Age hardening of Al and Cu alloys

UNIT-V

Composites: Classification, functions of matrix and reinforcement in composites, Rule of mixture, Polymer, metal and ceramic matrix composites, carbon- carbon composites, Applications of composites. **Advanced Materials**: Nanomaterials- Size-dependant properties, applications, Shape Memory Alloys (SMA) - Characteristics, applications, Metallic glasses: properties and applications.

8 Hrs

Self-study component: Cryogenic materials

Practical Content

24 Hrs

1. Preparation of specimen for metallographic examination.
2. Rockwell Hardness test.
3. Brinell Hardness test.
4. Vickers Hardness test.
5. Tension test using a UTM.
6. Izod Impact Tests.
7. Charpy Impact Tests.
8. Heat treatment: Annealing, Normalizing, Hardening and Tempering of Ferrous alloys and study their hardness.
9. Shear tests using UTM.
10. Bending Test using UTM.

Text Books

1. Willian D. Callister Jr., **"Materials Science and Engineering – an Introduction"**, John Wiley India Pvt.Ltd, New Delhi, 6th Edition, 2006, ISBN: 978-0471736967.
2. Donald R. Askeland, Pradeep, **"Essentials of Materials For Science and Engineering"**, CL Engineering, 2nd Edition, 2006, ISBN: 978-0495244462.

Reference Books

1. James F. Shackel ford, "**Introduction to Material Science for Engineering**", 6th edition Pearson, Prentice Hall, New Jersy, 2006.
2. V. Raghavan, "**Physical Metallurgy, Principles and Practices**", PHI 2nd Edition, New Delhi, 2006, ISBN: 978-8120330129.
3. Smith, "**Foundations of Materials Science and Engineering**", 3rd Edition McGraw Hill, 1997.

Web Resources

1. https://youtu.be/OTDVov_kw6A
2. https://www.digimat.in/nptel/courses/video/113104014/L20.html
3. https://youtu.be/I9fQ9KDk_uU
4. https://nptel.ac.in/courses/112104168
5. https://archive.nptel.ac.in/courses/113/104/113104074/

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

1. **Apply** the fundamental concepts of material science and metallurgy.
2. **Apply** various heat treatment processes to ferrous and nonferrous metals.
3. **Analyse** materials properties, composition and their phase transformation.
4. **Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.

Course Articulation Matrix															
Course Outcomes		**Program Outcomes**												**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	**Apply** the fundamental concepts of material science and metallurgy.	3													
CO2	**Apply** various heat treatment processes to ferrous and nonferrous metals.	3													
CO3	**Analyse** materials properties, composition and their phase transformation.		3												
CO4	**Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.									3	3			1	

SEE- Course Assessment Plan							
COs	**Marks Distribution**					**Total Marks**	**Weightage (%)**
	Unit I	**Unit II**	**Unit III**	**Unit IV**	**Unit V**		
CO1	2+9	2+9	2+9		2+9	44	44%
CO2				2+9		11	11%
CO3	9	9	9	9	9	45	45%
CO4	**Note: Assessment only in CIE**						
	20	20	20	20	20	100	100%
Application =55% Analysis = 45%							

COMPUTER AIDED MACHINE DRAWING

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – III

Course Code: P21AUL306	**Semester: III**	**L-T-P: 0-0-2**	**Credits: 01**
Contact Period - Lecture: 30(P) Hrs	**Exam: 3 Hrs.**	**Weightage: CIE:50%;**	**SEE:50%**

Course Learning Objectives:

The objectives of this course are to,

- Empowering the students with drafting skills and strengthens their ability to draw, read and interpret machine part.
- Assemble the machine parts using computer software and implementing the standards, codes and norms.

Course Content

Part - A

Section and Development of Solids: Sections of Pyramids, Prisms, Cone and Cylinder resting only on their bases. True shape of sections, Development of lateral surfaces.

Orthographic Views: Conversion of isometric views into orthographic projections of simple machine parts. (Bureau of Indian standards conventions are to be followed for the drawings).

Thread Forms and Fasteners: Thread terminology, sectional view of threads. ISO Metric (Internal and External), BSW (Internal and External), square and Acme threads. Hexagonal headed bolt and nut with washer (assembly). **16 Hrs**

Part - B

Assembly Drawings

Solids of Protrusion, Assembly drawing of following machine parts (3D parts to be created and assemble and then getting 2D drawing with required views, including part drawing).

Introduction to geometrical dimensioning and tolerance.

1. Screw Jack
2. I.C. Engine Connecting Rod
3. Plummer Block
4. Machine Vice

14 Hrs

Case study

1. Identify the engineering drawings symbols using GD and T.
2. Assembly drawing of fuel injector, knuckle joint, cotter joint and riveted joints.
3. Preparing Bill of Materials for mechanical system.

Text Books

1. N.D. Bhat and V.M. Panchal, "**Machine Drawing"**, Charotar Publishing House, 46th Edition, 2011, ISBN: 9789380358390.
2. K.R. Gopala Krishna, "**Machine Drawing"**, Subhash Publication, Revised and enlarged edition, 2017, ISBN: 978-93-83214-81-5.

Reference Books

1. N. Siddeshwar, P. Kannaiah and V.V.S. Sastri, "**Machine Drawing",** published by Tata Mc. Graw Hill, 2010, ISBN: 9780074603376.
2. Tryambaka Murthy, **"Machine Drawing",** CBS Publications, 2nd Edition, 2008, ISBN: 9788123916590.

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

1. **Apply** the concepts of engineering drawing to **develop** mechanical components.
2. **Apply** the concepts of section of solids to **analyse** cut section of machine components.
3. **Develop** the mechanical components in 2D and 3D environment and assemble the same.
4. **Create** the components of mechanical systems using modern CAD tool.
5. **Communicate** effectively through sketching and drawing.

Course Articulation Matrix

Course Outcomes		Program Outcomes												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	**Apply** the concepts of engineering drawing to **develop** mechanical components.	3		2											
CO2	**Apply** the concepts of section of solids to **analyse** cut section of machine components.	3	3												
CO3	**Develop** the mechanical components in 2D and 3D environment and assemble the same.			3											
CO4	**Create** the components of mechanical systems using modern CAD tool.			3		3							1	1	
CO5	**Communicate** effectively through sketching and drawing.										3				

Web Resources

1. https://www.youtube.com/watch?v=-_qz8_sbhwY
2. https://www.youtube.com/watch?v=zO8coRhrJM0
3. https://www.youtube.com/watch?v=-_qz8_sbhwY
4. https://www.youtube.com/watch?v=zO8coRhrJM0
5. https://www.youtube.com/watch?v=4hhJ0OSKVYgandlist=PLQL-DlNb9_TXAbUK_H4JyZnhv9MW3nhG
6. https://www.youtube.com/watch?v=boyN1l3fA6gandlist=PLQL-DlNb9_TVqG1Zrw-9F-S0LItg3T5fD
7. https://www.youtube.com/watch?v=yKl_FiUdAu4andlist=PLQL-DlNb9_TUHs8CUXYw-Lna-Gp4rTu9g

SEE- Course Assessment Plan

COs	Marks Distribution		Total Marks	Weightage (%)
	Part A	Part B		
CO1		8	8	16%
CO2	5	7	12	24%
CO3	8	7	15	30%
CO4	7	8	15	30%
CO5	**Note: Assessment only in CIE**			
	20	30	50	
Application =40% Develop = 60%				

EMPLOYABILITY ENHANCEMENT SKILLS (EES) - III
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – III

Course Code:	**P21HSMC308**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**28**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable students to:

- Build Personal Branding, team binding.
- Present the data using presentation skills in a better manner.
- Understand the importance of stress management, Entrepreneurship & Business skills.
- Usage of various voices in a sentence and critical reasoning.
- Explain the basic concepts in boat and stream, geometry and trigonometry problems.
- Calculations involving Permutations and combinations, probability and logarithms.
- Explain concepts behind logical reasoning modules of analytic, syllogisms, venn diagrams and puzzles.

UNIT – I	**8 Hours**

Soft Skills: Personal Branding, Synergy between Teams (Online and Offline), Interview skills, Stress Management, Entrepreneurship & Business skills.

Verbal Ability: Active voice and passive voice, critical reasoning.

Self-Study: Corporate ethics and Mannerism

UNIT – II	**10 Hours**

Quantitative Aptitude: Boats and streams, Geometry & Trigonometry, Permutations and combinations, Probability & Logarithms.

Self-Study: Pipes and cisterns

UNIT – III	**10 Hours**

Logical Reasoning: Analytical reasoning, Syllogisms, clocks and calendars, Venn diagram, puzzles.

Self-Study: Binary logic

Course Outcomes: On completion of this course, students are able to:	
CO – 1:	Exhibit amplified level of confidence to express themselves in English
CO – 2:	Develop the presentation skills, entrepreneurial skills by managing stress at various levels.
CO – 3:	Solve the problems based on Boats and streams, Geometry & Trigonometry, Permutations and combinations, Probability & Logarithms.
CO – 4:	Solve logical reasoning problems based on Analytical reasoning, Syllogisms, clocks and calendars, cases and Venn diagram, puzzles.

Text Book(s):

1. Word Power Made Easy New Revised and Expanded Edition, First Edition, Norman Lewis, Goyal Publisher.
2. Essential English Grammar by Raymond Murphy, Cambridge University Press, new edition
3. The 7 habits of Highly Effective People by Stephen R. Covey
4. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
5. Verbal reasoning by Dr. R. S Agarwal , published by S. Chand private limited.

Reference Book(s):

1. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd
2. CAT Mathematics by Abhijith Guha, PHI learning private limited.

Web and Video link(s):

1. NPTEL Course: Soft skills by By Prof. Binod Mishra, IIT Roorkee

https://onlinecourses.nptel.ac.in/noc21_hs76/preview

COURSE ARTICULATION MATRIX [Employability Enhancement Skills (EES) - III]

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	-	-	-	-	-	-	-	-	2	3	-	2
CO-2	-	-	-	-	-	-	-	-	2	3	2	2
CO-3	2	-	-	-	-	-	-	-	-	-	-	-
CO-4	2	-	-	-	-	-	-	-	-	-	-	-

INNOVATION AND DESIGN THINKING
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – III

Course Code	**P21AEC309**	**Credits**	**01**
Teaching Hours/Week (L: T:P: S)	**0:2:0**	**CIE Weightage**	**50%**
Total Hours of Pedagogy	**25**	**SEE Weightage**	**50%**
Exam Hour	**01**	**Total Marks**	**100**

Course Category: Foundation

Preamble: This course provides an introduction to the basic concepts and techniques of engineering and reverses engineering, the process of design, analytical thinking and ideas, basics and development of engineering drawing, application of engineering drawing with computer aide.

Course objectives:

- To explain the concept of design thinking for product and service development
- To explain the fundamental concept of design thinking
- To discuss the methods of implementing design thinking in the real world.

Module-1

Understanding Design Thinking
Definition of design - Design Vs Engineering Design– Difference between Design and Engineering Design– The General Design process Model – Design to Design thinking - Time line of Design thinking.

Module-2

Features of Design Thinking
Venn diagram of design thinking– Design thinking resources – Design thinking process Models – Design thinking methodologies

Module-3

Models to Do Design Thinking
Different kinds of thinking – 5 Stage d.School Process - 5 stages of Stanford – Empathize – Define- Ideate – Prototype – Test – Iterate - Applications of Design Thinking.

Module-4

Design thinking for Engineering - Concept models for comparing design thinking and engineering systems thinking - The Distinctive Concept Model - The Comparative Concept Model - The Inclusive Concept Model - The Integrative Concept Model.

Module-5

Design Thinking Tools and Methods - Purposeful Use of Tools and Alignment with Process - What Is: Visualization - What Is: Journey Mapping - What Is: Value Chain Analysis - What Is: Mind Mapping - What If: Brainstorming - What If: Concept Development - What Wows: Assumption Testing - What Wows: Rapid Prototyping - What Works: Customer Co-Creation - What Works: Learning Launch.

Course Outcomes:

Upon the successful completion of the course, students will be able to:

CO Nos.	Course Outcomes	Knowledge Level (Based on revised Bloom's Taxonomy)
CO1	Understanding Design Thinking process	L2
CO2	Appreciate various design process procedure	L2
CO3	Generate and develop design ideas through different Technique.	L2
CO4	Identify the significance of reverse Engineering to Understand products	L3
CO5	Practice the methods, processes, and tools of Design Thinking	L2

Suggested Learning Resources:

Text Books :

1. John.R.Karsnitz, Stephen O'Brien and John P. Hutchinson, "Engineering Design",Cengagelearning (International edition) Second Edition, 2013.
2. Roger Martin, "The Design of Business: Why Design Thinking is the Next Competitive Advantage",Harvard Business Press , 2009.

References:

1. Jake knapp, John keratsky and Braden kowitz "Sprint how to solve big problems and test new ideas in just five days"
2. Tim Brown "Change by design"
3. Steve Krug "Don't make me think; Revisited"
4. Roger martin "The design of Business"
5. Yousef Haik and Tamer M.Shahin, "Engineering Design Process", CengageLearning, SecondEdition, 2011.
6. Idris Mootee, "Design Thinking for Strategic Innovation: What They Can't Teach You at Businessor Design School", John Wiley & Sons 2013.
7. Hasso Plattner, Christoph Meinel and Larry Leifer (eds), "Design Thinking: Understand – Improve – Apply", Springer, 2011

BASIC ENGINEERING MATHEMATICS - I
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – III (Lateral Entry: Common to all branches)

Course Code:	**P21MDIP301**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**

Course Learning Objectives: The mandatory learning course **P21MADIP301**viz., **Basic EngineeringMathematics-I** aims to provide basic concepts of complex trigonometry, vector algebra, differential & integral calculus, vector differentiation and various methods of solving first order differential equations**.**

UNIT – I	**8 Hours**

Complex Trigonometry: Complex Numbers: Definitions & properties. Modulus and amplitude of a complex number, Argand's diagram, De- Moivre's theorem (without proof).

Vector Algebra: Scalar and vectors. Vectors addition and subtraction. Multiplication of vectors (Dot and Cross products). Scalar and vector triple products-simple problems.

Self-study component:	De-Moivre's theorem (without proof). Roots of complex number - Simple problems.

UNIT – II	**8 Hours**

Differential Calculus: Polar curves –angle between the radius vector and thetangent pedal equation- Problems. Taylor's series and Maclaurin's seriesexpansions- Illustrative examples.

Partial Differentiation: Elementary problems. Euler's theorem for homogeneous functions of two variables. Total derivatives-differentiation of composite and implicit function.

Self-study component:	Review of successive differentiation. Formulae for n^{th} derivatives of standard functions- Liebnitz's theorem (without proof). Application to Jacobians, errors & approximations.

UNIT – III	**8 Hours**

Integral Calculus: reduction formulae for $sin^n x$, $cos^n x$, and $sin^m x cos^m x$ and evaluation of these with standard limits-Examples. Applications of integrationto area, length of a given curve, volume and surface area of solids of revolution.

Self-study component:	Differentiation under integral sign (Integrals with constants limits)-Simple problems.

UNIT – IV	**8 Hours**

Vector Differentiation: Differentiation of vector functions. Velocity and acceleration of a particle moving on a space curve. Scalar and vector point functions. Gradient, Divergence, Curl and Laplacian (Definitions only).

Self-study component:	Solenoidal and irrotational vector fields-Problems.

UNIT – V		8 Hours
Ordinary differential equations (ODE's): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, linear differential equations of order one and equations reducible to above types.		
Self-study component:	Applications of first order and first degree ODE's - Orthogonal trajectories of Cartesian and polar curves. Newton's law of cooling, R-L circuits- Simple illustrative examples from engineering field.	
Course Outcomes: After the successful completion of the course, the students are able to		
CO1	**Explain** the fundamental concepts –in complex numbers and vector algebra to analyze the problems arising in related area of engineering field.	
CO2	**Identify** – partial derivatives to calculate rate of change of multivariate functions.	
CO3	**Apply** - the acquired knowledge of integration and differentiation to evaluate double and triple integrals to compute length surface area and volume of solids of revolution and indentify velocity, acceleration of a particle moving in a space.	
CO4	**Find** analytical solutions by solving first order ODE's which arising in different branches of engineering.	

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition), Khanna Publishers, New Delhi.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill publications, New Delhi, 11th Reprint, 2010.

REFERENCE BOOKS

1. Erwin Kreyszig, Advanced Engineering Mathematics (Latest Edition), Wiley Publishers, New Delhi.
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing House Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–West press, Reprint 2005.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005.

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**3**	**2**										
CO2	**3**	**2**										
CO3	**2**	**3**										
CO4	**2**											
CO5	**3**											
Strength of correlation: Low-1, Medium- 2, High-3												

EMPLOYABILITY ENHANCEMENT SKILLS (EES) - I

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER - III

Course Code:	**P21HDIP308**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**28**	**SEE Marks:**	**-**

Course Learning Objectives: This course will enable students to:

- Get introduced to some of the concepts of soft skills and enhance communication skills
- Recognize common mistakes done by an individual in the course of his / her communication
- Write effective emails
- Identify their strengths, weakness, opportunities and threats
- Understand the basic rules of sentence structures
- Understand the correct usage of parts of speech, tenses and articles
- Explain divisibility roles, properties of various types of numbers
- Explain application of percentage in our daily life
- Describe the concepts of profit, loss, discounts
- Explain concepts behind logical reasoning modules of arrangements and blood relations

UNIT – I	**10 Hours**

Soft Skills: LSRW, Listening, communication skills (verbal and non-verbal skills), public speaking, Email writing, SWOT Analysis

Self-Study: Motivation and Time Management

UNIT – II	**10 Hours**

Verbal Ability: Parts of Speech - Prepositions, Adjectives and Adverbs ; Tenses, Articles, Idioms and Phrasal verbs, Subject verb agreement, Synonyms and Antonyms

Self-Study: Para jumbles and one word substitution

UNIT – III	**8 Hours**

Quantitative Aptitude: Number system, Percentage, Profit & Loss
Logical Reasoning: Blood Relations and Arrangements

Self-Study: Speed Maths

Course Outcomes: On completion of this course, students are able to:	
CO – 1:	Exhibit amplified level of confidence to express themselves in English
CO – 2:	Understand the correct usage of tenses and articles
CO – 3:	Increase the number of words in his/her day to day
CO – 4:	Solve logical reasoning problems based on blood relations and arrangements
CO - 5:	Solve the problems based on number system, percentage and profit & loss

Text Book(s):

1. Word Power Made Easy New Revised and Expanded Edition, First Edition, Norman Lewis, Goyal Publisher.
2. Essential English Grammar by Raymond Murphy, Cambridge University Press, new edition
3. The 7 habits of Highly Effective People by Stephen R. Covey
4. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
5. Verbal reasoning by Dr. R. S Agarwal , published by S. Chand private limited.

Reference Book(s):

1. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd
2. CAT Mathematics by Abhijith Guha, PHI learning private limited.

Web and Video link(s):

1. Improve Your English Communication Skills Specialization https://www.coursera.org/specializations/improve-english

COURSE ARTICULATION MATRIX [Employability Enhancement Skills (EES) - I]

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	-	-	-	-	-	-	-	-	2	3	-	2
CO-2	-	-	-	-	-	-	-	-	-	2	-	2
CO-3	-	-	-	-	-	-	-	-	-	2	-	2
CO-4	2	-	-	-	-	-	-	-	-	-	-	-
CO-5	2	-	-	-	-	-	-	-	-	-	-	-

APPLIED MATHEMATICAL METHODS
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV (COMMON TO CV, MEC, IP, AUT)

Course Code:	**21MA401A**	**Credits:**	**03**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**50**

Course Learning Objectives:

- Adequate exposure to basics of engineering mathematics so as to enable them to visualize the applications to engineering problems.
- Analyze the concept of complex variables in terms real variables
- Understand the concept of statistical methods to fit curves of samples and correlation and regression analysis
- To have a insight into numerical techniques to find solution of equations having no annalistic solutions
- Provide insight into develop probability distribution of discrete and continuous random variables Testing hypothesis of sample distribution
- Special functions familiarise the power series solution to analyse the problems in ordinary differential equations

UNIT – I	**8 Hours**

Calculus of complex functions: Introduction to functions of complex variables. Definitions of limit, continuity and differentiability, Analytic functions: Cauchy- Riemann equations in Cartesian and polar forms (no proof) and consequences.Applications to flow problems. Construction ofanalytic functions: Milne-Thomson method-Problems.
Conformal transformations: Introduction. Discussion of transformations پ = ن2, پ = ۱ن, پ = z+1/z , (ن ≠ 0). Bilineartransformations- Problems.

Self-study component:	Derivation of Cauchy- Riemann equation in Cartesian and polar Forms.

UNIT – II	**8 Hours**

Complex integration: complex line integrals. Cauchy theorem, Cauchy integral formula. Taylor's and Laurent's series (Statements only) and illustrative examples. Singularities, poles and residues. (Statement only).Examples.
Curve Fitting: Curve fitting by the method of least squares, fitting thecurves of the forms ب = نۀ + b , ب = ۀb پ , y = ۀe^{bx} ۀۀo ب = نۀ^2+ ۀن +c **Statistical Methods:** Correlation and regression-Karl Pearson's coefficientof correlation and rank correlation- problems, Regression analysis, lines ofregression, problems.

Self-study component:	Contour integration Type-I & Type-II.

UNIT – III	**8 Hours**

Solution of algebraic and transcendental equations: Introduction, Bisection method, Regula-Falsi & Newton-Raphson method :- Illustrative examples only.
Numerical solution of ordinary differential equations (ODE's): Numericalsolutions of ODE's of first order and first degree – Introduction. Taylor's series method. Modified Euler's method, Runge - Kutta method of fourth order (All formulae without proof)**.** Illustrative examples only.

Numerical methods for system of linear equations- Gauss-Jacobi and Gauss- Seidel iterative methods. Determination of largest eigen value and	
Self-study component:	Solution of equations using secant method, Picards method.

UNIT – IV	**8 Hours**

Random variables and Probability Distributions: Review of random variables. Discrete and continuous random variables-problems. Binomial, Poisson, Exponential and Normal distributions (with usual notation of meanand variance)-:problems.

Joint Probability Distributions : Introduction, Joint probability and Joint distribution of discrete random variables and continuous random variables

Self-study component:	Geometric and Gamma distributions- problems.

UNIT – V	**8 Hours**

Special functions: Power series solution of a second order ODE, Series solution-Frobenius method. Series solution of Bessel's differential equation leading to $J_n(x)$. Expansions for $J_1(x)$ *and* $J_{-1}(x)$.. Series solutions of

Legendre's differential equation leading to $P_n(x)$ - Legendre's polynomials.

Rodrigue's formula (No Proof) - simple illustrative examples

Self-study component:	Basics of Power series; analytic, singular point and basic recurrence relations.

Course Outcomes: On completion of the course, student should be able to:

CO1	**Apply** the concepts of an analytic function and their properties to solve the problems arising inengineering field
CO2	**Use** the concept of correlation and regression analysis to fit a suitable mathematical model for thestatistical samples arise in engineering field
CO3	**Explain** various numerical techniques to solve equations approximately having no analytical solutions.
CO4	**Interpret** discrete and continuous probability distributions in analyzing the probability models and solveproblems involving Markov chains.
CO5	**Estimate** the series solutions of ordinary difference equation.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition 2018), Khanna Publishers, New Delhi.
2. E. Kreysizig, Advanced Engineering Mathematics, John Wiley and sons, 10th Ed. (Reprint) 2016.

REFERENCE BOOKS

1. V. Ramana: Higher Engineering Mathematics, McGraw –Hill Education,11th Ed..
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International PublishingHouse Pvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications,Reprint, 2010.

ONLINE RESOURCES

1. http://www.nptel.ac.in
2. https://en.wikipedia.org
3. http://mcatutorials.com/mca-tutorials-numerical-methods-tutorial.php
4. https://www.iitg.ac.in/physics/fac/charu/courses/ph503/book.pdf

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	**2**	**3**										
CO2	**3**	**2**										
CO3	**3**	**3**										
CO4	**2**	**3**										
CO5	**3**	**3**										
Strength of correlation: Low-1, Medium- 2, High-3												

Theory of Machines

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

Course Code: P21AU402	**Semester: IV**	**L-T-P: 3-0-0**	**Credits: 03**
Contact Period-Lecture: 40Hrs.	**Exam: 3Hrs.**	**Weightage: CIE:50 %;**	**SEE: 50%**

Prerequisites: The students should have undergone the course on basic concept on mechanisms and Elements of Mechanical Engineering.

Course Content

UNIT-I

Introduction: Definitions - Link or element, kinematic pairs, degrees of freedom, Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion, Machine. KINEMATIC CHAINS AND INVERSIONS: Inversions of Four bar chain - Single slider crank chain and Double slider crank chain.Intermittent Motion mechanisms –Geneva mechanism and Ackerman steering gear mechanism.

09 Hours

Self-study component: Uses of different inversions of mechanisms and its applications

UNIT-II

Velocity and Articulation Analysis of Mechanism: Introduction to vectors, Absolute and relative motions, motions of a link, velocity analysis by relative velocity method, four-link mechanism, slider crank mechanism.

Static force analysis: Equilibrium of two forces, three forces and four force members, members with two forces and couple, free body diagrams, static force analysis of single slider-crank mechanism, quick return motion mechanism

09 Hours

Self-study component: Static force analysis considering friction.

UNIT-III

Friction: Definition, Types of friction, Laws of Static and Dynamic, Co-efficient of Friction, Friction between sliding pair and turning pairs

Cams: Types of cams, types of followers, follower motions including SHM, uniform velocity, uniform acceleration and retardation and cycloidal motion. Disc cam with reciprocating follower having knife edge roller and flat faced follower.

08 Hour

Self-study component: Displacement diagram and cam profile for IC engine

UNIT-IV

Balancing of Rotating Masses: Static and dynamic balancing, balancing of single rotating mass in same plane and in different planes. Balancing of several masses rotating in same plane and in different planes. (Both Analytical and Graphical method)

07 Hours

Self-study component: Concept of static and dynamic loads

UNIT-V

Governors: Types of governors; force analysis of porter Governor, Hartnell Governor, controlling force, stability and sensitiveness.

Gyroscopic Effects and Gyroscope: Introduction, Spinning and Precision, Gyroscopic Couple, Effect of Gyroscopic couple on the stability of Automobile Vehicles(Four Wheelers and Two Wheelers). Simple Problems.

07Hours

Self-study component: Applications and uses of gyroscopic couple in industry

Text Books

1. Rattan S.S, "Theory of Machines", Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd edition -2005.
2. Thomas, Bevan, "Theory of Machines", CBS Publications.

Reference Books

1. Shigley. J. V. and Uickers, J.J., "Theory of Machin es& Mechanisms" , OXFORD University press - 2004
2. R.K Bansal, "Theory of Machines", S. Chand; 14th Revised edition, 1st 2005)
3. R.S.Khurmi, "Theory of Machines"

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

1. Calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms, and to Understand gear mechanism classification and to become familiar with gear standardization and specification in design.
2. Explain Terminology of gears and Importance of gear trains and their practical applications.
3. Know uses and advantages of belt drives Types and their nomenclature, Relationship between belt tensions commonly used design parameters.
4. Draw inversions and determine velocity and acceleration of different mechanisms, and to Calculate loss of power due to friction in various machine elements and Importance of Governors.
5. Explain Gyroscopic Effects and Gyroscope in automobile sector.

Course Articulation Matrix

Course Outcomes		Program Outcomes												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
CO1	Calculate mobility (number of degrees-of-freedom) and enumerate rigid links and types of joints within mechanisms, and to Understand gear mechanism classification and to become familiar with gear standardization and specification in design.	2	1											1	
CO2	Explain Terminology of gears and Importance of gear trains and their practical applications.	1	2											2	
CO3	Know uses and advantages of belt drives Types and their nomenclature, Relationship between belt tensions commonly used design parameters.	2	2	3		3									
CO4	Draw inversions and determine velocity and acceleration of different mechanisms, and to Calculate loss of power due to friction in various machine elements and Importance of Governors.	3	2	2		2								2	
CO5	Explain Gyroscopic Effects and Gyroscope in automobile sector.	3	2	2		3								2	

MECHANICS OF MATERIALS

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

Course Code: P21AU403	**Semester: IV**	**L-T-P: 3-0-0**	**Credits: 03**
Contact Period - Lecture: 40 Hrs.	**Exam: 3 Hrs.**	**Weightage: CIE:50%;**	**SEE:50%**

Course Learning Objectives:

The objectives of this course are to,

- Understand the basic concepts of stress, strain and deformation of mechanical elements subjected to axial, bending and torsional loads.
- Analyze shear force, bending moment in beams and crippling load in columns.

Course Content

UNIT-I

Simple stresses and strains: Stress, types, Saint Venant's principle, stress-strain curve for mild steel, working stress, proof stress, factor of safety, Hooke's law, modulus of elasticity, strain energy, proof resilience, longitudinal strain, lateral strain, poison's ratio, stress strain analysis of bars of uniform cross section, stepped bars, circular bar with continuously varying section, principle of superposition. Modulus of rigidity, bulk modulus, relation among elastic constants.

7 Hrs

Self study component: Rectangularbar with continuously varying section, volumetric strain.

UNIT-II

Compound bars: Stress analysis of composite bars. Thermal stresses in uniform and compound bars**. Compound stresses**: Principal planes and stresses, plane of maximum shear stress in general 2D system. Mohr's circle diagram (2D).

8 Hrs

Self study component: Strain on inclined plane due to normal stress in X and Y directions.

UNIT-III

Shear force and Bending Moment Diagrams (SFD and BMD): Types of beams, loads and supports, shear force and bending moment, sign conventions, point of contraflexure, and relationship between load intensity, shear force and bending moment. SFD and BMD for different beams subjected to concentrated loads, uniformly distributed load, uniformly varying load and inclined loads.

8 Hrs

Self study component: Applications of beams.

UNIT-IV

Bending and shear stresses in Beams: Theory of simple bending, assumptions in simple bending, relationship between bending stresses and radius of curvature, relationship between bending moment and radius of curvature, section modulus. Bending stresses in beams of uniform section. Shearing stresses in beams, shear stress across rectangular, I and T sections. (Moment of Inertia to be provided for numerical problems). **Deflection of Beams**: Introduction, Differential equation of deflection; Flexural rigidity, Macaulay's method for simply supported beams with point load and UDL.

9 Hrs

Self study component: Beam of uniform strength-uniform beam of rectangular section replaced by beam of constant depth and width.

UNIT-V

Torsional stresses: Introduction to torsion, pure torsion, assumptions, derivation of torsional equation, polar modulus, torsional rigidity and torque transmitted by solid and hollow circular shafts. **Columns:** Introduction to Columns, Euler theory for axially loaded elastic long columns, Euler equation for columns with Both ends hinged and Both ends fixed, Limitations of Euler's theory, Rankine's formula.

8 Hrs

Self study component: Euler equation for one end fixed and other end is free, and one end fixed and the other end is hinged.

Text Books

1. S. S. Bhavikatti, "**Strength of Materials**", Vikas Publication House-Pvt Ltd, 2nd edition, 2000, ISBN: 8125901647.
2. S. S. Rattan, **"Strength of Materials",** Tata McGraw-Hill, New Delhi, 2nd Edition, 2011, ISBN: 9780071072564.

Reference Books

1. James M. Gere, Stephen P. Timoshenko, **"Mechanics of Materials",** CBS Publishers and Distributers Delhi. ISBN: 978-9390219421, 2016.
2. W.A. Nash, **"Strength of Materials",** Schaum's Outline Series, 4th Edition, 2007, ISBN: 9780070466173.
3. Dr. R. K. Bansal, **"Strength of Materials",** Laxmi Publication, New Delhi, 5th Edition, 2007, ISBN: 9788131808146.
4. Ferdinand P Beer, E Russell Johnston, JR., John T DeWolf adapted by N Shivaprasad and S Krishnamurthy, **"Mechanics of Materials",** Tata McGraw-Hill.
5. Dr. B.C. Punmia, Ashok Kumar Jain and Arun Kumar Jain, **"Mechanics of Materials",** Laxmi Publications, New Delhi. 2002.

Web Resources

1.https://www.youtube.com/watch?v=GkFgysZC4Vc&list=PL27C4A6AEA552F9E6&ab_channel=nptelhrd
2. https://www.youtube.com/watch?v=vC8h1RF-KYs&ab_channel=IITDelhiJuly2018
3.https://www.youtube.com/watch?v=tao5K9Kihrs&ab_channel=IITDelhiJuly2018
4.https://www.youtube.com/watch?v=pN8zj44_DoY&ab_channel=Mechanicsofsolids
5.https://www.youtube.com/watch?v=1txkFwWWYds&t=759s&ab_channel=StructuralAnalysis-I
6.https://www.youtube.com/watch?v=CnONQoxubLw&ab_channel=nptelhrd
7.https://www.youtube.com/watch?v=wJWt0dcgafs&ab_channel=nptelhrd

Course Outcomes: At the end of the course, students will be able to;

1. **Apply** the concepts of normal stresses, strain, shear stress, bending stress torsional stress and buckling stress in mechanical components.
2. **Apply** the fundamentals of thermal stress and compound stresses in bars of uniform and compound section.
3. **Analyse** the uniform, stepped, compound bars, beams for different cross section and columns.
4. **Analyse** the beams for deflection using Macaulay's method.

Course Articulation Matrix

Course Outcomes		Program Outcomes												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	**Apply** the concepts of normal stresses, strain, shear stress, bending stress torsional stress and buckling stress in mechanical components.	3													

CO2	**Apply** the fundamentals of thermal stress and compound stresses in bars of uniform and compound section.	3													
CO3	**Analyse** the uniform, stepped, compound bars, beams for different cross section and columns.		3												
CO4	**Analyse** the beams for deflection using Macaulay's method.		3												

SEE- Course Assessment Plan

COs	**Marks Distribution**					**Total Marks**	**Weightage (%)**
	Unit I	**Unit II**	**Unit III**	**Unit IV**	**Unit V**		
CO1	2+9			2+9	2+9	33	33%
CO2		2+9	2+9			22	22%
CO3	9	9	9			27	27%
CO4				9	9	18	18%
	20	20	20	20	20	100	
Application =55% Analysis = 45%							

MANUFACTURING PROCESS-II

[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

Course Code: P21AU404	**Semester: IV**	**L-T-P: 3-0-2**	**Credits: 04**
Total Theory Teaching Hours: 40 **Total Laboratory Hours: 24**	**Exam: 3 Hrs.**	**Weightage: CIE: 50 %;SEE: 50%**	

Course Learning Objectives:

The objectives of this course are to,

- Understand the basic metal forming processes of forging, rolling, extrusion, drawing, sheet metal forming and powder metallurgy.
- Give complete insight regarding the mechanical equipment and operations involved to fulfil various applications.

Course Content

UNIT-I

Introduction to Metal Working: Classification of metal working processes, characteristics of wrought products, advantages and limitations of metal working processes. Effect of parameters in metal forming process-Temperature, strain rate, friction and lubrication, hydrostatic pressure in metalworking, Deformation zone geometry, workability of materials, residual stresses in wrought products.

8 Hrs

Self study component: Concepts of biaxial and triaxial stresses, plane stress and plane strain.

UNIT-II

Forging and Rolling: Classification of forging processes, forging machines and equipments, Forging die-design parameters. Material flow lines in forging. Forging defects, Residual stresses in forging, advantages and disadvantages of forging. Classification of Rolling processes. Rolling mills, Defects in rolled products, Rolling variables roll camber.

8 Hrs

Self study component: Hand forging equipments and operations.

UNIT-III

Extrusion and Drawing: Types of Extrusion, Extrusion variables, Extrusion dies. Seamless tube extrusion, Lubrication in Extrusion, Deformation of metal flow in extrusion, Defects in extruded products. Drawing equipment, Elements of drawing Die, dead zone formation, drawing variables, Tube drawing-classification of tube drawing.

8 Hrs

Self study component: Extrusion of brittle metals.

UNIT-IV

Sheet Metal Forming: Sheet metal forming methods, Dies and Punches-classification of dies. Open back inclinable press, Limiting drawing ratio in drawing, Forming limit criterion, Defects in deep drawn products. High energy rate forming (HERF) - Explosive forming, electromagnetic forming, electro hydraulic forming.

8 Hrs

Self study component: Parameters affecting drawability.

UNIT-V

Powder Metallurgy: Basic steps in powder metallurgy, methods of powder production, Characteristics of metal powder. Conditioning and blending powders, Compacting metal powders, Sintering-sintering mechanism, Isostatic pressing, types of isostatic pressing, finishing operations of powder metallurgy parts, advantages, disadvantages and applications of powder metallurgy.

8 Hrs

Self study component: Safety and environmental aspects of powder metallurgy.

Practical Content

24 Hrs

1. Use of forging tools and equipments.
2. Preparing model involving upsetting, drawing and bending operations, along with length and volume calculations.
   i. Model-I
   ii. Model-II
   iii. Model-III
3. Use of sheet metal tools and equipments.
4. Preparing sheet metal model.
   i. Model-I
   ii. Model-II
   iii. Model-III
5. Demonstration on extrusion honing process.
6. Demonstration of forming the parts from metallic powders.

Text Books

1. George E. Dieter, "**Mechanical Metallurgy",** Tata Mc Graw Hill Education, 3rd Edition, 2013, ISBN**:** 9781259064791.
2. Serope Kalpak Jain and Stevan R. Schmid, **"Manufacturing Engineering and Technology",** Pearson Education, 4th Edition, 2014, ISBN: 978-9332535800.

Reference Books

1. J.T. Black, Ronald A. Kohser, "**Materials and Processes in manufacturing",** Wiley, 11th Edition, 2011, ISBN: 978-0470924679.
2. G. W. Rowe, "**Principles of Industrial metal working process",** CBS Publisher, 1st Edition, 2005, ISBN: 978-8123904283.
3. Amitabha Ghosh and Asok Kumar Mallik, "**Manufacturing Science",** East-West press Pvt. Ltd., 2010, ISBN: 978-8176710633.
4. Sadhu Singh, "**Theory of Plasticity and Metal Forming Processes",** Khanna Publishers, 2003, ISBN: 978-8174090508.

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

1. **Apply** the concept of metal forming processes, types and applications.
2. **Apply** the knowledge of metal forming processes for production of engineering parts.
3. **Analyse** the various process parameters in metal forming processes.
4. **Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.

Web Resources

1. http://nptel.ac.in/courses/112107145/
2. https://youtu.be/yGKym19qxiM
3. https://youtu.be/Xf08dgnlwXg
4. https://youtu.be/9RtAis5pnq

Course Articulation Matrix														
Course Outcomes		**Program Outcomes**											**PSO**	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	**Apply** the concept of metal forming processes, types and applications.	3													
CO2	**Apply** the knowledge of metal forming processes for production of engineering parts.	3													
CO3	**Analyse** the various process parameters in metal forming processes.		3												
CO4	**Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.									3	3				

SEE- Course Assessment Plan							
COs	**Marks Distribution**					**Total Marks**	**Weightage (%)**
	Unit I	**Unit II**	**Unit III**	**Unit IV**	**Unit V**		
CO1	2+9			2+9		22	22%
CO2	9	2+9	2+9		2+9	42	42%
CO3		9	9	9	9	36	36%
CO4	**Note: Assessment only in CIE**						
	20	20	20	20	20	100	100%
Application =64% Analysis = 36%							

MECHANICAL MEASUREMENTS AND METROLOGY
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV

Course Code: P21AU405	**Semester: IV**	**L-T-P: 3-0-2**	**Credits: 04**
Total Theory Teaching Hours: 40 **Total Laboratory Hours: 24**	**Exam: 3 Hrs.**	**Weightage: CIE:50% SEE:50%**	

Course Learning Objectives:

The objectives of this course are to,

- The basic concepts of measurement and metrology, and strengthening their knowledge about advancements in system of limits, fits, tolerances and gauging of mechanical elements.
- The various measuring equipment's and use of this in industry for quality inspection.

Course Content

UNIT-I

Basic Concepts of Measurement and Metrology: Definition and significance of measurement, Generalized measurement system, Performance characteristics of measuring instruments (Only static characteristics), Inaccuracy of Measurements, Definition and objectives of metrology. Standards, Line and end standard, Wave length standard, Transfer from line to end standard. Slip gauges, Wringing phenomena, Numerical problems on building of slipgauges and calibration of end bars.

8 Hrs

Self study component: Imperial standard yard and International Prototype meter

UNIT-II

System of Limits, Fits, Tolerances and Gauging: Definition of tolerance, specification in assembly, Principle of interchangeability and selective assembly. Concept of limits of size and tolerances, Compound tolerances, accumulation of tolerances. Definition of fits, types of fits. Hole basis system and shaft basis system, Geometric dimensioning and tolerancing. Classification of gauges, Basic concept of design of gauges (Taylor's principles), wear allowance on gauges. Types of gauges -plain plug gauge, ring gauge, snap gauge, gauge materials, numerical problems on gauge design

8 Hrs

Self study component: Limit gauges for tapers.

UNIT-III

Comparators: Characteristics and classification of comparators. Mechanical comparators- Johnson Mikrokator, Sigma Comparators, Optical Comparators -principles, Zeiss ultra-optimeter, Electric and Electronic Comparators, LVDT, Pneumatic Comparators, Solex Comparator. Back Pressure gauges, **Surface Roughness and Metrology of Screw Thread:** Surface roughness terminology, Methods of measuring surface roughness, Taylor-Hobson Talysurf, Analysis of surface traces, Measurement of basic elements of thread, worked examples.

8 Hrs

Self study component: Measurements of alignment using Autocollimator

UNIT-IV

Transducers: Introduction, Transfer efficiency, classification of transducers. Mechanical Transducers: diaphragms, bellows. Electrical transducers: sliding contact resistive type, capacitive transducer, Piezo-Electric transducer. **Signal Conditioning:** Inherent problems in Mechanical systems, Electrical intermediate modifying devices, Input circuitry-simple current sensitive circuit, Electronic amplifiers, Filters, Types of filters, telemetry.

8 Hrs

Self study component: Applications of Transducers.

UNIT-V

Strain Measurement: Methods of strain measurement, Strain gauges, Preparation and mounting of strain gauges. **Measurement of Force:** Introduction, Proving ring. **Measurement of Torque:** Introduction, Hydraulic dynamometer. **Measurement of Pressure**: Introduction, McLeod gauge, Pirani Gauge. **Temperature Measurement**: Thermocouple, Laws of thermocouple, Thermocouple materials.

8 Hrs

Self study component: Pyrometers, Optical pyrometers.

Practical Content

24 Hrs

1. Calibration of measuring instruments.
2. Measurement of angle using Sine bar and Sine Centre.
3. Measurements using Profile Projector.
4. Measurements using Toolmaker's Microscope.
5. Measurement of alignment using Autocollimator.
6. Calibration of LVDT.
7. Measurements of Surface roughness using Tally surf.
8. Mechanical Comparator.
9. Measurement of Screw threads parameters using floating carriage.
10. Measurement of cutting tool forces using drill tool Dynamometer.

Text Books

1. R. K. Jain **"Engineering Metrology",** Khanna Publishers, Delhi, 20th Edition, 2004, ISBN: 9788174091536.
2. Thomas G. Beckwith, Roy D. Marangoni and John H.Lienhard, **"Mechanical Measurements",** Pearson Prentice Hall, 6th Edition, 2007, ISBN: 9780201847659.

Reference Books

1. I. C. Gupta, **"Engineering Metrology",** Dhanpat Rai Publications, 7th Edition, 2012, ISBN: 9788189928452.
2. Alsutko and Jerry Faulk, **"Industrial Instrumentation",** Delmar cengage learning, 1996, ISBN: 9780827361256.
3. R. S. Sirohi and H. C. Radha Krishna, **"Mechanical Measurements",** New Age International, Revised 3rd Edition, 2013, ISBN: 9788122403831.
4. Doblin, **"Measurement Systems",** Tata McGraw Hill, 6th Edition, 2012, ISBN: 9780070699687.

Web Resources

1. https://youtu.be/HpIEeBtJupY
2. https://youtu.be/-_qz8_sbhwY
3. https://youtu.be/uAntebtIgCY
4. https://youtu.be/rbk28swIiHU
5. https://youtu.be/OcbkOvjZujU
6. https://youtu.be/fbk0_nPNUTE
7. https://youtu.be/zmxjlFEcCUM
8. https://youtu.be/Hi7NUJdznc0
9. https://youtu.be/2vgkxHe_24g
10. https://youtu.be/TyM28gmhJcc

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

1. **Apply** fundamentals of metrology and measurement
2. **Design** tolerances and fits for selected product quality
3. **Analyze** appropriate method and instruments for inspection of various mechanical systems.
4. **Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.

Course Articulation Matrix

Course Outcomes		Program Outcomes												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	**Apply** fundamentals of metrology and measurement.	3													
CO2	**Design** tolerances and fits for selected product quality.			3											
CO3	**Analyze** appropriate method and instruments for inspection of various mechanical systems.		3												
CO4	**Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.									3	3				

SEE- Course Assessment Plan

COs	Marks Distribution					Total Marks	Weightage (%)
	Unit I	**Unit II**	**Unit III**	**Unit IV**	**Unit V**		
CO1	2+9	2+9	2+9	2+9	2+9	55	55%
CO2		9				9	9%
CO3	9		9	9	9	36	36%
CO4	**Note: To be assessed only in CIE**						
	20	20	20	20	20	100	100%
Application =55% Design=9% Analysis = 36%							

FLUID MEASUREMENT AND MACHINERY LABORATORY
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV

Course Code: P21AUL406	**Semester: IV**	**L-T-P: 0-0-2**	**Credits: 1**
Contact Period-Lecture: 30(P) Hrs.	**Exam: 3 Hrs.**	**Weightage: CIE:50%; SEE:50%**	

Course Learning Objectives:
The objectives of this course are to,

- Understand the basic measurement techniques of fluid flow.
- Evaluate the performance of vanes, turbines, pumps, compressor and blower.
- Provide training to students to enhance their practical skills.
- Develop team qualities and ethical principles.

Course Content

PART-A **10 Hrs**

Exp-1 Calibration of Venturi meter and determination of its co-efficient of discharge.

Exp-2 Calibration of Orifice meter and determination of its co-efficient of discharge.

Exp-3 Calibration of V-Notch for flow through channel.

Exp-4 Determination of coefficient of friction in flow through pipes.

Exp-5 Determination of Vane efficiency (Coefficient of impact) for different vanes.

PART-B **20 Hrs**

Exp-6 Performance test on Pelton wheel Turbine.

Exp-7 Performance test on Centrifugal Pump.

Exp-8 Performance test on Reciprocating Pump.

Exp-9 Performance test on Two Stage Reciprocating Air Compressor.

Exp-10 Performance test on Air Blower.

Reference Books

1. Dr. Jagadish Lal, **"Fluid Mechanics and Hydraulics",** Metropolitan Book Co. Pvt .Ltd, New Delhi, 2002, ISBN: 9788120002722.
2. Dr. R.K.Bansal, "**Fluid mechanics and hydraulic machines",** Laxmi publications Ltd., New Delhi, 9th Edition, 2015, ISBN: 9788131808153.

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

1. **Apply** Bernoulli's principle to determine flow rate, pressure changes for flow through pipes and **examine** the fluid flow rate in an open channel.
2. **Compare** the effect of friction in pipes of different materials.
3. **Analyse** the performance parameters of vanes, turbine, pumps, compressor and blower.
4. **Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.

Course Articulation Matrix															
Course Outcomes		Program Outcomes												PSO	
		1	2	3	4	5	6	7	8	9	10	11	12	01	02
CO1	**Apply** Bernoulli's principle to determine flow rate, pressure changes for flow through pipes and **examine** the fluid flow rate in an open channel.	3	2		1										
CO2	**Compare** the effect of friction in pipes of different materials.	3	1		1										
CO3	**Analyse** the performance parameters of vanes, turbine, pumps, compressor and blower.	3	3		2										
CO4	**Make use of** experimental data for writing a report as an **individual** or **as a team** member to **communicate** effectively.									3	3				
SEE- Course Assessment Plan															

COs	Marks Distribution			Total Marks	Weightage (%)
	Part A	Part B	Viva- Voce		
CO1	8			8	16%
CO2	7			7	14%
CO3		25		25	50%
CO4			10	10	20%
	15	25	10	50	
Application =16% Analysis = 64% Communication =20%					

EMPLOYABILITY ENHANCEMENT SKILLS (EES) - IV
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV

Course Code:	**P21HSMC408**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**50**
Total Number of Teaching Hours:	**28**	**SEE Marks:**	**50**

Course Learning Objectives: This course will enable students to:

- Solve problems on ages, mixtures and alligations and progressions.
- Understand the concepts of Data interpretation, crypt arithmetic and data sufficiency.
- Understand the basic concepts of C programming language.
- Apply programming constructs of C language to solve the real-world problem.
- Explore user-defined data structures like arrays, structures and pointers in implementing solutions to the problems.
- Design and Develop solutions to problems using functions.

UNIT – I	**10 Hours**

Quantitative Aptitude: Problems on Ages, Mixtures and Alligations, Progressions.
Logical Reasoning: Data Interpretation, Cryptarithmetic, Data sufficiency.

Self-Study: Sequential output tracing

UNIT – II	**08 Hours**

C Programming: Data types and Operators, Control statements, Looping, Arrays and Strings

Self-Study: Pre-processors

UNIT – III	**10 Hours**

C Programming: Functions, Recursion, Structure, Pointers, Memory management.

Self-Study: Enum and Union

Course Outcomes: On completion of this course, students are able to:

CO – 1:	Solve the problems based on ages, Mixtures, alligations and progressions.
CO – 2:	Apply suitable programming constructs of C language to solve the given problem.
CO – 3:	Design and Develop solutions to problems using functions and recursion.

Text Book(s):

1. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.

2. Exploring C by Yashavant Kanetkar, 2nd edition, BPB Publications
3. Test Your C Skills by Yashavant Kanetkar, 2nd edition, BPB Publications

Reference Book(s):

1. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd
2. Reema Thareja, Programming in C, 2nd Edition, Oxford University Press, 2016.
3. Schaum's outlines, Programming with C, Byron Gottfried, 3rdEdition, Tata McGraw-Hill Publication, 2017.

Web and Video link(s):

1. NPTEL Course: Problem Solving through Programming in C, Prof. Anupam Basu, IIT Kharagpur

https://nptel.ac.in/courses/106/105/106105171/

COURSE ARTICULATION MATRIX [Employability Enhancement Skills (EES) - IV]

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	2	-	-	-	-	-	-	-	-	-	-	-
CO-2	-	2	1	-	-	-	-	-	3	1	2	2
CO-3	-	1	2	-	-	-	-	-	-	2	-	1

INTERNSHIP - I [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV			
Course Code:	**P21INT409**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0 : 0 : 0**	**CIE Marks:**	**-**
Internship duration	**2 weeks**	**SEE Marks:**	**100**

All the students registered to II year of BE shall have to undergo a mandatory internship of 02 weeks during the intervening vacation of II and III semesters or III and IV semester. Internship shall include Inter / Intra Institutional activities. A Semester End Examination (Presentation followed by question-answer session) shall be conducted during IV semester and the prescribed credit shall be included in IV semester. The 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 Semester End Examination after satisfying the internship requirements. (The faculty coordinator or mentor has to monitor the students' internship progress and interact to guide them for the successful completion of the internship.)

List of Activities

1. Activities concerned with the works of Indian scholars like Charaka and Susruta, Aryabhata, Bhaskaracharya, Chanakya, Madhava, Patanjali, Panini and Thiruvalluvar, among numerous others. (Reference NEP 2020, page 04)
2. Activities such as training with higher Institutions or Soft skill training organized by Training and Placement Cell of the respective institutions.
3. Contribution at incubation/ innovation /entrepreneurship cell of the institute.
4. Participation in conferences/ workshops/ competitions etc.
5. Learning at Departmental Lab/Tinkering Lab/ Institutional workshop.
6. And working for consultancy/ research project with-in the institute. [Serial numbers 2 to 6, AICTE Internship Policy.pdf page 8]
7. Learning MS Word, Excel, Microsoft equations, MS drawing tools, MS Power point, etc.
8. Coding.
9. Mini-projects using commercially available assembled electronic products.
10. Debates, quizzes, and group discussions: On technica
11. Essay competitions: Both in Kannada and English on technical topics already studied.
12. Survey and study of published literature on the assigned topic: Technical paper survey, Preparation of synopsis. Exposure to technical paper publications.
13. Athletics and Sports.
14. Photography.
15. Short film production: Contemporary aspects, Technical aspects etc.
16. Music Competition (Vocal and Instrumental): Classical – Indian and western, Sugama-Sangeetha (Bhava Geethegalu), Folk songs, film songs etc.
17. Internship in Disaster Management. [AICTE APH 2021-22 pdf page166]

18. Solar energy connected activities that help common man. [AICTE APH 2021-22 pdf page166]
19. Working with Smart City Administration.
20. Hackathon (it is a design sprint-like event in which computer programmers and others involved in software development, including graphic designers, interface designers, project managers, and others, often including domain experts, collaborate intensively on software projects).
21. Industrial Safety, Fire Safety, Electrical Safety, Chemical Process Safety, Food Safety etc.
22. Internship and project work in Indian Knowledge System related Areas / Topics.
23. Industrial visits / small scale Industries / Factories / Cottage Industries / substation visit / short project tour, etc., and submission of report.

Documents to be submitted by Students for Internship Evaluation

I. Student's Diary

The main purpose of writing a daily diary is to cultivate the habit of documenting and to encourage the students to search for details. It develops the students' thought process and reasoning abilities. The students shall record in the daily training diary the day to day account of the observations, impressions, information gathered and suggestions given, if any, and activities carried out. It should contain the sketches and drawings related to the observations made by the students. The daily training diary should be signed after every day or at least twice a week by the Faculty/ in charge of the section (external expert) where the student has been working.

The student's Diary should be submitted by the students along with attendance record. It shall be evaluated on the basis of the following criteria:

- **(i)** Regularity in the maintenance of the diary.
- **(ii)** Adequacy and quality of information recorded.
- **(iii)** Drawings, sketches, and data recorded.
- **(iv)** Thought process and recording techniques used.
- **(v)** Organization of the information.

II. Internship Report

After completion of the Internship, the student shall prepare, with daily dairy as a reference, a comprehensive report in consultation with the evaluators to indicate what he has observed and learned in the training period along with the internship outcomes. The training report should be signed by the Evaluator.

The Internship report shall be evaluated on the basis of the following criteria and/or other relevant criteria pertaining to the activity completed.

- **(i)** Originality.
- **(ii)** Adequacy and purposeful write-up.
- **(iii)** Organization, format, drawings, sketches, style, language etc.
- **(iv)** Variety and relevance of learning experience.

Practical applications relationships with basic theory and concepts taught in the course.

Table – 1: Intra and Inter Institute Activities and Assessment Rubrics					
Sl No	**Sub Activity Head**	**Performance/ Appraisal**	**Assessment Rubrics (Allotted marks decide the letter grade)**	**Proposed Document as Evidence**	**Evaluated by**
1	Inter/Intra Institutional Workshop/ Training.	Excellent	80 to 100	**(i)** Student's Diary and **(ii)** Internship Report along with the certificate issued from relevant authorized Authority	**i)** Institute Faculty together with External Expert if any. **(ii)** Training and Placement Officer. **(iii)** Physical Education Officer or the concerned in charge Officer of the Activity
		Good	79 to 60		
		Satisfactory	59 to 40		
		Unsatisfactory and fail	<39		

BASIC ENGINEERING MATHEMATICS - II [As per Choice Based Credit System (CBCS) & OBE Scheme] SEMESTER – IV (Lateral Entry: Common to all branches)			
Course Code:	**P21MDIP401**	**Credits:**	**00**
Teaching Hours/Week (L:T:P):	**2-2-0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**40**	**SEE Marks:**	**-**

Course objective: The mandatory learning course **P21MADIP401** viz., **BASIC ENGINEERINGMATHEMATICS-II** aims to provide essential concepts of linear algebra, introductory concepts of second & higher order differential equations along with various techniques/ methods to solve them, Laplace & inverseLaplace transforms and elementary probability theory.

UNIT – I	**8 Hours**

Linear Algebra: Introduction - Rank of matrix by elementary row operations - Echelon form of a matrix. Consistency of system of linear equations - Gauss elimination method. Gauss-Jordan and LU decomposition methods. Eigen values and Eigen vectors of a square matrix.

Self-study component:	Application of Cayley-Hamilton theorem (without proof) tocompute the inverse of a matrix-Examples.

UNIT – II	**8 Hours**

Higher order ODE's: Linear differential equations of second and higher order equations with constant coefficients. Homogeneous /non-homogeneous equations. Inverse differential operators. and variation of parameters. Solution of Cauchy's homogeneous linear equation and Legendre's linear differential equation.

Self-study component:	Method of undetermined coefficients

UNIT – III	**8 Hours**

Multiple Integrals: Double and triple integrals-region of integration. Evaluation of double integrals by change of order of integration.

Vector Integration: Vector Integration: Integration of vector functions. Concept of a line integrals, surface and volume integrals. Green's, Stokes's and Gauss theorems (without proof) problems.

Self-study component:	Orthogonal curvilinear coordinates.

UNIT – IV	**8 Hours**

Laplace transforms: Laplace transforms of elementary functions. Transforms of derivatives and integrals, transforms of periodic function and unit step function-Problems only. Inverse Laplace transforms: Definition of inverse Laplace transforms. Evaluation of Inverse transforms by standard methods.

Self-study component:	Application to solutions of linear differential equations and simultaneous differential equations.

UNIT – V	**8 Hours**

Probability: Introduction. Sample space and events. Axioms of probability. Addition and multiplication theorems. Conditional probability – illustrative examples.

Self-study component:	State and prove Bayes's theorem.

Course Outcomes: After the successful completion of the course, the students are able to

CO1	**Apply** matrix theory for solving systems of linear equations in the different areas of linear algebra.
CO2	**Solve** second and higher order differential equations occurring in of electrical circuits, damped/un-damped vibrations.
CO3	**Identify** - the technique of integration to evaluate double and triple integrals by change of variables, and vector integration technique to compute line integral
CO4	**Explore** the basic concepts of elementary probability theory and, apply the same to the problems ofdecision theory.

TEXT BOOKS

1. B.S. Grewal, Higher Engineering Mathematics (44th Edition), Khanna Publishers, New Delhi.
2. B.V. Ramana, Higher Engineering Mathematics, Tata McGraw Hill publications, New Delhi, 11thReprint, 2010.

REFERENCE BOOKS

1. Erwin Kreyszig, Advanced Engineering Mathematics (Latest Edition), Wiley Publishers, New Delhi.
2. H. C. Taneja, Advanced Engineering Mathematics, Volume I & II, I.K. International Publishing HousePvt. Ltd., New Delhi.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint,2010.
4. V. Krishnamurthy, V.P. Mainra and J.L. Arora, An introduction to Linear Algebra, Affiliated East–Westpress, Reprint 2005.
5. D. Poole, Linear Algebra: A Modern Introduction, 2nd Edition, Brooks/Cole, 2005

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

Strength of correlation: Low-1, Medium- 2, High-3

EMPLOYABILITY ENHANCEMENT SKILLS (EES) - II
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – IV

Course Code:	**P21HDIP408**	**Credits:**	**01**
Teaching Hours/Week (L:T:P):	**0:2:0**	**CIE Marks:**	**100**
Total Number of Teaching Hours:	**28**	**SEE Marks:**	**-**

Course Learning Objectives: This course will enable students to:

- Get introduced to the concepts of teamwork and leadership
- Understand the importance of professional etiquettes
- Describe the reading with comprehension
- Explain the purpose, plan and ways to identify specific details in a paragraph for better comprehension
- Form grammatically correct sentences
- Explain the basic concepts in calculating simple interest and compound interest
- Explain concepts behind logical reasoning modules of direction sense, coding & decoding, series and visual reasoning

UNIT – I	**10 Hours**

Soft Skills: Etiquette, Presentation Skills, Introduction to Body Language, Interpersonal and Intrapersonal Skills, Team work, Leadership skills, Extempore

Self-Study: Concepts of Sympathy and Empathy

UNIT – II	**10 Hours**

Verbal Ability: Verbal Analogies, Sentence completion & correction, Reading comprehension

Self-Study: Paragraph sequencing

UNIT – III	**8 Hours**

Quantitative Aptitude: Simple & Compound Interest, Ratio & Proportion, Time & Work
Logical Reasoning: Direction Sense, Coding and Decoding, Series, Visual reasoning

Self-Study: Directions and Pythagoras Theorem, differences between mirror and water images

Course Outcomes: On completion of this course, students are able to:

CO – 1: Exhibit amplified level of confidence to express themselves in English

CO – 2: Critical awareness of the importance of teamwork and development of the skills for building effective teams

CO – 3: Solve the questions under reading comprehension confidently with higher accuracy

CO – 4: Solve the problems based on interest, ratio & proportion, time & work

CO – 5: Solve logical reasoning problems based on direction sense, coding & decoding and series

Text Book(s):

1. Word Power Made Easy New Revised and Expanded Edition, First Edition, Norman Lewis, Goyal Publisher.
2. Essential English Grammar by Raymond Murphy, Cambridge University Press, new edition
3. The 7 habits of Highly Effective People by Stephen R. Covey
4. Quantitative aptitude by Dr. R. S Agarwal, published by S.Chand private limited.
5. Verbal reasoning by Dr. R. S Agarwal , published by S. Chand private limited.

Reference Book(s):

1. Quantitative Aptitude by Arun Sharma, McGraw Hill Education Pvt Ltd
2. CAT Mathematics by Abhijith Guha, PHI learning private limited.

Web and Video link(s):

1. Teamwork Skills: Communicating Effectively in Groups https://www.coursera.org/learn/teamwork-skills-effective-communication

COURSE ARTICULATION MATRIX [Employability Enhancement Skills (EES) - II]

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO-1	-	-	-	-	-	-	-	-	2	3	-	2
CO-2	-	-	-	-	-	-	-	-	3	1	2	2
CO-3	-	-	-	-	-	-	-	-	-	2	-	1
CO-4	2	-	-	-	-	-	-	-	-	-	-	-
CO-5	2	-	-	-	-	-	-	-	-	-	-	-

BE – III / IV Semester – Common to all

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ

ವಿಷಯ ಸಂಕೇತ (**Course Code**)	**P21KSK307/407**	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	**50**
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ **Teachin Hours / Week (L:T:P)**	**0-2-0**	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	**50**
ಒಟ್ಟು ಬೋಧನ ಅವಧಿ	**25 ಗಂಟೆಗಳು**	ಒಟ್ಟು ಅಂಕಗಳು	**100**
ಕ್ರೆಡಿಟ್ಸ್ (**Credits**)	**1**	ಪರೀಕ್ಷೆಯ ಅವಧಿ	**01 ಗಂಟೆ**

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು:

೧. ವೃತ್ತಿಪರ ಪದವಿ ವಿದ್ಯಾರ್ಥಿಗಳಾಗಿರುವುದರಿಂದ ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಾಂಸ್ಕೃತಿಯ ಪರಿಚಯ ಮಾಡಿಕೊಡುವುದು.

೨. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಪ್ರಧಾನ ಭಾಗವಾದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳನ್ನು ಸಾಂಕೇತಿಕವಾಗಿ ಪರಿಚಹಯಿಸಿ ವಿದ್ಯಾರ್ಥಿಗಳಲ್ಲಿ ಸಾಹಿತ್ಯ ಮತ್ತು ಸಾಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಅರಿವು ಹಾಗೂ ಆಸಕ್ತಿಯನ್ನು ಮೂಡಿಸುವುದು.

೩. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವನ್ನು ಹಾಗೂ ಅವರುಗಳ ಸಾಧಿಸಿದ ವಿಷಯಗಳನ್ನು ಪರಿಚಯಿಸುವುದು

೪. ಕನ್ನಡ ಶಬ್ದಸಂಪತ್ತಿನ ಪರಿಚಯ ಮತ್ತು ಕನ್ನಡ ಭಾಷಿಯ ಬಳಕಿ ಹಾಗೂ ಕನ್ನಡದಲ್ಲಿ ಪತ್ರ ವ್ಯವಹಾರವನ್ನು ತಿಳಿಸಿಕೊಡುವುದು.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process – General Instructions):

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

೧. ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡವನ್ನು ಬೋಧಿಸಲು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಪ್ರಸ್ತುತ ಪುಸ್ತಕ ಆಧಾರಿಸಿ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನವನ್ನು ಅನುಸರಿಸುವುದು. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಪ್ರೇರೇಪಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.

೨. ಇತ್ರೀಚಿನ ತಂತ್ರಜ್ಞಾನದ ಅನುಕೂಲಗಳನ್ನು ಬಳಸಿಕೊಳ್ಳುವುದು – ಅಂದರೆ ಕವಿ–ಕಾವ್ಯ ಪರಿಚಯದಲ್ಲಿ ಕವಿಗಳ ಚಿತ್ರಣ ಮತ್ತು ಲೇಖನಗಳು ಮತ್ತು ಕಥೆ ಕಾವ್ಯಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟ ಧ್ವನಿ ಚಿತ್ರಗಳು, ಸಂಭಾಷಣೆಗಳು, ಈಗಾಗಲೇ ಇತರ ವಿಮರ್ಶಕರು ಬರೆದಿರುವ ವಿಮರ್ಶಾತ್ಮಕ ವಿಷಯಗಳನ್ನು ಟಿಪಿಟಿ, ಡಿಜಿಟಲ್ ಮಾಧ್ಯಮಗಳ ಮುಖಾಂತರ ವಿಶ್ಲೇಷಿಸುವುದು.

೩. ನವೀನ ಮಾದರಿಯ ಸಾಹಿತ್ಯ ಬೋಧನೆಗೆ ಸಂಬಂಧಪಟ್ಟ ವಿಧಾನಗಳನ್ನು ಶಿಕ್ಷಕರು ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಅನುಕೂಲವಾಗುವ ರೀತಿಯಲ್ಲಿ ಅಳವಡಿಸಿಕೊಳ್ಳಬಹುದು.

ಘಟಕ – ೧ ಲೇಖನಗಳು

೧. ಕರ್ನಾಟಕ ಸಂಸ್ಕೃತಿ – ಹಂಪ ನಾಗರಾಜಯ್ಯ

೨. ಕರ್ನಾಟಕದ ಏಕೀಕರಣ : ಒಂದು ಅಪೂರ್ವ ಚರಿತ್ರೆ – ಜಿ. ವೆಂಕಟಸುಬ್ಬಯ್ಯ

೩. ಆಡಳಿತ ಭಾಷೆಯಾಗಿ ಕನ್ನಡ – ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ ಮತ್ತು ಪ್ರೋ. ವಿ. ಕೇಶವಮೂರ್ತಿ

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**

ಘಟಕ – ೨ ಆಧುನಿಕ ಪೂರ್ವದ ಕಾವ್ಯ ಭಾಗ	
೧. ವಚನಗಳು: ಬಸವಣ್ಣ, ಅಕ್ಕಮಹದೇವಿ, ಅಲ್ಲಮಪ್ರಭು, ಆಯ್ದಕ್ಕಿ ಮಾರಯ್ಯ, ಜೇಡರದಾಸಿಮಯ್ಯ, ಆಯ್ದಕ್ಕಿ ಲಕ್ಕಮ್ಮ. ೨. ಕೀರ್ತನೆಗಳು: ಅದರಿಂದೇನು ಫಲ ಇದರಿಂದೇನು ಫಲ – ಪುರಂದರದಾಸರು ತಲ್ಲಣಿಸದಿರು ಕಂಡ್ಯ ತಾಳು ಮನವೇ – ಕನಕದಾಸರು ೩. ತತ್ವಪದಗಳು: ಸಾವಿರ ಕೊಡಗಳ ಸುಟ್ಟು – ಶಿಶುನಾಳ ಶರೀಫ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**
ಘಟಕ – ೩ ಆಧುನಿಕ ಕಾವ್ಯಭಾಗ	
೧. ಡಿವಿಜಿ ರವರ ಮಂಕುತಿಮ್ಮನ ಕಗ್ಗದಿಂದ ಆಯ್ದ ಕೆಲವು ಭಾಗಗಳು ೨. ಕುರುಡು ಕಾಂಚಾಣ: ದಾ.ರಾ. ಬೇಂದ್ರೆ ೩. ಹೊಸಬಾಳಿನ ಗೀತೆ: ಕುವೆಂಪು	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**
ಘಟಕ – ೪ ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯ	
೧. ಡಾ. ಸರ್. ಎಂ. ವಿಶ್ವೇಶ್ವರಯ್ಯ: ವ್ಯಕ್ತಿ ಮತ್ತು ಐತಿಹ್ಯ – ಎ ಎನ್ ಮೂರ್ತಿರಾವ್ ೨. ಕರಕುಶಲ ಕಲೆಗಳು ಮತ್ತು ಪರಂಪರೆಯ ವಿಜ್ಞಾನ: ಕರೀಗೌಡ ಬೀಚನಹಳ್ಳಿ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**
ಘಟಕ – ೫ ಕಥೆ ಮತ್ತು ಪ್ರವಾಸ ಕಥನ	
೧. ಯುಗಾದಿ: ವಸುಧೇಂದ್ರ ೨. ಮೆಗಾನೆ ಎಂಬ ಗಿರಿಜನ ಪರ್ವತ: ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**

ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಪರಿಣಾಮಗಳು (Course Outcomes)

೧. ಕನ್ನಡ ಭಾಷೆ, ಸಾಹಿತ್ಯ ಮತ್ತು ಕನ್ನಡದ ಸಂಸ್ಕೃತಿಯ ಪರಿಚಯವಾಗುತ್ತದೆ.
೨. ಕನ್ನಡ ಸಾಹಿತ್ಯದ ಆಧುನಿಕ ಪೂರ್ವ ಮತ್ತು ಆಧುನಿಕ ಕಾವ್ಯಗಳು ಮತ್ತು ಸಂಸ್ಕೃತಿಯ ಬಗ್ಗೆ ಆಸಕ್ತಿಯು ಮೂಡುತ್ತದೆ.
೩. ತಾಂತ್ರಿಕ ವ್ಯಕ್ತಿಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.
೪. ಕನ್ನಡ ಭಾಷಾಭ್ಯಾಸ, ಸಾಮಾನ್ಯ ಕನ್ನಡ ಹಾಗೂ ಆಡಳಿತ ಕನ್ನಡದ ಪದಗಳ ಪರಿಚಯವಾಗುತ್ತದೆ.

ಮೌಲ್ಯಮಾಪನದ ವಿಧಾನ (Assessment Details – both CIE and SEE)

(methods of CIE – MCQ, Quizzes, Open book test, Seminar or micro project)
The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is50%. The student has to obtain a minimum of 40% marks individually both in CIE and 35% marks in SEE to pass. Theory Semester End Exam (SEE) is conducted for 50 marks (01 hour duration). Based on this grading will be awarded.

Continuous Internal Evaluation:
Two Tests each of **40 Marks (duration 01 hour)**
Two assignments each of **10 Marks**

CIE methods / question paper is designed to attain the different levels of Blomm's taxonomy as per the outcome defined for the course.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ – Semester end Exam

SEE will be conducted as per the scheduled timetable, with common question papers for the subject,

a. The question paper will have 25 questions. Each question is set for 02 marks.
b. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 hour.

ಪಠ್ಯ ಪುಸ್ತಕ:
ಸಾಂಸ್ಕೃತಿಕ ಕನ್ನಡ
ಡಾ. ಹಿ.ಚಿ. ಬೋರಲಿಂಗಯ್ಯ ಮತ್ತು ಎಲ್. ತಿಮ್ಮೇಶ,
ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ

BE – III / IV Semester – Common to all

ಬಳಕೆ ಕನ್ನಡ – Balake Kannada (Kannada for Usage) **ಕನ್ನಡ ಕಲಿಕೆಗಾಗಿ ನಿಗದಿಪಡಿಸಿದ ಪಠ್ಯಪುಸ್ತಕ – (Prescribed Textbook to Learn Kannada)**			
ವಿಷಯ ಸಂಕೇತ (**Course Code**)	**P21KBK307/407**	ನಿರಂತರ ಆಂತರಿಕ ಮೌಲ್ಯಮಾಪನ ಅಂಕಗಳು	**50**
ಒಂದು ವಾರಕ್ಕೆ ಬೋಧನಾ ಅವಧಿ **Teachin Hours / Week (L:T:P)**	**0-2-0**	ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯ ಅಂಕಗಳು	**50**
ಒಟ್ಟು ಬೋಧನ ಅವಧಿ	**25 ಗಂಟೆಗಳು**	ಒಟ್ಟು ಅಂಕಗಳು	**100**
ಕ್ರೆಡಿಟ್ಸ್ (**Credits**)	**1**	ಪರೀಕ್ಷೆಯ ಅವಧಿ	**01 ಗಂಟೆ**

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯ ಉದ್ದೇಶಗಳು (Course Learning Objectives):

- To create the awareness regarding the necessity of learning local language for comfortable and healthy life.
- To enable learners to Listen and understand the Kannada language properly.
- To speak, read and write Kannada language as per requirement.
- To rain the learners for correct and polite conservation.

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವ್ಯವಸ್ಥೆ (Teaching-Learning Process – General Instructions):

These are sample Strategies, which teacher can use to accelerate the attainment of the course outcomes.

೧. ಬಳಕೆ ಕನ್ನಡವನ್ನು ತರಗತಿಯಲ್ಲಿ ಶಿಕ್ಷಕರು ಬೋಧಿಸಲು ವಟಿಯು ಸೂಚಿಸಿರು ಪಠ್ಯಪುಸ್ತಕವನ್ನು ಉಪಯೋಗಿಸಬೇಕು.

೨. ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ ಗಳನ್ನು ತಯಾರಿಸಲು ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ಉತ್ತೇಜಿಸುವುದು ಮತ್ತು ತರಗತಿಯಲ್ಲಿ ಅವುಗಳನ್ನು ಚರ್ಚಿಸಲು ಅವಕಾಶ ಮಾಡಿಕೊಡುವುದು.

೩. ಪ್ರತಿ ವಿದ್ಯಾರ್ಥಿ ಪುಸ್ತಕವನ್ನು ತರಗತಿಯಲ್ಲಿ ಬಳಸುವಂತೆ ನೋಡಿಕೊಳ್ಳುವುದು ಮತ್ತು ಪ್ರತೆ ಪಾಠ ಮತ್ತು ಪ್ರವಚನಗಳ ಮೂಲ ಅಂಶಗಳಿಗೆ ಸಂಬಂಧಪಟ್ಟಂತೆ ಪೂರಕ ಚಟುವಟಿಕೆಗಳಿಗೆ ತೊಡಗಿಸತಕ್ಕದ್ದು.

೪. ಡಿಜಿಟಲ್ ತಂತ್ರಜ್ಞಾನದ ಮುಖಾಂತರ ಇತ್ತೀಚೆಗೆ ಡಿಜಿಟಲೀಕರಣಗೊಂಡಿರುವ ಭಾಷೆ ಕಲಿಕೆಯ ವಿಧಾನಗಳನ್ನು ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ಮುಖಾಂತರ ಚರ್ಚಿಸಲು ಕ್ರಮಕೈಗೊಳ್ಳುವುದು. ಇದರಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳನ್ನು ತರಗತಿಯಲ್ಲಿ ಹೆಚ್ಚು ಏಕಾಗ್ರತೆಯಿಂದ ಪಾಠ ಕೇಳಲು ಮತ್ತು ಅಧ್ಯಯನದಲ್ಲಿ ತೊಡಗಲು ಅನುಕೂಲವಾಗುತ್ತದೆ.

೫. ಭಾಷಾಕಲಿಕೆಯ ಪ್ರಯೋಗಾಲಯದ ಮುಖಾಂತರ ಬಹುಬೇಗ ಕನ್ನಡ ಭಾಷೆಯನ್ನು ಕಲಿಯಲು ಅನುಕೂಲವಾಗುವಂತೆ ಕಾರ್ಯಚಟುವಟಿಕೆಗಳನ್ನು ಮತ್ತು ಕ್ರಿಯಾ ಯೋಜನೆಗಳನ್ನು ರೂಪಿಸುವುದು.

Module - 1

1. Introduction, Necessity of learning a local language. Methods to learn the Kannada language.
2. Easy learning of a Kannada Language: A few tips. Hints for correct and polite conservation, Listening and Speaking Activites
3. Key to Transcription.
4. ವೈಯಕ್ತಿಕ, ಸ್ವಾಮ್ಯಸೂಚಕ / ಸಂಬಂಧಿತ ಸಾರ್ವನಾಮಗಳು ಮತ್ತು ಪ್ರಶ್ನಾರ್ಥಕ ಪದಗಳು –Personal Pronouns, Possessive Forms, Interrogative words

ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**

Module - 2	
೧. ನಾಮಪದಗಳ ಸಂಬಂಧಾರ್ಥಕ ರೂಪಗಳು, ಸಂದೇಹಾಸ್ಪದ ಪ್ರಶ್ನೆಗಳು ಮತ್ತು ಸಂಬಂಧವಾಚಕ ನಾಮಪದಗಳು – Possessive forms of nouns, dubitive question and Relative nouns ೨. ಗುಣ, ಪರಿಮಾಣ ಮತ್ತು ವರ್ಣಬಣ್ಣ ವಿಶೇಷಣಗಳು, ಸಂಖ್ಯಾವಾಚಕಗಳು Qualitative and Colour Adjectives, Numerals ೩. ಕಾರಕ ರೂಪಗಳು ಮತ್ತು ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು – ಸಪ್ತಮಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯ – (ಆ, ಅದು, ಅವು, ಅಲ್ಲಿ) Predictive Forms, Locative Case	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**
Module - 3	
೧. ಚತುರ್ಥಿ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯದ ಬಳಕೆ ಮತ್ತು ಸಂಖ್ಯಾವಾಚಕಗಳು – Dative Cases, and Numerals ೨. ಸಂಖ್ಯಾಗುಣವಾಚಕಗಳು ಮತ್ತು ಬಹುವಚನ ನಾಮರೂಪಗಳು – Ordinal numerals and Plural markers ೩. ನ್ಯೂನ / ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾಪದಗಳು ಮತ್ತು ವರ್ಣ ಗುಣವಾಚಕಗಳು – Defective / Negative Verbs and Colour Adjectives	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**
Module - 4	
೧. ಅಪ್ಪಣೆ / ಒಪ್ಪಿಗೆ, ನಿರ್ದೇಶನ, ಪ್ರೋತ್ಸಾಹ ಮತ್ತು ಒತ್ತಾಯ ಅರ್ಥರೂಪ ಪದಗಳು ಮತ್ತು ವಾಕ್ಯಗಳು Permission, Commands, encouraging and Urging words (Imperative words and sentences) ೨. ಸಾಮಾನ್ಯ ಸಂಭಾಷಣೆಗಳಲ್ಲಿ ದ್ವಿತೀಯ ವಿಭಕ್ತಿ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ಸಂಭವನೀಯ ಪ್ರಕಾರಗಳು Accusative Cases and Potential Forms used in General Communication ೩. "ಇರು ಮತ್ತು ಇರಲ್ಲ" ಸಹಾಯಕ ಕ್ರಿಯಾಪದಗಳು, ಸಂಭಾವ್ಯಸೂಚಕ ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಕ್ರಿಯಾ ಪದಗಳು – Helping Verbs "iru and iralla", Corresponding Future and Negation Verbs ೪. ಹೋಲಿಕೆ (ತರತಮ), ಸಂಬಂಧ ಸೂಚಕ ಮತ್ತು ವಸ್ತು ಸೂಚಕ ಪ್ರತ್ಯಯಗಳು ಮತ್ತು ನಿಷೇಧಾರ್ಥಕ ಪದಗಳ ಬಳಕೆ – Comparative, Relationship, Identification and Negation Words	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**
Module - 5	
೧. ಕಾಲ ಮತ್ತು ಸಮಯದ ಹಾಗೂ ಕ್ರಿಯಾಪದಗಳ ವಿವಿಧ ಪ್ರಕಾರಗಳು – ifferint types of forms of Tense, Time and Verbs ೨. ದ್, –ತ್, –ತು, –ಇತು, –ಆಗಿ, –ಅಲ್ಲ, –ಗ್, –ಕ್, ಇದೆ, ಕ್ರಿಯಾ ಪ್ರತ್ಯಯಗಳೊಂದಿ ಭೂತ, ಭವಿಷ್ಯತ್ ಮತ್ತು ವರ್ತಮಾನ ಕಾಲ ವಾಕ್ಯ ರಚನೆ – Formation of past, Future and Present Tense Sentences with Verb Forms ೩. Kannada Vocabulary List : ಸಂಭಾಷಣೆಯಲ್ಲಿ ದಿನೋಪಯೋಗಿ ಕನ್ನಡ ಪದಗಳು – Kannada Words in Conversation	
ಬೋಧನೆ ಮತ್ತು ಕಲಿಕಾ ವಿಧಾನ	**ಪುಸ್ತಕ ಆಧಾರಿತ ಬ್ಲಾಕ್ ಬೋರ್ಡ್ ವಿಧಾನ, ಪ್ರಮುಖ ಅಂಶಗಳ ಚಾರ್ಟ್‌ಗಳನ್ನು ಬಳಸುವುದು, ಪಿಪಿಟಿ ಮತ್ತು ದೃಶ್ಯ ಮಾಧ್ಯಮದ ವಿಡಿಯೋಗಳನ್ನು ಬಳಸುವುದು, ವಿದ್ಯಾರ್ಥಿಗಳೊಂದಿಗೆ ಚಟುವಟಿಕೆಗಳ ಮುಖಾಂತರ ಚರ್ಚಿಸುವುದು.**

ಬಳಕೆ ಕನ್ನಡ ಪಠ್ಯದ ಕಲಿಕೆಯಿಂದ ವಿದ್ಯಾರ್ಥಿಗಳಿಗೆ ಆಗುವ ಅನುಕೂಲಗಳು ಮತ್ತು ಫಲಿತಾಂಶಗಳು : Course Outcomes (Course Skill Set): At the end of the Couse, The Students will be able

1. To understand the necessity of learning of local language for comfortable life.
2. To Listen and understand the Kannada language properly.
3. To speak, read and write Kannada language as per requirement.
4. To communicate (converse) in Kannada language in their daily life with kannada speakers.
5. To speak in polite conservation.

(**Assessment Details – both CIE and SEE)**

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and aearned the credits allotted to each subject / course if the student secures not less than 35% (18 Marks out of 50) in the semester – end examination (SEE), and a minimum of 40% (40 maeks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:
Two Tests each of **40 Marks (duration 01 hour)**
Two assignments each of **10 Marks**

CIE methods / question paper is designed to attain the different levels of Blomm's taxonomy as per the outcome defined for the course.

ಸೆಮಿಸ್ಟರ್ ಅಂತ್ಯದ ಪರೀಕ್ಷೆಯು ಈ ಕೆಳಗಿನಂತಿರುತ್ತದೆ – Semester end Exam (SEE)

SEE will be conducted as per the scheduled timetable, with common question papers for the subject,

1. The question paper will have 25 questions. Each question is set for 02 marks.
2. SEE Pattern will be in MCQ Model for 50 marks. Duration of the exam is 01 hour.

ಪಠ್ಯ ಪುಸ್ತಕ (Text book) :
ಬಳಕೆ ಕನ್ನಡ
ಲೇಖಕರು: ಡಾ. ಎಲ್. ತಿಮ್ಮೇಶ,
ಪ್ರಸಾರಾಂಗ, ವಿಶ್ವೇಶ್ವರಯ್ಯ ತಾಂತ್ರಿಕ ವಿಶ್ವವಿದ್ಯಾಲಯ, ಬೆಳಗಾವಿ

BE – III / IV Semester – Common to all

Constitution of India and Professional Ethics (CIP)			
Course Code	**P21CIP307/407**	**CIE Marks**	**50**
Teachin Hours / Week (L:T:P)	**0-2-0**	**SEE Marks**	**50**
Total Hours of Pedagogy	**25 Hours**	**Total Marks**	**100**
Credits	**1**	**Exam Hours**	**01 Hour**

Course Objectives: This course will enable the students

a. To know the fundamental political structure & codes, procedures, powers, and duties of Indian government institutions, fundamental rights, directive principles, and the duties of citizens.

b. To understand engineering ethics and their responsibilities, identify their individual roles and ethical responsibilities towards society.

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- ✓ Teachers shall adopt suitable pedagogy for effective teaching - learning process. The pedagogy shall involve thecombination of different methodologies which suit modern technological tools and software's to meet the present requirements of the Global employment market.
  - (i) Direct instructional method (Low /Old Technology),
  - (ii) Flipped classrooms (High/advanced Technological tools),
  - (iii) Blended learning (combination of both),
  - (iv) Enquiry and evaluation based learning,
  - (v) Personalized learning,
  - (vi) Problems based learning through discussion,
  - (vii) Following the method of expeditionary learning Tools and techniques,

1. Apart from conventional lecture methods, various types of innovative teaching techniques through videos, animation films may be adapted so that the delivered lesson can enhance the students in theoretical applied andpractical skills in teaching of 21CIP39/49 in general.

Module - 1

Introduction to Indian Constitution: Definition of Constitution, Necessity of the Constitution, Societies before and after the Constitution adoption. Introduction to the Indian constitution, Making of the Constitution,Role of the Constituent Assembly. Preamble of Indian Constitution & Key concepts of the Preamble. Salientfeatures of India Constitution.

Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community withadministration real time situations).

Module - 2	
Fundamental Rights (FR's), Directive Principles of State Policy (DPSP's) and Fundamental Duties (FD's): Fundamental Rights and its Restriction and limitations in different Complex Situations. DPSP's and its present relevance in Indian society. Fundamental Duties and its Scope and significance inNation building.	
Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community withadministration real time situations).
Module - 3	
Union Executive: Parliamentary System, Union Executive – President, Prime Minister, Union Cabinet, Parliament - LS and RS, Parliamentary Committees, Important Parliamentary Terminologies. Supreme Courtof India, Judicial Reviews and Judicial Activism.	
Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community withadministration real time situations).
Module - 4	
State Executive & Elections, Amendments and Emergency Provisions: State Executive, Election Commission, Elections & Electoral Process. Amendment to Constitution (Why and How) and Important Constitutional Amendments till today. Emergency Provisions.	
Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community withadministration real time situations).
Module - 5	
Professional Ethics: Definition of Ethics & Values. Professional & Engineering Ethics. Positive and Negative aspects of Engineering Ethics. Clash of Ethics, Conflicts of Interest. The impediments to Responsibility. Professional Risks, Professional Safety and liability in Engineering. Trust & Reliability inEngineering, Intellectual Property Rights (IPR's).	
Teaching-Learning Process	Chalk and talk method, Videos, Power Point presentation to teach. Creating real time stations in classroom discussions, Giving activities and assignments (Connecting Campus & community withadministration real time situations).

Course outcome (Course Skill Set)

At the end of the course the student should :

CO 1: Have constitutional knowledge and legal literacy.

CO 2: Understand Engineering and Professional ethics and responsibilities of Engineers.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks that is 20 marks. A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE and SEE taken together

Continuous Internal Evaluation:

Two Tests each of **40 Marks (duration 01 hour**)

Two assignments each of **10 Marks**

The average of two tests, two assignments, and quiz/seminar/group discussion will be out of 50 marks

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per theoutcome defined for the course.

Semester End Examination:

SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject.

- The question paper will have 25 questions. Each question is set for 02 marks.
- SEE Pattern will be in MCQ Model (Multiple Choice Questions) for 50 marks. Duration of the examination is 01 Hour.

Textbook:

1. **"Constitution of India & Professional Ethics"** Published by Prasaranga or published on VTU website with the consent of the university authorities VTU Belagavi.