SYLLABUS
(With effect from 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]
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

Professionalism
Empathy
Synergy
Commitment
Ethics
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)

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Course Code</th>
<th>Course Title</th>
<th>Teaching Department</th>
<th>Hrs / Week</th>
<th>Credit</th>
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P21 Scheme - III & IV Semester Syllabus
## COURSE SYLLABUS

### Course Code: P21MA301  
### Credits: 03
### Teaching Hours/Week (L:T:P): 2-2-0  
### Total Number of Teaching Hours: 40
### CIE Marks: 50  
### 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). Fourier 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 of variables. 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 difference interpolation 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.


Self-study component: Inverse Lagrange’s Interpolation formula, Central differences.

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<th>UNIT – IV</th>
<th>8 Hours</th>
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Self-study component: Finite Fourier transform, Fourier transform of derivatives of functions

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<tr>
<th>UNIT – V</th>
<th>8 Hours</th>
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</table>


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, Fourier Transforms and Basics ideas of PDE’s.

CO2 Explain various methods to find the Fourier constants, solution of PDE’s, Estimation of interpolation and find the area, solution of difference equations.

CO3 Apply the acquired knowledge to construct the Half-range Fourier series, Finding Fourier transforms and Inverse Laplace transforms for some standard functions.

CO4 Evaluate $Z$-transform of various functions, solutions of differential equations with initial and boundary conditions.

TEXT BOOKS


REFERENCE BOOKS

ONLINE RESOURCES

1. http://www.nptel.ac.in

<table>
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<tr>
<th></th>
<th>PO1</th>
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<th>PO3</th>
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**Strength of correlation:** Low-1, Medium-2, High-3
# ENGINEERING THERMODYNAMICS

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

## SEMESTER – III

<table>
<thead>
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<th>Course Code: P21AU302</th>
<th>Semester: III</th>
<th>L-T-P: 3-0-0</th>
<th>Credits: 03</th>
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<tr>
<td>Contact Period-Lecture: 40Hrs.</td>
<td>Exam: 3Hrs.</td>
<td>Weightage: CIE:50 % ; SEE: 50%</td>
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</table>

**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**


**Reference Books**

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

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<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
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<tr>
<td><strong>CO2</strong> Analyze the principle and process of energy interaction for different thermodynamics processes.</td>
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<tr>
<td><strong>CO3</strong> Interpret the fundamental concepts and laws of thermodynamics to analyze the performance of thermal systems.</td>
<td>3 3 1</td>
<td></td>
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<tr>
<td><strong>CO4</strong> Interpret the basic concepts of thermodynamics and able to apply for the different thermodynamic cycles.</td>
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<tr>
<td><strong>CO5</strong> Make use of mathematical expressions to analyze the performance of different thermal systems.</td>
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### Fluid Mechanics and Machinery

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

#### SEMESTER – III

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<th>Semester: III</th>
<th>L-T-P: 3-0-0</th>
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<td>Exam: 3Hrs.</td>
<td>Weightage: CIE:50 %; SEE: 50%</td>
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**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.

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

8 Hrs

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)

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

8 Hrs

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

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

Text Books

Reference Books

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
<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Understand fluid properties and concepts of fluid statics, kinematics &amp;</td>
<td>2 2 1</td>
<td>1</td>
</tr>
<tr>
<td>dynamics. L2</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO2 Apply the first principles, laws to formulate relations between variables/</td>
<td>2 2 1</td>
<td>2</td>
</tr>
<tr>
<td>parameters of static, kinematic &amp; dynamic behavior fluids. L3</td>
<td></td>
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</tr>
<tr>
<td>CO3 Analyze the effect of various parameters of fluid statics, kinematics and</td>
<td>2 2 1</td>
<td>3</td>
</tr>
<tr>
<td>dynamics by solving practical problems using derived relations and losses. L4</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>CO4 Develop knowledge about energy conversion in Turbo machines. L3</td>
<td>1 2 1</td>
<td>2</td>
</tr>
<tr>
<td>CO5 Comprehend the functioning of Centrifugal and Reciprocating pumps. L2</td>
<td>1 1 1</td>
<td>3</td>
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</tbody>
</table>
# MANUFACTURING PROCESS – I

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

**SEMMESTER – III**

<table>
<thead>
<tr>
<th>Course Code: P21AU304</th>
<th>Semester: III</th>
<th>L-T-P: 3-0-2</th>
<th>Credits: 04</th>
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<tbody>
<tr>
<td><strong>Total Theory Teaching Hours:</strong> 40</td>
<td><strong>Exam:</strong> 3Hrs.</td>
<td><strong>Weightage:</strong> CIE: 50%; SEE: 50%</td>
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<tr>
<td><strong>Total Laboratory Hours:</strong> 24</td>
<td><strong>Course Learning Objectives:</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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.

Self study component: Melting furnace classification.  
8 Hrs

**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: CO₂ moulding, Shell moulding, permanent mould casting, Pressure die casting, Squeeze Casting.

Self study component: stir casting and centrifugal casting.  
8 Hrs

**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.

Self study component: weldability and friction stir welding.  
8 Hrs

**UNIT-IV**


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

**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.

Self study component: Milling machine and grinding machine.  
8 Hrs
### Practical Content

<table>
<thead>
<tr>
<th>Practical Content</th>
<th>24 Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Testing of molding sand and core sand:</strong></td>
<td></td>
</tr>
<tr>
<td>1. Compression, shear and permeability tests on green sand specimen.</td>
<td></td>
</tr>
<tr>
<td>2. Sieve analysis to find grain fineness number of base sand.</td>
<td></td>
</tr>
<tr>
<td><strong>Foundry and casting:</strong></td>
<td></td>
</tr>
<tr>
<td>3. Use of foundry tools and other equipments.</td>
<td></td>
</tr>
<tr>
<td>4. Preparation of moulds using two moulding boxes with and without Patterns (Split pattern, Core boxes).</td>
<td></td>
</tr>
<tr>
<td>5. Production of metal component using sand casting.</td>
<td></td>
</tr>
<tr>
<td><strong>Machining processes:</strong></td>
<td></td>
</tr>
<tr>
<td>6. Preparation of one model on lathe involving plain turning, facing, knurling and eccentric turning.</td>
<td></td>
</tr>
<tr>
<td>7. External threads cutting, V-thread and square thread.</td>
<td></td>
</tr>
<tr>
<td>8. Taper turning by different methods.</td>
<td></td>
</tr>
<tr>
<td>9. Cutting of V-groove using a shaper.</td>
<td></td>
</tr>
<tr>
<td>10. Surface grinding.</td>
<td></td>
</tr>
</tbody>
</table>

### Text Books


### Reference Books


### 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](http://efoundry.iitb.ac.in/Academy/index.jsp)
2. [http://nptel.ac.in/courses/112107145/](http://nptel.ac.in/courses/112107145/)
4. [https://books.google.co.in/books?id=NOotk64Gx0C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false](https://books.google.co.in/books?id=NOotk64Gx0C&printsec=frontcover&source=gbs_ge_summary_r&cad=0#v=onepage&q&f=false)
7. [https://youtu.be/MD-PDz4EQAa](https://youtu.be/MD-PDz4EQAa)
8. [http://nptel.ac.in/courses/112105126/](http://nptel.ac.in/courses/112105126/)
### Course Articulation Matrix

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
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<tr>
<td><strong>CO1</strong></td>
<td><strong>Apply</strong> the concept of primary manufacturing processes such as casting, welding and machining.</td>
<td></td>
</tr>
<tr>
<td><strong>CO2</strong></td>
<td><strong>Identify</strong> real-time applications of special casting, welding and Machining processes.</td>
<td></td>
</tr>
<tr>
<td><strong>CO3</strong></td>
<td><strong>Examine</strong> the defects in casting and welding by <strong>analysing</strong> the microstructure.</td>
<td></td>
</tr>
<tr>
<td><strong>CO4</strong></td>
<td><strong>Analyse</strong> various cutting parameters in metal cutting.</td>
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<tr>
<td><strong>CO5</strong></td>
<td><strong>Prepare</strong> a report as an <strong>individual</strong> or as a <strong>team</strong> member to <strong>communicate</strong> effectively.</td>
<td></td>
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</table>

### SEE- Course Assessment Plan

<table>
<thead>
<tr>
<th>COs</th>
<th>Marks Distribution</th>
<th>Total Marks</th>
<th>Weightage (%)</th>
</tr>
</thead>
<tbody>
<tr>
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<td>Unit I</td>
<td>Unit II</td>
<td>Unit III</td>
</tr>
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<td><strong>CO1</strong></td>
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<tr>
<td><strong>CO2</strong></td>
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<td>2+9</td>
<td>2+9</td>
</tr>
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<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td><strong>CO4</strong></td>
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<tr>
<td><strong>CO5</strong></td>
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**Note:** Assessment only in CIE

Application =55%  Analysis = 45%
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<th>Course Code: P21AU305</th>
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<th>L-T-P: 3-0-2</th>
<th>Credits: 04</th>
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<tbody>
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<td>Total Theory Teaching Hours: 40</td>
<td>Exam: 3 Hrs.</td>
<td>Weightage: CIE:50%; SEE:50%</td>
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</tr>
<tr>
<td>Total Laboratory Hours: 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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, Bravais 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**


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.

<table>
<thead>
<tr>
<th>Practical Content</th>
<th>24 Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Preparation of specimen for metallographic examination.</td>
<td></td>
</tr>
<tr>
<td>2. Rockwell Hardness test.</td>
<td></td>
</tr>
<tr>
<td>5. Tension test using a UTM.</td>
<td></td>
</tr>
<tr>
<td>9. Shear tests using UTM.</td>
<td></td>
</tr>
<tr>
<td>10. Bending Test using UTM.</td>
<td></td>
</tr>
</tbody>
</table>

**Text Books**


**Reference Books**


**Web Resources**

1. https://youtu.be/OTDVov_kw6A
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.
<table>
<thead>
<tr>
<th>Course Articulation Matrix</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Course Outcomes</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
</tbody>
</table>

**SEE- Course Assessment Plan**

<table>
<thead>
<tr>
<th>COs</th>
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<th>Weightage (%)</th>
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<tr>
<td></td>
<td>Unit I</td>
<td>Unit II</td>
<td>Unit III</td>
</tr>
<tr>
<td>CO1</td>
<td>2+9</td>
<td>2+9</td>
<td>2+9</td>
</tr>
<tr>
<td>CO2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>CO4</td>
<td>20</td>
<td>20</td>
<td>20</td>
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</tbody>
</table>

Note: Assessment only in CIE

Application = 55%  Analysis = 45%
# COMPUTER AIDED MACHINE DRAWING

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

## SEMESTER – III

<table>
<thead>
<tr>
<th>Course Code: P21AUL306</th>
<th>Semester: III</th>
<th>L-T-P: 0-0-2</th>
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<tr>
<td>Contact Period - Lecture: 30(P) Hrs</td>
<td>Exam: 3 Hrs.</td>
<td>Weightage: CIE:50% ; SEE:50%</td>
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</tbody>
</table>

## 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).

### 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

### 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


## Reference Books

**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

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 <strong>Apply</strong> the concepts of engineering drawing to <strong>develop</strong> mechanical components.</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>CO2 <strong>Apply</strong> the concepts of section of solids to <strong>analyse</strong> cut section of machine components.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO3 <strong>Develop</strong> the mechanical components in 2D and 3D environment and assemble the same.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO4 <strong>Create</strong> the components of mechanical systems using modern CAD tool.</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>CO5 <strong>Communicate</strong> effectively through sketching and drawing.</td>
<td>3</td>
<td></td>
</tr>
</tbody>
</table>

**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-DINb9_TXAbUK_H4JyZnhv9MW3nhG
6. https://www.youtube.com/watch?v=boyN1I3fA6gandlist=PLQL-DINb9_TVqGi1Zrw-9FSOLJt3T5fD
7. https://www.youtube.com/watch?v=yKI_FiUdAu4andlist=PLQL-DINb9_TUHs8CUXYw-LnGp4rTu9g

**SEE- Course Assessment Plan**

<table>
<thead>
<tr>
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<th>Weightage (%)</th>
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<tbody>
<tr>
<td></td>
<td>Part A</td>
<td>Part B</td>
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<tr>
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<td>8</td>
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<tr>
<td>CO2</td>
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<td>CO3</td>
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<tr>
<td>CO4</td>
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<td>30%</td>
</tr>
<tr>
<td>CO5</td>
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</table>

**Note:** Assessment only in CIE

Application = 40%  Develop = 60%
EMPLOYABILITY ENHANCEMENT SKILLS (EES) - III
[As per Choice Based Credit System (CBCS) & OBE Scheme]
SEMESTER – III

<table>
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<tr>
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<th>P21HSMC308</th>
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<td>SEE Marks:</td>
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</table>

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

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

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

Self-Study: Pipes and cisterns

UNIT – III

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):**
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]**

<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
<th>PO2</th>
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| **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**

**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**

**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**

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

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

**Suggested Learning Resources:**

**Text Books :**

**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”
## Course Learning Objectives:
The mandatory learning course P21MADIP301 viz., Basic Engineering Mathematics-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).


**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 the tangent pedal equation- Problems. Taylor’s series and Maclaurin’s series expansions- 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 \( \sin^n x, \cos^n x, \text{ and } \sin^m x \cos^n x \) and evaluation of these with standard limits-Examples. Applications of integration to 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

Ordinary differential equations (ODE’s): Introduction-solutions of first order and first degree differential equations: homogeneous, exact, lineardifferential 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 problemsarising 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


REFERENCE BOOKS


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**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**

<table>
<thead>
<tr>
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<td>28</td>
<td>SEE Marks:</td>
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**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:

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<tr>
<td>CO – 1:</td>
<td>Exhibit amplified level of confidence to express themselves in English</td>
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<tr>
<td>CO – 2:</td>
<td>Understand the correct usage of tenses and articles</td>
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<td>CO – 3:</td>
<td>Increase the number of words in his/her day to day</td>
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<td>CO – 4:</td>
<td>Solve logical reasoning problems based on blood relations and arrangements</td>
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<tr>
<td>CO - 5:</td>
<td>Solve the problems based on number system, percentage and profit &amp; loss</td>
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</tbody>
</table>

**Text Book(s):**

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](https://www.coursera.org/specializations/improve-english)

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

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# APPLIED MATHEMATICAL METHODS

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

**SEMESTER – IV (COMMON TO CV, MEC, IP, AUT)**

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**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

**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 of analytic functions: Milne-Thomson method-Problems.

**Conformal transformations:** Introduction. Discussion of transformations \( \phi = \varphi^2, \chi = \varphi, \psi = z+1/z, (\omega \neq 0) \). Bilinear transformations- Problems.

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

## UNIT – II

**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 the curves of the forms \( \varphi = \chi a + b \), \( \xi = \chi b \), \( y = \chi e^{\xi} \). Contour integration Type-I & Type-II.

**Statistical Methods:** Correlation and regression-Karl Pearson’s coefficient of correlation and rank correlation- problems, Regression analysis, lines of regression, problems.

## UNIT – III

**Solution of algebraic and transcendental equations:** Introduction, Bisection method, Regula-Falsi & Newton-Raphson method :- Illustrative examples only.

Numerical methods for system of linear equations: Gauss-Jacobi and Gauss-Seidel iterative methods. Determination of largest eigen value and

<table>
<thead>
<tr>
<th>Self-study component:</th>
<th>Solution of equations using secant method, Picards method.</th>
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**UNIT – IV**


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

<table>
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<tr>
<th>Self-study component:</th>
<th>Geometric and Gamma distributions- problems.</th>
</tr>
</thead>
</table>

**UNIT – V**

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.

<table>
<thead>
<tr>
<th>Self-study component:</th>
<th>Basics of Power series; analytic, singular point and basic recurrence relations.</th>
</tr>
</thead>
</table>

**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 in engineering field.
- **CO2** Use the concept of correlation and regression analysis to fit a suitable mathematical model for the statistical 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 solve problems involving Markov chains.
- **CO5** Estimate the series solutions of ordinary difference equation.

**TEXT BOOKS**


**REFERENCE BOOKS**

ONLINE RESOURCES

1. [http://www.nptel.ac.in](http://www.nptel.ac.in)
2. [https://en.wikipedia.org](https://en.wikipedia.org)

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**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.

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

09 Hours

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

Self-study component: Static force analysis considering friction.

09 Hours

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.

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

08 Hours

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)

Self-study component: Concept of static and dynamic loads

07 Hours

UNIT-V

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


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

07 Hours
**Text Books**


**Reference Books**


**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**

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<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
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<tr>
<td>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.</td>
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<tr>
<td>CO2 Explain Terminology of gears and Importance of gear trains and their practical applications.</td>
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<tr>
<td>CO3 Know uses and advantages of belt drives Types and their nomenclature, Relationship between belt tensions commonly used design parameters.</td>
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<tr>
<td>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.</td>
<td>3 2 2</td>
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<tr>
<td>CO5 Explain Gyroscopic Effects and Gyroscope in automobile sector.</td>
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# MECHANICS OF MATERIALS

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

## SEMESTER – IV

<table>
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<tr>
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<th>L-T-P: 3-0-0</th>
<th>Credits: 03</th>
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<td>Contact Period - Lecture: 40 Hrs.</td>
<td>Exam: 3 Hrs.</td>
<td>Weightage: CIE:50%; SEE:50%</td>
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### 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.

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

7 Hrs

**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).

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

8 Hrs

**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.

Self study component: Applications of beams.

8 Hrs

**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.

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

9 Hrs

**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

P21 Scheme - III & IV Semester Syllabus
**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**


**Reference Books**


**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=tao5K9Khrs&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-1
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**

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CO1</strong> Apply the concepts of normal stresses, strain, shear stress, bending stress torsional stress and buckling stress in mechanical components.</td>
<td>1 2 3 4 5 6 7 8 9 10 11 12</td>
<td>01 02</td>
</tr>
</tbody>
</table>

**PSO**

- 01
- 02
**CO2** Apply the fundamentals of thermal stress and compound stresses in bars of uniform and compound section.

**CO3** Analyse the uniform, stepped, compound bars, beams for different cross section and columns.

**CO4** Analyse the beams for deflection using Macaulay’s method.

<table>
<thead>
<tr>
<th>SEE- Course Assessment Plan</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>COs</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>CO1</td>
</tr>
<tr>
<td>CO2</td>
</tr>
<tr>
<td>CO3</td>
</tr>
<tr>
<td>CO4</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Application =55%  Analysis = 45%
# MANUFACTURING PROCESS-II
[As per Choice Based Credit System (CBCS) & OBE Scheme]

**SEMESTER – IV**

<table>
<thead>
<tr>
<th>Course Code: P21AU404</th>
<th>Semester: IV</th>
<th>L-T-P: 3-0-2</th>
<th>Credits: 04</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Theory Teaching Hours: 40</td>
<td>Exam: 3 Hrs.</td>
<td>Weightage: CIE: 50%; SEE: 50%</td>
<td></td>
</tr>
<tr>
<td>Total Laboratory Hours: 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**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


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

<table>
<thead>
<tr>
<th>Content</th>
<th>Hrs</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Use of forging tools and equipments.</td>
<td>24</td>
</tr>
<tr>
<td>2. Preparing model involving upsetting, drawing and bending operations, along with length and volume calculations.</td>
<td></td>
</tr>
<tr>
<td>i. Model-I</td>
<td></td>
</tr>
<tr>
<td>ii. Model-II</td>
<td></td>
</tr>
<tr>
<td>iii. Model-III</td>
<td></td>
</tr>
<tr>
<td>3. Use of sheet metal tools and equipments.</td>
<td></td>
</tr>
<tr>
<td>4. Preparing sheet metal model.</td>
<td></td>
</tr>
<tr>
<td>i. Model-I</td>
<td></td>
</tr>
<tr>
<td>ii. Model-II</td>
<td></td>
</tr>
<tr>
<td>iii. Model-III</td>
<td></td>
</tr>
<tr>
<td>5. Demonstration on extrusion honing process.</td>
<td></td>
</tr>
<tr>
<td>6. Demonstration of forming the parts from metallic powders.</td>
<td></td>
</tr>
</tbody>
</table>

## Text Books


## Reference Books


## 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. [nptel.ac.in/courses/112107145/](http://nptel.ac.in/courses/112107145/)
2. [youtu.be/yGKym19qxiM](https://youtu.be/yGKym19qxiM)
3. [youtu.be/Xf08dgnlwXg](https://youtu.be/Xf08dgnlwXg)
4. [youtu.be/9RtAis5pnq](https://youtu.be/9RtAis5pnq)
## Course Articulation Matrix

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO1 Apply the concept of metal forming processes, types and applications.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO2 Apply the knowledge of metal forming processes for production of engineering parts.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO3 Analyse the various process parameters in metal forming processes.</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>CO4 Make use of experimental data for writing a report as an individual or as a team member to communicate effectively.</td>
<td>3 3</td>
<td></td>
</tr>
</tbody>
</table>

### SEE- Course Assessment Plan

<table>
<thead>
<tr>
<th>COs</th>
<th>Marks Distribution</th>
<th>Total Marks</th>
<th>Weightage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Unit I</td>
<td>Unit II</td>
<td>Unit III</td>
</tr>
<tr>
<td>CO1</td>
<td>2+9</td>
<td>2+9</td>
<td>2+9</td>
</tr>
<tr>
<td>CO2</td>
<td>9</td>
<td>2+9</td>
<td>2+9</td>
</tr>
<tr>
<td>CO3</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>CO4</td>
<td>Note: Assessment only in CIE</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Application = 64%  Analysis = 36%
### MECHANICAL MEASUREMENTS AND METROLOGY

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

**SEMESTER – IV**

<table>
<thead>
<tr>
<th>Course Code: P21AU405</th>
<th>Semester: IV</th>
<th>L-T-P: 3-0-2</th>
<th>Credits: 04</th>
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<tbody>
<tr>
<td>Total Theory Teaching Hours: 40</td>
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<td>Weightage: CIE:50% SEE:50%</td>
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</tr>
<tr>
<td>Total Laboratory Hours: 24</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### 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.

Self study component: Imperial standard yard and International Prototype meter

8 Hrs

**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

Self study component: Limit gauges for tapers.

8 Hrs

**UNIT-III**


Self study component: Measurements of alignment using Autocollimator

8 Hrs

**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.

Self study component: Applications of Transducers.

8 Hrs
## UNIT-V


**8 Hrs**

**Self study component**: Pyrometers, Optical pyrometers.

### Practical Content

**24 Hrs**

6. Calibration of LVDT.
7. Measurements of Surface roughness using Tally surf.
8. Mechanical Comparator.

### Text Books


### Reference Books


### Web Resources

2. https://youtu.be/-qz8_shibwY
6. https://youtu.be/fbk0_nPNUTE
8. https://youtu.be/Hl7NUJdznc0
9. https://youtu.be/2vgkxHe_24g
**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.

<table>
<thead>
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<tr>
<td>Course Outcomes</td>
</tr>
<tr>
<td>-----------------</td>
</tr>
<tr>
<td>CO1 Apply fundamentals of metrology and measurement.</td>
</tr>
<tr>
<td>CO2 Design tolerances and fits for selected product quality.</td>
</tr>
<tr>
<td>CO3 Analyze appropriate method and instruments for inspection of various mechanical systems.</td>
</tr>
<tr>
<td>CO4 Make use of experimental data for writing a report as an <strong>individual</strong> or <strong>as a team</strong> member to <strong>communicate</strong> effectively.</td>
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**SEE- Course Assessment Plan**

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<td>2+9</td>
</tr>
<tr>
<td>CO2</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CO3</td>
<td>9</td>
<td>9</td>
<td>9</td>
</tr>
<tr>
<td>CO4</td>
<td>20</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

Note: To be assessed only in CIE

Application =55%  Design=9%  Analysis = 36%
FLUID MEASUREMENT AND MACHINERY LABORATORY
[As per Choice Based Credit System (CBCS) & OBE Scheme]

SEMESTER – IV

<table>
<thead>
<tr>
<th>Course Code: P21AUL406</th>
<th>Semester: IV</th>
<th>L-T-P: 0-0-2</th>
<th>Credits: 1</th>
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<tbody>
<tr>
<td>Contact Period-Lecture: 30(P) Hrs.</td>
<td>Exam: 3 Hrs.</td>
<td>Weightage: CIE:50%; SEE:50%</td>
<td></td>
</tr>
</tbody>
</table>

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**

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**

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


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

<table>
<thead>
<tr>
<th>Course Outcomes</th>
<th>Program Outcomes</th>
<th>PSO</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>CO1</td>
<td>Apply Bernoulli’s principle to determine flow rate, pressure changes for flow through pipes and <strong>examine</strong> the fluid flow rate in an open channel.</td>
<td>3</td>
</tr>
<tr>
<td>CO2</td>
<td>Compare the effect of friction in pipes of different materials.</td>
<td>3</td>
</tr>
<tr>
<td>CO3</td>
<td>Analyse the performance parameters of vanes, turbine, pumps, compressor and blower.</td>
<td>3</td>
</tr>
<tr>
<td>CO4</td>
<td>Make use of experimental data for writing a report as an <strong>individual</strong> or as a <strong>team</strong> member to communicate effectively.</td>
<td></td>
</tr>
</tbody>
</table>

### SEE- Course Assessment Plan

<table>
<thead>
<tr>
<th>COs</th>
<th>Marks Distribution</th>
<th>Total Marks</th>
<th>Weightage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Part A</td>
<td>Part B</td>
<td>Viva- Voce</td>
</tr>
<tr>
<td>CO1</td>
<td>8</td>
<td></td>
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<td>25</td>
<td></td>
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</tr>
<tr>
<td>CO4</td>
<td>15</td>
<td>25</td>
<td>10</td>
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</tbody>
</table>

Application =16%  Analysis = 64%  Communication =20%
**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  
**Quantitative Aptitude:** Problems on Ages, Mixtures and Alligations, Progressions.  
**Logical Reasoning:** Data Interpretation, Cryptarithmetic, Data sufficiency.  
**Self-Study:** Sequential output tracing

### UNIT – II  
**C Programming:** Data types and Operators, Control statements, Looping, Arrays and Strings  
**Self-Study:** Pre-processors

### UNIT – III  
**C Programming:** Functions, Recursion, Structure, Pointers, Memory management.  
**Self-Study:** Enum and Union

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

<table>
<thead>
<tr>
<th>CO – 1:</th>
<th>Solve the problems based on ages, Mixtures, alligations and progressions.</th>
</tr>
</thead>
<tbody>
<tr>
<td>CO – 2:</td>
<td>Apply suitable programming constructs of C language to solve the given problem.</td>
</tr>
<tr>
<td>CO – 3:</td>
<td>Design and Develop solutions to problems using functions and recursion.</td>
</tr>
</tbody>
</table>

**Text Book(s):**
1. Quantitative aptitude 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

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/](https://nptel.ac.in/courses/106/105/106105171/)

<p>| COURSE ARTICULATION MATRIX [Employability Enhancement Skills (EES) - IV] |
|-----------------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|</p>
<table>
<thead>
<tr>
<th>COs</th>
<th>PO1</th>
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<tr>
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</tr>
<tr>
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<td>-</td>
<td>-</td>
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<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>CO-3</td>
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<td>1</td>
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<td>-</td>
<td>-</td>
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<td>-</td>
<td>-</td>
<td>-</td>
<td>2</td>
<td>-</td>
<td>1</td>
</tr>
</tbody>
</table>
**INTERNSHIP - I**

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

**SEMESTER – IV**

<table>
<thead>
<tr>
<th>Course Code:</th>
<th>Credits:</th>
<th>CIE Marks:</th>
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<tbody>
<tr>
<td>P21INT409</td>
<td>01</td>
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</table>

<table>
<thead>
<tr>
<th>Teaching Hours/Week (L:T:P):</th>
<th>SEE Marks:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 : 0 : 0</td>
<td>100</td>
</tr>
</tbody>
</table>

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.
10. Debates, quizzes, and group discussions: On technica
11. Essay competitions: Both in Kannada and English on technical topics already studied.
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).
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

<table>
<thead>
<tr>
<th>Sl No</th>
<th>Sub Activity Head</th>
<th>Performance/ Appraisal</th>
<th>Assessment Rubrics (Allotted marks decide the letter grade)</th>
<th>Proposed Document as Evidence</th>
<th>Evaluated by</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Inter/Intra Institutional Workshop/ Training.</td>
<td>Excellent</td>
<td>80 to 100</td>
<td>(i) Student’s Diary and</td>
<td>i) Institute Faculty together with External Expert if any.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Good</td>
<td>79 to 60</td>
<td>(ii) Internship Report along with the certificate issued from relevant authorized Authority</td>
<td>(ii) Training and Placement Officer.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Satisfactory</td>
<td>59 to 40</td>
<td></td>
<td>(iii) Physical Education Officer or the concerned in charge Officer of the Activity</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unsatisfactory and fail</td>
<td>&lt;39</td>
<td></td>
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</tbody>
</table>
**BASIC ENGINEERING MATHEMATICS - II**

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

**SEMESTER – IV (Lateral Entry: Common to all branches)**

<table>
<thead>
<tr>
<th>Course Code:</th>
<th>Credits:</th>
<th>Teaching Hours/Week (L:T:P):</th>
<th>CIE Marks:</th>
<th>SEE Marks:</th>
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<tr>
<td>P21MDIP401</td>
<td>00</td>
<td>2-2-0</td>
<td>100</td>
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<tr>
<td>Total Number of Teaching Hours:</td>
<td>40</td>
<td></td>
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</tbody>
</table>

**Course objective:** The mandatory learning course P21MDIP401 viz., BASIC ENGINEERING MATHEMATICS-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 & inverse Laplace transforms and elementary probability theory.

---

### UNIT – I

**8 Hours**


**Self-study component:** Application of Cayley-Hamilton theorem (without proof) to compute 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**

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

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

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

**TEXT BOOKS**


**REFERENCE BOOKS**


<table>
<thead>
<tr>
<th></th>
<th>PO1</th>
<th>PO2</th>
<th>PO3</th>
<th>PO4</th>
<th>PO5</th>
<th>PO6</th>
<th>PO7</th>
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<td>CO3</td>
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<td>CO4</td>
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**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

<table>
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<tr>
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<th>P21HDIP408</th>
<th>Credits:</th>
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<td>Teaching Hours/Week (L:T:P):</td>
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<td>CIE Marks:</td>
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<tr>
<td>Total Number of Teaching Hours:</td>
<td>28</td>
<td>SEE Marks:</td>
<td>-</td>
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</table>

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):
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]

<table>
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<tr>
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P21 Scheme - III & IV Semester Syllabus

<table>
<thead>
<tr>
<th>Course Code</th>
<th>P21KSK307/407</th>
<th>Teaching Hours</th>
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<td>01</td>
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</table>

**Course Details:**

- **Course Code:** P21KSK307/407
- **Lecture Hours:** 0-2-0
- **Credits:** 1

**Teaching-Learning Process – General Instructions:**

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

1. **Strategy 1:**
   - Aims to enhance the understanding of the course concepts through interactive and participatory teaching methods.
   - Focus on practical applications and real-life scenarios.

2. **Strategy 2:**
   - Emphasizes the importance of regular practice and revision through weekly quizzes and assignments.
   - Encourages students to form study groups and collaborate on problem-solving.

3. **Strategy 3:**
   -Focuses on the development of critical thinking and analytical skills through case studies and debates.
   - Involves guest lectures from experts in the field.

4. **Strategy 4:**
   - Aims to improve time management and stress management through relaxation techniques and regular breaks.
   - Includes meditation sessions and mindfulness exercises.

**General Instructions:**

- Encourage active participation in classroom discussions and activities.
- Provide regular feedback and constructive criticism.
- Foster a positive learning environment that encourages risk-taking and innovation.

P.E.S. College of Engineering, Mandya
Department of Automobile Engineering

BE – III / IV Semester – Common to all
Table of Contents

1. Course Outcomes

2. Assessment Details – both CIE and SEE

Course Outcomes

1. The student should be able to understand the basic concepts of automobile engineering.
2. The student should be able to apply the knowledge of automobile engineering in practical scenarios.
3. The student should be able to critically analyze and solve problems related to automobile engineering.
4. The student should be able to design and evaluate automotive systems and components.

Assessment Details – both CIE and SEE

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. 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.

**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.
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. "PÉærmïì (Credits) 1 01 Gonz

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.

Teaching-Learning Process – General Instructions:

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


Teachin Hours / Week (L:T:P) 0-2-0 50 Gonz Gonz

1. "PÉærmïì PAPÉZÀV (Prescribed Textbook to Learn Kannada)

Module - 1

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Teachin Hours / Week (L:T:P) 0-2-0 50 Gonz Gonz

1. "PÉærmïì PAPÉZÀV (Prescribed Textbook to Learn Kannada)
### Module - 2

1. Possessive forms of nouns, dubitive question and Relative nouns
2. Qualitative and Colour Adjectives, Numerals
3. Predictive Forms, Locative Case

### Module - 3

1. Dative Cases, and Numerals
2. Ordinal numerals and Plural markers
3. Defective / Negative Verbs and Colour Adjectives

### Module - 4

1. Permission, Commands, encouraging and Urging words (Imperative words and sentences)
2. Accusative Cases and Potential Forms used in General Communication
3. Helping Verbs “iru and iralla”, Corresponding Future and Negation Verbs
4. Comparative, Relationship, Identification and Negation Words

### Module - 5

1. Different types of forms of Tense, Time and Verbs
2. Formation of past, Future and Present Tense Sentences with Verb Forms
3. Kannada Vocabulary List : Kannada Words in Conversation
### Outcomes (Course Skill Set): At the end of the Course, 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 marks 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 Bloom’s taxonomy as per the outcome defined for the course.

#### 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.

#### Text book:

- [Text book name] by [Author]
BE – III / IV Semester – Common to all

### Constitution of India and Professional Ethics (CIP)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>P21CIP307/407</th>
<th>CIE Marks</th>
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<td>Teachin Hours / Week (L:T:P)</td>
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<tr>
<td>Credits</td>
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<td>Exam Hours</td>
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#### 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 the combination of different methodologies which suit modern technological tools and software’s to meet the present requirements of the Global employment market.
  1. Direct instructional method (Low /Old Technology),
  2. Flipped classrooms (High/advanced Technological tools),
  3. Blended learning (combination of both),
  4. Enquiry and evaluation based learning,
  5. Personalized learning,
  6. Problems based learning through discussion,
  7. 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 and practical 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. Salient features 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 with administration real time situations). |

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PES College of Engineering, Mandya
Department of Automobile Engineering

P21 Scheme - III & IV Semester Syllabus
| 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 in Nation 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 with administration 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 Court of 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 with administration real time situations). |

| Module - 4 |  
| --- | --- |

| Module - 5 |  
| --- | --- |
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 the outcome 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 Prasararanga or published on VTU website with the consent of the university authorities VTU Belagavi.