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(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)

(AICTE Model Curriculum Based Scheme)

Bachelor of Technology (B.Tech.) V Semester (Industrial & Production Engineering)

w.e.f. Juy 2023

S.No.	Subject Code	Category Code	Subject Name	Maximum Marks Allotted					Total Marks	Contact Hours Per Week			Total Credits
				Theory			Practical						
				End. Sem.	Mid Sem. Exam.	Quiz/ Assignment	End Sem.	Lab Work		L	T	P	
1	IP51	PEC	Professional Elective Course-I	70	20	10	-	-	100	3	1	-	4
2	IP52	PCC	Tool Engineering & Machine Tools	70	20	10	30	20	150	3	-	2	4
3	IP53	PCC	Metal Cutting Science	70	20	10	30	20	150	3	-	2	4
4	IP54	PCC	Work Study and Ergonomics	70	20	10	30	20	150	3	-	2	4
5	IP55	PCC	Fluid Mechanics	70	20	10	-	-	100	3	1	-	4
			Total	**350**	**100**	**50**	**90**	**60**	**650**	**15**	2	**6**	**20**
6	IP56	DLC	Self-Learning Presentation (SWAYAM/NPTEL/MOOC)	-	-	-	-	-	-	-	-	-	8
7	IP57	MC	NSS/NCC/Swatchhata Abhiyan/Rural Outreach	Qualifier									
Additional Course for Honours or Minor Specialization				Permitted to opt for maximum 8 credits against additional MOOC courses in subject code IP56 for the award of Honours (Minor Specialization).									

Note: 01. Departmental BOS will decide list of three/four optional subjects those are available in MOOC as well for PEC.

02. MOOC/NPTEL subjects shall be taken with permission of HOD/Coordinator.

Professional Elective Course-I		
S.No.	**Subject Code**	**Subject Name**
1	IP51A	Metrology & Quality Control
2	IP51B	Strategic Management
3	IP51C	Quality Engineering

1 hour lecture (L) = 1 credit	1 hour Tutorial (T) = 1 credit	2 hour Practical (P) = 1 credit

PEC: Professional Elective Course, PCC: Professional Core Course, DLC: Distance Learning Course, MC: Mandatory Course,

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
IP51 A	Metrology & Quality Control	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective:
To learn about various measurement techniques and equipment.

Course content:

METROLOGY & QUALITY CONTROL
(IP51 A)

Module 1

General concept of measurement: Definition-standards of measurement, Errors in measurement, Limit-gauging, various systems of limits, Fits and tolerance, Interchangeability, Tolerance analysis in manufacturing and assembly, ISI, and ISO system. Basic principles and design of standards of measuring gauges, Types of gauges and their design, Taylors Principal, Accuracy and precision, Calibration of instruments, Principals of light interference, Interferometer, Measurement and calibration, Tolerance analysis in manufacturing and assembly.

Module 2

Linear and angular measurements: Slip gauges, Micrometers, Dial gauges, Surface plates, Comparators Mechanical, Electrical, Pneumatic, and optical comparators, Angular measuring instruments-Sine bar, Angle gauges, Sprit level, Autocollimators, Clinometers, Measurement of straightness, flatness, squareness, roundness, and symmetry Inspection of screw threads and gears.

Module 3

Measurement of surface finish and measuring machines: Surface Finish-Definitions, types of surface texture, Surface roughness measurement methods, Visual inspection, Surface roughness blocks, Averaging Instruments, Profile-meters, Pneumatics and replica, Measurement of run out and concentricity, Length bar measuring machine, Optical projection, Comparators, Tool makers microscope, Inspection of Screw threads and gears, Measurement of straightness, flatness, roundness, squareness, and symmetry.

Module 4

Statistical Process Control: Basic Discrete and Continuous distributions, Measures of central tendency, Variability and shapes, Sampling, Size and Central value theorem, Control chart structure, Process plotting and stability, Study of out-of-control evidences, Defect detection and prevention, Use of control charts in evaluating past, present and future trends; Variables and Attributes, Concept of Control Charts, Types of Control Charts, Control Charts for Attributes, p Chart, np Chart, c Chart u Chart, Control Charts for Variables x Chart, R Chart.

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Module 5

Process Capability and Sampling Plans: Introduction, Variation in Process, Types of Variations, Factors Contributing Variations, Analysis of Process Capability, Acceptance sampling, Advantages and limitations of sampling inspection, Sampling methods, Single, Double and Multiple sampling plan, Operating Characteristic curve, Producer Risk and consumer Risk. Quality indices for acceptance sampling plans, Average outgoing quality limit (AOQL), Characteristics of OC curve, Characteristics of good sampling plan.

References:

1. ASTE. Handbook of Industrial Metrology. PHI Publications.
2. Jain. R.K. Engineering Metrology. Khanna Publications.
3. Gupta. I.C. A Text book of Engineering Metrology. Dhanpat Rai and Sons.
4. Galye. G.N. Metrology for Engineers. Elbs Publications.
5. Rajput. R.K. Engineering Metrology and Instrumentation. S.K. Kataria & Sons.

Course Outcomes:

At the completion of this course, students should be able to

CO1	calculate fits and Tolerance.
CO2	use linear and angular measuring instruments.
CO3	understand surface roughness measurement methods.
CO4	evaluate control charts for variables and attributes.
CO5	prepare Single, Double and Multiple sampling plan,

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	1	2	1	3	1	1	0	0	0	0	1
CO2	1	0	1	2	3	1	0	0	0	0	0	0
CO3	0	0	1	2	2	0	1	1	0	0	0	0
CO4	0	2	2	1	3	1	0	1	1	0	0	1
CO5	1	1	2	2	2	2	1	0	2	1	1	1

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
IP51 B	Strategic Management	70	20	10	-	-	100	3	1	-	4

Course Objective:

- To enhance knowledge about small scale industries.
- To provide knowledge about the methodology of entrepreneurship development program.
- To provide knowledge about principle of business incubation.
- To provide knowledge about the special aspects of entrepreneurship.
- To provide knowledge about network marketing.

Course content:

STRATEGIC ENTREPRENEURSHIP
(IP 51 B)

Module I
Small Scale Industries: Definition and types of SSI's; Role, scope, and performance in national economy; Problems of small-**scale** industries.
Industrial Sickness: Definition; Causes of sickness; Indian scenario, Government help; Management strategies; Need for trained entrepreneurs

Module II
Entrepreneurship Development Programs: Introduction, Origin of EDP's, Organizations involved in EDP's, Objectives of EDPs, Implementation of EDP's, Short comings of EDP's, Role in entrepreneurship development.

Module III
Business Incubation: Introduction, Origin, and development of business incubators in India and other countries, types of incubators, success parameters for a business incubator, Benefits to industries, institutes, government, and society; future prospects. A few case studies (at least 2).

Module IV
Special Aspects of Entrepreneurship: Entrepreneurship, Social entrepreneurship, international entrepreneurship, Rural entrepreneurship, Community Development, Women entrepreneurship.

Module V
Network Marketing: Introduction, E-business, E-commerce, E-auction, A basic internet e-business architecture, A multi-tier-business architecture.

RECOMMENDED BOOKS:

1. Strategic Entrepreneurship by P.K. Gupta, (Everest Publishing House)
2. Project Management – Strategic Design and Implementation by David Cleland (McGraw Hill)
3. Entrepreneurship-New Venture Creation by David H Holl (Prentice Hall of India)
4. Sustainable Strategic Management by Steed & Steed (Prentice Hall of India)
5. Marketing Management by Kotler (Prentice Hall of India)

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6. Management of Technology by Tarek Khalil (McGraw Hill)
7. Engineering Economic Principles by Henry Steiner (McGraw Hill)

Course Outcomes:

At the completion of this course, students should be able to

CO1	To get skill of small-scale industries.
CO2	Enhance the knowledge of entrepreneurship.
CO3	Strategic Knowledge of business incubation.
CO4	To get the knowledge of special aspects of entrepreneurship.
CO5	To build-up the knowledge of network marketing.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	0	0	1	0	1	1
CO2	2	2	3	0	3	1	0	1	0	1	0	1
CO3	1	1	3	1	3	0	1	0	0	0	0	1
CO4	1	1	0	0	3	0	0	0	0	0	0	1
CO5	1	0	3	1	3	0	0	0	0	0	0	1

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
		End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work		L	T	P	
IP51 C	Quality Engineering	70	20	10	-	-	100	3	1	-	4

Course Objectives:

- To impart knowledge about the significance of quality and the various tools/concepts of building quality into products.
- To learn the techniques used for quality control and quality improvement.
- To impart knowledge about plans for acceptance sampling and quality systems.

Course content:

QUALITY ENGINEERING
(IP51 C)

Module I
Introduction: Quality - meaning and significance, Essential components of quality, Phases or elements for building quality, Evolution of the concepts of quality, Spiral of progress of quality, Changing scope of quality activities, Ishikawa's seven quality tools, Quality Circles, Quality system economics, Hidden quality costs, Economic models of quality costs.

Module II
Taguchi's Quality Loss Function: System approach for quality management, Juran's quality trilogy, Quality planning activities, Sporadic and chronic quality problems, Causes of variation, General quality control methodology.

Module III
Statistical Quality Control: Control charts for variables: X bar-R, X bar-S, median, X-MR charts, Control charts for attributes: p, np, c charts, Product reliability, Process capability analysis.

Module IV
Acceptance Sampling: Plans and tables for attributes and variables, Sampling methods, Type of plans, Operating characteristic curves, Quality improvement methodology, Just-in-time philosophy.

Module IV
ISO 9000 Philosophy: Documentation, Implementation and certification process.

Recommended Books:

1. Juran, J.M. and Gryna, F.M, Quality Planning & Analysis, McGraw Hill (2001).
2. Grant, E.L., Statistical Quality Control, McGraw Hill (2008).
3. Feignbaum, A.V., Total Quality Control, McGraw Hill (1991).
4. Juran, J.M., Juran's Quality Control Handbook, McGraw Hill (1988).

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Course Outcomes:

At the completion of this course, students should be able to

CO1	To get the basic knowledge of Quality.
CO2	To enhance the knowledge of various Quality Management approaches.
CO3	To enhance the knowledge of statistics of Quality control.
CO4	To enhance the knowledge about sampling.
CO5	To enhance the knowledge about iso standard.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	0	0	1	0	1	1
CO2	2	2	3	0	3	1	0	1	0	1	0	1
CO3	1	1	3	1	3	0	1	0	0	0	0	1
CO4	1	1	0	0	3	0	0	0	0	0	0	1
CO5	1	0	3	1	3	0	0	0	0	0	0	1

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
IP52	Tool Engineering & Machine Tools	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course Objective:

- Provide knowledge about Basic Features and Kinematics of Machine Tools.
- Explain design of metal working tools.
- Explain principle and Design of jigs and fixtures.
- Explain Gear generation process Gear finishing process.
- Mould Design and Acceptance Tests.

Course content:

TOOL ENGINEERING & MACHINE TOOLS
(IP52)

Module 1: Basic Features and Kinematics of Machine Tools: Features of basic machine tools, Construction and operation, types of machine tools, Machine tools motion, and transmission-rotation in to rotation, Rotation in to translation, Kinematical-structures of machine tools, Elementary, Complex and compound structure.

Module 2: Design of Metal Working Tools: Design of press working tools, Press working terminology, Types of press working dies, Principle of metal shearing in press working operation, Design of Shearing, Piercing and Blanking dies, Press tool shearing operations, Bending, Forming and Drawing dies, Embossing, Coining and Spinning operations, Metal working defects.

Module 3: Design of jigs and fixtures: Principles of Jigs and Fixture Design, Locating and Clamping, Principles of location, Locating devices, Mean Locators or centralizers, Types of clamping devices, Strap clamps, Hinged clamps, C clamps, Quick acting clamps, Elements of Jigs, Types of Jigs, Drilling jigs, Types of drilling jigs, Milling Fixture, Elements of Milling Fixtures, Classification of Milling Fixtures, Turning Fixtures, Grinding and Broaching Fixture, Materials for Jigs and Fixtures, Usefulness of Jigs and Fixtures.

Module 4: Gear Cutting: Gear generation process: Gear Shaping, Gear Hobbing, Gear finishing process: Gear Shaving, Gear Burnishing, Gear Grinding, Gear Lapping, Gear Honing.
Broaching: Broaching machines, Broach terminology, Types of Broaches, Method of Broaching. **Thread production methods**: Thread chasing, Thread Rolling, Die Threading, Thread Tapping, Thread Milling, Thread Grinding.

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Module 5: Polymer and Composites: Introduction, Plastic processing, Injection, Compression and Blow moulding, Extrusion, calendaring and thermoforming, moulding of composites, Dies and mould design for plastics and rubber parts.

Powder Metallurgy: Production of metal powders, Compacting and Sintering.

Mould Design and Acceptance Tests: Common Instruments used in alignment tests, Test procedures, Installation and Leveling, Testing the quality of Grinding and Bearing surfaces, Testing the main Spindle for running, Axial slip, Alignment between two axes, Parallism between an axis and a surface.

References:

1. Mehta. N.K. Machine Tool Design and Numerical Control. TMH. Publications.
2. Sen. G.C., Bhattacharya. A., Principles of Machine Tools. New Central Book Publications.
3. Donaldson. Tool Design. TMH. Publication.
4. Jain. K.C. A Text Book of Production Engineering PHI. Publication.
5. Juneja, Sekhon & Seth. Fundamentals of Metal Cutting and Machine Tools. New Age Publications.
6. Sharma. P.C. Production Engineering. S. chand Publications.

TOOL ENGINEERING & MACHINE TOOLS LAB

List of Experiments (Expendable):

1. Draw Kinematical-structures of machine tools.
2. To study Complex and compound structure of machine tools.
3. To study Principle of metal shearing in press working operations.
4. Design of Shearing, Piercing and Blanking dies.
5. Jigs and Fixture Design.
6. To study Gear generation process.
7. To study various Performance parameters of Thread generation methods.
8. To study various methods of Powder Metallurgy

Course Outcomes:

At the completion of this course, students should be able to

CO1	Explain about Basic Features and Kinematics of Machine Tools.
CO2	Design metal working tools.
CO3	Design jigs and fixtures.
CO4	Explain Gear generation process Gear finishing process.
CO5	To do Mould Design and Acceptance Tests

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	2	1	1	1	1	1	0	0	1	0	1	1
CO2	2	2	3	0	3	1	0	1	0	1	0	1
CO3	1	1	3	1	3	0	1	0	0	0	0	1
CO4	1	1	0	0	3	0	0	0	0	0	0	1
CO5	1	0	3	1	3	0	0	0	0	0	0	1

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COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
IP53	Metal Cutting Science	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course Objective:
To learn about various machine tools and their applications

Course content:

METAL CUTTING SCIENCE
(IP53)

Module 1: Principles of metal cutting: Geometry of single pointed cutting tools, types of cutting tool, tool signature & nomenclature, Orthogonal and Oblique cutting, Measurement of cutting force, Merchant circle and force analysis of single point orthogonal cutting, cutting tool material, Mechanism of cutting and chip formation, Types of chips, Tool Failure.

Module 2: Tool Life and Thermal aspect of cutting: Heat distribution, Shear plane temperature in orthogonal cutting, Determination of tool temperature, Tool life equation, Effect of process parameters on tool life, Tool life tests, Mechanism of tool wear, Types of tool wear, Economics of Machining Process, Machinability.

Module 3: Cutting Fluids: Types of Cutting Fluid, Composition of Cutting Fluid, Selection of Cutting Fluids, Method of applying cutting fluid, Benefits,
Lathe: Lathe- specification, Components & accessories, various operations on lathes, Lathe parameters, Cutting speed, Depth of cut, Capstan & Turret lathes, tool layout, Machining time calculation, Methods of Screw production.

Module 4: Milling: Working principle, classification, Specification, Accessories & Attachment, Milling Cutters, Elements of plain milling cutter, up milling and down milling, Thread milling, Universal dividing head, Indexing Methods: Direct Indexing, Plain or Simple Indexing, Compound Indexing, Differential Indexing, Angular Indexing, Machining time calculation.

Module 5: Shapers: Classification and Specifications, Principal parts, Quick return mechanism, Shaper operations, Cutting speed, Feed, Depth of cut, Machining time calculation.
Drilling: Classification & specification of Drilling Machines, Work holding and Tool holding devices, Drilling Machine Operations, Machining time.

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References:

1. Groover MP; Fundamentals of modern manufacturing; Wiley India
2. Kaushish JP; Manufacturing processes; PHI
3. Boothroyd G, Knight WA; Fundamentals of machining and machine tools; CRC-Taylor and francis
4. Munoz J and Oswald PF; Manufacturing processes and systems; Wiley India;
5. Boston; Metal Processing.
6. Hazra Chowdhary; Workshop Technology. II
7. Lindberg – Materials & Processes of Manufacture.
8. Work shop technology by Raghuvanshi-Vol-II
9. Production Processes by HMT

Metal cutting science Lab

List of experiments (Expendable):

1 To make a job on lathe machine with operations like turning, step turning drilling, thread cutting and knurling.
2 Study of drilling machine and prepare a job on it.
3 To prepare job on milling machine.
4.To study of shaper machine to learn about working of quick return mechanism.
5 study of tool wear and tool life.
6.to study of cutting fluids.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Learn to build a job on lathe machine.
CO2	Method of applying cutting fluid.
CO3	Understand the working and operations of milling machine.
CO4	Knowledge of shaper machines and operations.
CO5	Analyze Tool Wear, its variables and estimation of tool life.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	0	1	1	2	1	1	1	0	0	0	0	1
CO2	0	0	1	1	1	1	0	0	0	0	0	0
CO3	0	0	1	2	2	0	1	1	0	0	0	0
CO4	0	0	2	1	0	1	0	1	1	0	0	1
CO5	1	1	2	2	1	2	1	0	2	1	1	1

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Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
IP54	Work Study & Ergonomics	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	150	L	T	P	4
		70	20	10	30	20		3	-	2	

Course Objective:

- To be familiar with work study procedure and its application
- To learn about human factor engineering.
- To learn about basiç procedure of method study.
- To be familiar with Job Evaluation process and Merit Rating.

Course content:

WORK STUDY & ERGONOMICS
(IP54)

MODULE I

Work Study: Purpose of Work Study, Objectives, Procedure, and Applications of Work Study, , the human factor in the application of Work Study, The influence of working condition on work study.

Human Factor Engineering: Objective of Ergonomics, Applications of Ergonomics, Man-Machine System, Characteristics of Man-Machine System, Classification of Man-Machine System, Working environment, Workplace design.

MODULE II

Method study: Method Study definition and objective of Method Study, Basic procedure, Process Analysis, Process Chart Symbol. Selection of job, Various Recording techniques like Outline Process Charts, Flow Process Charts, Man Machine Charts, Two handed Process Charts, String diagram, Flow diagram, Multiple activity chart, Simo, Cyclographs and Chrono-cyclographs, Critical examination, Development, Installation and Maintenance of improved method, Principles of Motion Economy ,Therbligs, Micro motion study, Memo motion study.

MODULE III

Work Measurement: Introduction & Definition, Objectives and basic procedure of Work Measurement, Time study, basic procedure, equipments needed, Methods of Measuring time, Selection of jobs, Breaking a job into Elements, Numbers of Observations, Performance Rating, Rating Procedure Allowances, Calculation of Standard Time, Predetermined motion time system (PMTS), Method time measurement (MTM).

MODULE IV

Job Evaluation and Merit Rating: Concept and objectives of Job Evaluation and Merit Rating, Job Evaluation Methods, Different Methods of Merit Rating.

Wage Incentive Plans: Requirement, Objectives of Wage Incentive Plans, Types of Wage Incentive Plans.

Work Sampling: Basic procedure, determining time standards by Work Sampling, Procedure for selecting random observations, Work Sampling errors.

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MODULE V

Display Systems and Controls: Display- Types of display, Visual display, Quantitative display, Qualitative display, Representational display, Alphanumeric display, Types of controls, Selection of control, Control resistance, Relationship between controls and displays, Use of anthropometric data.

Reference:

1. ILO; work-study; International Labor Organization
2. Barrnes RM; Motion and Time Study, Wiley pub
3. Currie RM; Work study; BIM publications
4. Megaw ED; Contemporary ergonomics; Taylor & Fracis
5. Mynard; Hand book of Industrial Engineering.

WORK STUDY & ERGONOMICS LAB

List Of Experiments (Expendable):

1. Preparation of two-handed process chart.
2. Preparation of Multiple Activity chart.
3. Preparation of flow process charts on activities in Workshop/ Laboratory/Office.
4. To conduct time study of the bulb holder assembly operation for the existing method.
5. Determination of time standard for a given job using stopwatch time-study.
6. Preparation of man-machine charts for an existing setup and development of an improved process.
7. Determination of time by MTM.

Course Outcomes:

At the completion of this course, students should be able to

CO1	Understand work study procedure application and its objective.
CO2	Able to prepare flow process chart, Man Machine Charts, Two handed Process Charts, String diagram, Flow diagram
CO3	Understand Job Evaluation and Wage Plans & Industrial Legislation.
CO4	Use Applications of work Measurement and work sampling.
CO5	To carry out micro motion and memo motion analysis.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	1	1	2	1	0	0	1	0	1	0
CO2	1	3	2	1	2	3	0	1	0	1	0	0
CO3	1	2	1	1	2	1	1	0	0	0	0	1
CO4	1	2	2	1	2	2	0	0	0	0	0	0
CO5	1	1	1	1	2	3	0	0	0	0	0	1

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Jabalpur Engineering College, Jabalpur
(Declared Autonomous by MP Govt., Affiliated to RGPV, Bhopal)
(AICTE Model Curriculum Based Scheme)
Bachelor of Technology (B.Tech.) V Semester (Industrial & Production Engineering)

COURSE CONTENTS **w.e.f. July 2023**

Subject Code	Subject Name	Maximum Marks Allotted					Total Marks	Hours/Week			Total Credits
		Theory			Practical						
IP55	Fluid Mechanics	End Sem	Mid-sem Exam	Quiz/ Assignment	End sem	Lab work	100	L	T	P	4
		70	20	10	-	-		3	1	-	

Course Objective

- To introduce and explain fundamentals of Fluid Mechanics and fluid properties.
- To give fundamental knowledge of fluid, its properties and behavior under various conditions of internal and external flows
- To provide knowledge of Euler's equation Bernoulli's equation and their application.
- To explain velocity measurement, flow measurement.
- Introduction of laminar & turbulent flow, Reynolds experiment & Reynolds number.

FLUID MECHANICS
(IP55)

Module-I: Review of Fluid Properties: Engineering Modules of measurement, mass, density, specific weight, volume and gravity, surface tension, capillarity, viscosity, bulk modulus of elasticity, pressure and vapor pressure. Fluid Static's: Pressure at a point, pressure variation in static fluid, Absolute and gauge pressure, manometers, Forces on plane and curved surfaces (Problems on gravity dams and tainter gates); buoyant force, Stability of floating and submerged bodies, Relative equilibrium.

Module-II: Kinematics of Flow: Types of flow-ideal & real, steady & unsteady, uniform & non-uniform one, two and three dimensional flow, path lines, streak-lines, streamlines and stream tubes; continuity equation for one and three dimensional flow, rotational & irrotational flow, circulation, stagnation point, separation of flow, sources & sinks, velocity potential, stream function, flow nets their utility & method of drawing flow nets.

Module-III: Dynamics of Flow: Euler's equation of motion along a streamline and derivation of Bernoulli's equation, application of Bernoulli's equation, energy correction factor, linear momentum equation for steady flow, momentum correction factor. The moment of momentum equation, forces on fixed and moving vanes and other applications.

Flow Measurements: Velocity measurement (Pitot tube, Prandtl tube, current meters etc.), flow measurement (orifices, nozzles, mouth pieces, orifice meter, nozzle meter, venture-meter, weirs and notches).

Module-IV: Dimensional Analysis and Dynamic Similitude: Dimensional analysis, dimensional homogeneity, use of Buckingham-pi theorem, calculation of dimensionless numbers, similarity laws, specific model investigations (submerged bodies, partially submerged bodies, weirs, spillways, rotodynamic machines etc.)

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Module-V : Laminar Flow: Introduction to laminar & turbulent flow, Reynolds experiment & Reynolds number, relation between shear & pressure gradient, laminar flow through circular pipes, laminar flow between parallel plates, laminar flow through porous media, Stokes law, lubrication principles.

References:

1. Modi & Seth; Fluid Mechanics; Standard Book House, Delhi
2. Som and Biswas; Fluid Mechnics and machinery; TMH
3. Cengal; Fluid Mechanics; TMH
4. White ; Fluid Mechanics ; TMH
5. JNIK DAKE; Essential of Engg Hyd; Afrikan Network & Sc Instt. (ANSTI)
6. Franiss JRD; A Text Book of fluid Mech. for Engg. Student
7. R Mohanty; Fluid Mechanics; PHI

Course Outcomes:

At the completion of this course, students should be able to-

CO1	Explain fundamentals of Fluid Mechanics and fluid properties..
CO2	Derive Euler's Equation of motion and Deduce Bernoulli's equation.
CO3	Distinguish the types of flows.
CO4	Find velocity measurement by using Pitot tube, Prandtl tube, current meters.
CO5	Find flow measurement bu using orifices, nozzles, mouth pieces, orifice meter, nozzle mete venture-meter, weirs and notches.

Mapping of Course outcomes (COs) with Program Outcomes (POs):

Course Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	2	1	1	1	1	1	0	1	1	2
CO2	3	2	2	2	1	0	0	0	1	1	1	1
CO3	2	2	3	2	2	2	2	1	2	1	2	3
CO4	1	2	2	3	1	0	0	0	1	3	1	1
CO5	1	1	3	3	2	1	2	1	2	2	2	3

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