Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	ME501	**Title of the Course**	Statistical Methods in Engineering	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	**1.** To introduce students about fundamental principles and knowledge of statistics and statistical tools. 2. To develop students' ability to compile statistical data, carry out statistical calculations 3. Applications of statistical techniques with emphasis to solve practical problems in science and engineering.						

Course Outcomes	
CO1	Comprehension of statistical inferences like Mean, Median, Mode and Dispersion and their applications in real-life situations.
CO2	Comprehension of statistical inferences like Correlation and Regression and its applications in real-life situations
CO3	Comprehension of sampling techniques and Hypothesis testing methods and their applications in real-life situations.
CO4	Comprehension of Probability distributions and their applications in real-life situations.
CO5	Comprehension of Non parametric tests and their applications in real-life situations.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Frequency Distributions**	**Frequency Distributions:** Graphic Representation of a Frequency Distribution-Histogram, Frequency Polygon, Cumulative Frequency Curves, Diagrammatic Representation of Data-Bar diagrams, Pie diagram. Measures of Central Tendency. Measures of Dispersion.	8	CO1
2	**Bivariate Distribution, Correlation**	**Bivariate Distribution, Correlation :** Scatter Diagram, Karl Pearson's Coefficient of correlation, Limits of correlation coefficient, Spearman's Rank Correlation. Regression: Lines of Regression, Regression Curves, Regression Coefficient, Properties of Regression Coefficients, Angle between two Regression Lines.	8	CO2
3	**Tests of Significance**	**Tests of Significance :** Null hypothesis, Alternative Hypothesis, Errors in sampling, Z-Test, Student's t-Test, x^2-Test for Goodness of Fit and Independence of Attributes, F- test for Equality of Population Variances.	8	CO3
4	**Probability Distributions**	**Probability Distributions :** Discrete Probability Distributions, Binomial, Poisson, Geometric and uniform. Continuous Probability Distributions-Normal, Gamma & Beta. Introduction to Central Limit Theorem (Without Proof)	8	CO4
5	**Non-Parametric Tests**	**Non-Parametric Tests :** Wilcoxon –Rank Sum Test, Mann-Whitney –Wilcoxon U-Test, Wilcoxon signed Rank Test, Kruskal-Wallis test.	8	CO5

Reference Books:

1. Fundamentals of Mathematical Statistics: Gupta and Kapoor ,Sultan Chand & Sons.
2. An Introduction to probability and Mathematical Statistics: Rohatgi V.K., Wiley Eastern Limited.
3. Non-Parametric Statistical Inference: Gibbons, J.D; McGraw Hill Inc.
4. Fundamentals of Applied Statistics: Gupta and Kapoor ,Sultan Chand & Sons.

e-Learning Source:

https://www.youtube.com/watch?v=TfWuAb23Ry0&list=PLbMVogVj5nJTwfajxAvmxttpDktlmMDp_

https://www.youtube.com/watch?v=pOtnzAXlXvI&list=PL3pGy4HtqwD0CWdFuygdF-gk0ORk5EFZg

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2		3					3	3	2	2
CO2	3	3	3	2	2		2					2	3	3	2
CO3	3	3	3	2	2		3					2	3	2	2
CO4	3	2	2	2	3		2				2	2	3	2	2
CO5	3	2	1	2	1		2				2	2	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	ME502	**Title of the Course**	Advanced Material Science	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	To review physics and chemical properties in the context of materials science & engineering. 2 To describe the different types of bonding in solids, and the physical ramifications of their differences. 3 Introduction to metals, ceramics, polymers, and electronic materials in the context of a molecular level understanding ofbonding. 4 Relation between processing, structure, and physical properties of recent developments in materials science & engineering within the framework of the class. 5 Make them achieve timely progress towards higher degree in Materials, Engineering and related fields.						

Course Outcomes	
CO1	Conceptually explain the classification schemes that are used to categorize engineering materials and explain the differences in the mechanical behavior of engineering materials based upon bond type, structure, composition, and processing.
CO2	Describe how and why defects (point, line and interfacial) in materials greatly affect engineering properties and limit their use in service .Calculate engineering stress, strainand the elastic modulus from data and for basic engineering applications.
CO3	To develop an understanding of the unique properties and characteristics of polymer based materials with common manufacturing processes and recent technological developments those are used in creating products from plastics.
CO4	To promote an understanding of the relationship between material structure, processing and properties composites.
CO5	Gain important conceptual and operational understanding of a wide range of methods for characterizing materials like that of Powder Metallurgy.

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	**Crystalline Structures**	Lattice Positions, planes and directions, Metal structures, Ceramic structures, Polymeric structures, Semiconductor structures.	6	CO1
2	**Imperfections in Crystalline Solids**	Vacancies, dislocations: edge and screw dislocation, elementary treatment of strain field and stress field, strain energy and line tension associated with a dislocation, partial dislocation, dislocation climb, cross slip, Lomer Cottrel barriers. Fracture: Types and their characteristics, nucleation of cracks, growth and failure, variables influencing fracture	13	CO2
3	**Polymers**	Polymerization, Structural features, thermo plastics and thermosetting plastics, additives, mechanical properties, optical properties. Advances in Material Processing: Advance in Powder Metallurgy, hot isostatic pressing, super plastic forming sol-gel process, self propagating high temperature synthesis, crystal growth techniques, epitaxy.	9	CO3
4	**Composite Materials:**	Method of preparation of fibers and fiber reinforced composites, micromechanics of composites, prediction of composite properties from its constituents, laminates and their applications, Basic stress-strain relationships, failure behaviours.	6	CO4
5	**Ceramics**	Types, structures, development and fabrication techniques, mechanical properties, optical properties.Powder Metallurgy: Sintering, process description, various process developments of W, Mo & heavy based materials e.g. cemented carbides, cermets, selection of contact materials for tool materials.	6	CO5

Reference Books:

1. Mechanical Metallurgy : Dieter CE
2. Physical Metallurgy Principles : Reed-Hill RE
3. Dislocation & Plastic in Crystals: Cottrell AH
4. Mechanics of Composite Materials: Jones RM
5. Physical Methods for Materials characterization Method: PEJ & Wild RK

e-Learning Source:

https://www.youtube.com/watch?v=MtqugJcsHZs&list=PLbRMhDVUMngdzwQyMgoUgdaGBqi_p4nVM

https://www.youtube.com/watch?v=v1qw-ttBOdA&list=PL716BC63A7418B310

https://www.youtube.com/watch?v=nfMO7_hwYuE&list=PLbMVogVj5nJS_jlBSbduzYmy6YX_K4KyM

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3

CO1	3	3	2	2	2	2	1					3	3	2	2
CO2	3	3	3	2	2	3	1					2	3	3	2
CO3	3	3	2	2	2	3						2	3	2	2
CO4	3	2	2	2	3	3						2	3	2	2
CO5	3	1	1	1	1	3						2	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	ME503	**Title of the Course**	Production Operation Management	**L**	**T**	**P**	**C**
Year	I	**Semester**	I	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. To know about the basics of Production and Operations Management, Sales Forecasting. 2. To learn about the product life cycle, Product and process design, capacity planning. 3. To learn about material requirement planning, network analysis through PERT/CPM. 4. To learn about production control, loading, sequencing and scheduling. 5. To learn about inventory control and computer aided production planning and control, SIX sigma, JIT.						

Course Outcomes	
CO1	Understand the basics of Production and Operations Management, Sales Forecasting.
CO2	Know about the product life cycle, Product and process design, capacity planning.
CO3	Know about material requirement planning, network analysis through PERT/CPM.
CO4	Understand about the production control, loading, sequencing and scheduling
CO5	Know about inventory control and computer aided production planning and control ,SIX sigma, JIT.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Sales Forecasting	Techniques used judgmental and causal forecasting. Market survey. Trend lines, time series, Moving average, Exponential Smoothing, Forecast error, Confidence limits for seasonal variations, Analysis of actual order forecasting under fluctuating demands. Cost and accuracy of forecast.	8	CO1
2	Product and Process Design Capacity Planning	Product Life cycle, Product Policy and selection. Product development and design process. Product analysis. Cost estimation and cost reduction. Standardization, Process planning, manpower requirements, line balancing.Problems of production planning and control. Break-Even Analysis. Capacity measures, capacity planning, estimating future capacity needs, Aggregate planning, guidelines for aggregate planning. Linear programming approach to aggregate planning. Master production schedule.	8	CO2
3	Material Requirement Planning (MRP) Project Scheduling with CPM and PERT	Introduction, MRP objectives, Functions served by MRP.Terminology, System outputs and MRP logic. Manufacturing resource planning (MRP-II), Capacity requirement planning (CRP). Introduction, CPM and PERT, Time-cost tradeoff (Crashing).Resource allocation.	8	CO3
4	Production Control	Introduction, Loading sequencing and scheduling. Priority sequencing, Assignment models, Scheduling, Dispatching, Expediting and Progress reporting (follow-up). In-process order control. Machine load control by use of Gantt chart, Schedule boards, Machine allocation methods, Manpower loading and scheduling.	8	CO4
5	Inventory Control Computer Aided Production Planning and Control	Introduction, Meaning and types of Inventories, Inventory control objectives, Models, Inventory costrelationships. Inventory control systems, selective control of inventory. ABC analysis, Reorder point. Consideration ofquantity discounts, Treatment of back orders. Probabilistic models with constant lead time. Information processing, JIT system, Designing fast response organizations.	8	CO5

Reference Books:

Production and Operation Analysis: Steven Nahmias, McGraw Hill.

Schaum's Outline of Operations Management: Jaseph Monks, TMH.

Production and Operations Management : Chary, TMH.

Production Planning and Inventory Control, Narsimhan,:McLeavy and Billington P.H.I.

e-Learning Source:

https://www.youtube.com/watch?v=aSd8Hbg-tuY&list=PLLy_2iUCG87A-kHGx4YUY97ShTTqBfA6-

https://www.youtube.com/watch?v=ZNLaoFdcCPs&list=PL040D2F9406691BE6

https://www.youtube.com/watch?v=_VJkKZFuRvE&list=PLSGws_74K01_MBJaKLVaP0iCupVawlL6i

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	1	1		1					3	2	2	2
CO2	3	3	3	2	1		2					2	2	2	1
CO3	3	2	1	1	2	1	3					3	3	2	1

CO4	3	2	2	2	3							2	2	3	2
CO5	3	1	1	2	1	2						2	3	1	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	ME504	**Title of the Course**	Production Engineering-I	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	I	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. To impart the knowledge about tool geometry in ASA and ORS systems, cutting tool materials. 2. Know about tool life, force analysis in metal cutting, types of chips. 3. To understand the concept of economics of metal cutting, design of single point cutting tool and grinding wheel specification. 4. To understand the various types of forming methods i.e. wire drawing and extrusion, yield criteria. 5. To know about sheet metal operations, rolling analysis and metal forming defects.						

Course Outcomes	
CO1	Understand the significance of different tool angle in metal cutting, inter-conversion of tool angles in ASA and ORS System.
CO2	Analyze tool life, draw merchant force circle diagram and types of chips.
CO3	Optimize metal cutting operation, design single point cutting tool and specify grinding wheel.
CO4	Apply different yield criteria to metal forming analysis, analyze wire drawing and extrusion.
CO5	Analyze sheet metal operation, rolling and know different metal forming defects

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Metal cutting	Types of cutting tools, tool geometry in ASA system, continental system and British maximum rake system, Cutting tool materials, Orthogonal and oblique cutting. Orthogonal rake and angle of inclinationcalculations.	7	CO1
2	Mechanics of chip	Mechanics of chip formation, Maximum orthogonal rake, Types of chips, Merchant's force circle, Shear angle relation, Tool wear and Tool life, Variables affecting tool life, Thermal aspects of metal machining. Cutting tooltemperature calculation. Limits of tool wear.	8	CO2
3	Economics of metal machining	Economics of metal machining, Design of a single point cutting tool, Friction in metal cutting, grinding: Wheel specifications, Grinding ratio, Wheel wear, Buffing and Honing, Machine Tool vibrations and chatter.	7	CO3
4	Metal forming	Yield criteria, and theory of plasticity, Wire drawing with friction and back-pull, Extrusion with friction and back pull for circular rods.	8	CO4
5	Sheet metal	Sheet Metal working, Dies, Shear angle on punch. Direct compression processes, Forming and Rolling Analysis,Analysis of sheet metal forming processes, Discussion on defects in metal forming processes. CAD/CAMapplications in forming.	10	CO5

Reference Books:

Manufacturing Science Vol I and II M.I. Khan, P.H.I. New Delhi

Manufacturing Science: Ghosh and Mallick. East West Press.

A Text Book of Production Engineering Sciences, PC. Pandey & C.K. Singh, Standard Publishers / Distributors, Nai Sarak, New Delhi.

e-Learning Source:

https://www.youtube.com/watch?v=aSd8Hbg-tuY&list=PLLy_2iUCG87A-kHGx4YUY97ShTTqBfA6-

https://www.youtube.com/watch?v=jdFrBtHeJbs&list=PLSGws_74K01-g9nnTMBssGURHawYYQfMQ

https://www.youtube.com/watch?v=inck14Enob8&list=PLSGws_74K019ONZcPcVWqdAIe1Y4ChVmi

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	2	2	2	1	-	2	-	2	3	3	3	3
CO2	3	3	3	2	2	2	2	-	2	-	1	2	3	3	3
CO3	3	3	3	2	2	2	1	-	2	-	2	3	3	3	2
CO4	3	3	3	2	1	3	1	-	1	-	3	2	3	3	3
CO5	3	3	2	2	2	2	1	-	3	-	3	3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:	2016-17						
Course Code	ME505	**Title of the Course**	PRODUCTION ENGINEERING LAB I	**L**	**T**	**P**	**C**
Year	**1st**	**Semester**	1st	**0**	**0**	**3**	**2**
Pre-Requisite	none	**Co-requisite**	none				
Course Objectives	• To impart knowledge/ techniques to determine the knowledge about tool geometry in ASA and ORS systems. • To impart knowledge/ techniques to know variation of diameter of a cylinder along its axis. • To impart knowledge/ techniques to understand roundness of a turned mild steel cylinder. • To impart knowledge/ techniques to understand the Measurement of Pitch Circle Diameter of a V-thread using 3 wire methods. • Imparting knowledge to measure and comparison of Flank Wear on Carbon Steel (C.S). H.S.S. and carbide Tip.						

Course Outcomes	
CO1	Determine the shear plane angle and study the about tool geometry in ASA and ORS systems
CO2	Determine the variation of diameter of a cylinder along its axis.
CO3	Understand the roundness of a turned mild steel cylinder.
CO4	Understand the Measurement of Pitch Circle Diameter of a V-thread using 3 wire methods
CO5	Measure and comparison of Flank Wear on Carbon Steel (C.S). H.S.S. and carbide Tip

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Shear plane angle	Study of Orthogonal cutting process and determination of shear plane angle	3	CO1
2	Variation of diameter	Study of variation of diameter of a cylinder along its axis	3	CO2
3	Roundness of a turned mild steel	Study of roundness of a turned mild steel cylinder	3	CO2
4	Pitch Circle Diameter	Measurement of Pitch Circle Diameter of a V-thread using 3 wire methods	3	CO3
5	Flank Wear	Measurement and comparison of Flank Wear on C.S. H.S.S. and Carbide Tip	3	CO1
6	CNC-CO Laser	Experiment on CNC-CO2 laser machining	3	CO1
7	CNC Milling	Experiment on CNC Milling laser machining	3	CO1
8.	Additive Manufacturing	Experiment on Additive Manufacturing	3	CO1

Reference Books:

Manufacturing Science Vol I and II M.I. Khan, P.H.I. New Delhi

Manufacturing Science: Ghosh and Mallick. East West Press.

A Text Book of Production Engineering Sciences, PC. Pandey & C.K. Singh, Standard Publishers / Distributors, Nai Sarak, New Delhi

e-Learning Source:

https://www.vlab.co.in/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3			3	2		3	2	3	3
CO2	3	3	2	3	2	3			3	2		3	3	2	3
CO3	3	3	2	3	2	3			3	2		3	2	2	2
CO4	3	3	2	3	2	3			3	2		3	2	3	2
CO5	3	2	2	2	2	3			2	2		3	3	2	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2016-17							
Course Code	ME506	**Title of the Course**	WORK SCIENCE	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	**II**	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. Be able to have the basic concepts of work science and industrial ergonomics. 2. To understand and apply method study and the techniques of method study. 3. Be able to model the problem using work measurement. 4. Be able to have the basic concepts of human body and limitations, human body and workplace design. 5. Be able to have the concepts of Man-Machine System, Display equipment, controls and effects of vibration, noise, sound and light.						

Course Outcomes	
CO1	To develop knowledge of work science, Basic concepts, work organization, work study, Objective benefits and scope of work study, Purpose and Advantages of work study, Capabilities and Limitations of the Person.
CO2	To Develop knowledge of Objectives and scope, Basic procedure in conducting method study, Steps involved in Method Study.
CO3	To develop knowledge of Objectives, Work measurement procedures (steps), Work measurement systems, Concept of standard rating, Time study procedure, Tools for time study, Activity sampling, sample size, Standard time by work sampling, Control charts applied to work sampling.
CO4	To develop knowledge of Muscular work, Nervous control of movements, dimensions, percentiles to be accommodated, workplace design comfortable work postures.
CO5	To develop knowledge o f Man-Machine System, Display equipment, controls, Relation between control and display instruments, Air pollution and ventilation at work.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Introduction: Introduction to work science, Basic concepts, work organization, work study, Objective benefits and scope of work study, Purpose and Advantages of work study, Fitting the tack to the characteristics, Capabilities and Limitations of the Person.	6	CO1
2	Method Study	Method Study: Objectives and scope, Basic procedure in conducting method study, Steps involved in Method Study: Select, record, examine develop, install and Maintain, Job selection for study, Recording techniques, Micro-and memo-motion study, Fundamental hand motions (therbligs), Principles of motion economy, Critical Examination, Development of proposed method, its Installation and maintenance.	7	CO2
3	Work Measurement	Work Measurement: Objectives, Work measurement procedures (steps), Work measurement systems, Concept of standard rating, Breaking the task into elements, Rating and Basic Time, Requirements of satisfactory rating, Time study procedure, Tools for time study, Number of cycles to be timed, Synthesis of standard time from elemental data, Activity sampling, sample size, Standard time by work sampling, Control charts applied to work sampling.	8	CO3
4	Workplace design	Workplace design : Muscular work, Nervous control of movements, Anthropometric data, Reach and clearance dimensions, percentiles to be accommodated, workplace design comfortable work postures, Room to grasp and moves things and operate controls, sedentary work, sedentary workplace design, Design of tools for skilled work, VDT workstation design and design of keyboards, Heavy work, Handling loads, skilled work.	7	CO4
5	Man-Machine System	Man-Machine System, Display equipment, controls, Relation between control and display instruments, Human visual system, eye movements, artificial lighting, light for manual fine work and VDT workstations, Noise Physiological and psychological effects of noise, damage to hearing, Protection against noise, Effects of vibrations on human performance, Thermo-regulation in human body, comfort indoors, Air quality and dryness, Air pollution and ventilation at work, Recommendations for comfort in-doors.	10	CO5

Reference Books:

1. Industrial Engineering, Khan, , New-Age
2 Motion and Time study, Barnes, Wiley India.
3. Industrial Ergonomics, Khan,, PHI
4. Human Factors in Engg. & Design, McCormic, McGraw Hill.
5. Fitting the task to the man, Grandjean, Taylor and Francis, London.

e-Learning Source:

1. https://www.youtube.com/watch?v=KNFZXNWYVno
2. https://www.youtube.com/watch?v=boyHAXgedCo

Course Articulation Matrix: (Mapping of COs with POs and PSOs)

PO-PSO CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO12	PSO1	PSO2	PSO3			
CO1	3	3	2	2	2	3						3	3	2	2			
CO2	3	3	3	2	2	2						2	3	3	2			

CO3	3	2	2	1	2	2	3					3	3	2	2			
CO4	3	3	2	2	2	3						2	3	2	2			
CO5	3	2	2	3	3	2	2					2	3	2	2			

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	ME507	**Title of the Course**	TOTAL QUALITY MANAGEMENT	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. To introduce students about the fundamental principles and philosophies of the quality management. 2. To develop students' ability to use various qualitative and quantitative tools and techniques for solving quality related problems. 3. Applications of statistical techniques with emphasis to solve practical problems. 4. Comprehension of leadership and strategic planning. 5. Introducing students to quality management systems especially ISO series.						

Course Outcomes	
CO1	Comprehend the Dimensions of quality in production system, Quality and Profitability, Quality Costing & different quality
CO2	philosophies
CO3	Understand Quality control, Quality assurance & Total quality control,
CO4	Know the Leadership and Strategic planning for TQM & Human Resources Development for TQM
CO5	Comprehend quality culture, Change management & Statistical Quality Control

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Fundamentals of Quality Management	Fundamentals of Quality Management: Quality as the new competitive weapon, Evolution of quality management, Dimensions of quality in manufacturing and service, Customer Focus – customer perception of quality, Quality Costing. Quality Management Philosophies: Overview of the contributions of Deming, Crosby, Juran Philosophy of quality, Taguchi techniques – introduction to quality loss function, signal to noise ratio.	8	CO1
2	Managing Quality	Managing Quality: Quality control, Quality assurance, Total quality management (TQM), Elements of TQM, Introduction to Lean Six sigma approach for quality Tools for the Quality Journey: Check sheet, Pareto diagram, Cause-and –effect diagram, Histogram, Scatter diagram, Flow Chart, Relationship between the tools and the PDCA Cycle, Design of experiments. Quality function Deployment -Benefits, Voice of customer, information organization, House of quality (HOQ), building a HOQ, QFD process	8	CO2
3	Leadership and Strategic planning for TQM	Leadership and Strategic planning for TQM : Leadership for quality, quality and organizational structure, Role of quality in strategic planning, Strategic quality management (SQM), Strategic planning process Human Resources Development & Strategic Information Management for TQM. : Human Resources Development for TQM,Strategic Information management for TQM. The strategic value of information, The scope of quality and operational performance, Role of Information, Technology.	8	CO3
4	Organizing for TQM	Organizing for TQM: Organizing for TQM, Teams, Quality circles, Developing a quality culture, Change management, Japanese 5S principles Statistical Quality Control: Theory of Control Chart for variable and attribute, acceptance sampling plans for attribute and variable	8	CO4
5	Quality system and ISO 9000 Series	Quality system and ISO 9000 Series: ISO 9000 Pre-requisites, different quality system and their structure, Quality policies and objectives, management responsibility, documentation methodology of implementation, quality audit and assessments. Miscellaneous: Relevance of JIT to TQM, Benchmarking and POKA YOKE, Relevance of TQM to world class manufacturing industries.	8	CO5

Reference Books:

Juran J.M., EGryan Jr., "Quality Planning and Analysis", TMH

Dr. K. Raja, "Total Quality Management", Eswar Press

H. Lal, "Total Quality Management, A practical Approach", New Age

K Shridhar Bhatt, "Total Quality Management", PHI

e-Learning Source:

https://www.youtube.com/watch?v=5pMWmU_8lfI&list=PLPjSqITyvDeUUUwunyiwq41yJZofQEzMI

https://www.youtube.com/watch?v=VxNIYCMr1Nc&list=PLueDbnzoKDZ-ZIJigjav-j8ZWz5CEoz-0

https://www.youtube.com/watch?v=ksR4Xy6tFcM

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	**2**	**2**	**2**		**1**							**2**	1		
CO2	**3**	**3**	**3**	**2**	**2**				**1**				3	1	1
CO3	**2**	**2**	**3**	**2**	**2**	**3**			**2**			**3**		2	1
CO4	**3**	**1**	**2**	**1**	**2**	**1**			**2**				3	3	3
CO5	**3**	**2**	**1**	**3**	**3**	**2**			**1**			**2**	3	3	3

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	ME508	**Title of the Course**	Plant Layout and Material Handling	**L**	**T**	**P**	**C**
Year	I	**Semester**	II	**3**	**1**	**0**	**4**
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. Get the basics of process layout & product layout . 2. Get the idea about the material handling systems . 3. Learn about the different types material handling methods , paths equipments and functions 4. Understand what effect process layout has on the material handling system 5. Visualize plant layout and material handling in industries.						

Course Outcomes	
CO1	Able to get the basics of process layout & product layout.
CO2	Able to get the idea about the material handling systems.
CO3	Able to know about the different types material handling methods , paths equipments and functions.
CO4	Understand proper material handling engineering techniques regarding hoisting and conveying equipment.
CO5	Understand toxic hazards of materials being handled, such as chemicals, dusts and poisons.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Introduction	Introduction : Definition, objective, principles of plant layout, need for re-layout decisions, types of layout problems, factors influencing plant layout, Types of layout-product, process, fixed, combination and group layout.	8	CO1
2	Procedure for Plant Layout	Procedure for Plant Layout: Basic Steps in layout procedure; procuring basic data, product analysis and design of production process, calculation for equipment requirements, plan general flow pattern in layout, selection of material handling equipment, determine the space required, construct master layout.	8	CO2
3	Techniques and Tools for Planning Layout	Techniques and Tools for Planning Layout: Assembly chart, operation process chart, multi product process chart, flow diagram, Man machine chart, string diagram, travel diagram, drafting, template and block, Layout planning tools and techniques. Quantitative Layout Analysis: Techniques of analysis, classification of layout design procedures, computerized layout planning, Manual layout design procedure, allocation method, activity relationships chart.	8	CO3
4	Improving and Revising Existing Layout	Improving and Revising Existing Layout: Need for changing layout, reasons for redesign, procedure for revision and improvement. Evaluation for an Effective Layout: Evaluation of a layout, measurement of effectiveness, methods of evaluation. Heuristics for plant layout	8	CO4
5	Material Handling:	Material Handling: Material handling principles, analysis of material handling system, unit load concept, factor-affecting selection of material handling equipment, layout and materials handling system.	8	CO5

Reference Books:

Francis, "Facility layout and Location, An Analytical Approach", PHI

David E. Mulcahy, "Material Handling Handbook", TMH.

Tompkins, J.A and White, J. A., "Facilities Planning" John Wiley & Sons

S.C Sharma, "Plant Layout and Materials Handling", Khanna Publishers

e-Learning Source:

https://www.youtube.com/watch?v=Up1oSSJn6oM

https://www.youtube.com/watch?v=1uMf4Ky0nyM

https://www.youtube.com/watch?v=PRI0wNoUfqk

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1					3	3	2	2

CO2	3	3	3	2	2	3	1					2	3	3	2
CO3	3	3	2	2	2	3						2	3	2	2
CO4	3	2	2	2	3	3						2	3	2	2
CO5	3	1	1	1	1	3						2	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session: 2022-23							
Course Code	ME509	**Title of the Course**	Production Engineering II	**L**	**T**	**P**	**C**
Year	**I**	**Semester**	II	3	1	0	4
Pre-Requisite	NONE	**Co-requisite**	NONE				
Course Objectives	1. To impart knowledge about the significance of casting and testing of newly developed engineering materials used in industries and research organizations for elastic and plastic deformations. 2. To inculcate specialized knowledge and skill in designing of various components used in mechanical engineering. 3. To cultivate the ability to develop and implement new and improved advanced welding processes. **4.** To impart knowledge about Laser beam welding, Electron Beam Welding, Plasma Arc Welding, High Frequency Welding and Underwater.						

Course Outcomes	
CO1	Fundamental concepts and importance of Sand Testing. Fluidity of molten metal and its measurement, Molten metal characteristic
CO2	Fundamental concepts and importance principles of Gating Design:
CO3	Fundamental concepts and importance of Casting Design considerations.
CO4	Fundamental concepts and design of Thin Cylinders and Thick Cylinders: Hoop, Longitudinal and Radial stresses s and strains. Volumetric strain. Thick cylinders subjectedto internal or external pressures, Compound cylinders.
CO5	Fundamental concepts and importance Advanced welding processes

Unit No.	**Title of the Unit**	**Content of Unit**	**Contact Hrs.**	**Mapped CO**
1	Introduction:	Introduction: Introduction to casting, Casting compared with other processes, comparison of different casting processes, Sand Casting Processes, Other Casting Processes Patterns: Design (Allowances) and design considerations. Sand Testing. Fluidity of molten metal and its measurement, Molten metal characteristics.	8	CO1
2	Principles of Gating Design	Principles of Gating Design: Types of gates, pouring basins design, Metal flow-rate and velocity calculations, Sprue terminology and design. Design of runners and gates. Principles of Risering (Feeder heads): Design of Risers, Chvorinow's rule and solidification time calculations for different shapes, Caines method, shape Factor method of riser size calculations Solidification of castings: Large casting in insulated mould, Directional solidification, Calculations for top and bottom gating systems. Equation of elastic curve, cantilever and simply supported beams, Macaulay's method, area moment method, fixed and continuous beams.	8	CO2
3	Casting Design considerations	Casting Design considerations: Metallurgical, mechanical and economic considerations, Casting defects and inspection, Finishing and cleaning of castings. Metal joining Processes: Introduction: Classification of welding Processes conditions for obtaining satisfactory welds, Importance of welding, selection of a welding process, Welding Science: Arc Characteristics. Arc Length control and welding power sources characteristics, constant current and constant potential power sources and their applications, Arc welding Power Supply Equipments, Power source selection, Welding Energy Input, Energy sources(types), Metal Transfer.	8	CO3
4	Welding Parameters and their effects	Welding Parameters and their effects: Metallurgical aspects in Welding, Weld-microstrures: fusion zone, Heat affected-zone (HAZ) and base metal. Weld-metal solidification, Residual stresses and distortion of welds, Stress relieving methods, Thermal and mechanical treatment of welds	8	CO4
5	Advanced welding processes	Advanced welding processes : Laser beam welding, Electron Beam Welding, Plasma Arc Welding, High Frequency Welding and Underwater welding processes, Analytical and Mathematical analysis: Calculation of heat input and relation between weld cross-section and energy input, Heat flow equations, width of heat affected zone, cooling rates, contact resistance, heat source, weld quality: undercuts, cracks, porosity, slag inclusion, Lack of fusion, Lack of penetration Faulty weld profile Testing and Inspection of welds. Welding & Environmental Hazards: Health Hazards of Welding , Short-Term (Acute) Health Effects , Long-Term (Chronic) Health Effects Other Health Hazards.	8	CO5

Reference Books:

1 . Flinn, R.A., "Fundamentals of Metal Casting", Addison-wesley, Reading, Mass

Little, "Welding and Welding Technology", McGraw Hill

Khan, M.I. "Welding Science and Technology", New Age Int.

Heine, "Principles of Metal casting", McGraw Hill

Jain, P.L., "Principles of Foundry Technology", McGraw Hill

e-Learning Source:

https://www.youtube.com/watch?v=A0dTvf_Q8BA&list=PL82E9A8429ED7BB27

https://www.youtube.com/watch?v=jdFrBtHeJbs&list=PLSGws_74K01-g9nnTMBssGURHawYYQfMQ

https://www.youtube.com/watch?v=inck14Enob8&list=PLSGws_74K019ONZcPcVWqdAIe1Y4ChVmi

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	2	2	2	1	1	1	3	3	3	3	2	2
CO2	3	3	3	2	2	3	1					2	3	3	2
CO3	3	3	2	2	2	3	2	3	2	1	3	2	3	2	2
CO4	3	2	2	2	3	3						2	3	2	2
CO5	3	1	1	1	1	3						2	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**

Integral University, Lucknow

Effective from Session:	2016-17						
Course Code	ME510	**Title of the Course**	PRODUCTION ENGINEERING LAB II	**L**	**T**	**P**	**C**
Year	**1st**	**Semester**	2nd	**0**	**0**	**3**	**2**
Pre-Requisite	none	**Co-requisite**	none				
Course Objectives	• To impart knowledge/ techniques to study of weld-bead geometry of air weld and underwater weld made by rutile electrodes. • To impart knowledge/ techniques to Study of the effect of moisture and clay content variation on mould hardness. • To impart knowledge/ techniques to Study of weld-bead microstructure in weld-zone HAZ and microstructure of the base metal for Air Welded Specimen and underwater welded specimen. • To impart knowledge/ techniques to Study of weld defects through X-ray reference radiographs and Conducting time and motion study using pin board setup. • Imparting knowledge / Experiment to Study of different welding parameters on weld bead using TIG/MIG welding apparatus.						

Course Outcomes	
CO1	To study of weld-bead geometry of air weld and underwater weld made by rutile electrodes.
CO2	To Study of the effect of moisture and clay content variation on mould hardness.
CO3	To Study of the effect of moisture and clay content variation on mould hardness.
CO4	To Study of weld defects through X-ray reference radiographs and Conducting time and motion study using pin board setup.
CO5	To Study and Experiment of different welding parameters on weld bead using TIG/MIG welding apparatus.

Unit No.	Title of the Unit	Content of Unit	Contact Hrs.	Mapped CO
1	Air weld and underwater	Study of weld-bead geometry of air weld and underwater weld made by rutile electrodes.	3	CO4
2	Mould hardness	Study of the effect of moisture and clay content variation on mould hardness.	3	CO1
3	HAZ and microstructure Air Welded Specimen	Study of weld-bead microstructure in weld-zone HAZ and microstructure of the base metal for Air Welded Specimen	3	CO3
4	HAZ and microstructure underwater welded specimen.	Study of weld-bead microstructure in weld-zone HAZ and microstructure of the base metal for underwater welded specimen.	3	CO3
5	X-ray reference radiographs.	Study of weld defects through X-ray reference radiographs.	3	CO3
6	Pin board setup	Conducting time and motion study using pin board setup.	3	CO4
7	TIG Welding apparatus	Experimental Study of different welding parameters on weld bead using TIG welding apparatus.	3	CO5
8	MIG Welding	Experimental Study of different welding parameters on weld bead using MIG welding apparatus.	3	CO5

Reference Books:

1 . Flinn, R.A., "Fundamentals of Metal Casting", Addison-wesley, Reading, Mass Little

2. "Welding and Welding Technology", McGraw Hill Khan, M.I. "Welding Science and Technology", New Age Int. Heine, "Principles of Metal casting", McGraw Hill Jain, P.L., "Principles of Foundry Technology", McGraw Hill

3 Khan, M.I. "Welding Science and Technology", New Age Int. Heine,

4. "Principles of Metal casting", McGraw Hill Jain, P.L., "Principles of Foundry Technology", McGraw Hill

e-Learning Source:

https://www.vlab.co.in/

	Course Articulation Matrix: (Mapping of COs with POs and PSOs)														
PO-PSO CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	2	3	2	3			3	2		3	2	3	3
CO2	3	3	2	3	2	3			3	2		3	3	3	3
CO3	3	3	2	3	2	3			3	2		3	2	2	2
CO4	3	3	2	3	2	3			3	2		3	3	3	2
CO5	3	2	2	2	2	3			2	2		3	3	2	2

1- Low Correlation; 2- Moderate Correlation; 3- Substantial Correlation

Name & Sign of Program Coordinator	**Sign & Seal of HoD**