HYDERABAD KARNATAKA EDUCATION SOCIETY'S

POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI

(An autonomous institution, affiliated to V.T.U.Belagavi)

Scheme of Teaching and Examination - 2022

M. Tech. Production Engineering

Choice Based Credit System (CBCS) and Outcome-Based Education (OBE)

I SEMESTER

S No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activity	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
01	BSC	22PPE11	Computational Methods	03	00	00	03	50	50	100	3
02	IPCC	22PPE12	Automation in Production System	03	02	00	03	50	50	100	4
03	PCC	22PPE13	Advance Joining Process	03	00	02	03	50	50	100	4
04	PCC	22PPE14	Non Traditional Machining	02	00	02	03	50	50	100	3
05	PCC	22PPE15	Theory of Metal Forming	02	00	02	03	50	50	100	3
06	MCC	22PPE16	Research Methodology and IPR	03	00	00	03	50	50	100	3
07	PCCL	22PPE17	Production Lab-1	01	02	00	03	50	50	100	2
08	AUD/ AEC	22PPE18/ 22PPE27	BOS recommended ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							
			Total	**17**	**04**	**06**	**21**	**350**	**350**	**700**	**22**

Note: BSC-Basic Science Courses, PCC: Professional core. IPCC-Integrated Professional Core Courses, MCC- Mandatory Credit Course.

AUD/AEC –Audit Course / Ability Enhancement Course (A pass in AUD/AEC is mandatory for the award of the degree)

Note:

Integrated Professional Core Course (IPCC): Integrated Professional Core Course (IPCC): Refers to Professional Theory Core Course Integrated with practical of the same course. The theory part of the IPCC shall be evaluated both by CIE and SEE. The practical part shall be evaluated by only CIE (no SEE). However, questions from the practical part of IPCC shall be included in the SEE question paper.

Audit Courses /Ability Enhancement Courses Suggested by BOS (ONLINE courses): Audit Courses:These are prerequisite courses suggested by the concerned Board of Studies. Ability Enhancement Courses will be suggested by the BoS if prerequisite courses are not required for the programs.

Ability Enhancement Courses:

- These courses are prescribed to help students to enhance their skills in in fields connected to the field of specialisation as well allied fields that leads toemployable skills. Involving in learning such courses are impetus to lifelong learning.
- The courses under this category are online courses published in advance and approved by the concerned Board of Studies.
- Registration to Audit /Ability Enhancement Course shall be done in consultation with the mentor and is compulsory during the concerned semester.
- In case a candidate fails to appear for the proctored examination or fails to pass the selected online course, he/she can register and appearfor thesamecourseifofferedduringthenextsessionorregisterforanewcourseofferedduringthatsession,inconsultationwith the mentor.
- TheAuditAbilityEnhancementCoursecarriesnocreditandisnotcountedforverticalprogression.However,apassinsuchacourseis mandatory for the award of the degree.

Skill development activities: Under Skill development activities in a concerning course, the students should

1. Interact with industry (small, medium, and large).
2. Involve inresearch/testing/projectstounderstandtheirproblemsandhelpcreativeandinnovativemethodstosolvetheproblem.
3. Involve in case studies and field visits/ fieldwork.
4. Accustom to the use of standards/codes etc., to narrow the gap between academia and industry.
5. Handle advanced instruments to enhance technical talent.
6. Gain confidence in modelling of systems and algorithms for transient and steady-state operations, thermal study, etc.
7. Work on different software/s (tools) to simulate, analyze and authenticate the output to interpret and conclude.

All activities should enhance student's abilities to employment and/or self-employment opportunities, management skills, Statistical analysis, fiscal expertise, etc.

Students and the course instructor/s to involve either individually or in groups to interact together to enhance the learning and application skills of the study they have undertaken. The students with the help of the course teacher can take up relevant technical–activities which will enhance their skill. The prepared report shall be evaluated for CIE marks

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II SEMESTER

S No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activity	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
01	PCC	22PPE21	Advanced Metal Casting	02	00	02	03	50	50	100	3
02	IPCC	22PPE22	Non Destructive Testing	03	02	00	03	50	50	100	4
03	PEC	22PPE23X	Professional Elective 1	02	00	02	03	50	50	100	3
04	PEC	22PPE24X	Professional Elective 2	02	00	02	03	50	50	100	3
05	MPS	22PPE25	Mini Project with Seminar	00	04	02	--	100	--	100	3
06	PCCL	22PPEL26	Professional Core course Laboratory	01	02	00	03	50	50	100	2
07	AUD/ AEC	22PPEUD27	Suggested ONLINE courses	Classes and evaluation procedures are as per the policy of the online course providers.							PP
			Total	**10**	**08**	**08**	**15**	**350**	**250**	**600**	**18**

Note: PCC: Professional core courses, PEC: Professional Elective Courses, IPCC-Integrated Professional Core Courses. MPS-Mini Project With Seminar; AUD/AEC; Audit Courses / Ability Enhancement Courses (Mandatory)

Professional Elective 1		Professional Elective 2	
Course Code		**Course Code**	
22PPE231	Industrial Tribology	22PPE241	Enterprise Recourse Planning
22PPE232	Project Management	22PPE242	Financial Management
22PPE233	Supply Chain Management	22PPE243	Quality & Reliability Engineering

Note:

1 Mini Project with Seminar: This may be hands-on practice**,** survey report, data collection and analysis, coding, mobile app development, field visit and report preparation, modelling of system, simulation, analysing and authenticating, case studies, etc.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide, if any, and a senior faculty of the department. Students can present the seminar based on the completed mini-project. Participation in the seminar by all postgraduate students of the program shall be mandatory.

The CIE marks awarded for Mini-Project work and Seminar shall be based on the evaluation of Mini Project work and Report, Presentation skill and performance in Question and Answer session in the ratio 50:25:25. Mini-Project with Seminar shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the Mini Project and Seminar shall be declared as fail in that course and have to complete the same during the subsequent semester. There is no SEE for this course.

2. Internship: All the students shall have to undergo a mandatory internship of **06 weeks** during the vacation of II and III semesters. A University examination shall be conducted during III semester and the prescribed internship credit shall be counted in the same semester. The internship shall be considered as a head of passing and shall be considered for vertical progression as well as for the award of degree. Those, who do not take-up/complete the internship shall be declared as fail in the internship course and have to complete the same during the subsequent University examination after satisfying the internship requirements.

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III SEMESTER

S No	Course	Course Code	Course Title	Teaching Hours per Week			Examination				Credits
				Theory	Practical/ Seminar	Skill Development Activity	Duration in hours	CIE Marks	SEE Marks	Total Marks	
				L	P	SDA					
01	PCC	22PPE31	Theory of Metal Cutting	03	00	02	03	50	50	100	3
02	PEC	22PPE32X	Professional Elective 3	03	00	00	03	50	50	100	4
03	OEC	22PPE33X	Open Elective course 1	03	00	00	03	50	50	100	3
04	PROJ	22PPE34	Project Work Phase-1	00	06	00	--	100	--	100	3
05	SP	22PPE35	Societal Project	00	06	00	--	100	--	100	3
06	INT	22PPE36	Internship	(06 weeks Internship Completed during the intervening vacation of II and III semesters.)			03	50	50	100	6
			Total	**09**	**12**	**03**	**12**	**400**	**200**	**600**	**22**

Note: PCC: Professional core Courses, PEC: Professional Elective Courses. PROJ-Project Work, INT-Internship, OEC Open Elective Courses, SP- Societal Project

Professional Elective 3		Open Elective 1	
Course Code		**Course Code**	
22PPE321	Advanced Probability and Statistics	22PPE331	Production and Operation Management
22PPE322	Industrial Robotics		
22PPE323	Work Study and Ergonomics		

Note:

1. **Project Work Phase-1:** The project work shall be carried out individually. However, in case a disciplinary or interdisciplinary project requires more participants, then a group consisting of not more than three shall be permitted.

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall pursue a literature survey and complete the preliminary requirements of the selected Project work. Each student shall prepare a relevant introductory project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

2. **Societal Project:** Students in consultation with the internal guide as well as with external guide (much preferable) shall involve in applying technology toworkout/proposing viable solutions for societal problems.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25.

Those, who have not pursued/completed the Societal Project, shall be declared as fail in the course and have to complete the same during subsequent semester/s after satisfying the Societal Project requirements. There is no SEE (University examination) for this course.

3. **Internship:** Those, who have not pursued /completed the internship, shall be declared as fail in the internship course and have to complete the same during subsequent University examinations after satisfying the internship requirements. Internship SEE (University examination) shall be as per the University norms.

CIE marks shall be awarded by a committee comprising of HoD as Chairman, Guide/co-guide if any, and a senior faculty of the department. The CIE marks awarded for project work phase-1, shall be based on the evaluation of Project Report, Project Presentation skill, and performance in the Question and Answer session in the ratio of 50:25:25

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IV SEMESTER

S No	Course	Course Code	Course Title	Teaching Hours per Week		Examination				Credits
				Theory	Practical/ Seminar	Duration in hours	CIE Marks	SEE Marks Viva voce	Total Marks	
				L	P					
01	Project	22PPE41	Project Work Phase-2	--	08	03	100	100	200	18
			Total	**--**	**08**	**03**	**100**	**100**	**200**	**18**

Note:

1. Project Work Phase-2:

Students in consultation with the guide/co-guide (if any) in disciplinary project or guides/co-guides (if any) of all departments in case of multidisciplinary projects, shall continue to work of Project Work phase -1to complete the Project work. Each student / batch of students shall prepare project document, and present a seminar.

CIE marks shall be awarded by a committee comprising of HOD as Chairman, all Guide/s and co-guide/s (if any) and a senior faculty of the concerned departments. The CIE marks awarded for project work phase -1, shall be based on the evaluation of Project Report, Project Presentation skill and performance in the Question and Answer session in the ratio of 50:25:25. SEE shall be at the end of IV semester. Project work evaluation and Viva-Voce examination (SEE), after satisfying the plagiarism check, shall be as per the University norms

TOTAL CREDITS : 22+18+22+18 = 80

BOS recommended ONLINE courses

M Tech I semester (08 weeks)

1. Joining Technologies for metals.
2. Manufacturing process on the casting and welding.
3. Welding application Techniques.
4. Advanced Machining Process.

M Tech II semester (10 weeks)

1. Introduction to composites.
2. Quality Engineering and management.
3. Rapid Manufacturing.
4. Theory of production process.

22PPE11	Computational Methods

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Learning Objectives:

- To enhance the problem-solving skills of engineering students using an extremely powerful problem-solving tool namely numerical method.
- To understand the system of equations, non-linearity and complicated geometries that are not uncommon in engineering practice and that are often impossible to solve analytically.

Module-I

Linear Algebra: System of Linear Algebraic equations by triangularization method ,Cholesky method, Partitions method, Gauss Jacobi, Gauss- Sidel's method and Power method for eigen values and eigen vectors.(RBT Levels:L1&L2)

[10 hours]

Module-II

Roots of equations: Muller method, Graeffe's root squaring method. Numerical solution of ordinary differential equation by Picards method of successive approximation, first order simultaneous equation by Picard and Runge-Kutta method. Second order equation by Picard's method.

.(RBT Levels:L2&L3) [10 hours]

Module-III

Partial Differential Equations: Numerical solution of one dimensional wave equation, Heat equation,(Schmidt's explicit formula) & Laplace equation (Gauss-Seidel process) by finite difference schemes. Illustrative examples on each method.

.(RBT Levels:L2&L3) [10 hours]

Module-IV

Probability distribution: Random variables , probability mass and probability distribution function, Probability distributions: Binomial ,Normal and Gaussian distributions & examples.

.(RBT Levels:L2&L3) [10 hours]

Module-V

Sampling Theory: Testing of hypothesis: Chi square test and F-test. Analysis of Variance (ANOVA):one way classification, Design of experiments, RBD.

.(RBT Levels:L2&L3) [10 hours]

Text Books:

1.

References:

2.

Course Outcomes: On completion of the course the students will be able to:

Acquire the idea of significant figures, types of errors during numerical computation.

Understand statistical and probabilistic concepts required to test the hypothesis and designing the experiments using RBD.

Learn various numerical methods to solve system of linear equations.

Understand the roots of algebraic/transcendental equations and solve PDE's numerically.

Analyze and solve PDE's related to wave equation arising in vibration analysis.

22PPE12	Automation in Production system

Credits	**:04**	**CIE Marks**	**:50**
Hours/Week	**:04**	**SEE Hours**	**:03**
Total Hours	**:52**	**SEE Marks**	**:50**

Course Objectives:

1. To understand the concepts Automation inproduction system.Including automated storage system, Automated production lines and inspection methods.
2. Application of industrial robotics and Programmable logic controllers in production system

Module-I

INTRODUCTION:- Production system, categories of manufacturing system, manufacturing support system,Automation in production systems, computerized manufacturing support system.

Module-II

AUTOMATION AND CONTROL TECHNOLOGIES :- Basic elements of automation system, Levels of Automation, steady state optimal control, adaptive control system, Direct Digital control system and supervisory control system.

HARDWARECOMPONENTS :- Sensors, Actuators, Analog to Digital converters and Digital to Analog converters.

Module-III

INDUSTRIAL ROBOTICS :- Robot anatomy, Robot control systems, sensors in robotics, industrial robot applications.

PROGRAMMABLE LOGIC CONTROLLERS :- Components of the PLC , Additional capabilities of PLC, Programming the PLC- Ladder logic diagrams.

Module-IV

MATERIAL TRANSPORT SYSTEMS :- Material handling , materials transport equipment –Automated guided vehicles (AGV), AGVS Applications, conveyors , types of conveyors.

STORAGE SYSTEMS :- storage system performance and location strategies, Automated storage systems –Objectives of Automated Storage system, Automated storage/Retrieval Systems, AS/RS Applications , Carousel Storage system

Module-V

AUTOMATED PRODUCTION LINES :- Fundamentals of Automated production lines, line configuration of Automated production line, work-around transfer mechanisms, Control of the production line.

INSPECTION TECHNOLOGIES :- Characteristics of measuring instruments, contact inspection methods–CMM and non contact inspection methods–Machine vision system and LASER System.

Text Books:

1. CAD/CAM – Zimmers & Grover PHI.
2. CAD/CAM/CIM – P. Radhakrishna, New Age International.
3. M.P. Grover, Automation, Production systems & computer Aided manufacturing , Prentice Hall.

References:

1. CAD/CAM – Zeid, Mc-Graw Hill
2. CAD/Cam, P. N. Rao.
3. Koren.Y “robotics for engineering” Mc-Graw Hill.
4. Rooks. B. (ed) “ Robert vision & Sensory controls vol-3 North Holland.

Course Outcomes: On completion of the course the students will be able to:

CO1	Analysis the Automation in production systems
CO2	Describe the different Automation control technology and there hardware components
CO3	Illustrate the concept of Industrial robotics, PLC components and programming
CO4	Summarize the material transport and storage system.
CO5	Acquire the knowledge of automated production line and different Inspection methods

22PPE13	Advanced Joining Process

Credits	**:04**	**CIE Marks**	**:50**
Hours/Week	**:04**	**SEE Hours**	**:03**
Total Hours	**:52**	**SEE Marks**	**:50**

Course Objectives:

- To teach the various types and select appropriate technique for joining suitable metals to know about welding defects and to take remedial measures.

Module-I

Introduction**,** Classification of welding processes, Commonly welded base metals, Advantages and Disadvantages of welding, Welding as compared to riveting and casting, Practical applications of welding. Arc welding process, Shielded Metal Arc welding, TIG welding, MIG welding, Electro slag welding process, Principles and applications.

Module-II

Resistance welding processes, Spot welding, Seam welding, Projection welding, Resistance butt welding, Solid state welding processes, Friction welding, Explosive welding, Ultrasonic welding, Diffusion welding, Principles and applications.

Module-III

Electron beam welding, Laser beam welding, Thermit welding, process, principles and applications. Advanced soldering and Brazing processes, Different types, Welding Symbols- Need for Representing the welds, Basic weld symbols, Location of Weld, Supplementary symbols, Dimensions of welds.

Module-IV

Defects in welds, Residual stresses in welding, Inspection of Welds: Destructive techniques like Tensile, Bend, Nick break, Impact and Hardness inspection. Non Destructive techniques like 'X' rays, Ultrasonic, Magnetic particle, Dye penetrant inspection, Quality Control In Welding – Introduction, Quality assurance v/s Quality control, Weld quality, Discontinuities in welds, their causes and remedies .

Module-V

Estimation of welding costs: Introduction, Component costs of welding processes, Factors involved in welding costs, Basic costing procedure, Standard time and cost calculations. Safety in welding, Different types of hazards: Electric shock, Arc radiation, Compressed gas, Fumes and Dust, Fire and Explosions, Noise hazard.

Text Books:

2. Welding Engineering Handbook by A.W.S.
3. Welding Engineering by Rossi.
4. Advanced Welding processes – Nikodaco & Shansky MIR Publications.
5. Welding Technology by O.P. Khanna.
6. Welding for engineers by Udin, funk & Wulf.
7. Welding and welding technology– R.L. Little.

References:

1. Dr.R.S.Parmer "Welding processes and Technology" Khanna Publishers.
3. H.S.Bawa "Manufacturing Technology-I" Tata Me Graw Hill Publishers New Delhi, 2007.
4. S.V.Nadkami, Modem Arc Welding Technology, Oxford & IBH Publishing Co. Pvt. Ltd.
5. CORNU.J. Advanced welding systems – Volumes I, II and III, JAICO Publishers,1994.
6. LANCASTER.J.F. – Metallurgy of welding – George Alien & Unwin Publishers, 1980
7. Carry B., Modern Welding Technology, Prentice Hall Pvt Ltd., 2002
8. P .L. Jain "Principles of foundry Technology" Tata Mc Graw Hill Publishers.

Course Outcomes: On completion of the course the students will be able to:

- Understand the different types of welding processes and their applications.
- Analyze the effects of process parameters that influence the welding quality of component.
- Select the NDT techniques for the evaluation of weld components.

22PPE14	Non Traditional Machining

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the various machining processes and their applications.

Module-I

Introduction: Need for non-traditional machining processes. Processes selection classification on-comparative study of different processes Ultrasonic Machining-Definition-Mechanism of metal elements of the process-Tool feed mechanism, theories of mechanics of causing effect of parameter applications.

Module-II

Abrasive Jet Machining: Principles – parameters of the process applications-advantages and disadvantages. Thermal Metal Removal Processes: Electric discharge machining - Process, Operation principles, electrode material, equipment, Wire cut electro discharge machine, process parameters and their effects, Gap flushing, Operational summery.

Module-III

Electro chemical and chemical processes**:** Electro chemical machining (ECM) Classification ECM process-principle of ECM – Chemistry of the ECM parameters of the processes-determination of the metal removal rate – dynamics of ECM process-Hydrodynamics of ECM process-polarization-Tool Design-advantages and disadvantages-applications. Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring. Chemical Machining Introduction-fundamental principle types of chemical machining Maskants-Etchentes- Advantages and disadvantages-applications**.**

Module-IV

Plasma Machining: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics – type of torches applications. Electron beam machining (EBM): Introduction-Equipment for production of Electron beam – Theory of electron beam machining – Thermal & Non thermal types characteristics – applications**.**

Module-V

Laser Beam Machining (LBM): Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications. Ion Beam Machining: Introduction-Mechanism of metal removal and associated equipment-process characteristics applications.

High Velocity forming process: introduction – development of specific process selection-comparison of conventional and high velocity forming methods – Types of high velocity forming methods-explosion forming process-elector hydraulics forming magnetic pulse forming**.**

Text Books:

References:

1. Chemical process principles (Part 1) – O.A. Hougen, K.M. Watson, R.A. Ragatz, Asia Publishing House.
2. Chemical Process Calculations - D.C. Sarkar, PHI Publications
3. Unit operations of Chemical Engineering (7th Ed.) – W.L. McCabe, J.C. Smith, P. Harriott, McGraw Hill International
4. Nonconventional Machining - P.K.Mishra, volume-1, Narosa Publishing House, The institution of engineers (India) text book series.

Course Outcomes: On completion of the course the students will be able to:

CO1	Identify the basic differences between non -traditional and traditional machining operations.
CO2	Describe the abrasive and electric discharge machining operations.
CO3	Illustrate the electro chemical and chemical machining operations.
CO4	Distinguish between the plasma and electron beam machining.
CO5	Illustrate the laser beam, ion beam machining methods and high velocity forming methods.

22PPE15	Theory of Metal Forming

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the fundamentals of metal forming, stress curves, analyze forging, extrusion, drawing and rolling processes. Know the defects and associated residual stresses developed.

Module-I

Components of stresses, Principle stresses, stress invariants, Stress Transformation law, Mean stress and stress deviator, Maximum and Octahedral shear stress, Components of strain, Principle strain, strain invariants, Octahedral shear strain, The Load-Extension diagram in simple tension.

Module-II

Introduction to metal forming, Effect of temperature on forming process-hot working, cold working. Effect of Metallurgical structure, Effect of speed of deformation work of Plastic deformation, Friction in forming operation, Yield Criteria and flow rules: Tresca yield Criteria, Von-mises yield Criteria, Geometrical representation of the yield Criteria, Yield Criteria for plane stress.

Module-III

Drawing: Principles of Rod and wire drawing, variables in wire drawing, Residual stresses in rod, wire and tube drawing, Defects in Rod and wire drawing. Extrusion: Classification, Extrusion equipment, variables in extrusion, Deformation in extrusion, Extrusion defects.

Module-IV

Classification of Forging, various stages during forging, deformation in compression, forging defects. Residual stresses in forging, Rolling of Metals: Classification, forces and geometrical relationships in rolling. Variables in rolling, , Defects in rolled products, Residual stresses in rolled products.

Module-V

High Energy Rate Forming Methods: Principles, advantages and applications, explosive forming, electro hydraulic forming. Electromagnetic forming, Sheet Metal forming: Introduction, Forming methods, shearing and Blanking, Bending, stretch forming, Deep drawing, redrawing operations, Defects in formed products.

Text Books:

References:

1. Mechanical Metallurgy – Dieter G.E. – Mc Graw Hill Publications.
2. Principles of Metal working – R.Rowe-Arnold London.
3. Metals Handbook –Volume II –ASM.
4. Fundamentals of working of metals-Sach G. Pergamun Press.

Course Outcomes: On completion of the course the students will be able to:

CO1	Analyze the techniques in determining a stresses and strains in components subjected to different types of service loads.
CO2	Illustrate the effects of temperature, friction and speed on metal forming process and different Yield Criteria and flow rules.
CO3	Calculate the load required for drawing and extrusion process.
CO4	Calculate the forming loads in forging and rolling process.
CO5	Illustrate various high energy rate forming methods and their specific applications.

22PPE16	Research Methodology and IPR

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the research design, problem formulation, literature survey an review, information retrieval, use of statistical techniques, writing of research reports and evaluation, ethics in research and Intellectual Property Rights.

Module-I

Research Methodology: Introduction, Meaning of Research, Objectives of Research, Types of Research, Research Approaches, Significance of Research, Research Methods versus Methodology, Research and Scientific Method, Research Process, Criteria of Good Research, Problems Encountered by Researchers in India. Defining the Research Problem: Research Problem, Selecting the Problem, Necessity of Defining the Problem, Technique Involved in Defining a Problem. An illustration.

Module-II

Reviewing the literature: Place of the literature review in research, bringing clarity and focus to research problem, improving research methodology, broadening knowledge base in researcharea, Enabling contextual findings, Review of the literature, searching the existing literature, reviewing the selected literature, Developing a theoretical framework, Developing a conceptual framework, Writing about the literature reviewed.

Research Design: Meaning of Research Design, Need for Research Design, Features of a GoodDesign, Important Concepts Relating to Research Design, Different Research Designs, Basic Principles of Experimental Designs, Important Experimental Designs.

Module-III

Design of Sample Surveys: Design of Sampling: Introduction,Sample Design,Sampling and Non-Sampling Errors, Sample Survey versus Census Survey, Types of Sampling Designs. Measurement and Scaling: Qualitative and Quantitative Data, Classifications of Measurement Scales, Goodness of Measurement Scales, Sources of Error in Measurement, Techniques of Developing Measurement Tools, Scaling, Scale Classification Bases, Scaling Technics, Multi dimensional Scaling, Deciding the Scale. Data Collection: Introduction, Experimental and Surveys, Collection of Primary Data, Collection of Secondary Data, Selection of Appropriate Method for Data Collection.

Module-IV

Testing of Hypotheses: Hypothesis, Basic Concepts Concerning Testing of Hypotheses, Testing of Hypothesis, Test Statistics and Critical Region, Critical Value and Decision Rule, Procedure for Hypothesis Testing, Hypothesis TestingforMean, Proportion, Variance, for Differenceof Two Mean, forDifference of Two Proportions, for Difference of Two Variances, P-Value approach, Power of Test, Limitations of the Tests of Hypothesis. Chi-square Test:Test of Difference of more than Two Proportions, Test of Independence of Attributes, Test of Goodness of Fit, Cautionsin Using Chi-square Tests, Ztest, Ttest, Ftest, ANOVA, Factor.

Analysis and Report Writing;Bibliography.Interpretation and Report Writing: Meaning ofInterpretation, Technique of Interpretation, Precaution in Interpretation, Significance of ReportWriting, Different Steps in Writing Report, Layout of the Research Report, Types of Reports, Oral Presentation, Mechanics of Writing a Research Report, Precautions for Writing Research Reports.

Module-V

Intellectual Property: The Concept, Intellectual Property System in India, World Intellectual Property Organization (WIPO), Protection of Intellectual Property under TRIPS, Patents Act - Meaning of a Patent – Characteristics/Features.Patentable and Non-Patentable Invention. Types of Patent applications in India.Procedure for obtaining Patent.The Designs Act- Introduction to Industrial Designs.Essential requirements of Registration. Designs which are not registrable, Procedure for Registration of Designs, Copyright Act,1957 and Related Rights - Meaning of Copy Right, Characteristics of Copyright, various rights of owner of Copyright.Procedure for registration, Publication and term of copyright Infringement of Copyright and Its remedies.Trade Mark Act, 1999,The Geographical Indications of Goods (Registration and Protection) Act1999

Text Books:

1. Research Methodology: Methods and Techniques C.R. Kothari, Gaurav Garg New Age International 4th Edition,2018.
2. Research Methodology a step-by- step guide for beginners. (For the topic Reviewing the literature under module 2) Ranjit Kumar SAGE Publications Ltd 3rd Edition, 2011.
3. Study Material(For the topic Intellectual Property under module 5) Professional Programme Intellectual Property Rights, Law and Practice, The Institute of Company Secretaries of India, Statutory Body Under an Act of Parliament, September

References:

1 Research Methods: the concise knowledge base Trochim Atomic Dog Publishing 2005.

Course Outcomes: On completion of the course the students will be able to:

CO1
CO2
CO3
CO4
CO5

22PPE21	Advanced Metal Casting

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

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Course Objectives:

- To teach the basic principles of metal casting, various types of melting practices, casting design principles and casting defects and remedial measures.

Module-I

Metal casting A process of shaping, casting history, Principles of casting, Foundry industry, Basic steps in making sand castings, Classification of foundry metals and alloys, The engineer and the foundry industry. Principles of Gating and Risering: Purpose of the gating system. Components of the gating System and its functions. Design of the gating System. Different types of gates. Gating ratio and its functions. Definition and functions of the riser. Types of risers and their application. Use of insulating material and exothermic compounds in risers

Module-II

Design of Casting: Factors to be considered in casting design. Design consideration in pattern making, moulding techniques and core making and assembly. Cooling stresses and hot spots in casting and modification in casting geometry to overcome them. Casting Quality Control: Casting defects and factors responsible for them. Different inspection and testing methods to evaluate the casting. Quality control activities in a foundry.

Module-III

Furnace Technology: Study of various furnaces used in foundry, construction and operation of crucible and hearth furnaces. Resistance, Arc and Induction furnaces-their construction. Operation and application. Heat treatment furnaces and drying ovens used in foundry. Gray Cast – Iron Foundry Practice: Chemical Composition and structure of gray cast iron. Melting of gray cast iron in Cupola and induction furnace. Inoculation of gray cast iron. Application of gray cast iron castings

Module-IV

Steel Casting Practice: Common steel casting, their composition, structure and properties. Melting and refining of steel. Gating and risering of steel castings, cleaning of steel castings. Aluminium Foundry Practice: Composition, properties and application of common aluminium alloy casting. Melting and casting of Al-alloys. Gating and risering of Al-alloy casting.

Module-V

Cleaning and inspection: Cleaning operation and equipment-Removal of gates and risers, flogging, Mechanical cutoff, Torch cutting, Surface cleaning, Tumbling, Blasting, Other types of surface cleaning- Trimming, Chipping, Grinding, Finishing. Inspection: Visual inspection, Dimensional Inspection, Metallurgical inspection, Chemical Analysis, Casting soundness, Pressure testing, Radiographic inspection, Magnetic particle inspection.. Foundry Mechanization and Modernization: Introduction to modernization. Mechanization of foundry and its advantages. Mechanization of sand plant, moulding and core making mechanization in melting, pouring and shakeout units. Material handling equipments and conveyor systems.

References:

1. Heine, et. Al, Principle of metal casting: Tata-McGraw-Hill Publication.
2. Lal, M. Khanna, P.O, A test book of Foundry Technology Dhapat Rai & Sons Publication.
3. Titov. Stepnov., Foundry Practice. (Part-I & II).
4. Beelely, P.R. Foundry Technology, Butterworth.

Course Outcomes: On completion of the course the students will be able to:

CO1	Explain the fundamentals casting and design the gating system.
CO2	Design the casting their by evaluating defects with different inspection and testing methods.
CO3	Explain the various furnaces used in foundry for melting.
CO4	Distinguish between the steel and aluminum foundry practice.
CO5	Illustrate the modernization and mechanization of foundry.

22PPE22	Non Destructing Testing

Credits	**:04**	**CIE Marks**	**:50**
Hours/Week	**:04**	**SEE Hours**	**:03**
Total Hours	**:52**	**SEE Marks**	**:50**

Course Objectives:

- To teach the various Non Destructive Evaluation and Testing methods, theory and their industrial applications.

Module-I

Introduction to NDT**:** Selection of NDT methods. Visual inspection, leak testing, Liquid penetration inspection- advantages and limitations.

Module-II

Magnetic particle inspection**:** Methods of generating magnetic field, types of magnetic particles and suspension liquids, steps in inspection – applications and limitations of the test. Eddy current inspection**:** principle of operation, process variables , inspection coils- applications and limitations the test.

Module-III

Ultrasonic inspection**:** Basic equipment, characteristics of ultrasonic waves, variables during ultrasonic inspections. Inspection methods - normal incident pulse echo, angle beam pulse echo and transmission type. Method of display- A,B and C scan mode. Transducer elements, couplets, search units, contact type and immersion types inspection methods, inspection of products like casting, extrusions, rolled product, weld set- applications and limitations of the test.

Module-IV

Radiography inspection**:** Principles, radiation sources. X-Rays and their generation, gamma rays and their generation. Radio graphic films. X-ray filters, image intensifiers. Industrial radiography. Image quality indicators, radiography sensitivity- applications and limitations of the test. Neutron radiography working methodology its application and limitations. Thermal NDT inspection principles, inspection methods-applications and limitations of the test.

Module-V

Optical Holography**:** Basics of Holography, recording and reconstruction-info metric techniques of inspection, procedures of inspection, typical applications.

Acoustical Holography: working principle, applications and limitations. Microwave NDT- working principle, applications and limitations.

Text Books:

References:

1. McGonnagle JJ “Non Destructive testing” – Garden and reach New York
2. Non destructive Evolution and quality control” volume 18 of metals hand book 9 editionasia internal 1989
3 Davis H.E Troxel G.E Wiskovil C.T the Testing instruction of Engineering materials Mc graw hill.

Course Outcomes: On completion of the course the students will be able to:

CO1	Select appropriate non-destructive techniques to know the defects.
CO2	Illustrate magnetic particle and eddy current testing and handle the both tests.
CO3	Utilize Ultrasonic testing tools and outline their advantages and limitations.
CO4	Examine the components for defects using radiographic non destructive testing tools and outline their advantages and limitations.
CO5	Illustrate Optical, Acoustic and Microwave testing methods and assess their applications and limitations.

22PPE231	Industrial Tribology

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the friction phenomena, lubrication in all regime, different wear processes in contacts between metallic, ceramic & polymeric surfaces, and cause & remedies of a tribological failure.

Module-I

Introduction: Friction, wear and lubrication, types of egg. Contacts: conforming and non-conforming. Types of motion; rubbing sliding. Oscillating. Rolling. and Surface of interactions: elastic and plastic deformations. Properties of materials. Surface energy and flash temperature theory.

Module-II

Friction: Laws of sliding friction, concept of adhesion, Tabor's mode off friction elastic thermo friction, rolling friction, measurement of friction. wear: Laws of wear. Types of wear such as adhesive, declamination, abrasive, fatigue, corrosive, fretting, erosive, electrical and oxidative. Measurement of wear in dry at me sphere and different environments. Prevention and control of wear and friction in machines, wear of cutting tool and dies, study of abrasion in grinding, lapping and honing.

Module-III

Lubrication: Mechanisms of lubrication, Boundary. Squeeze film hydrodynamic and elasto hydro-dynamic and hydro static lubrications plasto hydrodynamic lubrication, solution of Reynolds's equation in two and three-dimensional flow. Pressure distribution load carrying capacity friction forces in oil film and Co-efficient of friction in joumal bearing. Sold lubricants types and applications.

Module-IV

Bearing Design: Design of bearing: clearance in journal bearing. minimum film thickness, sommar-field Number, Oil grooves and flow of oil in axial and circumferential grooves ca vi tat ions and turbulence in oil bearings. Heat generation and cooling or bearing Hydrostatic and dynamic and their applications in machine Tools. Design of air bearing and other gas bearing.

Module-V

Tribology in manufacturing: Friction in manufacturing, Lubrication to control friction in manufacturing, solid lubrication, Tribology of rolling, drawing, extrusion and forging .

Text Books:

References:

1. Paulo Davim, *Tribology for Engineers:A practical guide*, Woodhead publishing, 2011.
2. Kragelski, *Friction, Wear and Lubrication,* Vol. I, II, III, MIR Publishers, 1983
3. Basu, Sen Gupta and Ahuja, *Fundamentals of Tribolgy*, PHI, 2000.
4. Sharma Aggarwal, A Test Book, Kataria
5. Main Engg. Hand Book, A M/c Desig.'., McGraw Hill.
6. Industrial Tribology, Tribology failures and their analysis, Dr. B.S. Prabhu

Course Outcomes: On completion of the course the students will be able to:

CO1	Understand friction, wear and lubrication phenomena.
CO2	Recognize the type of wear by analyzing contact behavior of smooth and rough surfaces.
CO3	Analyze the friction phenomena and select a suitable lubricant for a specific application.
CO4	Design journal and air lubricated bearings by minimizing friction and power losses.
CO5	Suggest a manufacturing method to improve wear resistance.

22PPE232	Project Management

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the concepts of project definition, life cycle, Market and demand analysis, Financial analysis and systems approach and to handle the complex tasks of time estimation and project scheduling, including PERT and CPM.

Module-I

Project Characteristics and Type: Concepts of Project, Categories of Projects, Project Characteristics, Project Cycle, Project Identification: Sources of Project Idea, Criteria for Selecting a particular project and Importance of Project Identification. Project Formulation: Elements of Project Formulation. Project Objectives, Project Implementation process. Project Management and Scope: Nature of Project Management, Project life cycle, Project management as a conversion process, Project environment, Project direction, coordination and Control, Key Skills of Project Manager, Tools and Techniques of project management.

Module-II

Cost of the Project, Components of Capital Cost of a project, Introduction to Project Financing, Sources of Finance, Project Evaluation: Investment evaluation techniques- payback period, accounting rate of return, net present value, IRR, profitability index, Estimation of cash flow for new project- replacement projects, depreciation tax shield, Conflict in ranking as per DCF & their criteria.

Module-III

Project Appraisal: Objectives, Essentials of a Project Methodology, Market appraisal – Technical appraisal – Financial appraisal, Cost of Capital, Analysis of Risk, Techniques of Risk Analysis, Breakeven Analysis, Sensitivity Analysis, Social Cost Benefit Analysis

Module-IV

Project scheduling: Introduction, Scheduling Strategies and Guidelines, Types of scheduling – Forward and Backward Scheduling – Gantt Charts, Flow shop Scheduling – 'n' jobs and '2' machines, 'n' jobs and '3' machines. Job shop Scheduling – '2' jobs and 'n' machines, Priority decision rules. Manpower Management in Projects –Functional Approach to Manpower Management, - The Element of decision Process –Project Team Concepts – Field Autonomy- Policies Governing Projects .

Module-V

Project control: Project controls requirements for a project or Role of MIS in project controls, performance controls, schedule controls, cost controls. Networks Techniques in Project Management: Bar chart, Bar chart for combined activities, logic and network diagram, *PERT/CPM* Analysis, Resource allocation methods.

Text Books:

References:

1. Projects - appraisal, preparation, budgeting and implementation - Prasannachandra ,Tata MCgraw hill.
2. Project Management - Dennis lock - Gower Publishing Ltd - 8th Revised edition.
3. Project Management - K Nagarajan, New Age International (P) Ltd.
4. Project Management- R K Singal, M Singal, R Singal. S K Kataria and Sons.
5. Project Management – by R. Panneerselvam and P. Senthil kumar PHI learning India PVT Ltd.
6. Project Management by Bhavesh .M Patel, Vikas Publishing Hous PVT Ltd.
7. Project Management by S. Choudhury Tata Mcgraw Hill Co.
8. Text book of project management by P. Gopalakrishnan & VE. Ramamoorthy Macmillan India Ltd.

Course Outcomes: On completion of the course the students will be able to:

CO1	Illustrate the process of project management and its application in delivering successful projects.
CO2	Develop a project plans and apply techniques to monitor, review and evaluate the cost of a project and cash flows.
CO3	Summarize the various techniques to measure project performance and suggest modifications, if necessary.
CO4	Decide the scheduling of a jobs with flow shop or priority rules.
CO5	Draw the network diagram and evaluate the project duration and allocate the resources.

22PPE233	Supply Chain Management

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the fundamentals of supply chain strategy, logistics, sourcing and outsourcing supply chain networks, tools and techniques.
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Module-I

Introduction**:** Definition and objectives of supply chain, decision phases in supply chain, process overview of supply chain, importance of supply chain. Supply Chain Performance: Achieving Strategic fit, drivers of supply chain performance, frame work for structuring drivers- facilities, inventory, transportation and information. Obstacles for achieving strategic fit.

Module-II

Designing supply chain network: Role of distribution in supply chain, factors influencing design of distribution network, design options for distribution network, value of distributors in supply chain. Network design in Uncertain Environment: Impact of Uncertainty, DCF analysis, evaluating network design decisions using decision trees.

Module-III

Economies of Scale in Supply Chain: Role of inventory in supply chain, economies of scale to exploit fixed costs and quantity discounts, managing multi echelon cycle inventory. Transportation: Factors affecting transportation decision, modes of transportation and their characteristics, designing transportation networks, trade-off in transportation design international transportation.

Module-IV

Revenue Management: Multiple customer segments, perishable assets, seasonal demand & bulk and spot customers. Coordination and IT in Supply Chain: Bullwhip effect, obstacles to coordination, managerial levers to coordination, role of IT in Supply Chain, Supply Chain IT framework, e-business.

Module-V

Emerging Concepts**:** Reverse Logistics; Reasons, Activities, Role. RFID Systems; Components, applications, implementation. Lean supply chains, Implementation of Six Sigma in Supply Chains.

Text Books:

References:

1. Sunil Chopra & Peter Meindl - “Supply chain Management” Pearson education
2. Martin Christopher - “Introduction to Supply Chain Management”
3. B.S.Sahay _ “ Supply Chain Management” Mcmillan.

Course Outcomes: On completion of the course the students will be able to:

- Understand the supply chain management that covers planning, design and operations.
- Analyze the role of Transportation in supply chain management.
- Examine the supply chain of organizations and measure performance improvement.

22PPE241	Enterprise Resource Planning

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the enterprise systems and show how organizations use enterprise systems to run their operations more efficiently and effectively. Also to learn about the critical success factors and implementation strategies that lead to enterprise system sucess, and about the informational, knowledge, and decision-making opportunities afforded by enterprise systems.

Module-I

Introduction to Enterprise Resource Planning (ERP)Information System and Its Components, Value Chain Framework, Organizational Functional Units, Evolution of ERP Systems, Role of ERP in Organization, Three-Tier Architecture of ERP system. ERP and Implementation ERP implementation and strategy, Implementation Life cycle, Pre-implementation task, requirement definition, implementation Methodology.

Module-II

ERP Business Modules :

Finance, manufacturing, human resources, quality management, material management, marketing, Sales distribution and service. Case study on Supply Chain management (SCM), Customer relationship Management (CRM).

Module-III

Introduction to ERP related Technologies

Business Process Re-engineering (BPR) ,Data warehousing ,Data Mining, On-line Analytical Processing(OLAP), Product Life Cycle Management (PLM). Geographical Information Management ,RFID, QR Code ,Bar Coding, E-commerce and their application in Enterprise planning. Extended ERP and security issues.

Module-IV

Enterprise application Integration (EAI), open source ERP, cloud ERP

Managing ERP Securities: Types of ERP security Issues, System Access security, Data Security and related technology for managing data security.

Module-V

Cases of ERP for Enterprises.

Cases of ERP like My SAP for Business suite implementation at ITC,ERP for Nestle GLOBE Project, Oracle ERP Implementation at Maruti Suzuki. Need of ERP for Small and Medium size enterprises.(Zaveri).

Text Books:

1.Alexis Leon, ERP Demystified: II Edition, Tata McGraw Hill.
2.Rajesh Ray, Enterprise Resource Planning, Text and cases, Tata McGraw Hill.
3.Sandeep Desai, Abhishek Srivastava, ERP to E2ERP: A Case study approach, PHI.
4.Jyotindra Zaveri, Enterprise Resource Planning, Himalaya Publishing House, 2012.

References:

1.V.K. Garg & N.K. Venkatakrishnan, Enterprise Resource Planning: concepts & practices, by ; PHI.
2.Supply Chain Management Theories & Practices: R. P. Mohanty, S. G. Deshmukh, -DreamtechPress.
3.Enterprise wide resource planning: Theory & practice: by Rahul Altekar, PHI.
4.Customer Relationship Management, Concepts and cases, Second Edition.

Course Outcomes: On completion of the course the students will be able to:

CO1	Understand the basic structure of ERP and identify implementation strategy used for ERP.
CO2	Apply design principles for various business modules in ERP.
CO3	Apply different emerging technologies for implementation of ERP.
CO4	Analyze security issues in ERP.
CO5	Acquire ERP concepts for real world applications.

22PPE242	Financial Management

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the types of investment in finance and evaluate the assets of a management.

Module-I

Nature of Financial Management: Scope of Finance Function, Changing role of financial managers, Objectives of financial management-profit maximization, wealth maximization, Financial Decisions, Risk Return Trade-Off, organization of finance function. **(Only Theory)** Investment Decisions: Introduction, Time value of money, Future Value: Future Value of a Single Cash Flow, Future Value of an Annuity, Sinking Fund, Present Value: Present Value of a Single Cash Flow, Present Value of an Annuity, Present Value of an Uneven Cash Flow. **(Problems).**

Module-II

Risk Analysis in Capital Budgeting: Nature of Risk, Risk Defined, Sensitivity Analysis, Scenario Analysis, Break-Even Analysis, Accounting Break-even Analysis, Financial Break-even Analysis, Selection of a Project, Risk Adjusted Discount Rate Method, Certainty Equivalent Method. **(Only Theory).** Cost of Capital: Basic concept of Average Cost of Capital, Company Cost of Capital and Project Cost of Capital, Cost of Debt & Preference, Cost of Equity, The CAPM approach, The Dividend Growth Model Approach, Determination of weight average cost of capital & marginal cost of capital schedule**.(Problems).**

Module-III

Concept of Leverage, Return on Investment leverage, Marginal-Analysis leverage, Operating leverage, Fixed-charges leverage, Combined leverage, Financial leverage. Dividend Theories and Policy: Concept and Significance, Relevance of Dividend Policy: Walter's Model, Gordon's Model, Irrelevance of Dividend Policy: Modigliani and Miller theory, stable dividend, stable payment, growth, factors affecting the dividend policy **(Only Theory).**

Module-IV

Working capital management: Factors influencing working capital requirements, current assets policy & current assets finance policy, determination of operating cycle & cash cycle, Estimation of working capital requirements of a firm. **(Problems).** Introduction to Cash Management, Motives for Holding Cash, Ascertaining Cash Requirements, Managing cash inflows and outflows: The Concept of Float, Instruments of Cash Collection, Ways to Accelerate Cash Collection, Controlling Disbursements, Optimal Cash Balance**.(Only Theory).**

Module-V

Financial Statements: Balance sheet, Profit & Loss Account, Funds Flow Statement, Cash Flow Statement, Profits Versus Cash Flow, Taxes. **(Only Theory).** Financial Analysis, Use of Financial Analysis, Nature of Ratio Analysis, Types of Financial Ratio, Significance of Financial Ratio, Application of Financial Ratio, Limitations of Financial Ratio Analysis**. (Problems)**

Text Books:

References:

1 Financial Management - Pandey, I. M. - Sangam Books Ltd - ISBN-10: 812590638X, 8th edition, 1999.

2. Financial Management - Prasanna Chandra (Theory & Practice) – TMH

3. Essentials of Managerial Finance - Weston & Brigham - W B Saunders - ISBN: 0030754747.

4. Financial Management - Vyuptakesh Sharan (Fundamentals) - PearsonEducation, 2012.

Course Outcomes: On completion of the course the students will be able to:

- To understand the types of investment in finance.
- Evaluate and monitor short term and long term investments in current assets.
- Start and manage new business.

22PPE243	Quality and Reliability Engineering

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the comprehensive knowledge about the principles, practices, tools and techniques of quality improvement and quantitative reliability.

Module-I

Basic Concepts: Definitions of Quality and Reliability, Parameters and Characteristics, Quality control, Statistical Quality Control, Reliability concepts. Concepts in Probability and Statistics: Events, Sample Space, Probability rules, Conditional probability, Dependent and Independent Events, Application of Probability concepts in Quality Control, Problems.

Module-II

Statistical Aspects and Probability Distributions: Statistical Tools in Quality Control, The Concept of Variation, Graphical Tools for data representation and analysis, Discrete and Continuous Distributions, Normal, Poisson, Binomial, Weibull Distribution, Problems.

Module-III

Failure Data Analysis: Introduction, Failure Data, Quantitative measures, MTTF, MTBF, Bathtub Curve, Mean Life, Life Testing, Problems, Introduction to Failure Mode and Effect Analysis Acceptance Sampling: Fundamentals of acceptance sampling, types of acceptance sampling, military std 105, O-C Curve, AQL, LTPD, AOQL..

Module-IV

System Reliability:Series, Parallel and Mixed Configuration, Block Diagram Concept, r-out-of-n structure solving problems using mathematical models. Maintainability and Availability:Introduction, Formulas, Techniques available to improve maintainability and availability trade-off among reliability, maintainability and availability, Simple problems.

Module-V

Reliability Improvement and Allocation: Difficulty in achieving reliability, Methods for improving reliability during design, Different techniques available to improve reliability, Optimization, Reliability-Cost trade off, Prediction and Analysis, Problems.

Text Books:

References:

1. Halpern, Seigmund (1978) “The Assurances Sciences”, Prentice Hall International, New Jersey, U.S.A
2. Juran, J.M and Gryna, F.M. (1982) “ Quality Planning and Analysis”, Tata McGraw Hill publishing Company Ltd., New Delhi, India.
3. Blanchard, Benjamin S. (1986) “Logistics Engineering and Management”, Prentice Hall International, New Jersey U.S.A.
4. Kraus, John W. (1988) “Maintainability and Reliability”, Handbook of Reliability Engineering and Managemtn, Editors – Ireson. W.G. and Cooms, C.F. McGraw Hill Book Company Inc. U.S.A.
5. Srinathm K.S. (1985) “Concepts in Reliability Engineering” Affiliated East-West Press Private Ltd ,New Delhi, India.

Course Outcomes: On completion of the course the students will be able to:

- Summarize the fundamentals and significance of quality, durability and reliability of engineering products.
- Find overall solutions on safety, reliability and maintainability challenges for industrial applications and public administration.
- Implement the quality engineering tools in industrial application and Improve the team working skill.

22PPE31	Theory of Metal Cutting

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the effects of tool geometry, mechanics of chip formation, tool material ,tool life and surface finish.

Module-I

Geometry of Cutting Tools: Nomenclature of single point tool, and multi point tool, Effect of cutting parameters on tool geometry, Index able inserts. Tool Materials: Desirable properties of tool materials, Types of tool materials like Carbon tool steels; H.S.S cemented carbides, ceramics, CBN and coated tools.

Module-II

Mechanics of Metal Cutting: Classification of cutting process, chip formation, types of Chips, Mechanism of chip formation. Geometry of chip I single point cutting, forces on Chip velocity relationship, Friction in Metal Cutting. Measurement of Cutting forces: Requirement of Dynamometer, Classification of cutting force dynamometer, Lathe tool dynamometer, Drill, Milling and Grinding Dynamometer.

Module-III

Thermal Aspects in Metal Cutting: Heat sources in metal cutting, Temperature in chip formation, temperature distribution, and Experimental determination of tool temperature. Cutting fluids: Properties of cutting fluids, selection of cutting fluids, application of cutting fluids and recommended cutting fluids.

Module-IV

Tool wear: Different wear mechanisms, Types of tool wear like coater, flank, and diffusion, etc tool wear measurement. Tool life: Different tool wear criterion, Tool life equations, effect of process parameters in tool life, tool life tests. Factors affecting mach inability.

Module-V

Economics of Machining: Costs associated with machining operations cutting speed and tool life for minimum cost of production, Problems on Economics of Machining.

Text Books:

References:

1. Metal cutting principles by M.C. Shaw -Oxford Publication
2. Metal cutting by E.H. Trent.
3. Fundamentals of Metal Machining by Boothroyd.
4. Fundamentals of metal cutting & Machine Tools by B.L. Juneja & G.S - Sekhar, Wiley Eastern
5. Metal Cutting by V.C. Venkatesh & S. Chandrasekharan -Pantice Hall
6. Metal cutting by Dr. B.J. Ranganath -Vikas Publications

Course Outcomes: On completion of the course the students will be able to:

CO1	Illustrate the effects of tool geometry on machining force components and surface finish .
CO2	Understand the Mechanism of chip formation in different materials.
CO3	Discover the mechanics and thermal issues associated with chip formation.
CO4	Estimate the tool life for different tool materials.
CO5	Evaluate the costs associated with machining operations.

22PPE321	Advanced Probability and Statistics

Credits	**:04**	**CIE Marks**	**:50**
Hours/Week	**:04**	**SEE Hours**	**:03**
Total Hours	**:52**	**SEE Marks**	**:50**

Course Objectives:

- To teach the probability and statistics tools for quality assurance procedure for their products.

Module-I

Introduction to probability theory, Discrete and Continuous Random Variables, Distribution of Random Variables: Binomial, Poisson, Hypergeometric, Multinomial, Normal, Gamma, Exponential, Chisquare, F, t. Mathematical Expectation of Random Variables.

Module-II

Moment Generating Functions, Limit Theorems, Jointly Distributed Random Variables, ConditionalProbability and Conditional Expectation.

Module-III

Introduction to Stochastic Process, Discrete time Markov Chains : Introduction, Chapman kolmogorv Equation, State Classification : Transient, Recurrent, Absorbing States, Transient and Steady State Analysis, Markov Decision Process, Continous Time Markov Chains : Poisson Process, Birth and Death Process.

Module-IV

Testing of Hypothesis: Estimation theory, Hypothesis testing, Inference on the mean of a population, Inference on the variance of a normal population, Inference on a population proportion, Testing for Goodness of Fit, Inference for a difference in Means, Variances known, Inference for a difference in means of two normal distributions, Variances unknown, Inference on the Variances of two normal populations, Inference on two population proportions. ANOVA.

Module-V

Introduction to Multivariate Techniques, Analysis of Dependence: Linear Regression, Multiple Linear Regression, Discriminant Analysis (Non Analytical Treatment). Analysis of Interdependence: Principal Component Analysis (Non Analytical Treatment), Factor Analysis(Non Analytical Treatment).

Text Books:

1.Applied statistics and Probability for Engineers – Douglas C Montgomery, George C Runger, 2nd Edn, John Wiley and Sons, ISBN-0-471-18027-5, 1999.
2. Statistics for Management, Richard I Levin, David S Rubin, 6th Edn, Prentice Hall India,

References:

1. Probability and Statistics in Engineering - William W Hines, Douglas C Montgomery - John Wiley and Sons
2. Business Statistics for Management and Economics - Daniel, Terrell - Houghton Mifflin Company.
3. Probability and Statistics - by Walpole & Mayer - MacMillan Publishing Company - 1989.

Course Outcomes: On completion of the course the students will be able to:

CO1	Identify and Interpret Various Distributions and relate to real time data.
CO2	Apply Conditional Probability Concepts to Various Scenarios.
CO3	Apply Markov Models to Various real time problems.
CO4	Form the hypothesis and able to test their hypothesis with various statistical tools.
CO5	Apply Univariate and Multi Variate analysis to real time situations.

22PPE322	Industrial Robotics

Credits	**:04**	**CIE Marks**	**:50**
Hours/Week	**:04**	**SEE Hours**	**:03**
Total Hours	**:52**	**SEE Marks**	**:50**

Course Objectives:

- To teach the fundamentals of robot, components of robot, sensors used in robot ,drives and programs used to actuate the robot and utilize robot technology in various applications.

Module-I

Introduction: Definition, types and representation of robots, Construction of manipulators, Advantages and disadvantages of various kinematics structures. Applications.

Module-II

Pneumatic, Electric and Hydraulic actuators, characteristics and control, Non-servo robots, motion planning, Feedback systems, encoders, Servo control, PTP & CP.

Module-III

Kinematics, Homogeneous Co-ordinates, solution of Inverse kinematics problems. Multiple solutions, Jacobean work-envelopes, Trajectory planning, manipulator dynamics and force control

Module-IV

Robot sensors, vision, Ranging, LASER Acoustic, tactile, Developments in sensor technology, sensory control, Programming languages-VAL, RAIL, AML.

Module-V

Mobile Robots- Introduction, land surface robots-arrangement of wheels and tracks navigation for land vehicles – control and communications, types of operation of mobile robots, legged robots-Leg number and arrangement – control – climbing robots submersible robots in air and space – Automated Guided Vehicles (AGV) Walking Devices.

Text Books:

1. Robotics, K.S.Fu / McGraw Hill.

References:

1. J.Duffy, “Analysis of Mechanism and Robot Manipulators'”, John Willey & Sons, 1980.
2. B. Rooks (ED) “Robot Vision and Sensory Controls”, Vol3, North Holland.
3. M.P.Groover, “Industrial Robotics”, MGHI.
4. Craig, “Robotics”, Addison-Wesley.
5. D.J.Todd, “Walking Machines – An Introduction to Legged Robots”, Kogan Page Ltd, London, 1985.
6. Y.Koren, “Robotics for Engineers”, MGH

Course Outcomes: On completion of the course the students will be able to:

- Identify the components of a robot and program the robot for different applications
- Discuss about the various applications of robots, justification, implementation and safety of robot
- Demonstration of knowledge in robotic engineering.

22PPE323	Work Study and Ergonomics

Credits	**:04**	**CIE Marks**	**:50**
Hours/Week	**:04**	**SEE Hours**	**:03**
Total Hours	**:52**	**SEE Marks**	**:50**

Course Objectives:

- To teach the methods for productivity measurements and improvements, work study methods, ergonomic methods for workplace design.

Module-I

Introduction, productivity, productivity and production, productivity measurement, means of increasing productivity, improving the productivity by reducing work content. Introduction to work study, Method study, objectives of method study, basic procedure in method study, record, examine, develop, movements of workers and materials, string diagram, worker-type flow process chart, multiple activity chart, travel chart.

Module-II

Definition of work measurement, purpose and uses of work measurement, basic procedure, techniques of work measurement. Definition of time study, time study equipments and forms, selecting the job, approach to the worker, steps in making a time study, obtaining and recording information, breaking the job into elements, sample size, stop watch procedure.

Module-III

Definition of Rating, The qualified and average worker, standard rating and performance, comparing the observed rate of working with the standard, factors affecting the rate of working, scales of rating, how the rating factors is used, recording the rating. calculation of basic time, selected time, Allowances, calculation of allowances, relaxation allowances, other allowances, standard time. Principles of motion economy and application, Evaluate, define, install, and maintain the method, Importance of method study in the office. Purpose and application of micro motion study, therbligs, equipments, cycle graph and chronocyclegraph, memo motion study.

Module-IV

Introduction to Ergonomics, consequences of not using ergonomics, areas of study covered under ergonomics, system approach to ergonomic models, work capabilities of industrial worker, Work design consideration, functions performed by Man & Mechanism involved, general principles for carrying out physical activities, development of stress in human body & their consequences

Module-V

Man-Machine system, Design of work place-Machine at work place-Working at work place-Seat for work place, Influence of Climate, Noise & vibration and Lighting systems on the efficiency of human performance., Measuring work by physiological methods – Heart rate measurement– measuring oxygen consumption–Establishing time standards by physiology methods.

Text Books:

1. Bridger R S, Introduction to Ergonomics, Taylor and Francis, 2008.

References:

1. Aft, Work Measurement and Methods, Wiley John and Sons, 2000 28
2. Barnes, Raeph.M., “Motion and Time Study – Design and Measurement of Work “, John Wiley &sons, New York, 1990
3. Mc.Cormick, E.J., “Human Factors in Engineering and Design”, McGraw Hill
4. ILO, “Introduction to Work study”, Geneva, 1974.
5. Applied Ergonomics Hand Book - Brien Shakel (Edited) - Butterworth Scientific, London – 1988.

Course Outcomes: On completion of the course the students will be able to:

CO1	Illustrate the fundamentals of productivity and analyze Work study.
CO2	Distinguish between time study and method study.
CO3	Compare the observed rate of working with the standard their by calculating a standard time.
CO4	Analyze the ergonomic methods for workplace design.
CO5	Perform ergonomic analysis to provide comfortable work environment with a view to maximize the performance of men/machines.

22PPE331	Production and Operation Management

Credits	**:03**	**CIE Marks**	**:50**
Hours/Week	**:03**	**SEE Hours**	**:03**
Total Hours	**:42**	**SEE Marks**	**:50**

Course Objectives:

- To teach the demand forecasting techniques and costing, factors affecting plant location, site selection and space requirements, various components and functions of operation management such as aggregate planning, process planning, production scheduling, assembly line balancing.

Module-I

Introduction: Definition; Concept of production; Production System; Types of production system-Job Shop, Batch, Mass, Continuous production; Operation System; Operation management: Definition – Objectives, Operations Strategic Role; Trends in Operations Management; Productivity ; Factors affecting productivity. Forecasting: Introduction, Nature and use of Forecast: Technology Forecast, Economic Forecast, Demand Forecast, Factors affecting Forecast. Forecasting objectives and Uses, Demand Pattern: Historical, Seasonal demand, Cyclical, Trend Pattern. Forecasting methods, Exponential smoothing, Regression and Correlation Methods.

Module-II

Facility location and layout: Introduction, Factors affecting location decisions, Locations planning for goods and services, Economic analysis, Location Model-Factor rating, Weighted factor rating, Load-distance and Cost Volume Analysis. Location Economics. Plant Layout-Principles & Objectives, Classification of layout- Process, Product, Combination, Fixed position layout.

Module-III

Strategic Capacity planning: Introduction, Strategic Capacity Decision, Defining and Measuring capacity, Determinants of Effective Capacity, Strategy Formulation: Steps in the Capacity Planning Process, Forecasting Capacity Requirements, Make or Buy, Evaluating Alternatives: Cost-Volume Analysis, Financial Analysis.

Module-IV

Product Development and Design: Introduction, Concepts in Product Development – standardization – simplification – Speed to market, Purpose of a Product Design, Major factors affecting process design, Types of processes design. Concurrent engineering. Aggregate planning: Definition, Planning and scheduling, Objectives of Aggregate planning, Variables used in Aggregate planning, Aggregate planning strategies, Aggregate planning method- Transportation Model.

Module-V

Materials Management and Inventory Control: Scope and Status of Material Management, Purchasing processes, Vendors selection criteria, Make or Buy decisions, Inventory costs and the Economic Order Quantity (EOQ) equation, ABC analysis. Material requirement planning: Introduction, MRP Concept and Objectives, MRP Inputs & Outputs, Bill of material, Lot Sizing in MRP, Benefits and Requirements of MRP.

Text Books:

Modern Production/Operations Management,. by Buffa and Sarin, John Wiley & Sons.

References:

"Industrial Engineering And Production Management", Martang Telsang, S. Chand & Co.
"Operations Management-Theory and Problems", Joseph Monks, McGraw Hill Inc. New York,
"Production and Operations Managements By Chary.
"Production System: Planning, Analysis and Control", James Riggs, John Wiley & Sons,
"Production and Operation Management", N.G. Natr, TMH, New Delhi, (1996).
"Production and Operation Management", R. Paneerselvon, TMH, New Delhi, (1999).
"Just In Manufacturing", Korgaonkar , Tata McGraw Hill Co.,Ltd, New Delhi.
'Operation Management By William J Steveson, Tata McGraw Hill Co. Ltd, New Delhi
"Operation Management Decision-making In Operation Functions", Roger. G. Schroeder, Mc Graw Hill.

Course Outcomes: On completion of the course the students will be able to:

CO1	Illustrate the principles and objectives of forecasting, planning, design and control of production systems.
CO2	Identify and suggest correct type of layout, tools and techniques for developing a layout.
CO3	Assess the capacity planning process.
CO4	Design the product through standardization and simplification of process.
CO5	Analyze the concepts of MRP and implement in crucial areas of the industry.