	POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI Choice Based Credit System (CBCS) Scheme of Teaching and Examination 2018 – 19 (Effective from the academic year 2018 – 19 for 2018-19 admitted students)												
	V Semester												
Sl. No.	Course and Course Code		Course Title	Teaching Department	Teaching Hours/Week				Examination				Credits
					Theory Lecture	Tutorial	Practical / Drawing	Self Study	Duration in hours	SEE Marks	CIE Marks	Total Marks	
1.	HU	19HU51	Management and Entrepreneurship	Humanities/IP	3	-	--	--	03	50	50	100	3
2.	PC	19IP52	Work System Design	I & PE	3	-	--	01	03	50	50	100	3
3.	PC	19IP53	Quality Assurance & Reliability (QA & R)	I & PE	3	-	--	--	03	50	50	100	3
4.	PC	19IP54	Machine Design (MD)	I & PE	3	2	--	--	03	50	50	100	3
5.	PC	19IP55	Engineering Economics (EE)	I & PE	3	-	--	--	03	50	50	100	3
6.	PC	19IP56	CNC M/C Tools	I & PE	3	-	-	--	03	50	50	100	3
7.	HU	19HU01	Recruitment Process Training	Humanities	--	-	2	--	02	50	50	100	0
8.	PC	19IPL57	CNC M/C Tools Laboratory	I & PE	--	--	2	--	03	50	50	100	1
9.	PC	19IPL58	Quality Assurance (QA) Laboratory	I & PE	--	--	2	--	03	50	50	100	1

10.	PC	19IPL59	Work System Design Laboratory	I & PE	-	--	2	--	-	50	50	50	1
Total					**18**	**02**	**08**	**01**	**26**	**500**	**500**	**1000**	**21**
	Note: Hu: Humanities, PC: Professional core, NCMC: Non-credit mandatory course. Note: Management and Entrepreneurship course shall be offered by CV, ME, IP, Auto and CCT Departments at V semester level and E&CE, CSE, IS, IT and E&E departments at VI semester level												

Course title: Entrepreneurship, Management and Finance			
Course code:	19HU51	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: --			

Course Objectives:

To enable the students to obtain the basic knowledge about Entrepreneurship and Management and finance in the following topics:-

- The Meaning, Functions, Characteristics, Types, Role and Barriers of Entrepreneurship,. Government Support for Entrepreneurship
- Management – Meaning, nature, characteristics, scope , functions, role etc and Engineers social responsibility and ethics
- Preparation of Project and Source of Finance
- Fundamentals of Financial Accounting
- Personnel and Material Management, Inventory Control.

Modules	**Teaching hours**
Module I Entrepreneur : Meaning of Entrepreneur; Functions of an Entrepreneur; Characteristics of an entrepreneur , Types of Entrepreneur; Entrepreneurs – an emerging class ; Role of Entrepreneurs in economic development; Barriers to entrepreneurship, Government Support for Innovation and Entrepreneurship in India - Start-up-India, Make-in-India, PMMY, AIM , STEP, BIRAC, Stand-up India, TREAD	**8**
Module II Management: Introduction – Meaning – nature and characteristics of Management, Scope and functional areas of management, Roles of Management, Levels of Management, Henry Fayol - 14 Principles to Management , Engineers Social responsibility and Ethics	**8**
Module III	

Preparation of project and source of finance: **eparation of project:** Meaning of project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents **Source of finance**: Long Term Sources(Equity, Preference, Debt Capital, Debentures, loan from Financial Institutions etc) and Short Term Source(Loan from commercial banks, Trade Credit, Customer Advances etc)	**8**
Module IV Fundamentals of financial accounting: Definition, Scope and Functions of Accounting , Accounting Concepts and Conventions: Golden rules of Accounting, Final Accounts - Trading and Profit and Loss Account, Balance sheet	**9**
Module V rsonnel management, material management and inventory control Personnel management: Functions of Personnel Management, Recruitment, Selection and Training, Wages, Salary and Incentives Material management and inventory control: Meaning, Scope and Objects of Material Management. Inventory Control- Meaning and Functions of Inventory control ; Economic Order Quantity(EOQ) and various stock level (Re-order level, Minimum level, Maximum level, Average level and Danger level)	**9**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. Financial Accounting -B S RAMAN- United Publishers Manglore, Maheswar S N &Maheswari S K-Vikas Publishing House.
2. Management & Entrepreneurship- K R Phaneesh- Sudha Publications ,Prof Manjunatha& Amit kumar G – laxmi Publication, VeerbhadrappaHavina l-New Age International Publications.
3. Principles of Management First Edition (English, G. Murugesan), Laxmi Publications – New Delhi

Reference Books:

1) Industrial Organization & Engineering Economics-T R Banga& S C Sharma-Khanna Publishers, Dehli.

E books and online course materials:

https://bookboon.com/en/management-organisation-ebooks

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
15HU71	**CO1**	Describe about Entrepreneurship.
	CO2	Apply the concepts of management and Engineers Social responsibility & Ethics practice.
	CO3	Prepare project report & choose different Source of Finance.
	CO4	Apply Fundamentals of Financial Accounting and interpret the final accounts
	CO5	Apply personnel management skills, Material and inventory control techniques

Course title: Work System Design			
Course code:	**19IP52**	Credits:	04
Teaching hours/week:	03+ 1hr self study	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: -			

Course Objectives: The main objective of this course is

- To impart knowledge and skills in the theory and practice of systematic analysis of work methods, work measurement and work design,
- To improve productivity.
- To enable the students to be trained with planning of plant layouts and selection of site locations.

Modules	**Teaching hours**

Module I **Introduction to Industrial Engineering:** Definition, history of Industrial Engineering, contribution to industrial engineering, objectives, place of Industrial engineering in an organisation. **Productivity**: Definition, reasons for low productivity, task of management. Productivity of materials, land, building, machine and power. Measurement of productivity, factors affecting productivity, measures to improve productivity. Total time of job, management techniques to reduce work content and ineffective time **Work Study**: Definition, objective and scope of work study, advantages and procedure of Work study. Human factors in work study, relationship of work study man with management, supervisor and workers.	**8**
Module II **Method Study** : Definition, objective, procedure, criteria for job selection, various recording techniques and their applications, like outline process chart, flow process chart, two handed process chart, multiple activity chart, SIMO chart, flow diagram, string diagram, cycle graph and chronocycle graph, critical examination, Therbligs, principles of motion economy, classification of movements, micro-motion study. Development and installation of new method. Examples on recording techniques.	**9**
Module III **Work measurements**: Definition, objectives and benefit of work measurement, work measurement techniques. **Stop Watch Time study**- definition, time study equipment, selection of job, steps in time study, breaking the job into elements, recording information, Rating, scales of rating, factors affecting rate of working, standard performance, allowances and standard time determination**.** **Work sampling**- need, confidence levels, sample size determination, random observation, conducting the study. **Predetermined motion time study**- Concept of PMTS, Method Time Measurement (MTM), Work factor system.	**9**
Module IV **Facility Location:** importance of location, factors affecting site location, rural vs urban location, factors in heavy manufacturing locations, light industry location, warehouse location, retail location. Quantitative and Qualitative analysis. Location break even analysis, P-Q chart, relationship chart (REL), introduction to systematic layout planning**,** introduction to layout, industrial buildings.	**8**
Module V **Plant Layout:** Definition of Plant Layout, Objectives of a good layout, and types of layout like product layout, process layout, fixed position	**8**

layout, cellular layouts and hybrid layouts. Types of flow patterns. Basic features of manufacturing, advantages and disadvantages of Job, Batch, Line and Continuous production, types and assumptions, assembly line balancing-simple problems	

Question paper pattern:

CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.

SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. ILO- Introduction to Work study, 4th ed.
2. M. S. Sanders and Ernest J. McCormick- Human Factors Engineering and Design, McGraw Hill Inc
3. Barnes Ralph, Motion and Time Study, Design and Measurement of Work, Wiley
4. Suresh Dalela - Work Study and ergonomics, Standard Publishers Distributers
5. S.K.Sharma- Work Study And Ergonomics, S.K. Kataria& Sons

Reference Books:

1. James Apple, "Plant layout and Material Handling", The Ronalt Press Co., New Delhi
2. Francis, McGinnis and White, "Facilities Layout and Location- an analytical approach", PHI
3. Thomas Thinandavha Munyai, Boysana LephoiMbonyane, Charles Mbohwa– Productivity Improvement in Manufacturing SMEs :Application of Work Study, CRC Press

Online materials: https://nptel.ac.in/courses/112107142/

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
16IP52	CO1	Describe the importance and usage of principles of Industrial Engineering and work study at various sectors in an organization and its effectiveness in improvement of productivity.
	CO2	List and Apply the various charts and diagrams to analyze the existing and develop improved methods of working.
		Understand the concept of rating and determine the time standards using appropriate techniques of work measurement

	CO3	
	CO4	Understand the locational principles and apply the concept of location selection, and evaluate different locations.
	CO5	Understand the various manufacturing and Apply plant layout principles to determine flow lines and design plant layouts.

Course title: Quality Assurance and Reliability Engineering			
Course code:	**19IP53**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Mathematics			

Course Objectives:

- This course introduces students
- To teach concepts and methods of modern statistical quality control.
- Students learn to apply standard quality control tools.
- They learn the theoretical statistical concepts that justify the use of particular quality control tools in particular situations.
- They learn theory and methods for analyzing the performance of different quality control tools.

Modules	**Teaching hours**
Module I **Introduction:** Definition of quality, Quality function, Dimensions of quality, Quality Engineering terminology, Statistical methods of quality improvement, Quality costs – Four categories costs and hidden costs. Brief revision of Frequency distribution and Histogram. Probability distribution – Binomial, Poisson and Normal distribution. **Quality Assurance:** Definition and concept of quality assurance, Departmental assurance activities. Quality Audit concept, Structuring the audit program, Planning and performing audit activities, Audit reporting, Ingredients of a quality audit program	**8**

Module II **Statistical Process Control (SPC):** Introduction to Statistical Process Control – Chance and assignable causes of variation. Basic principles of control charts, Choice of control limits, Analysis of patterns of control charts. **Process Capability** – Basic definitions, Standardized formula, Relation to product tolerance and Six-sigma concept of process capability. **Control Charts for Variable:** Control charts for Mean and Range (R), Statistical basis of the charts, Development and use of X bar and R charts, Interpretation of charts. Control Charts for X-bar and standard deviation (σ), Development and use of X-bar and σcharts., X-bar and σ control charts with variable sample size.	**9**
Module III **Control Charts for Attributes:** Control charts for fraction non-conforming (defectives) – Development and Operation of control chart, Brief discussion on variable sample size. Control Charts for Non-conformities (defects) – Development and operation of control chart for constant sample size and variable sample size. Choice between variable and attribute control charts. Guidelines for implementing control charts. **Sampling Plans and Operating characteristic curves** – construction and use. Acceptance plans – Single, Double and Multiple sampling. Determination of average outgoing quality, Average outgoing quality level, Average total inspection, Producer's risk and Consumer's risk. Construction of O.C Curve	**9**
Module IV **Quality Circles:**Concept, structure, role of different members, tools used and case studies. **ISO Quality Systems:** ISO/QS9000 Quality Systems – History of ISO 9000 Standards, QS 9000 quality standards, Goals and their standards.	**8**
Module V **Introduction to Reliability Engineering** **Reliability:** Definition, Mean failure rate, Mean time to failure, Mean time between failure, hazard rate, hazard models. Constant hazard, linearly increasing hazard, Weibull model. System reliability, series, parallel and mixed configuration simple problems, Life testing – Objective, classifications. **Reliability Improvement:** Reliability improvement redundancy, element, unit and stand by redundancy, reliability allocation for a series system. Maintainability and availability	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. D.C. Montgomery, "Introduction to Statistical Quality Control", 3rd edition, John Wiley and Sons.
2. J.M. Juran and Frank M. Gryna, "Quality Planning and Analysis", 3rd edition, Tata McGraw Hill.

3.L S Srinath-"Engineering Reliability",

Reference Books:

1. Grant and Leavenworth, "Statistical Quality Control", McGraw Hill.
2. Janet L. Novack and Kathleen C. Bosheers, "The QS9000 Documentation Toolkit", Prentice Hall PTR.
3. Suresh Dalela and Saurabh, "ISO 9000 A Manual for Total Quality Management", S.Chand and Co. Ltd., Ram Nagar, New Delhi.
4. Tapan P. Bagchi, "ISO 9000 Concepts, Methods and Implementation", Wheeler Publishing. A Division of AH Wheeler & Co. Ltd., New Delhi.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
16IP53	CO1	Students will gain the knowledge of quality concepts and basics of statistics.
	CO2	Prepare graphical presentation using quality control techniques
	CO3	Analyse control charts and sampling plans
	CO4	Analyse quality circles and ISO quality systems in process control
	CO5	Analyse reliability of the systems

Course title: Machine Design			
Course code:	19IP54	Credits:	04
Teaching hours/week:	03+ 02 (Tutorials)	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	
Prerequisite: Strength of Materials & Material Science			

Course Objectives: To study;

- The standards & codes, theories of elastic failure, stress concentration and design for static & fatigue strength
- The design of structural joints (riveted joints, welded joints), detachable joints (keys, cotter joints and knuckle joints)
- Design of machine elements such as power transmission shafts, mechanical spring flanged and spur gear

Modules	Teaching hours
Module I **Design for static strength:** Introduction, design considerations, codes and standards, failure of ductile and brittle materials, Theories of elastic failure. Stress concentration, stress concentration factor, methods of reducing stress concentration **Design for fatigue strength**: Introduction, variable stresses and endurance limit of materials, factors affecting the fatigue strength, size effect, load effect and surface finish effect. Soderburg equation and modified Goodman diagram.	**9**
Module II **Cotter and knuckle joints:** Introduction, types of cotter joints, design of socket and spigot cotter joint. **Design of Knuckle joint**: Applications, design **Keys:** Types of keys, stresses in keys strength of square key**,** length of key	**8**
Module III **Design of shafts**: Materials, design considerations, types of shafts, design for strength and rigidity design of shafts subjected to torsion, bending and thrust. ASME and BIS codes for design of transmission shafts **Couplings:** Types of couplings, applications, Design of rigid flange and	**8**

bushed pin type flexible couplings.	
Module IV **Riveted and welded joints:** Stresses in riveted joints, efficiency of riveted joints, and design of typical joints, boiler and structural joints. **Design of welded joints:** Applications, types, strength of fillet welds, welded joints subjected to eccentric loads., strength-rigidity criteria and shaft subjected to torsion only.	**8**
Module V **Design of springs:** Types, stresses in coiled springs, circular and non circular sections, deflection of coiled springs, design of compression and tension springs. **Design of spur gear:** classifications of gears, gear profile, system of gear teeth, beam strength of gear teeth, Levis equation, dynamic tooth load, and design for w	**9**
Question paper pattern: There will be two questions from each module and students have to answer at least one question from each module. Each question will carry 20 marks and consists of 1 to 3 sub-questions. Sub question may consist of definitions, derivations and problems	
Text books: 1. J.K.B.Das AND P.L.Srinivas Murthy, Design of machine elements, Sapna Book House Banglore 2. R.S.Khurmi and J.K.Gupta, Machine design, Eurasia publishing house(Pvt.) LTD. New Delhi 3. K. Mahadevan and Balaveerareddy, Design data hand book, CBS Publication	
Reference Books: 1. Joseph. E Shigley and charles R. Mischke, Mechanical engineering design, TATA McGraHill 2nd Ed., 2003 2. C.S. Sharma and KamleshPurohit, Design of machine elements Prentice Hall of India, 2003. 3. N.C.Pandya and C.S.Shah, Elements of machine design Charotar Publication House, Anand, India.	

4. Hall Holowenko Theory and problems of machine design by, Lauhlin(Schaum Series)
5. by Paul H-Black, Adams, Machine design, McGraw Hill Co.
6. K.Lingaiah, Design data hand book, McGraw Hill Co. 2nd Ed. 2003
7. H.G.Patil and shrihashiPrakashan Machine data hand book Beagaum.

E books and online course materials:

Design materials from scribd

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18IP54	CO1	Understand standards, codes, apply theories of failure and stress concentration in the design of machine components subjected to static & fatigue loads
	CO2	Analyze and design the detachable joints (keys, cotter joints & knuckle joints).
	CO3	Use codes and standards in the design analysis of power transmission shafts and couplings
	CO4	Classify and design structural joints (riveted joints & welded joints) to meet desired needs within the realistic constraints of safety
	CO5	Identify materials, analyze and design springs and gears for static, dynamic and wear loads.

Course title: Engineering Economics

Course code:	19IP55	Credits:	03
Teaching hours/week:	3 (Theory)	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: -			

Course Objectives:

The objective of this course is to give the working engineer an overview of the economics methods employed in effective engineering decisions.

Modules	Teaching hours
Module I Introduction to Engineering Economics, Engineering and Economics, Engineering decision, Engineers as decision makers, Problem solving and decision making, Decision maze, Intuition and analysis, Tactics and strategy. Demand and supply, law of demand, elasticity of demand, factors governing elasticity of demand, law of returns, law of diminishing returns**.**	**8**
Module II Interest rate, simple and compound interest, Nominal and effective rate of interest, cash flow diagram, Compound interest factors- single payment compound amount factor, single payment present worth factor, Uniform series sinking fund factor and uniform series compound amount factor, Uniform series capital recovery factor and uniform series present worth factor, Arithmetic gradient conversion factor for uniform series.	**7**
Module III Introduction , conditions for present worth comparison, Rule of 72, basic problems on PW comparison, PW comparison of assets with unequal lives, Future worth comparison, Pay back comparison	**7**
Module IV Introduction & situations for Equivalent annual worth comparison, Assets with equal lives, Assets with unequal lives, Use of sinking fund method, annuity contract for guaranteed income**.** Introduction to concept of ROR, IRR &MARR, Cost of capital concept, comparison of alternatives using IRR.	**11**
Module V	**9**

Definition, causes and importance of depreciation, Methods of computing depreciation.Causes, consequences and control of inflation in India, Tax concepts, lease or buy decisions	

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. "Engineering Economics", Paneerselvam, PHI Publishers
2. "Engineering Economics", James Riggs, Mcgraw Hill Publications
3. "Engineering Economics", R.K. Hegde,

Reference Books:

1. "Engineering Economy", Paul DeGarmo
2. "Engineering Economics", Thuesen H

E books and online course materials:

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
18IP55	CO1	Understand the need of economics for engineers and the process of decision making
	CO2	Understand the laws associated with demand and supply in order to calculate demand and price elasticity of demand
	CO3	Understand the interest factors and time value of money and apply it to value streams of cash flow
	CO4	Understand the need for economic analysis of alternatives and be able to compare alternatives based on various criteria
	CO5	Be competent to compute the book value by applying various methods of depreciation calculation and understand the effects of inflation and taxation

Course title: CNC M/C Tools			
Course code:	19IP56	Credits:	03

Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite: Manufacturing processes			

Course Objectives:

- To provide necessary knowledge for the Operation and programming of numerical control machines.
- Instruction in Programming using G-Code will be provided. Demonstrations using both On board programming software will be given to the Students.
- To write program for the MTAB MAXTURN PLUS lathe

Modules	Teaching hours
Module I **Introduction:** History of NC machines, Basics and need of CNC machines, NC, CNC and DNC systems, Applications of CNC machines in manufacturing, Classifications of CNC machines .Types of controls. CNC controllers, Advantages of CNC machines.	**8**
Module II **Structure of CNC machine Tools** CNC machine building, Structural details, configuration and design, Guide ways-Frictional and anti friction and other types of guide ways. Accessories of machine centre- Automatic tool changer, Automatic pallet changers, Spindle drives and feed drives, control systems of NC system	**9**
Module III **NC machines tools and machine control unit and Drives and control:** Nomenclature of the NC Machines axes, Features of NC machine tools**,** NC actuation system Part program to command signal. MCU organization, Spindle Drives- DC and AC motors, Feed drives- stepper motors.	**8**
Module IV **Tolling and maintenance of CNC** NC tooling, Cutting tool materials, Multi coated cemented carbide inserts, present and qualified tools, Tool holders, Special tool holders, tool planning, ISO specification of tools, Tooling system for marching centre and turning centre. Work holding devices maintenance of CNC machine.	**8**
Module V	

Manual part programming, coordinate system, structure of part program, G-codes and M-codes, NC part program using CAD/CAM- turning centre and milling centre. Computer assisted part programming- APT language, Examples,	**9**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:
Numerical Control And Computer Aided Manufacturing ; P.N. Rao

Reference Books:
1. James Madison. CNC Machining Hand book, Industrial Press Inc. 1996.
2. .Stevekar, Arthur Gill, CNC

E books and online course materials:NPTEL

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
16IP54	CO1	Identify new and ongoing developments in the area of numerical control of Machine tool.
	CO2	Describes the basic concepts of CNC machines Structure
	CO3	Describes the principles of computer numerical control. Machines.
	CO4	Define the cutting tools , materials for CNC machines according to ISO specifications, and work holding devices
	CO5	Apply the program to Operate the CNC machine to produce the a component safely using correct sequence operations

Course : CNC M/C Tools Lab			
Course code:	19IPL51	Credits:	1
Teaching hours/week:	-	Total teaching hours:	-
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	
Prerequisite: CNC Machine Tools			
Course Objectives:			

- To make familiar to students about CNC programming methodology and list the standard codes and formats
- Student should learn tooling paths, the common CNC operations and utilise the fundamentals underlying laws related to CNC Machines, relationships between CNC program me and final machined component.
- To make students skill in program me and operation sheet in required format for machine Operation.

Course contents	Practical Hours
Module I Study of CNC Machine Tool Length offset measurement, tool nose radius, head stock, tail stock, Feed, controls, tool life process chart preparation. MTAB CNC tutor	**8**
Module II Introduction to NC Manual Part Programming and Computer Assisted part programming-Exercise.	**9**
Module III Production of Various Contour Shapes using CNC Lathe	**8**
Module IV NC Programming Using CAD Models.	**8**
Module V Generation of CNC programming using Suitable package Simulation of CNC programmes using standard packages	**9**

Question paper pattern: Students have to answer two questions. One question is set for 20 marks and another question is set for 30 marks

Reference Books:

CNC programming Lathe NTTF

CNC MT Lab Manual

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	To demonstrate understanding and application of the concepts of CNC machines MTAB CNC TUTOR
	CO2	To show expertise and proficiency in logical decision making in writing the program

19IPL51	**CO3**	To exhibit the skills of writing programs related to CNC different machines in order to generate the necessary output
	CO4	To reveal the skill of oral communication to present views on programming aspects
	CO5	To prepare report about the technical details of experimental work related to software application or development

Course title: Quality Assurance lab			
Course code:	**19IPL52**	Credits:	01
Teaching hours/week:	-	Total teaching hours:	-
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	

Course Objectives:
The objective of this course is to provide students with skills in systematic understanding of Quality Assurance Techniques

Course contents	**Practical Hours**
1.To test the Goodness of fit for the given quality characteristic using Binomial distribution	**4**
2.To test the Goodness of fit for the given quality characteristic using Poisson distribution	**4**
3.To test the Goodness of fit for the given quality characteristic using Normal distribution	**4**
4.Construction of control chart for attribute quality characteristic	**4**
5.Construction of control chart for variable quality characteristic	**4**
6. Application of Acceptance Sampling Techniques (Single sampling plan and OC Curve) Using Deming's Red Bead Experiment	**4**
7. Exercises on FMEA	**4**

Question paper pattern: Students have to answer two questions. One question is set for 20 marks and another question is set for 30 marks

1.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IPL52	CO1	Understanding of Binomial Distribution
	CO2	Understanding of Poisson distribution
	CO3	Understanding of Normal distribution
	CO4	Understanding Control Chart and sampling Techniques
	CO5	FMEA

Course title: Work System Design Laborotary			
Course code:	**19IPL53**	Credits:	01
Teaching hours/week:	-	Total teaching hours:	-
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	

Course Objectives:
The objective of this course is to provide students with skills in systematic analysis of work methods, work measurement, work system design and layout studies to improve productivity.

Course contents	**Practical Hours**
1. Recording Techniques: Preparing following charts and diagrams - Outline process chart - Flow process chart - Flow diagram - Multiple Activity Chart - String Diagram - Two handed process chart	**12**

2. Applications of principles of motion economy	**2**
3. Rating Exercises	**2**
4. Determining the standard time for simple operations using Stop Watch Time Study	**4**
4. Purdue Finger and hand Dexterity Test	**4**
6. Line Balancing	**2**
7. Study and improvement of Plant Layout	**2**

Question paper pattern: Students have to answer two questions. One question is set for 20 marks and another question is set for 30 marks

Text books:

2. ILO- Introduction to Work study, 4thed.
3. Suresh Dalela - Work Study and ergonomics,
4. S.k.Sharma- Work Study And Ergonomics,

Reference Books:

1. Barnes Ralph, Motion and Time Study – Design and Measurement of Work, Wiley
2. M. S. Sanders and Ernest J. McCormick- Human Factors Engineering and Design, McGraw Hill Inc.,

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IPL53	CO1	List and construct process charts and diagrams to determine operation sequences and optimize work methods.
	CO2	Describe the principles of motion economy and apply in designing of work places
	CO3	Apply rating principle and determine/calculate time standards using stop watch time study
	CO4	Identify the role of normal distribution and acceptance sampling in quality management
	CO5	List and distinguish between different layouts and identify work flow patterns

	POOJYA DODDAPPA APPA COLLEGE OF ENGINEERING, KALABURAGI **Scheme of Teaching and Examination 2018 – 19** **(Effective from the academic year 2020 – 21 for 2019-20 admitted students)**						
	VI Semester						
Sl. No.	**Course and Course Code**	**Course Title**	**Teaching Department**	**Teaching Hours/Week**		**Examination**	**Credits**

					Theory Lecture	**Tutorial**	**Practical/ Drawing**	**Self Study**	**Duration in hours**	**SEE Marks**	**CIE Marks**	**Total Marks**	
1.	PC	19IP61	Human factors & Ergonomics (HF & E)	I & PE	3	-	--	1	03	50	50	100	4
2.	PC	19IP62	Operation Research	I & PE	3	2	--	-	03	50	50	100	4
3.	PE	19IP63X	Elective- 1	I & PE	3	--			03	50	50	100	3
4.	PE	19IP64X	Elective- 2	I & PE	3	--	--		03	50	50	100	3
5.	IE	19IP65X	Industrial Elective	I & PE	3	--			03	50	50	100	3
6.	OE	19IP66X	Open Elective- 1	I & PE	3	-	--		03	50	50	100	3
7.	HU	19HU02	Aptitude	Humanities	--		2		02	50	50	100	1
8.	IE/PC	19IPL67	Non-Destructive Testing (NDT) Laboratory	I & PE	--	-	2		03	50	50	100	1
9.	PC	19IPL68	HF & E Laboratory	I & PE	--	--	2		03	50	50	100	1
10.	MP	19IPMP63	Mini-project	I & PE			2		03	50	50	100	2
11.	INT		Internship	(To be carried out during the intervening vacations of VI and VII semesters)					-	--	--	--	-
Total					**18**	**02**	**08**	**01**	**29**	**500**	**500**	**1000**	**25**
	Note: PC: Professional core, PE: Professional Elective, OE: Open Elective, MP: Mini-project, INT: Internship.												
	Internship: All the students admitted to III year of BE/B.Tech have to undergo mandatory internship of 4 weeks during the vacations of VI and VII semesters and /or VII and VIII semesters. Note Management and Entrepreneurship course shall be offered by CV, ME, IP, Auto and CCT Departments at V semester level and E&CE, CSE, IS, IT and E&E departments at VI semester level												

VI semester electives

SUB CODE	**Elective-1 (Manufacturing Stream)**	**SUB CODE**	**Elective-2 (Industrial Engineering Stream)**
19IP631	Essentials of (EIT)	19IP641	Supply Chain Management
19IP632	Artificial Intelligence	19IP643	Facility Planning
19IP633	Theory of Metal Forming	19IP645	Materials Management

Industrial elective (IE)-19IP65X

SUB CODE	**Elective-1**
19IP651	Non-Destructive testing and Applications (NDT & A)
19IP652	Software Testing

VI Open Elective (OE)-19IP66X

19IP661	Human Resource Management
19IP662	Value engineering
19IP663	Simulation modelling & analysis

Course title: Human Factors and Ergonomics			
Course code:	**19IP61**	Credits:	04
Teaching hours/week:	3 + 2 (Tutorials)	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite- -			

Course Objectives:
To study, understand and apply the basic parameters of Human factors engineering/ Ergonomics in the design of work systems that helps in improving the efficiency and effectiveness.

Modules	**Teaching hours**
Module I **Introduction:** Introduction to Human factors Engineering/Ergonomics: Scope and objectives, Definition & historical evolution, Basic principles, System approach to ergonomics, Significance of ergonomics, Components of man-machine systems **Displays and controls**: Displays: Classification of displays, quantitative and qualitative displays, alphanumeric displays, multiple displays, colour, resolution, auditory displays, display layouts, Controls: types, design criteria of controls, Relationship between displays and controls.	**8**

Module II Static and dynamic anthropometry, Ergonomics and design, user-centred approach, statistical description of human variability, Anthropometric data: measurements, percentiles, use of anthropometric data in design, adjust-ability requirements, visibility and normal line of sight. Work space design-clearance, reach, working heights, design for standing and seated work, an ergonomic approach to work station design	**9**
Module III **Biomechanics of work**: Musculoskeletal system & work related musculoskeletal disorders: causes and prevention, Lower back pain, awkward postures, and risk associated with it. RULA/REBA/Strain index/OWAS methods for risk assessment in occupational tasks. Manual material Handling: NIOSH lifting equation.	**10**
Module IV **Environmental conditions-** Illumination: nature of light, visibility, effects of lighting on performance, measurement. Noise: noise and effects of noise on performance, noise exposure limits, measuring noise levels, control of noise Hot and cold environments: occupational heat stress exposure, assessment at workplace, permissible limits	**7**
Module V **Work Physiology**: Physical work, measures of physiological work load and energy consumption, measurement of heart rate, BP, cardiovascular health, lung capacity, Spirometry, Strength and endurance-measurement of hand grip force, pinch force and arm.	**8**

Question paper pattern:

CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.

SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text Books:

1. Mark S. Sanders and Ernest J Mc McCormick; Human Factors in Engineering and Design; McGraw-Hill and Co. Singapore, 7th Ed. 1992
2. R S Bridger, Introduction to Ergonomics, Taylor & Francis, 2nd Ed. 2003,
3. Suresh Dalela- Work Study and Ergonomics
4. M.I.Khan- Industrial Ergonomics- PHI
5. L.P.Singh- Work Study and Ergonomics- Cambridge press

Reference Books:

1. GavrielSalvendy-Editor, Handbook of Human Factors and Ergonomics, Wiley
2. Stephen Pheasant – Body Space -Anthropometry, Ergonomics and the Design of Work, Third Edition 3rd Edition, CRC Press
3. Stephen J. Guastello- Human Factors Engineering and Ergonomics: A Systems Approach, Second Edition 2nd Edition
   Online link: https://nptel.ac.in/courses/107103004/31

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IP61	CO1	Identify the role of ergonomics and its application in occupational tasks.
	CO2	Identify the importance of Anthropometry and Apply Ergonomic concepts in the existing systems and design of new systems.
	CO3	Apply the various ergonomics assessment tools to identify the risk factors in the work systems.
	CO4	Assess the effect of environmental factors like Heat stress, noise, illumination, vibration, dust and fumes on human performance.
	CO5	Understand the "physiology" of human body and types of movements causing ergonomic problems related to tools, task and workplace

Course title: Operations Research			
Course code:	**19IP62**	Credits:	04
Teaching hours/week:	4 + 2 (Tutorials)	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite- -			

Course Objectives:

OR students will be well grounded in the mathematical, engineering, and modelling skills that are the basis for operations research, and they will be prepared to apply those skills to the efficient design, analysis, operation and control of complex systems.

Their OR academic program will include:

1. One or more advanced courses on applications in: supply chain and manufacturing systems; data analysis; information engineering; financial engineering; or service systems.
2. A collaborative systems design experience.
3. Collaborative project experiences involving both written and oral presentations.

4. Courses with significant experiential learning components. 5. Experiences with identifying, accessing, evaluating, and interpreting information and data in support of assignments, projects, or research. 6. Course experiences with large-scale data sets	
Modules	**Teaching hours**
Module I **Introduction to OR : Definitions, Phases of OR study and applications** **Linear Programming problems**: Mathematical Formulation, Standard Form, basic Solutions, Feasible Solutions, Optimal Solutions, Degenerate solutions, Graphical and Simplex methods. Two Phase and Big-M methods, Unbounded, In feasible and alternative solutions. Resolving Degeneracy in LPP, Revised simplex methods sensitivity analysis.	**10**
Module II **Assignment problem:** Formulation, Hungarian Method, Unbalanced problem, Assignment for maximization, Travelling Salesman problem **Transportation Problem:** Formulation of Transportation Model, Basic Feasible solution by NWC Rule, Row Minimum, Lowest cost entry and Vogel approximation methods. Optimality methods, Unbalanced problem, degeneracy in transportation.	**9**
Module III **Project management :** Network Construction, CPM: determination of critical path and Total elapsed time, Concept of slack and Float, PERT-Estimation of Project duration and Variance, analysis about the completion of projects. **Crashing of Networks:** Basic concept, Optimal cost of the project	**8**
Module IV **Queuing Theory:** Queuing system : Types and Characteristics, Steady state analysis of M/M/1 and concept of M/M/K model **Replacement problem**: Basic Concept of Replacement of items that deteriorate with time: costs involved, Replacement procedure with and without consideration of Time value of money. Replacement of items that fail suddenly: Group Replacement	**8**

Module V **Games Theory :** Formulation of Games, Characteristics of games, Two-Person Zero Sum game, Maximin/Minimax principle, Saddle point, games without saddle point, solution for (2 X 2) game, dominance property, Graphical solution for (2 x n) and (n x 2) games	**7**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Reference Books:

01. Taha S A –"Opeartions Research and Introduction", McMillian
02. Philips, Ravindran and Soeberg- "Principles of Operations research", PHI
03. Hiller and Liberman-" Introduction to Operations Research", McGraw Hill V Edn
04. S.D.Sharma –"Opeartions Research", Kedarnath, Ramnath and Co.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IP62	**CO1**	Develop proficiency with tools for optimization and their application in industry Involving scarce resources
	CO2	Apply the concept of assignment and transportation problem to formulate and solve decision making problem
	CO3	utilize the network techniques to manage the scarce resources and optimize for a given project
	CO4	Apply the concept of queuing and games theory and solve for optimization
	CO5	Perform economic analysis for replacement problem

Course title: Human Factors and Ergonomics (HF & E) Laboratory			
Course code:	**19IPL68**	Credits:	1
Teaching hours/week:	-	Total teaching hours:	-
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	

Course Objectives:

- To expose the students to the different aspects of human factors and its effects on Productivity
- To design an ergonomically sound workplace for comfortable and efficient working this leads to increase in productivity

Course contents	**Practical Hours**
1. Study and Measurement of Anthropometrics Data for different work positions and conditions. 2. Correlating heart beat and oxygen consumption rate with work output using bicycle Ergo meter, treadmill and Oxylog. 3. Study of the different types of Displays and Controls. 4. Study of factors affecting design of chairs, tables, consumer goods etc. 5. Measurement of Noise 6. Measurement of Illumination, temperature and humidity in the workplace and their effect on human performance 7. Postural Analysis- Analysis of working postures in manual work to assess the risk factors using tools like RULA, REBA etc 7. NIOSH lifting equation- Determination of lifting capacity by using NIOSH equation and find out the lifting index.	**42**

Question paper pattern:

1. Write up with necessary programs = 15 Marks
2. Execution = 25 Marks
3. Oral = 10 Marks
Total = 50 Marks

Reference Books:

3. H F & E Lab Manual

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	**CO #**	**Course Outcome (CO)**

19IPL68	CO1	Identify the role of human factors and ergonomics and also areas of application in the work system
	CO2	Apply the ergonomic concepts and anthropometric data, in the evaluation of existing work systems and design of new systems
	CO3	Analyze and calculate the risk level in a job which causes stress, fatigue and musculoskeletal disorders and design appropriate work systems.
	CO4	Categorize the effect of environmental factors like noise, heat stress, and illumination and vibration levels on performance.
	CO5	Design, develop and conduct ergonomic related experiments and analyze he results

Course title: Industrial Training / Mini Project/ Case Study			
Course code:	**19IPMP69**	Credits:	1
Teaching hours/week:	-	Total teaching hours:	-
Practical ours/week	02	Total practical hours	28
CIE: 50 marks	SEE: 50 marks	SEE: 3 hours	
Prerequisite: -			

Course Objectives:

The objective of the course is to

- Apply the knowledge of Industrial and production engineering.
- Expose the students to industrial environment
- Develop analytical ability of the students.

Course contents	**Practical Hours**
Each candidate must complete the prescribed number of days of practical training to the satisfaction of the concerned department. This training will be arranged in the summer vacation following the 6th semester. Training should be carried out preferably in industry or R&D institutions in India. One faculty will act as coordinator for practical training. Training in academic institutions is discouraged. The department will appoint a training supervisor for each student. The supervisor is expected to keep contact with the assigned students through e-mail and /or telephone. The students will be required to get their training plan reviewed by their supervisor within the first week and report their progress on weekly basis. Supervisor, if desires, may visit the organization. Visits within the country will be supported by the institute.	**28**

Question paper pattern: *1. Write up with necessary programs = 15 Marks* *2. Execution = 25 Marks* *3. Oral = 10 Marks* *Total = 50 Marks*	

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IPMP69	CO1	Demonstrate the skill to form and work in group to perform the selected task.
	CO2	Execute the selected task as per the schedule
	CO3	Apply or upgrade the technical skills.
	CO4	Execute the skill to choose better option among technical alternatives
	CO5	Communicate technical information to others effectively by means of formal presentations, drawings and reports.

Course title: Essentials of IT			
Course code:	**19IP631**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	

Prerequisite:
- Computer Basics
- 'C' Programming

Course Objectives:
The main objective of this course is to add a value to the employ ability of the students in the field Information Technology.

Modules	**Teaching hours**
Module I **Introduction to Computer Systems**: Basics of computer systems - Various hardware components - Data storage and various Memory units -	**08**

Central Processing Unit - Execution cycle - Introduce to software and its classifications. **Operating system concepts**: Introduction – Memory management - Process management – Inter process Communication – Deadlocks - File management - Device management.	
Module II **Problem solving Techniques**: Introduction to problem solving - Computational problem and it's classification - Logic and its types. **Introduction to algorithms**: Implementation of algorithms using flowchart - Flowcharts implementation through RAPTOR tool. Searching and sorting algorithms.	**08**
Module III **Introduction and classification to Data Structures**: Basic Data Structures - Advanced Data Structures. **Programming Basics**: Introduction to Programming Paradigms and Pseudo Code -Basic programming concepts - Program Life Cycle - Control Structures.	**08**
Module IV **Introduction and Demonstration** of 1-D Array and 2-D Array - Searching and Sorting techniques - Demonstration Concept of memory references in arrays –Strings - Compiler Concepts - Code Optimization techniques. **Structured Programming:** Functions – Structures - File Handling - Introduction to Software Development Life Cycle - Industry Coding Standards and Best Practices - Testing and Debugging - Code Review	**09**
Module V RDBMS- data processing – the database technology – data models-ER modeling concept –notations – Extended ER features-Logical database design – normalization. SQL – DDL statements – DML statements – DCL statements-Joins - Sub queries – Views-Database design Issues.	**09**
Question paper pattern: **CIE:** Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions. **SEE:** There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.	
Text Books: 1. C Programming by – Balaguruswamy 2. Fundamentals of Database Systems by – Alamsri and Navathe 3. Data structures through C – S.K.Srivastava and Deepali Srivastava 4. Computer Fundamentals – B.Ram	

Course outcomes: **On completion of the course, the student will have the ability to:**		
Course Code	**CO #**	**Course Outcome (CO)**
19IP661	**CO1**	*Work with computer, its parts, software, operating systems and various devices attached to computer.*
	CO2	Solve computational problems by applying problem solving technique and using RAPTOR tool.
	CO3	*Write pseudo code for programs and understand various data structures and their usage.*
	CO4	Write programs for one and two dimensional arrays involving searching and sorting based on structure programming concept.
	CO5	Use database technology, design database and write queries to databases using SQL.

Course title: Artificial Intelligence			
Course code:	19IP632	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite:			

Course Objectives:

- *To make the students aware of the concepts and types of AI.*
- *To make the students capable of representing the knowledge and how to acquire knowledge.*
- *To make the students aware of inference engine and its usage and also about enhancement and validation of expert rules.*
- *4. To make student aware of Genetic Algorithm, Fuzzy Logic and Neural Networks and applications of AI.*

Modules	**Teaching hours**
Module I **Introduction:** An overview of Artificial Intelligence (AI), Data Processing (DP), Management Information System (MIS), Decision Support System (DSS). Algorithms, heuristics, Express system concepts, origin of expert system.	**7**
Module II **Types of Expert Systems:** Early, Recent, future expert systems.	**9**

Knowledge Representation: Components, KB, Consideration, Alternative modes, representation via rule based system.	
Module III **Knowledge Acquisition:** KA & domain expert, KA via rule induction, software for rule induction. **Inference Engine:** Role, Search strategies, forward chaining, backward chaining, algorithms, mixed modes, illusions.	**10**
Module IV **Enhancement & Validation:** Sources of uncertainties, approaches, bridges in expert system, explanation & justification, validation rules. **Genetic Algorithm, Fuzzy Logic and Neural Networks:** Basic Concepts.	**5**
Module V Case studies on genetic algorithm, Fuzzy Logic and Neural Networks **Applications of AI:** Applications of AI in the field Mechanical, Automobile, Aerospace etc.	**7**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. Introduction to Expert System, James P. Iginizio, McGraw Hill.

Reference Books:

1 Introduction to Artificial Intelligence & Expert System, D. W. Patterson, Prentice Hall.
2 Principle of Foundry technology, P. L. Jain, Tata McGraw Hill.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IP663	**CO1**	Identify problems that are amenable to solution by AI methods
	CO2	Formalize a given problem in the language/framework of different AI methods.

	CO3	Implement basic AI algorithms (e.g., standard search algorithms or resolution).
	CO4	Design and carry out an empirical evaluation of different algorithms on a problem formalization and state the conclusions that the evaluation supports.
	CO5	SummarizeApplications of AI in the field Mechanical, Automobile, Aerospace etc.

Course title: Theory of Metal Forming

Course code:	19IP633	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	

To study the basic concepts of metal forming techniques and to develop force calculation in metal forming process.

Module 1 Theory of plastic deformation – Yield criteria – Tresca and Von-misses – Distortion energy – Stress strain relation – Mohr's circle representation of a state of stress – cylindrical and spherical co-ordinate system – upper and lower bound solution methods – Overview of FEM applications in Metal Forming Analysis	
Module 2 Analysis of plastic deformation in Forging, Rolling, Extrusion, rod/wire drawing and tube drawing. Effect of friction – calculation of forces, work done – Process parameters, equipment used – Defects –applications – Recent advances in Forging, Rolling, Extrusion and Drawing processes – Design consideration in forming.	
Module 3 Formability studies – Conventional processes – H E R F techniques – Super plastic forming techniques – Hydro forming – Stretch forming – Water hammer forming – Principles and process	
Module 4 Overview of P/M technique – Advantages – applications – Powder preform forging – powder rolling –	

Tooling, process parameters and applications. - Orbital forging – Isothermal forging – Hot and cold isostatic pressing – High speed extrusion – Rubber pad forming – Fine blanking – LASER beam forming	
Module 5 Surface treatment for drawing, sheet metal forming, Extrusion, hot and cold forging. Processing of thin Al tapes – Cladding of Al alloys – Duplex and triplex steel rolling – Thermo mechanical regimes of Ti and Al alloys during deformation – Formability of welded blank sheet –Laser structured steel sheet - Formability of laminated sheet.	

	CO1	
	CO2	
	CO3	
	CO4	
	CO5	

Course title: Human Resources Management			
Course code:	**19IP661**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	

Course Objectives:

- To develop the knowledge, skills and concepts needed to resolve actual human resource management problems or issues.
- To identify the human resources needs of an organization or department.
- To Conduct a job analysis and produce a job description from the job analysis.
- To analyze various recruitment / selection strategies, training methods and performance evaluation approaches in order to identify which is better applicable for a given organization

- To provide understanding of the framework within which an organization operates and how it affect the management of people
- To distinguish how an organization establishes reward, motivational and developmental schemes
- To provide a clear underrating of features and issues related to international HRM

Modules	Teaching hours
Module I Introduction: Evolution of HRM, Objectives, Functions and Policies. Human Resource Planning process, job analysis job description and job specification Recruitment and Selection: Sources of Man power, Advertisement Selection procedure Components of Selection procedure : application form, Written Tests, Group Discussions, Interview – Different methods, procedure guidelines, Graphology	**7**
Module II Training and Development: Identification of Training needs, objectives Different methods Training Evaluation, Executive Development Training as a tool for continuous growth of Individual and Organizers.	**9**
Module III Induction procedure, transfers, promotion, exit interview. Motivation: Motivation, The hierarchy of need theory, Theory X and theory Y, Two factors theory-Hygiene and Motivator factors, Financial and Non-financial Motivators Communication: communication function its significance, barriers in communication process, effective communication	**9**
Module IV International HRM: Managing across borders, International staffing, Skills of a global manager, Non verbal communication, Dual career couples, Mentoring Industrial Disputes and Settlement: Industrial disputes, Indian Industrial Disputes act, Settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Industrial tribunal, Adjudication	**9**

Module V Performance Appraisal: Meaning, need, purpose and contents of performance appraisal, Methods – traditional and modern methods, Advantages and limitations of different methods, Personal Counselling based on Annual Confidential Reports. Case Studies : on Staffing, Training, Performance evaluation Motivation and Industrial disputes (At least Two)	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Text books:

1. Dr. K Ashwathappa-Human Resources Management, Tata McGraw Hill, 4th Edition, 2005.
2. P Subba Rao- Human Resources Management and Industrial Relations Himalaya publishing house
3. Hersey and Blanchard -Management of Organizations Behaviour, Prentice Hall of India, 10th Edition – 2012.
4. Arun Monappa -Industrial Relations, TMH, ISBN – 0-07-451710-8, 2007

Reference Books:

1. Decenoz and Robbins -Personnel / Human resource Management, PHI, 2002.
2. C.B Mamoria -Management of Human Resources, Himalaya Publication House, 2003.
3. Jain -Industrial Acts, TMH Publications, 2004.

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	Execute the basic human resource functions, perform HRP and understand difference between domestic and international HRM
	CO2	Develop the right type of recruitment and selection strategy for a given organization

19IP651	**CO3**	Design and develop the appropriate training program for the employees of an organization after analyzing the training needs
	CO4	Apply the basics of creating healthy working environment and work culture in which employee contribute with their full potential
	CO5	Measure and monitor people's performance in an organization
	CO6	exploit the possibilities employing leadership qualities and also effective communication in managing human resource in an organization

Course title: Facility Planning			
Course code:	**19IP642**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite			

Course Objectives:

This is an introductory course on facilities planning with emphasis on the analysis, design and evaluation of manufacturing facilities and material handling systems.

Students completing this course will be able to understand:

- *The concepts of planning, locating and designing efficient facilities*
- *Material handling systems and their applicability*

Modules	**Teaching hours**
Module I *Introduction: Introduction to facilities planning, plant layout, material handling and their interrelationships,* Plant location-Definition of plant, importance of location, locational problems, factors affecting location of plant, factors in heavy manufacturing, light industry, warehouse and retail locations, rural vs. urban location, Qualitative and Quantitative analysis, theories of location, Single and Multi-facility problem, analytical problems	**9**
Module II Plant layout: Definition of plant layout, Objectives of a good layout,	**9**

factors affecting plant layout, principles of a good layout, types of layout like product layout, process layout, fixed position layout, cellular layouts and hybrid layouts. Types of flow patterns, nature of industries, qualitative and quantitative aids for creating layouts, P-Q chart, relationship chart (REL), introduction to systematic layout planning Line balancing.	
Module III Computerized layout planning: evaluation of a layout, computerizes layout, various techniques like CRAFT, CORELAP, COFAD, ALDEP and PLANET- procedure, merits and demerits	**8**
Module IV Storage systems: Dedicated and randomized storage location policy, space requirements, sizing on the basis of service levels and costs. Plant and ancillary services:planning for plant and ancillary services-space requirements, location and its features	**8**
Module V *Material Handling: Concept of material handling, principles of material handling, Importance of material Handling, classification of MH equipments, constructional features of MH equipments, factors affecting selection of MH systems and equipments, conveyors, cranes, hoists and industrial trucks, application considerations.* Safety in plant: importance of safety, Industrial safety policy and OSH certification	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Reference Books:

1.Francis and White, Facility Layout and Location, PHI

2.Tompkins and White, Facility Planning, John Wiley & Sons

3.Agarwal, Plant Layout and Material Handling,

4.James Apple- Plant Layout & Material Handling, the Ronalt press

5.RichardMuther, Practical Plant Layout, McGrawHill

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)

19IP653	**CO1**	*Select appropriate location for establishing industrial plants by applying the concepts of location selection*
	CO2	Solve facility design problems by analyzing layout models and design algorithms
	CO3	*Solve facility location problems by applying analytical facilities location methods*
	CO4	Design and analyze material handling systems in the warehousing, manufacturing and supporting operations.
	CO5	develop algorithms for new planning layouts for typical applications in the industries

Course title: Facility Planning			
Course code:	**19IP642**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite			

Course Objectives:

This is an introductory course on facilities planning with emphasis on the analysis, design and evaluation of manufacturing facilities and material handling systems.

Students completing this course will be able to understand:

- *The concepts of planning, locating and designing efficient facilities*
- *Material handling systems and their applicability*

Modules	**Teaching hours**
Module I *Introduction: Introduction to facilities planning, plant layout, material handling and their interrelationships,* Plant location-Definition of plant, importance of location, locational problems, factors affecting location of plant, factors in heavy manufacturing, light industry, warehouse and retail locations, rural vs. urban location, Qualitative and Quantitative analysis, theories of location, Single and Multi-facility problem, analytical problems	**9**
Module II Plant layout: Definition of plant layout, Objectives of a good layout, factors affecting plant layout, principles of a good layout, types of layout	**9**

like product layout, process layout, fixed position layout, cellular layouts and hybrid layouts. Types of flow patterns, nature of industries, qualitative and quantitative aids for creating layouts, P-Q chart, relationship chart (REL), introduction to systematic layout planning Line balancing.	
Module III Computerized layout planning: evaluation of a layout, computerizes layout, various techniques like CRAFT, CORELAP, COFAD, ALDEP and PLANET- procedure, merits and demerits	**8**
Module IV Storage systems: Dedicated and randomized storage location policy, space requirements, sizing on the basis of service levels and costs. Plant and ancillary services:planning for plant and ancillary services-space requirements, location and its features	**8**
Module V *Material Handling: Concept of material handling, principles of material handling, Importance of material Handling, classification of MH equipments, constructional features of MH equipments, factors affecting selection of MH systems and equipments, conveyors, cranes, hoists and industrial trucks, application considerations.* Safety in plant; importance of safety, Industrial safety policy and OSH certification	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Reference Books:

1.Francis and White, Facility Layout and Location, PHI

2.Tompkins and White, Facility Planning, John Wiley & Sons

3.Agarwal, Plant Layout and Material Handling,

4.James Apple- Plant Layout & Material Handling, the Ronalt press

5.RichardMuther, Practical Plant Layout, McGrawHill

Course outcomes:
On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)

19IP653	**CO1**	*Select appropriate location for establishing industrial plants by applying the concepts of location selection*
	CO2	Solve facility design problems by analyzing layout models and design algorithms
	CO3	*Solve facility location problems by applying analytical facilities location methods*
	CO4	Design and analyze material handling systems in the warehousing, manufacturing and supporting operations.
	CO5	develop algorithms for new planning layouts for typical applications in the industries

MATERIALS MANAGEMENT

Subject Code : 19IP 653	**Credits : 04**	
C.E.E. : 50 Marks	**S.E.E. : 50 Marks**	**S.E.E : 03 Hrs. Duration**
Hours/Week : 3 hrs. (Theory) + 2 Hrs (Tutorials)		**Total Hours : 42**

MATERIALS MANAGEMENT

Subject Code : 19IP643 **Credits : 04**

Hours/Week : 3 hrs. (Theory) **Total Hours : 42**

C.E.E. : 50 Marks S.E.E. : 50 Marks S.E.E : 03 Hrs. Duration

Course objective: ***The course will expose you to the extent at which the huge investment on materials (raw materials, parts and components, work-in-process and finished goods)***

can be effectively and efficiently managed to improve the quality of product, reduce inventory order time, production cycle time and providing prompt and quality customers' services.

Upon completion of this course you should be able to:

- ***define materials management and state its relevance to firm's profit maximization objective***
- ***explain and demonstrate the basic understanding of purchasing process, policies and procedures***
- ***explain forecasting methods and why materials forecast must be done***
- ***explain the roles of inventory management, how to determine order quantity using inventory models***
- ***discuss how materials can be stored.***

Section A

Introduction: Dynamics of Material management, Material management at micro-level. Material management at macro-level Inventories of materials, Total concept, definition, A brief history of development, An overview. System approach to materials management, The process of management and materials function, The materials function, Interfaces, An overview of system concept, Benefits of integrated system approach.

05 Hrs

Forecasting, Objectives, and the Materials Organization: System design, Integral control of flow of materials, Forecasting and Planning, Forecasting methods, Objectives of Materials management, Organization of Material Management, Environmental change, The development of functional organization, A question of structuring, leadership style.

05 Hrs

Materials Planning: Making the materials plan work, the materials cycle and flow control system, materials budget.

Purchasing: Purchasing principles, procedures and practices, Fundamental objectives of purchasing, scope, responsibility and limitations, Sources of supply and Supplier selection, purchasing policy and

procedures, Purchase budgets and Statistics. **05Hrs**

Purchasing in Materials Management: System concept, Price determination, Price forecasting, Price – Cost Analysis, The Learning Curve, Negotiations, Reciprocity, Cost – Plus Contracts, Hedging, Forward buying, Buying Ethics, Principles and Standards of purchasing, Make-or-Buy, information, Documentation and purchasing library, Legal aspects of purchasing, Law of agency, Law of contract, Legal status of buyer, Warranties and conditions, Right of inspection, Right of rejection, Vendor-Vendee relations, Vendor development. **06 Hrs**

Section B

Purchasing of Capital Equipment, Plant and Machinery: Responsibility and decision, Purchasing V/s Leasing.

International Buying and Import Purchasing: Industrial needs, Import procedure and documents, Classification of stores, Categories of importers, Import application, Basis licensing, Import purchasing procedures, Letter of credit, Income-tax clearances, Customs tariff, Registration of licenses at post.
05 Hrs

Inventory Management -I: Definition of inventory, The need for inventory and its management, Functions of inventory management, Types of inventories, Inventory control, Cost elements, Economic order quantity, Standard deterministic EOQ models, Max-Min system,
05 Hrs

Inventory Management -II Inventories and demand uncertainty, Determining safety stock, Q-System, Effect of quantity discounts, P-System, Optional replenishment system, Demand forecasting, Demand and uncertainty and risk, Store keeping and inventory control, A practical approach, ABC inventory classification, The need for system approach, Material Requirement Planning, Basic Tool, Conclusion.
06 Hrs

Stores Management and Operation: Storage system, Stores location and Layout. Development of storing, Centralization and Decentralization of stores, Standardization and variety reduction, the system, Merits and Demerits of Codification, Materials accounting and materials audit.

Materials Management Information System : MIS – Management and MM, Computer System for MIS and MM. **05Hrs**

REFERENCE BOOKS:

1. Datta A.K. "Materials Management, Procedures, Texts and Cases", Prentice-Hall of India Pvt. Ltd., New Delhi, 2001.
2. Gopalkrishna P. and M. Sundaresan, "Materials Management: An Integrated Approach, Prentice-Hall of India Pvt. Ltd., New Delhi, 1997.

Course title: Non-destructive Testing Methods			
Course code:	19IP651	Credits:	
Teaching hours/week:	3	Total teaching hours:	42
CIE:	SEE:	SEE:	
Prerequisite: Mathematics, Physics& Chemistry			

Course Objectives:

- To enhance the knowledge of students in Quality aspects.
- To make ensure the soundness of components/Equipment and thereby assuring the reliability.
- To impart skills and awareness to the students in various manufacturing/production process specifically allied to quality.
- Provide the information to students about defects in the materials and their causes.

To provide Demo to the students in Four NDT methods

Methods	**Teaching hours**
LIQUID PENETRANT TEST **Overview of the Method** • Course Objectives • Capabilities and Limitations of the Method • Objectives of Testing• Materials and Classification of Liquid Penetrant Techniques **The Liquid Penetrant Process** • Overview of the Process• Procedure of testing • Physical Properties of Penetrant Materials and Factors Affecting their Operation **PT Material Properties and Parameters**	**8**

• Penetrant Material Performance Characteristics• Penetrant Sensitivity • Detection, Perception and the Human Eye• The Physical Properties of the "Ideal" Penetrant• Physical Properties of Emulsifiers• Developers and Sensitivity• Special Purpose Materials and their Application **Discontinuities and Classifying Indications** •Origin and Nature of Discontinuities • The Inspection Process: Interpretation and Evaluation • Penetrant Indications •Examples of Indications	
MAGNETIC PARTICLE TEST METHOD **Course Objectives** • Capabilities and Limitations of the Method • Objectives of Testing • The Magnetic Particle Testing Process **Basic Principles of Magnets and Magnetic Fields** • Basic Principles of Magnetism• Origin of Magnetic Force • Atoms and Domains • Magnetic Behaviours: Diamagnetism, Paramagnetism, and Ferromagnetism • Magnetic Sources• Characteristics of Magnetic Flux Fields **Magnetic Properties – the Hysteresis Loop** • Permeability• Reluctance• Residual Magnetism• Retentivity • Coercive Force• Relationship of Magnetic Properties • The Hysteresis Loop **Effects of Discontinuities on Magnetic Fields** • Detecting Discontinuities• Magnetic Field Distortion **Applying Magnetic Fields** • Circular and Longitudinal Magnetic Fields• Test Materials: Magnetic Particle Media **Types of Currents for Producing Magnetic Fields** • DC & AC and their calculations • Rectified Current (HWDC and FWDC) **Principles of Demagnetization** • AC /DC Demag Techniques • Reasons to Demag Equipment **Equipment Selection Criteria** • Stationary Equipment and Accessories• Mobile Equipment and Accessories• Portable Equipment and Accessories The Nature and Origin of Discontinuities **Sources of Discontinuities** • Inherent Discontinuities• Processing Discontinuities • In-service Discontinuities	**8**
ULTRASONIC TEST METHOD **Principles of Ultrasonics** • Equipment • Testing techniques • Calibration • Evaluation of Base-Material Product Forms(Rolled, Extruded,Forged,castings and	**8**

Composite structures and also other products such as Rubber, Glass etc **Evaluation of Weldments** • Welding processes • Weld geometries • Welding discontinuities • Origin and typical orientation of discontinuities• Response of discontinuities to ultrasound **Discontinuity Detection** • Sensitivity to reflections• Resolution • Determination of discontinuity size• Location of discontinuity• Evaluation	
RADIOGRAPHIC TESTING METHOD • Nuclear Physics-Interaction of Radiation with Matter • Shielding, Radiation Detectors, Biological Effects• Radiation Protection, Basic Rules & Techniques• Sources of Radiation and their characteristics• Film Radiography• Film Processing• Inspection Techniques and Procedures• Sensitivity & Definition, I.Q.Is, Other Accessories• Types of Discontinuities • Techniques in radiography • Manufacturing processes and discontinuities • Interpretation of Radiographs	**8**

Question paper pattern:
CIE:

SEE:

Text books:

1. Allgaier, Michael W. (tech. ed.), Ness, Stanley (tech. ed.), McIntire, Paul (ed.), and Moore, Patrick O. (ed.), Non-destructive Testing Handbook, Volume 8: Visual and Optical Testing, American Society of Non-destructive Testing,
2. Golis, Matthew, An Introduction to Non-destructive Testing. American Society of Non-destructive Testing,

Reference Books:

1. Practical Non-destructive Testing by Baldev Raj, T. Jayakumar, M. Thavasimuthu
2. Understanding How Components Fail, Wulpi, Donald, ASM International

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
	CO1	**Understand** different manufacturing/Production process and appropriate methods/techniques used to detect and evaluate flaws in materials and objects without destroying the specimen at hand

	CO2	**Recognize** the challenges with regard to the quality in material testing and analysing the failures of the structure or component in due course of their application
	CO3	**Understand** different terminologies in quality field and attributing their characteristics during workman ship

Course title: Supply Chain Management			
Course code:	**19IP641**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite - -			

Course Objectives:
To expose students to latest techno managerial theory for understanding the basics and advanced managerial efforts to be put in real industries across the globe with a vision to enhance the quality of customer without compromising for the price.

Modules	**Teaching hours**
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.	**9**
Module II Obstacles for achieving strategic fit, 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.	**8**
Module III Network design in Uncertain Environment. Impact of Uncertainty DCF analysis, evaluating network design decisions using decision trees. Supply Economies of Scale in Chain: Role of inventory in supply chain, economies of scale to exploit fixed costs and quantity discounts, managing multi echelon cycle inventory.	**9**
Module IV Transportation: Factors affecting transportation decision, Modes of transportation and their characteristics, designing transportation networks,	**8**

trade-off in transportation design international transportation. Revenue Management: Multiple customer segments.	
Module V 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.	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Reference Books:

1. 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 student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IP654	**CO1**	*Explain supply chain management, supply chain performance.*
	CO2	Apply sc strategic fit and designing aspects of sc network distribution
	CO3	Analyze uncertain environment in sc and economies of scale
	CO4	Explain transportation aspects and revenue management
	CO5	Explain types of assets and coordination in SCM, IT & e commerce

Course title: Supply Chain Management			
Course code:	**19IP661**	Credits:	03
Teaching hours/week:	03	Total teaching hours:	42
CIE: 50 marks	SEE: 50 marks	SEE: 03 hours	
Prerequisite - -			

Course Objectives:
To expose students to latest techno managerial theory for understanding the basics and advanced managerial efforts to be put in real industries across the globe with a vision to enhance the quality of customer without compromising for the price.

Modules	Teaching hours
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.	**9**
Module II Obstacles for achieving strategic fit, 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.	**8**
Module III Network design in Uncertain Environment. Impact of Uncertainty DCF analysis, evaluating network design decisions using decision trees. Supply Economies of Scale in Chain: Role of inventory in supply chain, economies of scale to exploit fixed costs and quantity discounts, managing multi echelon cycle inventory.	**9**
Module IV Transportation: Factors affecting transportation decision, Modes of transportation and their characteristics, designing transportation networks, trade-off in transportation design international transportation. Revenue Management: Multiple customer segments.	**8**
Module V 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.	**8**

Question paper pattern:
CIE: Question paper will be for 20 consisting of two questions carrying 10 marks each. Students have to answer both the questions.
SEE: There will be two questions from each module and students have to answer 5 questions selecting at least one question from each module. Each question will carry 20 marks and consist of a maximum of 3 sub-questions.

Reference Books:

4. 1 Sunil Chopra & Peter Meindl - "Supply chain Management" Pearson education
5. Martin Christopher - "Introduction to Supply Chain Management"
6. B.S.Sahay " Supply Chain Management" Mcmillan

Course outcomes:

On completion of the course, the student will have the ability to:

Course Code	CO #	Course Outcome (CO)
19IP641	CO1	*Explain supply chain management, supply chain performance.*
	CO2	Apply Supply Chain strategic fit and designing aspects of Supply network distribution
	CO3	Analyze uncertain environment in Supply Chain and economies of scale
	CO4	Explain transportation aspects and revenue management
	CO5	Explain types of assets and coordination in SCM, IT & e commerce