



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19

DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

SCHEME FOR THE ACADEMIC YEAR 2016-17

V SEMESTER B.E. INDUSTRIAL ENGINEERING AND MANAGEMENT

Course Code										Course Title	Teaching Department	Credit Hours/week					Contact Hrs/Wk
												L	T	P	S	Total	
1	6	I	M	5	D	C	C	I	M	COMPUTERS IN MANUFACTURING	IEM	3	0	1	2	6	5
1	6	I	M	5	D	C	O	P	R	OPERATIONS RESEARCH	IEM	3	1	0	0	4	4
1	6	I	M	5	D	C	Q	A	R	QUALITY ASSURANCE & RELIABILITY	IEM	3	0	1	2	6	5
1	6	I	M	5	D	C	E	N	E	ENGINEERING ECONOMY	IEM	2	1	0	0	3	3
1	6	I	M	5	D	C	F	P	D	FACILITIES PLANNING AND DESIGN	IEM	3	0	0	0	3	3
1	6	I	M	5	D	E				ELECTIVE- I	IEM	3	0	0	0	3	3
<b>Total</b>											<b>17</b>	<b>2</b>	<b>2</b>	<b>4</b>	<b>25</b>	<b>23</b>	

L-Lecture Hours/Week, 1 Credit=1hour, P-Practical Hours/Week, 1 Credit=2Hours,

T-Tutorial Lecture Hours/Week, 1 Credit =2 hours, S-Self-Study to be added to contact Hrs. /Week

CIE-Continuous Internal Evaluation, SEE-Semester End Examination (of 3 hours duration)

16IM5DEAPT	Applied Thermodynamics
16IM5DEPDD	Product Design & Development
16IM5DEOBE	Organizational Behavior
16IM5DE TOM	Theory of Machines
16IM5DETEG	Tool Engineering

ELECTIVE-I



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>COMPUTERS IN MANUFACTURING</b>	<b>Course Code</b>	<b>16IM5DCCIM</b>
<b>Credits</b>	<b>06</b>	<b>L-T-P-S</b>	<b>3-0-1-2</b>

**Prerequisites: Nil**

**UNIT-1**

**INTRODUCTION:** Role of computers in design and manufacturing. Influence of computers in manufacturing environment. Product cycle in conventional and computerized manufacturing environment, Introduction to CAD and CAM, Advantages and disadvantages of CAD and CAM .Application of computers in design process. **06Hrs**

**UNIT- 2**

**COMPUTER GRAPHICS:** Software configuration of a graphic system, functions of a graphics package, construction of geometry, wire frame and solid modeling, geometric 2D homogeneous transformation with simple problems. **06Hrs**

**UNIT- 3**

**INTRODUCTION TO COMPUTER NUMERICAL CONTROL:** Fundamental concepts of Numerical control, Numerical control modes, Numerical control elements, open and closed loop systems, advantages and limitations.

Drives of CNC system: Hydraulic drives, DC Motors, Stepper motors. Adaptive control systems: ACO and ACC systems.

Turning tool geometry, modular tooling system, milling tooling systems, tool presetting, automatic tool changers (ATC), Tool magazines. **10Hrs**

**UNIT- 4**

**PROGRAMMING OF CNC MACHINE TOOLS:** Introduction to part programming, co-ordinate systems, dimensioning, axes and motion nomenclature, structure of a part program, tool radius and length compensation, subroutines, canned cycles. Manual part programming, APT programming, writing programs using G& M codes, and by APT Language. **12Hrs**



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**UNIT- 5**

**INTRODUCTION TO ROBOTICS:** Introduction, robot configuration, robot motions, Programming the robots, Robot programming methods, End effectors, work cell control and interlocks Robot sensors, Robot applications. **06Hrs**

**UNIT-6**

**LABORATORY EXPERIMENTS:**

1) CNC Turning: Writing and simulation of manual part program using G & M codes for Simple parts including turning, taper turning, and shoulder turning and cutting. Use of radius compensation, canned cycles. (4 programs)

Demonstration of one CNC program

2) CNC Milling- Writing and simulation of manual part program using G & M codes for simple parts including Surface milling, Edge milling, Contour milling, Drilling, and pocket milling. Tool length compensation, use of canned cycles.(4 programs)

Demonstration of one CNC program

3) Programming of Robots by lead through and off line methods. Use of robot to pick and place, stacking of objects in increasing or decreasing order. (4 programs)

**Assessment of Self Study:**

Student group of 5 members to submit following assignments in CNC & Robotics lab at the end of the course.

1. Writing a CNC program for a part drawing.
2. Simulating the CNC program using G & M codes manual part programming software.
3. Loading of CNC program on to the machine.
4. Executing the program on CNC Machine to prepare the part.
5. Checking the model with respect to dimensions and accuracy of the contours, surface finish etc.
6. Documentation, presentation and report submission.

**Text Books:**

- 1) **Computer Control of Manufacturing Systems**, Yorem Koren ,McGraw Hill, 1983  
ISBN-0-07-Y66379-3,
- 2) **CAD/CAM**, Mikell P. Grover, Emory, W. Zimmers Pearson Education Inc.,2003  
ISBN-81-203-0402-0,
- 3) **CAD/CAM Principle and Applications**, PN Rao, Tata McGraw Hill, 7<sup>th</sup> Reprint, 2007



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

ISBN-0-07-058373-0,

**References:**

- 1) **Principle of interactive Computer Graphics**, Newman and Sproull, TMH, 2<sup>nd</sup> Edition, 1978, ISBN13-978-0070463-387
- 2) **CAD/CAM**, Ibrahim Zeid, THM, 1991, ISBN-00707-28577,
- 3) **Numerical control and CAM**, Kundra, Rao and Tiwary, Tata McGraw Hill Publishing Co., New Delhi, 1987, ISBN 13-978 00 745 17 406,
- 4) **Mechatronics HMT** – Tata McGraw Hill publishing company, ISBN 0-07-462127-5
- 5) **CAD/CAM/CIM** – P. Radhakrishnan, S. Subramanyan and Raju – New Age International Publishers, 2009 Edition, ISBN-13-978-8122422368

**Online Resource :** [www.nptel.ac.in](http://www.nptel.ac.in)

**Scheme of Examination:** To set one question each from Units **1, 2 & 5** and two questions each from Units **3 & 4**.

**Course Outcomes**

<b>CO1</b>	Is able to understand the role of computers in design and manufacturing, computerized manufacturing environment, CAD and CAM, their advantages and will acquire the knowledge of hardware of computer systems used in CAD/CAM
<b>CO2</b>	Is able to understand, the various functions of graphic packages and will be in a position to use the computers for the engineering design applications. Students will be knowing the concepts of geometrical modeling, study the various types of geometrical models and their possible applications and limitations
<b>CO3</b>	Able to ascertain about the development and principles of numerical control technology, understand the basics of CNC hardware, Control systems, CNC tooling and work holding devices.
<b>CO4</b>	Is able to understand the different types of CNC programming, requirements of programming, structure of a program and other related topics. The students will have practical experience in writing CNC programs and also operating of CNC machines
<b>CO5</b>	Is able to empathize a Robot – types of robots, configuration, robot motions, end effectors, robot programming methods, and their applications.

**ASSESSMENT:**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>OPERATIONS RESEARCH</b>	<b>Course Code</b>	<b>16IM5DCOPR</b>
<b>Credits</b>	<b>04</b>	<b>L-T-P-S</b>	<b>3-1-0-0</b>

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.

**Prerequisites: Nil**

**UNIT-1**

**INTRODUCTION:** OR definition, scope, phases, limitations, models, applications and advantages of OR **02Hrs**

**LINEAR PROGRAMMING:** Definition, mathematical formulation, standard form, graphical method: feasible, infeasible, multiple solution, unbounded solution and simplex method: feasible, infeasible, multiple solution, unbounded solution, introduction to duality in LPP with simple problems **10 Hrs**

**UNIT - 2**

**TRANSPORTATION PROBLEM:** Formulation of transportation model, basic feasible solution using different methods, optimal solutions, degeneracy in transportation problems, unbalanced transportation problem **05Hrs**

**ASSIGNMENT PROBLEM:** Formulation, balanced, unbalanced and maximization assignment problem, travelling salesman problem using Hungarian method **05Hrs**

**UNIT - 3**

**QUEUING THEORY:** Queuing system and their characteristics, analysis of Markovian queues, M/M/1, M/M/K queuing system **05Hrs**

**UNIT - 4**

**PROJECT MANAGEMENT USING NETWORK ANALYSIS:** Network construction, determination of critical path and duration, floats using CPM. PERT-Estimation of project duration, Variance and crashing of projects **10Hrs**

**UNIT - 5**

**GAME THEORY:** Two persons - zero sum game, games with and without saddle point, graphical solution, dominance property **05Hrs**

**Text books:**

- 1) **Operations Research and Introduction**, Taha H A, Pearson Education, 9th Edition, 2014
- 2) **Introduction to Operation Research**, F K Hiller and Liberman, McGraw hill Education Pvt. Ltd, 9th Edition, 2011



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

- 3) **Operations Research –Principles and practice**, Philips Ravindaran and Soleberg, Wiley Publication, 2nd Edition, 2007

**Reference books:**

- 1) **Operations Research**, S D Sharma, KedarNath, Ram Nath Publication, 2014
- 2) **Operations Research**, Kanthiswarup and others, Sultan Chand and sons, 2014
- 3) **Operations Research Problems and Solutions**, J K Sharma, McMillan Publishers, 3<sup>rd</sup> Edition, 2009.
- 4) **Operations Research**, P K Gupta and Hira, S Chand Publications, 2007.

CO1	To be able to understand the fundamental concept and approach of linear programming appropriate to the further study of operations research and identify problems in real life
CO2	To be able to recognize and optimize the transportation and assignment problems
CO3	To be able to recognize and solve Queuing theory problems
CO4	To be able to use network planning procedures for solving logistics problems
CO5	To be able to recognize and solve Game theory problems

**Online Reference:** [www.nptel.ac.in](http://www.nptel.ac.in)

**Course Outcomes**

**Scheme of Examination:** Each question from each unit and internal choice from **unit-1** and **unit-2**

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>QUALITY ASSURANCE AND RELIABILITY</b>	<b>Course Code</b>	<b>16IM5DCQAR</b>
<b>Credits</b>	<b>06</b>	<b>L-T-P-S</b>	<b>3-0-1-2</b>

**Prerequisites: Nil**

**UNIT-1**

**INTRODUCTION TO QUALITY:** Definition of Quality, Quality function, Dimensions of Quality, Quality Engineering terminology, Brief history of quality methodology, statistical methods for quality improvement, Quality costs – four categories costs and hidden costs. Brief discussion on sporadic and chronic quality problems, Introduction to Quality function deployment.  
**06Hrs**

**UNIT- 2**

**QUALITY ASSURANCE:** Definition and concept of quality assurance, departmental assurance activities. Quality audit concept, audit approach etc. structuring the audit program, planning and performing audit activities, audit reporting, ingredients of a quality program.  
**04Hrs**

**STATISTICAL PROCESS CONTROL:** Introduction to statistical process control—chance and assignable causes variation. Basic principles of control charts, choice of control limits, sample size and sampling frequency, rational subgroups. Analysis of patterns of control charts. Case Studies on application of SPC, Process capability—Basic definition and six sigma concept of process capability, Seven QC tools.  
**07 Hrs**

**UNIT- 3**

**CONTROL CHARTS FOR VARIABLES:** Controls charts for  $\bar{X}$  and Range statistical basis of the charts, development and use of  $\bar{X}$  and R charts, interpretation of charts. Control charts for  $\bar{X}$  and standard deviation(S), development and use of  $\bar{X}$  and S chart. Control charts for individual measurements. Gauge R and R and MSA.  
**06Hrs**

**CONTROL CHARTS FOR ATTRIBUTES:** Controls chart for fraction non- conforming (defectives) development and operation of control chart, brief discussion on variables sample size.



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19

DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

**CONTROL CHART FOR NON-CONFORMITIES (DEFECTS)** – Development and operation of control chart for constant sample size and variable sample size. Choice between variables and attributes control charts. Guidelines for implementing control charts. **06Hrs**

#### UNIT-4

**SAMPLING INSPECTION:** Concept of accepting sampling, economics of inspection, Acceptance plans–single, double sampling. Operating characteristic curves–construction and use. Determinations of average outgoing quality, average outgoing quality level, average total inspection, producer risk and consumer risk, published sampling plans. **06Hrs**

#### UNIT-5

**RELIABILITY AND LIFE TESTING:** Failure models of components, definition of reliability, MTBF, Failure rate, common failure rate curve, types of failure, reliability evaluation in simple cases of exponential failures in series, paralleled and series-parallel device configurations, Redundancy and improvement factors evaluations **05Hrs**

#### UNIT-6

1. To test the Goodness of fit for the given quality characteristic using Uniform distribution
2. To test the Goodness of fit for the given quality characteristic using Binomial distribution
3. To test the Goodness of fit for the given quality characteristic using Poisson distribution
4. To test the Goodness of fit for the given quality characteristic using Normal distribution
5. Conduction of Repeatability and Reproducibility studies for appraiser and instrument using R & R Software
6. Assessing Process Capability of the given manufacturing process using Normal Probability Paper method and process capability indices
7. Experiments on Application of 7 QC Tools as applied to Manufacturing and Service Operations.
8. Construction of control chart for attribute equality characteristic
9. Construction of control charts using Systat Software/Minitab
10. Attribute sampling Plans–Single, Double and multiple sampling plans.
11. Experiments on correlation and Simple linear regressions
12. Experiments on multiple linear regressions
13. Conduction of Design of Experiments Full Factorial approach for the given quality characteristic for machining operations/ catapult/Golf experiment
14. Exercises to demonstrate Taguchi's Orthogonal Array technique through DOE software.

#### Text Books

1. **Introduction to statistical Quality Control-** DC Montgomery, John Wiley and Sons, 7<sup>th</sup> edition ISBN : 978-1-118-32416-5
2. **Quality Planning & Analysis** - J M Juran, Frank M Gryna; Tata Mc Graw Hill, 4<sup>th</sup> edition, ISBN-13: 978-0070393684





**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**Reference Books**

- 1) **Statistical Quality Control** - Grant and Leavenworth, McGraw Hill, 7<sup>th</sup> Edition  
ISBN-13: 978-0078443541
- 2) **Total Quality Management** – NVR Naidu, KM Babu and G. Rajendra –New Age International Pvt.Ltd–2006
- 3) **Total Quality Management**-Kesavan R,I.K International, New Delhi –2007  
ISBN-13: 978-8189866860

**Online Reference:** [www.nptel.com](http://www.nptel.com)

**E-Books :** <http://bookboon.com/en/quality-management-ebook>

**Course Outcomes**

<b>CO1</b>	To understand the underlying reasons for modern quality philosophies & methodologies, as compared with the earlier practices
<b>CO2</b>	To develop abilities to construct control charts and analyze process data generated overtime
<b>CO3</b>	To understand the statistical basis of control charts, process capability analysis and acceptance sampling
<b>CO4</b>	To understand various issues regarding reliability engineering

**Scheme for Examination:** Five questions choosing one each from each unit and **Unit2** and **3** with choice questions

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19  
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

<b>Course</b>	<b>ENGINEERING ECONOMY</b>	<b>Course Code</b>	<b>16IM5DCENE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>2-1-0-0</b>

**Prerequisites:** Nil

### UNIT-1

**INTRODUCTION:** Engineering Decision- Makers, Engineering and Economics, Problem solving and Decision making, Intuition and Analysis, Tactics and Strategy, Decision maze. Practical oriented decision making. **05Hrs**

**INTEREST AND INTEREST FACTORS:** Interest rate, simple interest Compound interest, Cash- flow diagrams, Exercises and Discussion on time value of money. **05Hrs**

### UNIT- 2

**PRESENT WORTH COMPARISON:** Conditions for present worth comparisons, Basic Present worth comparisons, Present worth equivalence, Net Present worth, Assets with unequal lives, infinite lives, Future worth comparison, Pay – back comparison, Exercises, Discussions and problems. **06 Hrs**

### UNIT- 3

**EQUIVALENT ANNUAL WORTH COMPARISONS:** Equivalent Annual Worth Comparison methods, Situations for Equivalent Annual Worth Comparison Consideration of asset life, Comparison of assets with equal and unequal lives, Use of sinking fund method, Annuity contract for guaranteed income, Exercises, Problems. **06 Hrs**

**RATE OF RETURN CALCULATIONS:** Rate of return, Minimum acceptable rate of return, IRR, IRR misconceptions, Cost of capital concepts. **03 Hrs**

**DEPRECIATION:** Causes of Depreciation, Basic methods of computing depreciation charges **03 Hrs**

### UNIT-4

**REPLACEMENT ANALYSIS:** Deterioration, obsolescence, inadequacy, Economic life for cycle replacements **03 Hrs**

**STRUCTURAL ANALYSIS OF ALTERNATIVES:** Identifying and Defining alternatives, IRR analysis of mutually exclusive alternatives, Capital Budget view point, Rankine criteria. **04 Hrs**



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19  
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

**UNIT-5**

**ESTIMATING & COSTING:** Components of costs such as Direct Material Cost, Direct Labour Cost, Fixed, Over – Heads, Factory Costs, Administrative – Over Heads, First Cost, Marginal Cost, Selling price, Estimation for simple components

**EFFECTS OF INFLATION:** Causes, consequences and control of inflation. After tax actual cash flow comparisons, Lease/ Buy decisions **05 Hrs**

**Text Books:**

1. **Engineering Economy**- Riggs J.L. McGraw Hill, 2002, ISBN 0-07912248-5.
2. **Engineering Economy** - Paul Degarmo, Macmillan Pub, Co. 2001, ISBN-00-232 86008.
3. **Engineering Economy** - Naidu, Babu and Rajendra –, New Age International Pvt. Ltd 2008, ISBN-13:4788122419092
4. **Engineering Economics**- R Panner Selvam – PHI Publishing Pvt Ltd, 2<sup>nd</sup> Edition, ISBN; 978-81-203-4837-0 2008

**Reference Books:**

1. **Industrial Engineering and Management**–O. P.Khanna, Dhanpat Rai & Sons 2000, ISBN-818992835X
2. **Financial Management** - I M Pandey, Vikas Publishing House 11<sup>th</sup> Edition, 2002, ISBN- 978932598229
3. **Engineering Economy** -Thuesenh.G. PHI, 9<sup>th</sup> Edition, 2002, ISBN-10:01 30281289

**Online reference:**[www.ntpel.com](http://www.ntpel.com)

E Books :<http://bookboon.com/en/search?q=engineering%20economics&p=1>

**Course Outcome**

<b>CO1</b>	Able to learn Problem solving and Decision making using Intuition and Analysis,
<b>CO2</b>	Know Decision maze, Interest and Interest Factors: time value of money
<b>CO3</b>	Able to use Present Worth Comparison: Future worth comparison, Pay –back comparison, Equivalent Annual Worth Comparison methods, sinking fund method, Rate of Return Calculations to solve complete engineering problems
<b>CO4</b>	To calculate Depreciation charges, Replacement Analysis, Structural Analysis of Alternatives
<b>CO5</b>	Know Estimating & Costing, Effects of Inflation: Lease/ Buy decisions

**Scheme of Examination:** One Question to be set from each unit and Two Questions will be set from the unit 1 & 3. Student will answer any 5 questions selecting at least one from each unit.

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**

**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19  
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

<b>Course</b>	<b>FACILITIES PLANNING AND DESIGN</b>	<b>Course Code</b>	<b>16IM5DCFPD</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT - 1**

**PLANT LOCATION:** Factors influencing plant location, Theories of plant location and Locational Economics.

**PLANT LAYOUT-** Objectives of plant layout, Principles of plant layout, types of plant layout, their merits and demerits. **05 Hrs**

**MATERIAL HANDLING:** Objectives and principles of Material handling, Unit load concept, classification of material handling equipment. **03 Hrs**

**UNIT - 2**

**PLANT LAYOUT DESIGN:** Traditional Layout procedures: Immer's Basic Steps, Nadler's ideal systems approach, Muther's SLP, Apple's Plant Layout Procedure and Reed's procedure, Activity relationship chart, relationship Diagram, Space relationship diagram. **04 Hrs**

**COMPUTERIZED LAYOUT PLANNING:** Classification of Layout Algorithms – distance based Vs. Adjacency based approaches, Pairwise Exchange Method, Graph based method. CRAFT, CORELAP, ALDEP – Input requirements and procedure Introduction to Simulated Annealing and Genetic Algorithm in Layout design. **06 Hrs**

**UNIT - 3**

**SPACE DETERMINATION & AREA ALLOCATION:** Factors for consideration in space planning, receiving, storage, production, shipping, tool room and tool crib, other auxiliary service actions. Establishing total space requirement. The area allocation procedure, the plot plan.

**CONSTRUCTING THE LAYOUT:** Methods of constructing the layout, Evaluation of layout, efficiency indices, presenting layout to management. **08 Hrs**

**UNIT - 4**

**QUANTITATIVE APPROACHES TO LOCATION MODELS:** Facility location models - Single and Multi-facility, Location Models, Location- Allocation Models and numerical problems. **04 Hrs**

**OTHER FACILITIES LAYOUT MODELS:** – Quadratic Assignment Problem, Warehouse layout models. Machine Layout Models and Simple Problems **04 Hrs**



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19  
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

UNIT – 5

**LAYOUT MODELS AND DECISION MAKING:** Conventional Storage models, AS & RS, Simulation Models–simple problems, Introduction to MCDM, MADM approaches-AHP

**06 Hrs**

**Text Books:**

- 1) **Facilities Planning** – James A. Tomkins, John A. White, Yavuz. Bozer, J M.A. Tanchoco, John Wiley and Sons, 2010, ISBN 978-0-470-44404-7
- 2) **Plant Layout and Material handling** - James M Apple., John, Wiley and Sons, 2<sup>nd</sup> Edition, 1977
- 3) **Facility layout and Location** - Francies,R.L. and White,J.A., McGraw Hill 2<sup>nd</sup> edition 1992.

**Reference Books:**

- 1) **Practical layout** - Muther Richard, McGraw Hill-1955.
- 2) **Facilities Design** – Sunderesh Heragu, PWS Publishing Company, ISBN-0-534-95183.
- 3) **Plant Layout Design** - James M Moore, McMilan Co.1962 LCCCN61- 5204.

**Course Outcomes**

<b>CO1</b>	Be able to learn various factors influencing the decision regarding locations of industrial plants, plant layouts and material handling.
<b>CO2</b>	Be able to get an insight into traditional layout procedures, and the how the earlier layout designers used to address the problem. A comparative study is possible after gaining the knowledge regarding computerized layout planning procedures
<b>CO3</b>	Understand the functions that demand space in a layout, services that are to be provided, building constraints, area allocation procedures etc. that in turn help him/her to visit the layout problem in a new light and construct a layout in a step by step manner
<b>CO4</b>	Learn to address the problems in an quantitative manner for problem solving, either taking a single facility or multiple facilities for analysis at any given time and gather a huge data involving a large number of people.
<b>CO5</b>	Be able to understand various layout models developed over a long period of time mathematically. This exposure is important from the point of view of layout.

**Scheme of Examination:**

Five Questions to be set with one question from each unit carrying 20 marks each. **Unit-2 & Unit-3** will have an internal choice.



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**  
**ELECTIVE – I**

<b>Course</b>	<b>APPLIED THERMODYNAMICS</b>	<b>Course Code</b>	<b>16IM5DEAPT</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT- 1**

**GAS POWER CYCLES:** Air standard cycles; Carnot, Otto, Diesel, Dual and Stirling cycles, P-V and T-S diagrams, description, efficiencies. Comparison of Otto, Diesel and Dual cycle and numerical problems **06Hrs**

**UNIT- 2**

**GAS TURBINES:** Classification of Gas Turbines, Analysis of open cycle gas turbine cycle. Advantages and disadvantages of closed cycle. Methods to improve thermal efficiency and numerical problems. **06Hrs**

**UNIT- 3**

**VAPOUR POWER CYCLES:** - Carnot vapour power cycle, drawbacks as a reference cycle. Simple Rankine cycle; description, T – S diagram, analysis for performance. Comparison of Carnot and Rankine cycles. Effects of pressure and temperature on Rankine cycle performance. Actual vapour power cycles. Ideal and practical regenerative Rankine cycles, open and closed feed water heaters. Reheat Rankine cycle and numerical problems. **11Hrs**

**UNIT- 4**

**RECIPROCATING COMPRESSORS:** - Operation of a single stage reciprocating compressors. Work input through P – S diagram and steady state steady flow analysis. Effects of clearance, volumetric efficiency. Adiabatic, isothermal and mechanical efficiencies. Multi-stage compressor, optimum intermediate pressure, inter-cooling, minimum work for compression and numerical problems. **11Hrs**

**UNIT -5**

**I.C. ENGINES:** Testing I C engine performance, related numerical problems, heat balance sheet, Morse test and numerical problems. **06 Hrs**

**Text Books:**

- 1) **Basic and Applied Thermodynamics**, P.K. Nag, Tata Mc Graw Hill, 3<sup>rd</sup> Edition, 2009.
- 2) **Thermodynamics an Engineering approach**, Yunus A. Cengel and Michael A. Boles, Tata McGraw Hill Publication, 2008.

**Reference Books:**

- 1) **Engineering Thermodynamics**, Rajput, Laxmi Publications Pvt Ltd., 3rd Edition, 2007.
- 2) **Fundamentals of Thermodynamics**, G.J. Van Wylen and R.E. Sonntag, Wiley Eastern
- 3) **I C Engines**, M.L. Mathur and R.P. Sharma, 2014





B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19  
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

Online course: [www.nptel.ac.in](http://www.nptel.ac.in)

**Scheme of Examination:** One question from **units 1, 2 & 5** and two questions from **Units 3 & 4**

**Course Outcomes**

<b>CO1</b>	Be able to understand the basic concepts of thermodynamics and describe energy exchange processes in terms of various forms of energies like heat and work in the systems
<b>CO2</b>	Be able to state the First Law for a closed system, open system and apply the steady flow energy equation to a system of thermodynamic components (heaters, coolers, pumps, turbines etc.) to estimate required balances of heat, work and energy flow
<b>CO3</b>	Be able understand the Second Law of Thermodynamics - Heat engines and Refrigerators, Reversible and irreversible processes, Carnot cycle and Entropy
<b>CO4</b>	Be able to apply ideal cycle analysis to simple Heat Engine and Gas Turbine cycles to estimate thermal efficiency and work as a function of pressures and temperatures at various points in the cycle.
<b>CO5</b>	Be able to conduct experiments on Petrol and Diesel engines. Be able to calculate the efficiencies of the Petrol and Diesel engines

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19  
DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

Course	PRODUCT DESIGN & DEVELOPMENT	Course Code	16IM5DEPDD
Credits	03	L-T-P-S	3-0-0-0

**Prerequisites:** Nil

### UNIT-1

**INTRODUCTION:** Characteristics of successful product development, Design and development of products, duration and cost of product development, the challenges of product development.

**DEVELOPMENT PROCESSES AND ORGANIZATIONS:** A generic development process, concept development: the front-end process, adopting the generic product development process, the AMF development process, product development organizations, the AMF organization.

**PRODUCT PLANNING:** The product planning process, identify opportunities. Evaluate and prioritize projects, allocate resources and plan timing, complete pre project planning, reflect all the results and the process. **10Hrs**

### UNIT-2

**IDENTIFYING CUSTOMER NEEDS:** Gather raw data from customers, interpret raw data in terms of customer needs, organize the needs into a hierarchy, establish the relative importance of the needs and reflect on the results and the process.

**PRODUCT SPECIFICATIONS:** What are specifications, when are specifications established, establishing target specifications, setting the final specifications.

**CONCEPT GENERATION:** The activity of concept generation clarify the problem, search externally, search internally, explore systematically, reflect on the results and the process. **06 Hrs**

### UNIT-3

**CONCEPT SELECTION:** Overview of methodology, concept screening, and concept scoring,

**CONCEPT TESTING:** Define the purpose of concept test, choose a survey population, choose a survey format, communicate the concept, measure customer response, interpret the result, and reflect on the results and the process.

**PRODUCT ARCHITECTURE:** What is product architecture, implications of the architecture, establishing the architecture, variety and supply chain considerations, platform planning, related system level design issues. **10 Hrs**



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19

DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

#### UNIT- 4

**INDUSTRIAL DESIGN:** Assessing the need for industrial design, the impact of industrial design, industrial design process, managing the industrial design process, assesses the quality of industrial design.

**DESIGN FOR MANUFACTURING:** Definition, estimation of manufacturing cost, reducing the cost of components, assembly, supporting production, impact of DFM on other factors.

**PROTOTYPING:** Prototyping basics, principles of prototyping, technologies, planning for prototypes **06 Hrs**

#### UNIT-5

**INTELLECTUAL PROPERTY RIGHTS:** Basic principles of IP laws: Introduction, Concept of property, Need for a holistic approach, Basis for protection, Invention, Criteria for patentability, Non – patentable inventions. Patents: Introduction, principles underlying the patent law in India, patentable invention. Procedure for obtaining patent. **04Hrs**

**PRODUCT DEVELOPMENT ECONOMICS:** Elements of economic analysis, base case financial model,. Sensitive analysis, project trade-offs, influence of qualitative factors on project success, qualitative analysis.

**MANAGING PROJECTS:** Understanding and representing task, baseline project planning, accelerating projects, project execution, postmortem project evaluation. **04 Hrs**

#### Text Books:

- 1) **Product Design & Development** - Karl T. Ulrich & Steven D., Tata McGraw Hill, 5<sup>th</sup> Edition, 2006

#### Reference Books:

- 1) **Product Design and Manufacturing** by A.K. Chitale and R.C. Gupta, PHI.
- 2) **Basic principles and acquisition of Intellectual Property Rights"**, Dr. T Ramakrishna, CIPRA, NSLIU -2005.
- 3) **Intellectual Property Law Handbook**, Dr.B.L.Wadehhra, Universal Law Publishing Co. Ltd., 2002.
- 4) **New Product Development** by Tim Jones, Butterworth Heinr1ann, Oxford, UIC 1997.
- 5) **New Product Development: Design & 'Analysis** by Roland Enene, Kinetovicz, John Wiley and Sons Inc., N. Y. 1990.
- 6) **Product Design for Manufacture and Assembly** by Geoffrey Boothroyd, Peter Dewhurst and Winston Knight, Taylor & Francis group, 3<sup>rd</sup> Edition, 2011
- 7) **Successful Product Design** by Jill Hollins, Stout Pugh, Butterworth, London 1 990.

#### Online Links:

<http://nptel.ac.in/courses.php>

**Scheme for examination:** Five questions choosing one each from each unit and **Unit 1** and **3** with choice questions



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**Course Outcomes**

CO1	Understand the basic concepts of product design
CO2	Understand the product design process in industry
CO3	Understand the economic factors involved in PD
CO4	Understand the basic concepts of IPR
CO5	Understand modern approaches helpful in product design

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19

DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

<b>Course</b>	<b>ORGANIZATIONAL BEHAVIOR</b>	<b>Course Code</b>	<b>16IM5DEOBE</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites:** Nil

#### **UNIT - 1**

**INTRODUCTION:** Definition of Organization Behavior and Historical development, Environmental context (Information Technology and Globalization, Diversity and Ethics, Design and Cultural, Reward Systems.

**THE INDIVIDUAL:** Foundation of individual behavior, Ability.

**LEARNING:** Definition, Theories of Learning, Individual Decision Making, classical conditioning, operant conditioning, social Making, learning theory, continuous and intermittent reinforcement. **06 Hrs**

#### **UNIT - 2**

**PERCEPTION:** Definition, Factors influencing perception, attribution theory, selective perception, projection, stereotyping, Halo effect.

**VALUES AND ATTITUDES:** Definitions, values, Attitudes: Types of values, job satisfaction, job involvement, professional Ethics, Organizational commitment, cognitive dissonance. **10 Hrs**

#### **UNIT – 3**

**MOTIVATION:** Maslow's Hierarchy of Needs, Mc. Gregor's theory X and Y, Herzberg's motivation Hygiene theory, David Mc Cleland three needs theory, Victor vroom's expectancy theory of motivation.

**THE GROUP:** Definition and classification of groups, Factors affecting group formation, stages of group development, Norms, Hawthorne studies, group processes, group tasks, group decision making.

**CONFLICT MANAGEMENT:** Definition of conflict, functional and dysfunctional conflict, stages of conflict process. **10 Hrs**

#### **UNIT – 4**

**LEADER SHIP:** Definition, Behavioral theories – Blake and Mounton managerial grid, Contingency theories, Hersey - Blanchard's situational theory, Leadership styles, characteristics, Transactional, transformation leaders. **08 Hrs**

#### **UNIT - 5**

**THE ORGANIZATION:** Mechanistic and Organic structures, Minitberg's basic elements of organization, Organizational Designing and Employee behaviour, organization development, quality of work life (QWL), Team building. **06 Hrs**



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**Text Books:**

1. **Organizational Behavior**, Stephen P Robbins, 9<sup>th</sup>Edn, Pearson Education Publications, ISBN–81–7808–561-5, 2002
2. **Organizational Behavior** – Fred Luthans, 9<sup>th</sup>Edn, McGraw Hill International Edition, ISBN–0–07–20412–1, 2011

**Reference Books:**

1. **Organization Behavior** – Hellriegel, Srocum and woodman, Thompson Learning, 9<sup>th</sup> Edition, PHI, 2001
2. **Organizational Behavior** – Aswathappa – Himalaya Publishers. 2001.
3. **Organizational Behavior** – VSP Rao and others, Konark Publishers 2002.
4. **Organizational Behavior** (Human behaviour at work) 9<sup>th</sup> Edition John Newstron / Keith Davis. 2002.
5. **Management of Organizational Behavior**, Paul Henry and Kenneth H. Blanchard, Prentice Hall of India, 1996.

**On line reference:** [organizational-behavior-15e-stephen-p-robbins-timothy-a-judge-pdf](#)

**Course Outcomes**

<b>COs</b>	The students will have the ability to learn and understand
<b>CO1</b>	About the individual and learning: In the context of Environment, Information Technology, Globalization, Diversity and Ethics. To design Organizations in various Cultural and reward systems including individual behavior. Learning process to Modify behavior to meet organizations goals, to condition and reinforce positive attitudes and values.
<b>CO2</b>	About Perception: to be satisfied, to involve professionally, ethically and commitment to the job with High moral values and attitudes
<b>CO3</b>	About Motivation: to motivate people to work efficiently in groups to increase the effectiveness of the Organization using group dynamics, decisions, tasks and manage conflicts
<b>CO4</b>	About Leadership; to lead, acquire leadership characteristics, to become transactional and Transformational leaders.
<b>CO5</b>	About organization: To Design Conducive Behavior to Develop Quality of Work life Balance and to Work in Teams

**Scheme Of Examination:** FIVE Questions to be set with one question from units 1 to 5 carrying 20 marks each. Questions in **unit 2 & 3 units** will have an internal choice.

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**

**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

<b>Course</b>	<b>THEORY OF MACHINES</b>	<b>Course Code</b>	<b>16IM5DETOM</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

**UNIT-1**

**INTRODUCTION:** Definitions: Link or element, kinematic pairs, degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, structure, Mobility of Mechanism, Inversion.

Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain. **05Hrs**

**MECHANISMS:** Quick return motion mechanisms-Drag link mechanism, Whitworth mechanism and Crank and slotted lever Mechanism. Straight line motion mechanisms –Peaucellier's mechanism and Robert's mechanism, Intermittent Motion mechanisms – Geneva mechanism and Ratchet and Pawl mechanism. Toggle mechanism, Pantograph, Ackerman steering gear mechanism. **06Hrs**

**UNIT- 2**

**CAMS:** Types of cams, Types of followers, Displacement, Velocity and Acceleration time curves for cam profiles. Disc cam with reciprocating follower having knife-edge, roller and flat-faced follower, Disc cam with oscillating roller follower, Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion. **08Hrs**

**UNIT- 3**

**BALANCING OF MACHINERY:** Static and Dynamic balancing, balancing of single rotating mass in same plane and in different planes, balancing of several rotating masses in same plane and in different planes, balancing of reciprocating masses Inertia effect of crank and connecting rod. **05Hrs**

**UNIT-4**

**SPUR GEARS:** Gear terminology, law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio, Interference in involute gears, Methods of avoiding: interference, Back lash, Comparison of involute and cycloidal teeth **05Hrs**

**GEAR TRAINS:** Simple gear trains, Compound gear trains for large speed reduction, epicyclic gear trains, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains. **05Hrs**

**UNIT- 5**

**BELTS, ROPES AND CHAINS:** Introduction, Belt and Rope drives, open and crossed belt drives, action of belt on pulleys, velocity ratio, slip, law of belting, length of belt, Ratio of friction, chains, chain length and analytical, classification of chains. **03Hrs**





**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**

**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**GOVERNORS:** Types of governors; force analysis of Porter and Hartnell governors. Controlling force, stability, sensitiveness, isochronism's, effort and power. **05Hrs**

**Text Books:**

- 1) **Theory of Machines**, Rattan S.S, Tata McGraw-Hill Publishing Company Ltd., New Delhi, and 2<sup>nd</sup>Edition -2005.
- 2) **Theory of Machines**, Sadhu Singh, ,” Pearson Education (Singapore) Pvt. Ltd., Indian Branch, New Delhi, 2<sup>nd</sup> Edition. 2006.
- 3) **Theory of Machine**, Jagadish Lal, , Dhanpat Rai Publications, New Delhi, 1971

**Reference books:**

- 1) **Theory of Machines**, Shigley. J. V. and Uickers, J.J., Oxford University press, 2004
- 2) **Theory of Machines-I**, by A.S.Ravindra, Sudha Publications, Revised 5<sup>th</sup> Edition, 2004.

**Scheme: Choice from unit 1 & unit 4 , and one question each from the remaining units 2 , 3 and 5.**

**Course Outcomes**

<b>CO1</b>	Able to understand various mechanisms and nature of working
<b>CO2</b>	Students learn to construct profile of Cams with analytical problems
<b>CO3</b>	Students learn about gearing systems and gear trains with analytical problems
<b>CO4</b>	Students learn about gearing systems and gear trains with analytical problems

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.



B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19

DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT

<b>Course</b>	<b>TOOL ENGINEERING</b>	<b>Course Code</b>	<b>16IM5DETEG</b>
<b>Credits</b>	<b>03</b>	<b>L-T-P-S</b>	<b>3-0-0-0</b>

**Prerequisites: Nil**

#### **UNIT -1**

**CUTTING TOOL MATERIALS :** Introduction, Desirable properties of tool materials, characteristics cutting tool materials, single point cutting tool geometry, single point tool nomenclature, chip flow direction, tool angles specifications, cutting parameters and tool geometry, Indexable inserts, chip breakers. **06Hrs**

#### **UNIT-2**

**TOOL WEAR, TOOL LIFE AND MACHINABILITY:** Introduction, Tool wear mechanism, types of tool damage during cutting, wear and chipping, characteristics of different tool materials, tool wear equation, tool failure criteria, Taylor's tool life equation, effect of process parameters on tool life, tool life test, Machinability. (Includes simple problems) **06Hrs**

#### **UNIT -3**

**TOOLS IN MILLING :** Milling Cutters, materials of milling cutters, Elements of fluted milling cutters (Cutter nomenclature), Geometry of milling cutter, milling parameters, effects of various factors in milling operations, selection of milling cutters, face milling cutters, end milling cutters, carbide milling cutters, Indexing. (Includes simple problems) **08Hrs**

#### **UNIT-4**

**TOOLS IN DRILLING:** Drilling operations, cutting speeds and feeds, various types of drills, drilling with jet pulsing, Drill points shapes for various applications, Drill wear, Drill point sharpening, chip control and chip breakers in drilling, introduction to counter boring, counter sinking, spot facing, Reaming. (Includes simple problems)

**GRINDING WHEELS:** Introduction, grinding wheels, specification of grinding wheels, recommendation for selection of grinding wheels, Operating conditions, grinding fluids, mounting of grinding wheels. (Includes simple problems) **10Hrs**

#### **UNIT-5**

**PRESS TOOLS :** Introduction, press operations, components of press, classification of presses, Flywheel considerations, transfer presses, selection of presses, components of die assembly, classification of dies, clearance between Die and Punch, automation of power press.

**POWDER METALLURGY:** Process details and special characteristics of powder metallurgy process, Compaction techniques like CIP and HIP (Cold isostatic and hot isostatic pressing), Applications of powder metallurgy. **10 Hrs**



**B.M.S. COLLEGE OF ENGINEERING (Autonomous), BENGALURU-19**  
**DEPARTMENT OF INDUSTRIAL ENGINEERING & MANAGEMENT**

**Text Books:**

- 1) **Production Technology**. R. K. Jain, Khanna Publications, Edition 2014, ISBN 10817409-0991
- 2) **Production Technology**, H M T, Tata McGraw-Hill Publishing Company Limited, 2001 Edition, ISBN-97800709-64433
- 3) **Text Book of Production Technology**- K. C. Jain and A. K. Chithale, PHI, edition 2014, ISBN 9788120347496
- 4) **Fundamentals of Metal Cutting Tools**, B. L. Juneja. G. S. Sekhon Nithin Seth, New age International Publishers, Edition 2007, ISBN-978-812-241-4677

**Reference Book:**

- 1) **ASM Handbook on Powder Metallurgy** - Vol 17, ASM publications, PHI Learning Pvt. Limited.
- 2) **Principles of Machine Tools** by G. C. Sen and Amitabha Bhattacharya, Edition 2009, ISBN -9788173811555
- 3) **Metal cutting theory & cutting tool design**, V. Arshinow and G. Alfseev Mir Publication Moscow.
- 4) **Metal cutting and Tool Design.**, B.J. Ranganath, Vikas Publishers, 2<sup>nd</sup> Edition.

**Course Outcomes:**

CO1	Is able to select proper tool for given machining operation, the designation of cutting tool, cutting tool parameters and other related topics.
CO2	Is able to understand Tool life, Tool wear and machinability aspects
CO3	Is able to understand Milling operations, Milling cutter to be used, parameter in Milling and Indexing operation
CO4	Is able to understand types of Drilling operations, various types of drills used and other related topics
CO5	Is able to understand Press tool operations, selection of presses, dies and punch and other related topics

**Scheme of Examination:** To set one question from each **units 1, 2& 3** and two questions from **unit-4** and **unit-5**.

**ASSESSMENT**

**Continuous Internal Evaluation (CIE)** includes periodic class tests, quizzes or Alternative Assessment Tools (AAT) prescribed by the faculty handling a course prior to beginning of the classes like assignments, problem solving, case studies, group discussion, seminar, mini-project etc.

**Semester End Examination (SEE)**-a written examination for theory courses and practical/design examination with built-in-oral part (Viva voice)

Both CIE and SEE have equal (50:50) weightages. The student's performance in a course shall be judged individually and together based on the results of CIE and SEE.