III Semester

Transform Calculus, Fourier Series and Numerical Techniques			
Course Code	**21MAT31**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

The goal of the course Transform Calculus, Fourier series and Numerical techniques 21MAT 31 is

- To have an insight into solving ordinary differential equations by using Laplace transform techniques
- Learn to use the Fourier series to represent periodical physical phenomena in engineering analysis.
- To enable the students to study Fourier Transforms and concepts of infinite Fourier Sine and Cosine transforms and to learn the method of solving difference equations by the z-transform method.
- To develop proficiency in solving ordinary and partial differential equations arising in engineering applications, using numerical methods

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.
1. In addition to the traditional lecture method, different types of innovative teaching methods may be adopted so that the delivered lessons shall develop students' theoretical and applied mathematical skills.
2. State the need for Mathematics with Engineering Studies and Provide real-life examples.
3. Support and guide the students for self–study.
4. You will also be responsible for assigning homework, grading assignments and quizzes, and documenting students' progress.
5. Encourage the students for group learning to improve their creative and analytical skills.
6. Show short related video lectures in the following ways:
- As an introduction to new topics (pre-lecture activity).
- As a revision of topics (post-lecture activity).
- As additional examples (post-lecture activity).
- As an additional material of challenging topics (pre-and post-lecture activity).
- As a model solution for some exercises (post-lecture activity).

Module-1 Laplace Transform

Definition and Laplace transforms of elementary functions (statements only). Problems on Laplace's Transform of $e(t)$,$t_n f(t)$,$f(t)/t$. Laplace transforms of Periodic functions (statement only) and unit-step function – problems.
Inverse Laplace transforms definition and problems, Convolution theorem to find the inverse Laplace transforms (without Proof) problems. Laplace transforms of derivatives, solution of differential equations.
Self-study: Solution of simultaneous first-order differential equations. (RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-2 Fourier Series

Introduction to infinite series, convergence and divergence. Periodic functions, Dirichlet's condition. Fourier series of periodic functions with period 2π and arbitrary period. Half range Fourier series. Practical harmonic analysis.
Self-study: Convergence of series by D'Alembert's Ratio test and, Cauchy's root test.
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3 Infinite Fourier Transforms and Z-Transforms

Infinite Fourier transforms definition, Fourier sine and cosine transforms. Inverse Fourier transforms, Inverse Fourier cosine and sine transforms. Problems.
Difference equations, z-transform-definition, Standard z-transforms, Damping and shifting rules, Problems. Inverse z-transform and applications to solve difference equations.
Self Study: Initial value and final value theorems, problems.
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4 Numerical Solution of Partial Differential Equations

Classifications of second-order partial differential equations, finite difference approximations to derivatives, Solution of Laplace's equation using standard five-point formula. Solution of heat equation by Schmidt explicit formula and Crank- Nicholson method, Solution of the Wave equation. Problems.
(8 Hours)
Self Study: Solution of Poisson equations using standard five-point formula.
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5

Second-order differential equations - Runge-Kutta method and Milne's predictor and corrector method. (No derivations of formulae).
Calculus of Variations: Functionals, Euler's equation, Problems on extremals of functional. Geodesics on a plane, Variational problems. (8 Hours)
Self Study: Hanging chain problem
(RBT Levels: L1, L2 and L3)

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- To solve ordinary differential equations using Laplace transform.
- Demonstrate the Fourier series to study the behaviour of periodic functions and their applications in system communications, digital signal processing and field theory.
- To use Fourier transforms to analyze problems involving continuous-time signals and to apply Z-Transform techniques to solve difference equations
- To solve mathematical models represented by initial or boundary value problems involving partial differential equations
- Determine the extremals of functionals using calculus of variations and solve problems arising in dynamics of rigid bodies and vibrational analysis.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally to 50 marks.

Suggested Learning Resources:

Books

Text Books:

1. B. S. Grewal: "Higher Engineering Mathematics", Khanna publishers, 44th Ed.2018
2. E. Kreyszig: "Advanced Engineering Mathematics", John Wiley & Sons, 10th Ed. (Reprint), 2016.

Reference Books

1. V. Ramana: "Higher Engineering Mathematics" McGraw-Hill Education, 11th Ed.
2. Srimanta Pal & Subodh C. Bhunia: "Engineering Mathematics" Oxford University Press, 3rd Reprint, 2016.
3. N.P Bali and Manish Goyal: "A textbook of Engineering Mathematics" Laxmi Publications, Latest edition.
4. C. Ray Wylie, Louis C. Barrett: "Advanced Engineering Mathematics" McGraw – Hill Book Co.Newyork, Latest ed.
5. Gupta C.B, Sing S.R and Mukesh Kumar: "Engineering Mathematic for Semester I and II", Mc- Graw Hill Education(India) Pvt. Ltd 2015.
6. H.K.Dass and Er. Rajnish Verma: "Higher Engineering Mathematics" S.Chand Publication (2014).
7. James Stewart: "Calculus" Cengage publications, 7th edition, 4th Reprint 2019.

Web links and Video Lectures (e-Resources):

- http://.ac.in/courses.php?disciplineID=111
- http://www.class-central.com/subject/math(MOOCs)
- http://academicearth.org/
- http://www.bookstreet.in
- VTU e-Shikshana Program
- VTU EDUSAT Program

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Quizzes
- Assignments
- Seminars

Material Science and Metallurgy			
Course Code	**21 IP/IM32**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	4	Exam Hours	03

Course objectives:

- The foundation for understanding the structure and behavior of materials common in mechanical engineering.
- Topics to explore the mechanical properties of metals and their alloys, polymers, ceramics, smart materials and composites
- To understand modifications of material properties by heat treatment processes
- Selections of different materials for various applications are highlighted
- Impart knowledge of various failure modes of materials

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the student's understanding.
8. Individual teachers can device innovative pedagogy to improve teaching-learning.

MODULE-1 8 HOURS

Crystal Structure

Unit Cells, Crystal systems, BCC, FCC, and HCP structures, Coordination number and atomic packing factors Crystal Imperfection-Point, line and surface imperfections

Atomic Diffusion

-Fick's laws of diffusion, Factors affecting Diffusion, Steady and non-steady state diffusions

Dislocation

Characteristics of dislocations slip systems, slip in single crystals, Plastic deformation of polycrystalline materials, Deformation by twinning

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning

	activities and Giving assignments

MODULE-2	8 HOURS
Fracture Types of fracture, ductile and brittle fracture, Ductile to brittle transition temperature, mechanism of fracture(Griffith's theory) **Fatigue** Fatigue test, SN curves,fatigue properties, Factors affecting fatigue life **Creep** Creep curve, Mechanism of creep, creep properties, creep testing	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-3	8 HOURS
Phase Diagrams Solid solutions, Hume Rothary rules, substitutional, and interstitial solid solutions, Intermediate phases, Gibbs phase rule, types of phase diagram- solid solution, eutectic system, peritectic, eutectoid transformation, peritectoid transformation, monotectic and syntactic reation, Construction of equilibrium diagrams, lever rule. Iron carbon equilibrium diagram Description of phases, Solidification of steels and cast irons, Invariant reactions, TTT curves, Continuous cooling curves	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-4	8 HOURS
Heat Treatment of Metals Annealing and its types, normalizing, Hardening, Hardenability, tempering, Martempering, Austempering, surface hardening methods like carburizing, cyaniding, Nitriding, Flame hardening and induction hardening. Age hardening of Aluminium –Copper alloys **Recovery, Recrystallization and Grain Growth** Recrystallization temperature, Annealing temperature v/s cold-worked and recovered grains, Direction of grain boundary motion.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE 5	8 HOURS
Steels and cast irons Ferrous alloys, steels – low medium and high carbon, AISI designation steels, Cast irons – types and properties, Composites and ceramics **Composite materials**: Definition, classification, Types of matrix materials & reinforcements, Application of composites, Ceramics, Glasses, Glass – ceramics, clay products, Refractories, abrasives and cements.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Tensile test of metallic and non metallic specimens using Universal Testing Machine
2	Shear test of metallic and non metallic specimens using Universal Testing Machine
3	Compression test of metallic and non metallic specimens using Universal Testing Machine
4	Torsion Test

5	Bending Test on metallic and nonmetallic specimens
6	Charpy Tests on M.S and C.I Specimen
7	Izode Tests on M.S and C.I Specimen
8	Brinell, Rockwell and Vickers's Hardness test.
9	To study the wear characteristics of ferrous, non-ferrous and composite materials for different parameters.
Demonstration only	
10	Fatigue Test
11	Preparation of specimen for Metallographic examination of different engineering materials. Identification of microstructures of plain carbon steel, tool steel, gray C.I, SG iron, Brass, Bronze & composites.
12	Heat treatment: Annealing, normalizing, hardening and tempering of steel. Hardness studies of Heat treated samples

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Understand the mechanical properties of metals and their alloys.
- Analyze the various modes of failure and understand the microstructures of ferrous and nonferrous materials.
- Describe the processes of heat treatment of various alloys.
- Acquire the Knowledge of composite materials and their production process as well as applications
- Understand the properties and potentialities of various materials available and material selection procedures.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in thedifferentmponent and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks scored ot of 100, shall be reduced proportionally to 50 marks.

Suggested Learning Resources:

Books

1. "An Introduction -Material's Science and Engineering", William D Callister, John Wiley and Sons India Pvt Ltd., 6th Edition, 2006 New Delhi
2. Foundation of Material Science and Engineering, Smith, McGraw Hill, 3rd Edition, 1997

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=iyJvxOLq02s
- https://www.youtube.com/watch?v=wzZlB75j-Ks
- https://www.youtube.com/watch?v=P3pHya6S5t0
- https://www.youtube.com/watch?v=cpvTwYAUeA8
- https://www.youtube.com/watch?v=lH5Ab-RMSpY
- https://www.youtube.com/watch?v=1wWd8zFizHY
- https://www.youtube.com/watch?v=PV1vPAkNMPw
- https://www.youtube.com/watch?v=MJoYwtX_zFA
- https://www.youtube.com/watch?v=7hmF3WoQkTg
- https://www.youtube.com/watch?v=vAvLiihHe58

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, assignments are to be given under each of the topics covered.

Manufacturing Process - I			
Course Code	**21IP/IM33**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

- Define various terms associated with casting processes
- Explain methods of construction of moulds.
- Select moulding machine and moulding process based on material type
- Select appropriate joining process, type of joints.
- Explain different non-destructive testing method

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1 Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.

2 Show Videos/animation films to explain the content, wherever possible.

3 Encourage collaborative Learning (Group Learning) in the class.

4 Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

5 Discuss how every concept can be applied to the real world thus helping to improve the students understanding.

6 Individual teachers can device innovative pedagogy to improve teaching-learning.

MODULE-1 8 HOURS

CASTING PROCESS

Introduction: Concept of Manufacturing process, its importance. Classification of Manufacturing processes.

Introduction to Casting process &steps involved. Varieties of components produced by casting process. Advantages & Limitations of casting process.

Patterns: Definition, functions, Materials used for pattern, various pattern allowances and their importance, Classification of patterns.

Sand Moulding: Types of base sand, requirement of base sand. Moulding sand mixture ingredients for different sand mixtures. Method used for sand moulding, such as Green sand, dry sand and skin dried moulds.

Binder: Definition, Types of binder used in moulding sand. Additives: Need, Types of additives used and their

properties.	
Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos and Lab Visit.

MODULE-2 8 HOURS

Cores: Definition, Need, Types. Method of making cores, Binders used, core sand moulding.
Concept of Gating & Risers: Principle and types. Fettling and cleaning of castings. Basic steps, Casting defects, Causes, features and remedies. **Moulding Machines:** Jolt type, Squeeze type, Jolt & Squeeze type and Sand slinger.
Special moulding Process (Only brief Introduction): No bake moulds, Flaskless moulds, Sweep mould, CO2 mould, Shell mould, Investment mould.
Metal moulds: Gravity die-casting, Pressure die casting, Centrifugal casting, Squeeze Casting, Slush casting, Thixo-casting and Continuous Casting Processes.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos and Lab Visit.

MODULE-3 8 HOURS

elting Furnaces: Constructional features &working principle of coke fired, oil fired and Gas fired pit furnace.(Only brief Introduction) Resistance furnace, Coreless Induction furnace, Electric Arc Furnace, Cupola furnace.
Forging: Introduction , Merits, Smith forging operations, Types of forges and heating furnaces, Introduction to forging presses, Upset/machine forging, Forging defects.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos and Lab Visit.

MODULE-4 8 HOURS

WELDING
Welding process: Definition, Principles, Classification, Application, Advantages& limitations of welding.
Arc Welding: Principle, Metal Arc welding (MAW), Flux Shielded Metal Arc Welding (FSMAW), Inert Gas Welding (TIG & MIG) Submerged Arc Welding (SAW) and Atomic Hydrogen Welding processes (AHW).
Gas Welding: Principle, Oxy – Acetylene welding, Chemical Reaction in Gas welding, Flame characteristics. Gas torch construction &working. Forward and backward welding.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos and Lab Visit.

MODULE 5 8 HOURS

Special types of welding: Resistance welding - principles, Seam welding, Butt welding, Spot welding and projection welding. Friction welding, Explosive welding, Thermit welding, Laser welding and Electron beam welding.
Inspection Methods: Methods used for Inspection of casting and welding. Visual, Magnetic particle, Fluorescent particle, Ultrasonic, Radiography, Eddy current, Holography methods of Inspection.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos and Lab Visit.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Preparation of molds using two molding boxes using patterns or without patterns. (Split pattern, Match plate) by using foundry tools and other equipment.
	Demonstration only
2	Preparation of one casting (Aluminium or cast iron)
3	Testing of Moulding Sand and Core Sand: Preparation of sand specimens and conduction of the following tests: a) Compression, Shear and Tensile tests on Universal Sand Testing Machine. b) Permeability test c) Core hardness &Mould hardness tests. d) Sieve Analysis to find Grain Finest number of Base Sand e) Clay content determination in Base Sand
4	Preparation of simple welded joints like Lap, Butt, T-welds, L-welds using Arc and Gas welding process.

5	Preparing minimum three forged models involving upsetting, drawing and bending operations. Out of these three models, at least one model is to be prepared by using Power Hammer

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Define various terms associated with casting processes.
- Explain methods of construction of moulds, different non-destructive testing methods.
- Select moulding machine and moulding process based on material type.
- Define various steps associated with forging process.
- Select appropriate joining process and type of joints.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

4. The question paper will have ten questions. Each question is set for 20 marks.
5. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
6. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100shall be proportionally reduced to 50 marks

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical

component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Manufacturing Process-I by Dr.K. Radhakrishna,Sapna Book House 5th Revised Edition 2009.
2. Manufacturing & Technology Foundry Forming and Welding by P.N.Rao, Tata McGraw Hill 3rd Ed., 2003
3. Process and Materials of Manufacturing by Roy A Lindberg Pearson Education 4th Edition, 2006
4. Manufacturing Technology by Serope Kalpakjian, Steuen. R. Sechmid Pearson Education Asia 5th Edition, 2006

Web links and Video Lectures (e-Resources):

https://youtu.be/cBWavCXbKMo
https://youtu.be/tB2ga9mISks
https://youtu.be/1oZnxZj6-Ig
https://youtu.be/EIBDp6U8bHo
https://youtu.be/jeQw-MrlXR4
https://youtu.be/IEVvFueCq0s
https://youtu.be/fL8ysJj3m7Y
https://youtu.be/aeSCjRaV9Og
https://youtu.be/Nao_mLIh5dk
https://youtu.be/twUAa5LWUvk

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Make the students to cast a material using wax with sand casting technique in lab.
- Take the students to nearest foundry industry.
- Group discussion and quiz on the subject in class.

Basic Thermodynamics and Fluid Mechanics			
Course Code	**21IP34**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Define work, heat, and laws of thermodynamics.
- Evaluate thermal performance of temperature and work and heat.
- Discuses fluid properties and fluid statics, calculate, Buoyancy, Stability of floating and Fluid Dynamics.
- Types of fluid flow, apply Bernoulli's principle to solve fluid flow problems.
- Discusses Major and Minor losses, expression for drag and lift

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby sites to give brief information about the Industrial and Production Engineering structures.
3. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
4. Encourage collaborative (Group Learning) Learning in the class.
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
10. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Fundamental Concepts & Definitions: Thermodynamics definition and scope, Some practical applications of engineering thermodynamic Systems, Characteristics of system boundary and control surface. Microscopic and Macroscopic approaches. Thermodynamic properties; definition and units, intensive and extensive properties, Thermodynamic equilibrium; definition, mechanical equilibrium, thermal equilibrium, chemical equilibrium. Types of process, quasi-static process. Zeroth law of thermodynamics, Temperature concepts.

Work and Heat: Definition of work. Thermodynamic definition of work; examples, sign convention, work is a path function. Definition of heat, sign convention, heat is a path function, comparison of work heat. Displacement work;Expressions for displacement work in various processes through p-v diagrams.

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. Creating real time stations in classroom discussions. Giving activities &assignments.

Module-2

First Law of Thermodynamics: Joules experiments, Statement of the First law of thermodynamics, extension of the First law to non - cyclic processes-energy, energy is a property of the system, specific heat at constant volume, specific heat at constant pressure, enthalpy. Extension of the First law to control volume; steady state-steady flow energy equation, unsteady flow process analysis, applications of SFEE

Second Law Of Thermodynamics: Limitation of first law of thermodynamics, Qualitative difference between heat & work; Cyclic heat engine; Energy Reservoirs; Kelvin-Planck statement of the Second law of Thermodynamics; Clausius's statement of Second law of Thermodynamics; (Equivalence of two statements not included)

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities and assignments.

Module-3

Properties of Fluids: Introduction, Properties of fluids, viscosity, surface tension, capillarity, Fluid Statics:Fluid pressure at a point, pressure variation in a static fluid at rest, simple manometers and differential manometers.

Buoyancy: Buoyancy, center of buoyancy, metacentre and metacentric height, conditions of equilibrium of floating and submerged bodies, determination of Metacentric height theoretically.

Teaching-Learning Process	Power Point presentation and YouTube videos, Animation videos methods, Video demonstration or Simulations, Chalk and Talk are used for Problem Solving, enhance experiential skills

Module-4

Fluid Kinematics: Types of fluid flow, continuity equation in 2D and 3D (Cartesian Co-ordinates only), velocity and acceleration

Fluid Dynamics: Introduction equation of motion, Euler's equation of motion, Bernoulli's equation from first principles and also from Euler's equation, limitations of Bernoulli's equation.

Teaching-Learning Process	Chalk and talk are used for Problem Solving, Group Learning, PowerPoint presentation and Animations andyou tube videos, enhance experiential skills

Module-5

Flow through pipes: Minor losses through pipes. Darey's and Chezy's equation for loss of head due to friction in pipes. HGL and TEL (no problems).

Flow past immersed bodies : Drag, Lift, expression for lift and drag, boundary layer concept, displacement, momentum and energy thickness

Teaching-Learning Process	Chalk and talk are used for Problem Solving, Group Learning, enhance experiential skills,PowerPoint presentation and Animations andyou tube videos.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Define work, heat, and laws of thermodynamics.
- Evaluate thermal performance of temperature and work and heat.
- Discuses fluid properties and fluid statics, calculate, Buoyancy, Stability of floating andFluid Dynamics.
- Types of fluid flow, apply Bernoulli's principle to solve fluid flow problems.
- Discusses Major and Minor losses, expression for drag and lift

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Textbooks

1. Basic Engineering Thermodynamics, A.Venkatesh Universities Press, 2008
2. Basic and Applied Thermodynamics, P.K.Nag Tata McGraw Hill Pub 2nd Ed., 2002
3. Fluid Mechanics and Fluid Power, Kumar.D.S, Kataria and Sons, 2004
4. Fluid Mechanics Dr.BansalR.K.Lakshmi Publications 2004

Reference Books

5. Thermodynamics, An Engineering Approach, Yunus A. Cenegal and Michael A.Boles, Tata McGraw Hill publications 2002
6. Engineering Thermodynamics, J.B.Jones and G.A.Hawkins, John Wiley and Sons
7. Fundamentals of Classical Thermodynamics, G.J.VanWylen and R.E.Sonntag , Wiley Eastern.
8. Fluid Mechanics and hydraulics, Dr.Jagadishlal Metropolitan Book CoLtd., 1997
9. Fluid Mechanics (SI Units), Yunus A. Cingel John M.Oimbala Tata Mac GrawHill 2006
10. Fluid Mechanics John F.Douglas, Janul and M.Gasiosek and john A.Swaffield Pearson Education Asia 5th ed., 2006

Web links and Video Lectures (e-Resources):

http://mhhe.com/nag/et
https://www.sfu.ca/~mbahrami/ENSC%20388/Notes/Intro%20and%20Basic%20Concepts.pdf
https://www.youtube.com/watch?v=6QXtnmB1vqk
https://www.youtube.com/watch?v=F7L4ZCWtp94
https://www.youtube.com/watch?v=sA99mw3D2Ds
https://archive.nptel.ac.in/courses/112/105/112105171/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Contents related activities (Activity-based discussions)
- For active participation of students, instruct the students to prepare Exercise problems
- Organizing Group wise discussions and machineries issues based activities
- Quizzes and Discussions
- Seminars and assignments

Computer Aided Component Drawing			
Course Code	**21IPL35**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03

Course objectives:

- Use tools of drafting and modeling software
- Draw the sections of solids, orthographic views of simple machine parts using software
- Sketch and explain various thread forms and their application.
- Calculate parameters related to riveted joints and sketch them.
- Create solid models and draw the sectional views of automotive systems.

Sl.NO	**Lab Exercises**
1	**Sections of Solids:** Sections of Pyramids, Prisms, Cubes, Tetrahedrons, Cones
2	**Orthographic views**: Conversion of pictorial views into orthographic projections of simple machine parts with or without section.
3	**Thread forms:** Thread terminology, forms of threads – BSW Thread, Sellers thread, ISO Metric thread, square and Acme thread. Conventional representation of threads.
4	**Fasteners:** Hexagonal headed bolt and nut with washer (assembly), square-headed bolt and nut with washer (assembly).
5	**Keys, cotter and knuckle joints:** Types of Keys, Cotter and knuckle Joints

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Use tools of drafting and modeling software
- Draw the sections of solids, orthographic views of simple machine parts using software
- Sketch and explain various thread forms and their application.
- Calculate parameters related to riveted joints and sketch them.
- Prepare assembly drawing from the list of components.
- Create solid models and draw the sectional views of automotive systems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

1. Machine Drawing K. R. Gopala Krishna Subhash Publication.

2. A Primer on Computer Aided Machine Drawing Published by VTU
3. A Text Book of Computer Aided Machine Drawing S. Trymbaka Murthy CBS Publishers, New Delhi 2007
4. Machine Drawing with Auto CAD Goutam Purohit & GouthamGhosh 1st Indian print Pearson Education, 2005

Social Connect and Responsibility			
Course Code	**21UH36**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Samskrutika Kannada			
Course Code	**21KSK37/47**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Balake Kannada			
Course Code	**21KBK37/47**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Constitution of India and Professional Ethics			
Course Code	**21CIP37/47**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

An Overview of Emerging Technologies			
Course Code	**21IP/IM381**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- To understand the emerging technologies in the context of Industrial and Production Engineering.
- To study data science as a tool for decision making in Engineering.
- To understand the concept of AI, IOT and other Emerging Technologies.
- To study the role of ethics in modern Technology driven era.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction to Emerging Technologies:

Evolution of technologies, Introduction to Industrial revolution, Historical background of the Industrial Revolution, Human to Machine Interaction, Future trends in emerging technologies.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-2

Data Science:

Overview for Data Science, Definition of data and information, Data types and representation, Data Value Chain, Data Acquisition, Data Analysis, Data Curating, Data Storage.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-3

Artificial Intelligence (AI):

Concept of AI, meaning of AI, History of AI, Levels of AI, Types of AI.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, AI lab visit, Activity based learning.

Module-4

Internet of Things (IoT):

Overview of IOT, meaning of IOT, History of IOT, Architecture of IOT, Advantages of IOT, Applications of IOT at Manufacturing, Agriculture, Smart home, Smart city.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning.

Module-5

Ethics, Professionalism and Other Emerging Technologies:

Technology and ethics, General ethical principles, Digital privacy.

Other Technologies: Block chain technology, Cloud and quantum computing, Cyber security, Additive

manufacturing (3D Printing)

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Identify different emerging technologies
2. Select appropriate technology and tools for a given task
3. Identify necessary inputs for application of emerging technologies
4. Understand the latest developments in the area of technology.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Emerging exponential technologies, Dr. Deepak G Kulkarni and Dr. Prayag P Gokhale. Himalaya Publishing House.
2. Introduction to Emerging Technologies Course Module, Tesfahunegn Minwuyelet (MSC) & Makonnen Wagaw (Ph.D.) CH-1, 4 & 5 from BDU, Girma Debela (MSc) CH-2 from ASTU.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=Keq0gNtXuss
- https://www.britannica.com/event/Industrial-Revolution
- https://www.simplilearn.com/top-technology-trends-and-jobs-article
- https://www.heavy.ai/learn/data-science
- https://engineering.purdue.edu/ME/Research/HumanMachine
- https://study.com/academy/lesson/types-of-data-text-numbers-multimedia.html
- https://www.simplilearn.com/data-analysis-methods-process-types-article
- https://builtin.com/artificial-intelligence
- https://www.techtarget.com/iotagenda/definition/Internet-of-Things-IoT
- https://archive.ethicsandtechnology.eu/wp-content/uploads/downloadable-content/Brey-2017-Ethics-Emerging-Tech.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Basics of Industrial Safety

Course Code	**21IP/IM382**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- To know about Industrial safety programs and toxicology, Industrial laws , regulations and source models
- To understand about fire and explosion, preventive methods, relief and its sizing methods
- To analyse industrial hazards and its risk assessment

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction:

Elements of safety programming: awareness of Risk, why do accidents occur, how effective is the Legislation.

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-2

Safety Management:
Introduction , Organisation and Personnel, planning, Safety Management System, Management representation Competence Mapping , Communication, Design, emergency preparedness, System Audits, Review, Safety Committees, Corrective Preventive action, Right of employees, Personal protective equipment Restrictions on contract work.

Teaching-Learning Process	Chalk and Talk, Power point presentation.

Module-3

Upgrading developmental programs:
Safety procedures, Arrangements and performance measures. Education, Training and development safety.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-4

Safety performance Planning:
An overview of an accident, Safety professional occupational health and industrial hygiene.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-5

Investigation and preventation:
Reasons, Results, Repair The 'Permit – to – work' systems. Trips, slips and falls Safe handling and storage – materials handling.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :
1. Analyze the effect of release of toxic substances
2. Understand the industrial laws, regulations and source models.
3. Apply the methods of prevention of fire and explosions.
4. Understand the relief and its sizing methods.
5. Understand the methods of hazard identification and preventive measures

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. Industrial Safety Management, L M Deshmukh.
2. Fundamentals of Industrial Safety and Health, Dr. K U istry, Gujjar Graphics and Printers, 2008.
3. Industrial Safety Management, 21st Century Perspectives of Asia, Springer,2018.

Web links and Video Lectures (e-Resources):

- https://connecteam.com/workplace-safety-training-need/
- https://iosh.com/employees/awareness-courses/working-safely/
- https://connecteam.com/workplace-safety-tips-manufacturing/
- https://www.aiche.org/academy/courses/ch910/foundations-process-safety
- https://www.safetyandhealthmagazine.com/articles/14054-common-workplace-safety-hazards

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Introduction to Risk Management			
Course Code	**21IP/IM383**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:
After studying this course, you should be able to:

- Demonstrate knowledge of the range of financial and financial related risks facing organisations.
- Understand the credit risk
- Understand operational risk and how to manage it.
- Understand market risk

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Discuss how every concept can be applied to the real world thus helping to improve the students understanding.
6. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

AN OVERVIEW
Risk definition/policies, Risk process- Risk Organization, Key risks-Credit risk, market risk, operational risk, liquidity risk, legal risk, interest rate risk and currency risk.

Asset Liability Management, ALM Concept, ALM organization, ALCO techniques/tools, Simulation, Gap, Duration analysis, Linear and other statistical methods of control.

Risk measurement & Control, Calculation, Risk exposure analysis, Risk management/mitigation policy, Risk immunization policy/strategy for fixing exposure limits, Risk management policy and procedure, Risk adjusted return on capital, Capital adequacy norms

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions andunderstanding through peer learning, promoting self-learning activities and Giving assignments

Module-2

Risk management, Capital adequacy norms, Prudential norms, Exposure norms, Concept of Mid office, Forwards, Futures, Options, Strategies and Arbitrage opportunities, Regulatory prescriptions of risk management.
Introduction. Basel-I, Three pillars of Basel-II and Capital for Operational risk, Frame work for risk management, RBI guidelines on risk management, Risk rating and risk pricing. Methods for estimating capital requirements.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions andunderstanding through peer learning, promoting self-learning activities and Giving assignments

Module-3

CREDIT RISK MANAGEMENT
Credit risk-standardized approach, Credit risk-advanced approach, Credit rating/credit scoring and rating system design, Credit Bureaus, Stress test and sensitivity analysis, Internal Capital Adequacy Assessment Process (ICAAP), Introduction to structured products.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions andunderstanding through peer learning, promoting self-learning activities and Giving assignments

Module-4	
OPERATIONAL RISK MANAGEMENT Introduction, Basel-I & II, RBI guidelines, Likely forms of operational risk and causes for significant increase in operational risk, Sound Principles of Operational Risk Management (SPOR), SPOR- organizational set up and key responsibilities of ORM, SPOR- policy requirements and strategic approach for ORM, SPOR identification, measurement, control/mitigation of operational risks, Capital allocation for operational risk, methodology, qualifying criteria for banks for the adoption of the methods, Computation of capital charge or operational risk.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions andunderstanding through peer learning, promoting self-learning activities and Giving assignments
Module-5	
MARKET RISK Introduction and definition. Prescriptions of Basel- I & II, Liquidity risk. Interest rate risk, foreign exchange risk, Price risk (Equity), Commodity risk, Treatment of market risk under Basel, Standardized duration method, Internal measurement approach-VaR.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions andunderstanding through peer learning, promoting self-learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Explain various types of risks
- Summarize the principal types of financial risk – market risk and capital adequacy, credit risk, liquidity risk, operational, legal and compliance risks, reputational risk
- Examine the notion that risk management should become part of an organisation's culture
- Explain the methodological principles of Value at Risk (VaR). Is it is a reliable indicator of portfolio risk – e.g. are asset returns normally distributed?
- Explain how, especially in the aftermath of a financial crisis, there is need for an integrated or holistic approach to risk management – increasing recognition that market risk, credit risk and liquidity risk are all interdependent

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject

SEE paper will be set for 50 questions of each of 01 mark. The pattern of the question paper is MCQ. The time allocated for SEE is 01 hours

Suggested Learning Resources:

Books

1. Risk management and insurance, Mark S Dorfman, 9th edition, PHI publication
2. Risk management, Indian institution of banking and finance, MACMILLAN publications, CAIIB
3. Risk management and derivatives, Rene M Stulz,
4. Principles of Risk management and insurance, George E rejda, Michael Mcnamara,13th edition, pearson.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=IP-E75FGFkU
- https://www.youtube.com/watch?v=ZKDB64uYIIo
- https://www.youtube.com/watch?v=1LgJVxvE8AY
- https://www.youtube.com/watch?v=qAP1gccYbfs
- https://www.youtube.com/watch?v=kaB-RUnrhlU
- https://www.youtube.com/watch?v=s2ogL-1wdaE
- https://www.youtube.com/watch?v=U4Kh7Ig0R8M
- https://www.youtube.com/watch?v=Fcw1-Olmi_s

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. At the end of the lecture/presentation, Group discussions are to be given for practice and also as assignments under each of the topics covered.

Additional Mathematics - I			
Course Code	**21MATDIP31**	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	--
Total Hours of Pedagogy	40	Total Marks	100
Credits	--	Exam Hours	--

IV Semester

Mechanical Measurements and Metrology			
Course Code	**21 IP/IM42**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	4	Exam Hours	03

Course objectives:

- Explain significance of mechanical measurements, elements of a generalized measuring system, theory and working principle of measuring instruments for the measurement of force, torque, flow, temperature, pressure and strain
- Define Metrology, appreciate the objectives of Metrology, and explain the importance of standards.
- Interpret the limits specified, identify fits and explain the concept of tolerance
- Use comparators, screw and gear metrology

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborativeLearning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the student's understanding.
8. Individual teachers can device innovative pedagogy to improve teaching-learning.

MODULE-1 8 HOURS

Standards of measurement: Definition and Objectives of metrology, Standards of length International prototype meter, Imperial standard yard, Wave length standard, subdivision of standards, line and end standard, Slip gauges, Wringing phenomenon of slip gauges, Indian Standard on slip gauge. (Numerical problems on building of slip gauges are excluded).

System of Limits, Fits, Tolerance: Definition of tolerance, Specification in assembly, Principle of interchangeability and selective assembly, limits of size, Indian standards, concept of limits of size and tolerances, compound tolerances, accumulation of tolerances, definition of fits, types of fits and their designation (IS919-1963), geometrical tolerance, positional-tolerances, System of fits, hole basis system, shaft basis system. Numerical problems on limits, fits and tolerances.

Teaching-Learning	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and

Process	understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-2 8 HOURS

Gauges: classification of gauges, brief concept of design of gauges, Taylor's principles in the design of guages, Method of gauge maker's tolerance, Wear allowance on gauges, Types of gauges-plain plug gauge, ring gauge, snap gauge, limit gauge and gauge materials. Numerical problems on the design of gauges.

Comparators: Introduction to comparators, characteristics, classification of comparators, mechanical comparators-Johnson Mikrokator, sigma comparators, dial indicator, optical comparators-principles of optical level, Zeiss ultra optimeter, electric and electronic comparators- eletrolimitguage, LVDT, pneumatic comparators-flow type and back pressure type, solex pneumatic comparators.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises,Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-3 8 HOURS

Angular measurements: Verniarbevel protractor,optical bevel protractor, sine bar, principle of sine bar and use of sine bars, sine centre, use of angle gauges. Clinometer.

Optical measurements: Principle of interferemetry, interference patterns, principle of optical flat, Optical flats, principle of autocollimator, Tool maker's microscope.

Screw thread and gear measurement: Terminology of screw threads, measurement of major diameter, minor diameter, pitch, angle and effective diameter of screw threads by 2-wire and 3-wire methods, best size wire, gear tooth terminology, use of gear tooth verniercaliper and micrometer.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-4 8 HOURS

Measurements and measurement systems: Definition, significance of measurement, generalized measuring system, definitions and concept of accuracy, precision, calibration, threshold, sensitivity, hysterisis, repeatability, linearity, loading effect, system response-times delay. Errors in measurement, classification of errors. Transducers, transfer efficiency, primary and secondary transducers, electrical, mechanical, electronic transducers, advantages of each type transducers.

Intermediate modifying and terminating devices: Mechanical systems, inherent problems, electrical intermediate modifying devices, input circuitry, ballast circuit, electronic amplifiers and telemetry. Terminating devices, mechanical, cathode ray oscilloscope, oscillographs, X-Y plotters

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE 5 8 HOURS

Measurement of force, torque and pressure: Principle, analytical balance, Unequal arm balance, platform balance, proving ring. Torque measurement, Prony brake, hydraulic dynamometer, electric dynamometer Eddy-current and DC dynamometer. Pressure measurements, types of pressure measuring devices, Bridgeman gauge, Mcloed gauge, Pirani gauge, thermocouple vacuum gauge.

Temperature and strain measurement: Resistance thermometers, thermo electric effects-Seebeck effect, peltier effect, Thompson effect, thermocouple, law of thermo couple, materials used for construction of thermocouples, pyrometer-total radiation pyrometer and optical pyrometer. Strain measurements, strain gauge, types strain gauges-mechanical strain gauge, optical strain gauge and electrical strain gauge, preparation and mounting of strain gauges, gauge factor, methods of strain measurement

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Calibration of Micrometer using slip gauges
2	Calibration of Thermocouple and Pressure Gauge (Bourdon tube pressure gauge)
3	Calibration of LVDT and Calibration of Load cell

4	Measurement of angle using Sine Centre / Sine bar / bevel protractor
5	Measurements using Optical Projector / Toolmaker Microscope
6	Measurement of alignment using Autocollimator
7	Measurement of Screw threads Parameters using Two wire or Three-wire method
8	Measurement of gear tooth profile using gear tooth vernier /Gear tooth micrometer
Demonstration only	
9	Measurements of Surface roughness, Using Tally Surf/Mechanical Comparator
10	Measurement of cutting tool forces using a. Lathe tool Dynamometer b. Drill tool Dynamometer.
11	Determination of modulus of elasticity of a mild steel specimen using Strain gauges.
12	Measurement using Optical Flats

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Explain significance of mechanical measurements, elements of a generalized measuring system, theory and working principle of measuring instruments for the measurement of force, torque, flow, temperature, pressure and strain
2. Define Metrology, appreciate the objectives of Metrology, and explain the importance of standards.
3. Interpret the limits specified, identify fits and explain the concept of tolerance
4. Explain the use of comparators, screw and gear terminology

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation

of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.

- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

Textbook

1. Mechanical Measurements, Beckwith Marangoni, Pearson Education, 6th Ed., 2006.
2. Engineering Metrology, R.K. Jain, Khanna Publishers, 1994
3. Engineering Metrology, I.C. Gupta, DhapatRai Publications Mechanical Measurements, R.K. Jain, Khanna Publishers

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=7ZteZ5UTW6E
- https://www.youtube.com/watch?v=U8y48L_qn6E
- https://www.youtube.com/watch?v=3pNqYFCMdpA
- https://www.youtube.com/watch?v=4fPW-SMABwY
- https://www.youtube.com/watch?v=eQB63tMz8SI
- https://www.youtube.com/watch?v=saoOUXYXde0
- https://www.youtube.com/watch?v=A3sPqnczDLQ
- https://www.youtube.com/watch?v=a2zzBnyxv1E
- https://www.youtube.com/watch?v=7ZteZ5UTW6E
- https://www.youtube.com/watch?v=5wqaGZICdTI
- https://www.youtube.com/watch?v=BxVzeeMy00c
- https://www.youtube.com/watch?v=Ctw0NlKATWU
- https://www.youtube.com/watch?v=M0UYpipTAWM

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Manufacturing Process-II			
Course Code	**21IP43**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

- Explain the nomenclature of single point cutting tool, mechanics of chip formation, tool failure criteria and to solve problems on evaluation of tool life
- Construction and working of various systems in a Lathe, Shaper, Planing and Drilling machine
- Classify grinding and milling machines and explain their construction
- Explain the principles of broaching
- Select non-traditional machining process for given application

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

7 Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.

8 Show Videos/animation films to explain the content, wherever possible.

9 Encourage collaborative Learning (Group Learning) in the class.

10 Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

11 Discuss how every concept can be applied to the real world thus helping to improve the students understanding.

12 Individual teachers can device innovative pedagogy to improve teaching-learning.

MODULE-1 (8 HOURS)

Classification of metal removal process and machines: Concept of orthogonal and oblique cutting Geometry of single point cutting tool and tool angles, tool nomenclature. Mechanism of Chip Formation: Type of chips. Mechanics of metal cutting, Merchants circle diagram and analysis, Ernst Merchant's solution, shear angle relationship, Tool Wear and Tool failure, tool life. Effects of cutting parameters on tool life. Tool Failure Criteria, Taylor's Tool Life equation.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-2 (8 HOURS)

Desired properties and types of cutting tool materials – HSS, carbides coated carbides, ceramics. Cutting fluids. Desired properties, types and selection. Heat generation in metal cutting, factors affecting heat generation. Heat distribution in tool and work piece and chip.

Turning (Lathe), Shaping Machines: Classification, constructional features of Turret and Capstan Lathe. Tool Layout, shaping Machine, Different operations on lathe.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-3 (8 HOURS)

Drilling machines: drilling & related operations, Classification of drilling machine, constructional features and working principle of Radial, multi spindle, Gang, Deep hole and automatic drilling machine, Types of drill & drill bit nomenclature.

Milling machines: Classification, constructional features, milling cutters nomenclature, milling operations, up milling and down milling concepts. Various milling operations. **Indexing:** Simple, compound, differential and angular indexing calculations. Simple problems on simple and compound indexing.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
MODULE-4 (8 HOURS)	
Grinding machines: Types of abrasives, Grain size, bonding process, grade and structure of grinding wheels, grinding wheel types. Classification, constructional features of grinding machines (Center less, cylindrical and surface grinding). **Broaching process** - Principle of broaching. Details of a broach. Types of broaching machines constructional details. Applications, Advantages and Limitations.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
MODULE 5 (8 HOURS)	
Finishing and other Processes: Lapping and Honing operations Principles, arrangement of set up and application. Super finishing process, polishing, buffing operation and application. **Non-traditional machining processes:** Need for non-traditional machining, Principle, equipment & operation of Laser Beam, Plasma Arc Machining, Electro Chemical Machining, Ultrasonic Machining, Abrasive Jet Machining, Water Jet Machining, Electron Beam Machining, Electron Discharge Machining and Plasma Arc Machining.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Preparation of 2 to 3 models involving the following operation plain turning, taper turning , step turning, facing, thread cutting, knurling, drilling, boring, internal thread cutting, Eccentric turning.
2	Measurement of cutting forces, determination of shear angle, chip thickness ratio and verification of Merchant's angle relationship in turning operation.
3	Study of different types chips formed by different materials (atleast one ductile and one brittle material) with different parameters like cutting speed, feed.
4	Simple problems on simple and compound indexing.
Demonstration only	
5	Models involving the milling operations such as production of flat and taper surfaces.
6	Models using surface grinding demonstration of cylindrical grinding cutter and tool grinder
7	Assembly and disassembly of lathe parts (Tailstock and headstock).
8	Conducting acceptance test in lathe, milling machine.
9	Cutting of gear teeth using milling machine.
10	Models involving the shaping operations such as production of flat surfaces, V & rectangular grooves, cutting dovetails.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Explain the nomenclature of single point cutting tool, mechanics of chip formation, tool failure criteria and to solve problems on evaluation of tool life.
- Apply the knowledge of various manufacturing processes.
- Design and analyze various manufacturing processes and tooling.
- Construction and working of various systems in a Lathe, Shaper, Planing and Drilling machine.
- Classify grinding and milling machines and explain their construction.
- Explain the principles of broaching.
- Select non-traditional machining process for given application.
- Figure out application of modernization in machining.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical

component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

1. Workshop Technology by Hazara Choudhry, Media Promoters & Publishers Pvt. Ltd., Vol-II, 2004.
2. Production Technology by R. K. Jain, Khanna Publications, 2003.
3. Manufacturing Science by Amitabh Ghosh, East West Press, 2003.
4. Fundamentals of Metal Machining and Machine by G. Boothroyd, McGraw-Hill, 2000.
5. Production Technology by HMT,Tata McGraw-Hill, 2001.

Web links and Video Lectures (e-Resources):

- www.nptel.ac.in
- https://youtu.be/6cxazvaS6SA
- https://youtu.be/bUrp8JMRwx4
- https://youtu.be/nUQ9rvNES7U
- https://youtu.be/GghdbT0CyvI?list=PLVxUmFzqKAUHf1pg7NhMzD58pQVnhR8XA
- https://youtu.be/h2pKPpLWwr8?list=PLVxUmFzqKAUHf1pg7NhMzD58pQVnhR8XA
- https://youtu.be/2fDJ1Wk-y04?list=PLVxUmFzqKAUHf1pg7NhMzD58pQVnhR8XA
- https://youtu.be/YCLZMx_nhsM
- https://youtu.be/W-V7zfOVNkE (TOOL WEAR)
- https://youtu.be/ar-cG8tHVRQ
- https://youtu.be/hheFVuUBpxo
- https://youtu.be/K39bnxmIz7Q
- https://youtu.be/GHukUKMLDMY
- https://youtu.be/NgbbB1tdmo4
- https://youtu.be/0hgLg-f8gSY
- https://youtu.be/V3u8wTjAedU
- https://youtu.be/Gun5Kr-lmls(milling operations)
- https://youtu.be/NoHaCXS5n4g
- https://youtu.be/TyZL90po6bg
- https://youtu.be/6doeORtYeU4
- https://youtu.be/HTtnAXrzD4w

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Mechanics of Materials			
Course Code	**21IP44**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Explain the basic concepts of stress, strain, behaviour of engineering materials under different loading conditions.
- Calculate principal stresses using analytical and graphical methods, shear force and bending moments, deflection and slope of beams, critical loads for different type of columns using Euler's equation
- Plot shear force and bending moment diagrams for beams carrying different types of loads, and various support conditions

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the students' understanding.
8. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Simple Stress and Strain:

Introduction, Stress and types, Strain, Tensile test on a mild steel bar, Hooke's Law and Poisson's ratio, Stress-Strain relation for cast iron and non-ferrous materials, Extension / Shortening of bars — uniform cross section, with cross sections varying in steps, with continuously varying cross sections (circular and rectangular), Principle of superposition, Elongation due to self weight. Volumetric strain, expressions for volumetric strain for bars with uniform circular and rectangular cross sections, Simple shear stress and shear strain, Elastic constants (No derivation for relationship between elastic constants).

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Module-2

Principal stresses: Stresses in a tensile member, Stresses due to pure or simple shearing, mutually perpendicular direct stresses, Principal planes and stresses, Two-dimensional stress system.

Thick and Thin Cylinder :(Problems are not included) Stresses in thin cylinders, change in dimensions of cylinder (diameter, length and volume). Thick cylinders -Lame's equations for radial and hoop stresses (compound cylinders and spherical shells not included).

Torsion of Circular Shafts: Introduction, Torsion equation — assumptions and derivation, Torsional rigidity / Stiffness of shafts. Power transmitted by solid and hollow circular shafts, Simple numerical problems.

Columns: Introduction, End conditions, Assumptions in deriving Euler's equations.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-3

Bending Moment and Shear Force in Beams:

Introduction - types of beams, loads and reactions, Shear force and bending moment, Sign conventions, Relationship between load intensity, shear force and bending moment; Shear force and Bending moment diagrams for different beams subjected to concentrated loads, uniformly distributed load, (UDL) uniformly varying load (UVL) and couple.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Module-4

Bending Stresses in Beams:

Moment of inertia and section modulus for different sections (I, T, rectangular, and circular —only formulae). Introduction to theory of simple bending, assumptions in simple bending theory, Bending stress equation – relationship between bending stress and radius of curvature, relationship between bending moment and radius of curvature; Moment carrying capacity of a section. Simple problems on rectangular, symmetrical I (about NA) and T sections. (composite / notched beams not included).

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Module-5

Deflection of Beams:

Introduction, Differential equation for deflection (flexure), Sign conventions and assumptions, Equations for deflection and slope - Double integration method for cantilever and simply supported beams for point load, uniformly distributed load, uniformly varying load, and couple (Macaulay's method not included).

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to:

1. Provide the basic concepts and principles of mechanics of materials.
2. Calculate stresses and deformations of objects under external loadings.
3. Apply the knowledge of mechanics of materials applications and design problems.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

7. First test at the end of 5th week of the semester
8. Second test at the end of the 10th week of the semester
9. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

10. First assignment at the end of 4th week of the semester
11. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

12. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

7. The question paper will have ten questions. Each question is set for 20 marks.
8. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
9. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Books

1. Strength of Materials by R K Rajput, S. Chand and Company Pvt, 2014.
2. Fundamentals of Strength of Materials by P N Chandramouli, PHI Learning Pvt. Ltd, 2013.
3. Mechanics of Materials by R C Hibbeler, Pearson, Latest edition
4. Mechanics of Materials by James M Gere, Thomson Learning, Latest edition
5. Mechanics of Materials by Ferdinand Beer, Russell Johston and others, McGraw Hill Education (India) Pvt. Ltd, Latest edition

Web links and Video Lectures (e-Resources):

- www.nptel.ac.in
- https://www.youtube.com/watch?v=aQf6Q8t1FQE&vl=en
- https://youtu.be/1YTKedLQOa0
- https://youtu.be/C-FEVzI8oe8
- https://youtu.be/Bls5KnQOWkY
- https://www.youtube.com/watch?v=MvBqCeZllpQ

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Axial deformation activity
- Simple or direct shear stress activity
- Torsional shear stress and design activity
- A couple additional possible activity
- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Biology For Engineers			
Course Code	**21BE45**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	02

CAD and CAE Lab			
Course Code	**21IPL46**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03

Course objectives:

- To Study the fundamentals of CAD.
- To develop a sound knowledge of Assembly of components.
- To have basic skills to analysis the structural components.

Sl.NO	Experiments
1	Assembly drawing of following machine parts (3D parts to be created and assembled and then getting 2D drawing with required views, along with 3D part drawings).
	i. Screw jack (Bottle type) ii. Machine vice
2	Modelling of simple machine parts using Graphics Package
3	Study of Finite Element Analysis Package - 1D, 2D, Structural problems
4	Evaluation of displacement (Strain) and Stress.
5	Problems involving on Beams and Trusses

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Understand the concepts of component design.
- Understand the various parameters of analysis on components.
- Understand the different models of machine parts.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

- Machine Drawing K. R. Gopala Krishna Subhash Publication.
- A Primer on Computer Aided Machine Drawing Published by VTU
- A Text Book of Computer Aided Machine Drawing S. Trymbaka Murthy CBS Publishers, New Delhi 2007
- Machine Drawing with Auto CAD Goutam Purohit & GouthamGhosh 1st Indian print Pearson Education, 2005

Samskrutika Kannada			
Course Code	**21KSK37/47**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	03

Balake Kannada			
Course Code	**21KBK37/47**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Constitution of India & Professional Ethics			
Course Code	**21CIP37/47**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Essentials of New Product Development			
Course Code	**21IP/IM481**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- To enable the students to understand the new products and strategies.
- To help the students focus on and analyse value and cost accounting.
- To develop relevant skills necessary for cost calculation.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction:

New products, new product strategy -market definition Idea generation.

Manufacturing Planning: Selection of optimum process, standardization. Break even analysis.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-2

Value Analysis: Steps in selection, analysis and implementation, Selection of cutting speed for optimum cost -problems.	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.
Module-3	
Cost Accounting: Cost estimation -difference -types -steps involved in cost estimation.	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.
Module-4	
Types of Cost: Cost Centers, Direct –Indirect, Material cost -direct indirect material cost Overhead cost.	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Activity based learning.
Module-5	
Cost Calculation: Cost calculation for machined components, welding, casting and forged components illustrations - calculation of sales cost.	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Activity based learning.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the new product concepts.
2. Understand the manufacturing planning.
3. Understand the different types of cost.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. **Design and Marketing of New Products** - Glen L Urban - John R Hauser- Prentice Hall. New Jersey, 1980.
2. **Production and Costing** - Narang CBS & Kumar V - Khanna Publishers- 2001.
3. **Cost management in the New Manufacturing Age** -Yasuhiro Monden, ProductivityPress-1992.

Web links and Video Lectures (e-Resources):

- https://www.wallstreetmojo.com/value-analysis/
- https://www.netsuite.com/portal/resource/articles/financial-management/break-even-analysis.shtml#:~:text=A%20break%2Deven%20analysis%20is,cover%20all%20of%20your%20costs.
- https://icmai.in/upload/CASB/2017/CAS15.pdf

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

An overview of Quality Improvement Tools			
Course Code	**21IP/IM482**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- Foundation for understanding of composite materials.
- Exposer to the fabrication of composites.
- To impart the knowledge of structural applications of composites.
- To learn Micro analysis of unidirectional lamina.
- To learn the study properties of MMC's.
- To impart the knowledge for applications of natural composites

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction: Total Quality Control and The Seven New QC Tools Relation diagram, KJ method (affinity diagram), Systematic diagram, Matrix diagram, Matrix data analysis, Process decision program chart (PDPC), Arrow diagram.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-2

Seven QC Tools: Applying the Seven New QC Tools, Affinity diagram, Need, Process and Examples.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-3

Systematic diagram and matrix diagram, Need, Process, Examples

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-4

Matrix data analysis, PDPC & arrow diagram method, Need, Process, Examples

Teaching-Learning Process	Chalk and Talk, Power point presentation.

Module-5

Education to introduce the seven new QC tools conclusion: Implementation of seven new QC tools, Strategic Plan for implementation of seven new QC tools.

Teaching-Learning Process	Chalk and Talk, Power point presentation.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Increased customer or staff satisfaction
- Increased reach to a target population
- Dissemination of information, products, or evidence-based practices
- Quality enhancement of services or programs;
- Quality enhancement of data systems
- Organizational design improvements

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. MANAGEMENT FOR QUALITY IMPROVEMENTS, Norman Bodek Shigeru Mizuno,
2. Quality Management for Organizations Using Lean Six Sigma Techniques, Erik Jones, 1st Edition

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=rIF8E5O1RUI
- https://asq.org/quality-resources/affinity#:~:text=The%20affinity%20diagram%20organizes%20a,%2C%20complex%20issue%2C%20or%20problem.
- https://www.youtube.com/watch?v=R5xITJk_V90
- https://www.youtube.com/watch?v=QOy2gYuWxSc
- https://www.youtube.com/watch?v=-uc7jRFuOQQ
- https://www.youtube.com/watch?v=0hzqHwu1i_I
- https://www.youtube.com/watch?v=QJVHNvoKyJM
- https://www.4cpl.com/blog/7-qc-tools-for-quality-improvement-with-a-strategic-plan/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Basics of Financial Management			
Course Code	**21IP/IM483**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	01

Course objectives:

- Provide the learner with an in-depth understanding of the link between company decision-making and the operation of capital markets
- Ensure the learner understands and appreciates the strong linkages between finance and globalisation
- Demonstrate the importance of working capital management and the tools to manage it
- Help the learner to explore the financial environment in which firms and managers must operate.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain concepts
3. Encourage collaborative (Group Learning) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

Financial system: significance and definition, perfect capital market, types of markets, liberalisation of the financial system, Factors determining savings, financial liabilities, savings rate in ninth and 10th plan, financial intermediation, payment and settlement system.

Commercial banking: Evolution, variable rate lending, characteristics of bank, risk management, type of risks, RBI guidelines for risk management, risk management system, entry of banks into insurance in India, analysis of assets and liabilities of scheduled commercial banks.

Teaching-Learning Process	To understand the critical role of manager through Chalk and Talk method Theory and practice through presentation To develop the personal skill of manager through g through live examples and videos

Module-2

Reserve Bank of India: Introduction to central banking, instruments of monetary control, reserve bank of India, public debt, secondary debt market, reserve requirements, selective credit control, advances to priority sector, supervision system.

Development banking: Nature of development banking, financial appraisal, liquidity ratios, capital ratios, the breakeven point, technical appraisal, economic uprising, social cost benefit analysis, promoters contribution, apprising term loans, development finance institutions.

Teaching-Learning Process	To develop the personal skill of manager through live examples and videos Theory and practice through presentation

Module-3

Merchant banking: Introduction, banking commission report (1972), Merchant banking in India, origin of merchant banking abroad, regulation of merchant banking, primary market, definition of merchant banker,prospectus, mandated functions of merchant bankers.

Mutual funds: Mutual funds in India, types of mutual funds, GETFs, Written from mutual funds, mutual fund holders account, recommendations of the study group, SEBI's directives for mutual funds, private mutual funds, asset management company, RBI guidelines.

Teaching-Learning Process	To develop interpersonal skill of manager through live examples and videos Theory and practice through presentation

Module-4

Money market: Features of money market, instruments, secondary market for money market instruments

Foreign exchange market: Market regimes and trade, trade in foreign exchange market, impact of technology on trading, speculation, foreign exchange rates, market makers, transaction cost, forward exchange rates, cross rates, spot exchange : settlement procedure, currency arbitrate, nominal, real, affective exchange rates, edging exchange risk, definition of exchange risk, edging with options.

Teaching-Learning Process	To develop group skill of managers through live examples and videos Theory and practice through presentation

Module-5

Primary market: Introduction, instruments, debentures, credit rating of debt instruments, preference shares, equity shares, public issue of securities, underwriting public issues Through prospectus, venture capital.

Secondary market: stock exchanges:Introduction, growth of stock exchanges, growth pattern of listed stock, stockbrokers, functions of a stock exchange.

Foreign investment and its regulations: Significance and role of foreign investment, non-residential Indians Accessing international capital markets, Introduction guidelines for external commercial borrowings.

Teaching-Learning Process	To develop specific communication skillsthrough meetings and interviews Presentation by the students on oral and written presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Describe the financial environment within which organisations must operate
2. Critically evaluate the financial objectives of various types of organisations and the respective requirements of stakeholders
3. Discuss the function of capital markets
4. Explain alternative sources of finance and investment opportunities and their suitability in particular circumstances
5. Assess the factors affecting investment decisions and opportunities presented to an organisation

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Text Books

1. Indian financial system, M Y Kham, 7th edition.
2. Indian financial system, H R Machiraju, fourth edition, Vikas publications.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=gqcXs6HoAnY
- https://www.youtube.com/watch?v=5ld2x94RuH0
- https://www.youtube.com/watch?v=iHFfX0AnlvY
- https://www.youtube.com/watch?v=EU-NyBxHuGU
- https://www.youtube.com/watch?v=5YkYJqQjWI4
- https://www.youtube.com/watch?v=_p3-sVHulmM
- https://www.youtube.com/watch?v=C0Ktvoh-oFM
- https://www.youtube.com/watch?v=GPibEnh6HiA
- https://www.youtube.com/watch?v=Nonw1yiWEWs
- https://www.youtube.com/watch?v=czO-HIgdxiQ
- https://www.youtube.com/watch?v=d4PxM_Jug0E
- https://www.youtube.com/watch?v=agk5fW7eq3M

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Group discussions on Finance management.

Universal Human Values			
Course Code	**21UH49**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Inter/Intra Institutional Internship			
Course Code	**21INT49**	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	--	SEE Marks	--
Total Hours of Pedagogy	--	Total Marks	100
Credits	02	Exam Hours	03

Additional Mathematics – II			
Course Code	**21MATDIP41**	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	--
Total Hours of Pedagogy	40	Total Marks	100
Credits	--	Exam Hours	--

V SEMESTER

Design of Machine Elements			
Course Code	**21IP51**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Enable students to attain the basic knowledge required to understand, analyze, design and select machine elements required in transmission systems.
- Reinforce the philosophy that real engineering design problems are open-ended and challenging
- Impart design skills to the students to apply these skills for the problems in real life industrial applications
- Inculcate an attitude of team work, critical thinking, communication, planning and scheduling through design projects

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

DESIGN FOR STATIC STRENGTH: Design considerations; Codes and Standards, static loads and factor of safety. Theories of failure: Maximum Normal Stress Theory, Maximum Shear Stress Theory, Distortion energy theory. Failure of Brittle and Ductile materials. Stress concentration. Determination of stress concentration factor.

Teaching-Learning Process	Chalk and Talk, Power point presentation.

Module-2	
DESIGN FOR FATIGUE STRENGTH: S – N Diagram, fatigue. Endurance limit. Modifying factors: Load, Size and Surface finish effects. Fatigue stress concentration factor. Fluctuating stresses. Goodman and Soderberg Relationship. Stresses due combined loading.	
Teaching-Learning Process	Chalk and Talk, Power point presentation.
Module-3	
DESIGN OF SHAFTS: Design of shafts subjected to torsion, bending moment and combined torsion moment and axial loading. ASME and BIS Codes for design of transmission shafting. Design for strength and rigidity. Shafts under fluctuating loads and combined loads	
Teaching-Learning Process	Chalk and Talk, Power point presentation.
Module-4	
DESIGN OF GEARS: Introduction to Spur, Helical and Bevel Gears. Design of Spur gear, Lewis equation, form factor, stresses in gear tooth, Dynamic load and wear load.	
Teaching-Learning Process	Chalk and Talk, Power point presentation.
Module-5	
RIVETED JOINTS AND WELDED JOINTS: Types of riveted joints, failures of riveted joints, Boiler joint, Efficiency. Types of welded joints, Strength of butt and fillet welds, eccentrically loaded welds. **DESIGN OF SPRINGS:** Types of springs, Stresses in Coil springs of circular and non-circular cross-sections. Tension and compression springs. Stresses in Leaf springs.	
Teaching-Learning Process	Chalk and Talk, Power point presentation.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :
1.able to understand various forces acting on a body
2. will be able to design shafts, gears, springs
3 will be able to design various kind of joints
4 will be able to put together all the above and design a complex machine

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100 shall be reduced proportionally to 50 marks

Suggested Learning Resources:

Books

- Mechanical Engineering Design, Joseph Edward Shigley, Tata McGraw Hill New Delhi – 1986
- Machine Design VL. Maleev and Hartman CBS Publishers and Distributors Delhi – 1983
- Design of Machine Elements V. B. Bahandari Tata McGraw Hill, New Delhi 2000
- Machine Design Robert. L. Norton Pearson Education Asia, New Delhi – 2001
- Theory and Problems of Machine Design Hall, Holowinko, Laughlin Schaums Outline Series 2002
- Elements of Machine Design N. C. Pandey and C. S. Shah Chorotar Publishing house 2002

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=-bg9qerlMgs
- https://www.youtube.com/watch?v=nnqpBMufX4I
- https://www.youtube.com/watch?v=TOAanx0QPKs
- https://www.youtube.com/watch?v=8bml2pK6Ra0

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Computer Integrated Manufacturing and Automation			
Course Code	**21IP52**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

- To learn the basic concepts of Computer Integrated Manufacturing and the benefits that can be achieved by integrating technology with manufacturing systems.
- To have a fundamental knowledge of CNC Machine Tools.
- To imbibe the basic knowledge of Robotics and their application to production
- To develop the fundamental skill sets in CNC Programming
- To inculcate the fundamental knowledge CIM, Group Technology and Flexible Manufacturing

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

MODULE-1 8 HOURS

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/CAM/CIM.

Production Concepts and Mathematical Models: Manufacturing lead time, Operation time, Capacity, Availability, Work-in-process, Problems.

Teaching-Learning Process	Chalk and Talk, Power point presentation, Animations

MODULE-2 8 HOURS

CNC Machine Tools: Turning tool geometry, milling tooling systems, tool presetting, ATC, work holding, CNC machine tools, overview of different CNC machining centers, CNC turning centers.

Teaching-Learning Process	. Chalk and Talk, Power point presentation, Animations

MODULE-3 8 HOURS

AI & Robotics:

AI based Robot Architecture & Applications in Automated Manufacturing, Robot Vision & Motion, AI Search Algorithms For Robot Planning and Manipulation, Multi agent and swarm robotics, Robot to Robot and Robot to human coordination (Cobots - collaborative robotics) Reliable & Trusted AI in Robotics.

Teaching-Learning Process	Chalk and Talk, Power point presentation, Animations

MODULE-4 8 HOURS

Automated material Handling Storage: Material functions, types of material handling equipment, analysis of material handling systems, design of system, conveyor system, automated guided vehicle systems, automated storage/retrieval systems, caroused storage systems work in process storage, interfacing handling & storage with manufacturing.	
Teaching-Learning Process	Chalk and Talk, Power point presentation, Animations
MODULE 5 8 HOURS	
CNC Programming: Steps involved in development of a part program, manual part programming-milling and turning, ISO programming in drilling, milling and turning with numerical problems.	
Teaching-Learning Process	Chalk and Talk, Power point presentation, Animations

PRACTICAL COMPONENT OF IPCC

Sl.NO	Lab Exercises
1	Study of functions assigned to Alphabets and Symbols. G and M codes, grouping of codes, Assigned and Unassigned, Model and Non Model codes.
2	Writing the program for Step Turning
3	Writing the program for Taper Turning
4	Writing the program for Threading
5	Writing the program for Milling
6	Writing the program for key ways
7	Writing the program for Drilling
8	Writing the program for counter boring
Demonstration Only	
9	Exercises on Robots
	General Configuration of
	a. Robot.
	b. Different Programming methods
	c. Overview of Robot languages.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Outline the use of computers and NC technology in CIM systems.
- Understand the concepts of CNC machine tool technology.
- Comprehend the applications of robots in CIM.
- Develop CNC programs for turning and milling operations.
- Plan and control the CIM systems effectively. Apply the GT and FMS in actual manufacturing practice

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester
- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical

component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

- CAD/CAM Principles and Applications, P.N. Rao, TMH, New Delhi, 2002.
- CAD/CAM Mikell P-groover, Emory W.Zimrners, Jr Pearson Education inc 2003
- CAD/CAM/CIM P.Radhakrishnan, S.Subramanyan New Age InternationalPublication, Revised ThirdEdition 2007.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=_OaBMsUgqgQ
- https://workshopinsider.com/an-overview-of-cnc-machining/
- https://aibusiness.com/author.asp?section_id=789&doc_id=773741
- https://www.designedconveyor.com/2019/11/04/the-4-types-of-material-handling-equipment/
- https://www.youtube.com/watch?v=YoslM2Sxihs

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Quality Assurance and Reliability			
Course Code	**21IP/IM 53**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To understand the fundamentals of Quality tools and techniques
- To apply the quality and reliability tools and techniques to real world problems
- To Interpret the results of quality and reliability study for decision making

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the students' understanding.
8. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

INTRODUCTION: Definition, Quality characteristics, Quality of design, conformance, and performance. Quality costs, Value of quality Vs Cost of quality, Quality control and Inspection, Introduction to SQC, TQC, TQM, and Quality Circles

PROBABILITY DISTRBUTIONS: Variable and Attribute data, Definition of Probability and Basic laws, Probability distributions for Variables (Normal, Exponential and Weibull distributions) and Attributes (Hypergeomtric, Binomial and Poison's distributions), Numerical Exercises

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-2

STATISTICAL PROCESS CONTROL: Introduction, Sources of variation, Chance and Assignable causes of variation. Control Charts: basic principles and objectives, Aalpha (α) and Beta (β) errors, Analysis of Control chart patterns

CONTROL CHARTS FOR VARIABLES: Control charts for X-bar and range (R), X-bar and Standard deviation (σ), Development and use of these control charts. Estimation of Process capability, Relationship of Process capability with Specification Tolerance. Numerical Exercises.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-3

CNTROL CHARTS FOR ATTRIBUUTES: Variable Vs Attribute control charts. Defect Vs Defective, Control Chart for defectives: 'p' chart and 'np' chart, development and use of these control charts. Control Chart for defects: 'c' chart and 'u' chart, development and use of these control charts. Numerical Exercises.

QUALITY SYSTEMS: Introduction, Concept of Quality Audit, Quality Audit types, Need for quality systems, Introduction to ISO 9000, ISO 14000, ISO 27000, and ISO 50000 series quality systems.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-4

ACCEPTACE SAMPLING: Introduction to Acceptance Sampling, Sampling methods. Operating Characteristic (OC) curves, Producer's risk (α) and Consumer's risk (β), Acceptable Quality Level (AQL), Rejection Quality level (RQL/LTPD), Indifferent Quality Level (IQL), Average Outgoing Quality Limit (AOQL), Characteristics of OC curves. Single, Double, and Multiple Sampling Plans: Computing ATI, AFI, ASN, AOQL, Numerical Exercises. Introduction to Item by item Sequential Sampling Plan.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-5

RELIBILTY: Introduction, Failure data analysis, Definition of MTTF, MTBF, MTBM, MTTR, MDT. Bathtub curve. Deriving an expression for Reliability. System Reliability: Series, Parallel, and Mixed configurations. Reliability improvement, Redundancy: Element, Unit, and Standby methods. Numerical exercises

STATISTICAL TOLERANCING: Introduction, Statistical theorem, Tolerance of Parts and Assembly, Numerical exercises

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain the fundamentals of Quality tools and techniques
2. Implement the quality and reliability tools and techniques in the real world scenario
3. Understand the results of quality and reliability study and use it for decision making

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks. Marks scored out of 100, shall be proportionally reduced to 50 marks
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.

The students have to answer 5 full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1. Statistical Quality Control by Grant and Leavenworth Mc Graw-hill
2. Quality Planning and Analysis by J.M. juran and Frank M Gryna –Tata McGraw hill
3. Introduction to Statistical Quality Control by D. Montgomery –Johnwiley
4. Statistical Quality Control by R.C Gupta, Khanna publishers.
5. Statistical Quality Control by M Mahajan – Dhanpat Rai & sons.

Web links and Video Lectures (e-Resources):

- http://www.ru.ac.bd/stat/wp-content/uploads/sites/25/2019/03/405_02_Montgomery_Introduction-to-statistical-quality-control-7th-edtition-2009.pdf
- https://www.youtube.com/watch?v=tSbB5GtW1d0
- https://www.youtube.com/watch?v=uPTdz8mkxi8
- https://www.youtube.com/watch?v=os17KYZAnd0
- https://www.youtube.com/watch?v=X_JSyINygNg
- https://www.youtube.com/watch?v=Ugcb7Vlp0Ts
- https://www.youtube.com/watch?v=8XE56DbAGKM
- https://www.youtube.com/watch?v=328lcikqqs0
- https://www.youtube.com/watch?v=CmYpqVn3NoI
- https://www.youtube.com/watch?v=kRGQDaE_fSg
- https://www.youtube.com/watch?v=TFCcfl4DyUo
- https://www.youtube.com/watch?v=3GkDnw94Xxk
- https://www.youtube.com/watch?v=WSr6AU0InMk
- https://www.youtube.com/watch?v=d7Tl3E_lOMc
- https://www.youtube.com/watch?v=hmqsK_lifeI
- https://www.youtube.com/watch?v=kWLOwKC8JIs
- https://www.youtube.com/watch?v=TDPJ_ZareQY

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Hydraulics and Pneumatics			
Course Code	**21IP54**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

1. To Study the fundamentals of Hydraulic Power Pumps, Actuators and Motors.
2. To develop a sound knowledge of control components in Hydraulic Systems.
3. To have basic skills to design Hydraulic Circuits and analyze them.
4. To acquire the fundamental knowledge on pneumatic control.
5. To develop skill sets to handle Pneumatic Actuators , Valves, Pneumatic circuits and logic circuits

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby sites to give brief information about the Industrial and Production Engineering structures.
3. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
4. Encourage collaborative (Group Learning) Learning in the class.
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.

Module-1

Introduction to Hydraulic Power and Pumps: review of fluid mechanics, Pascal's Law, structure of hydraulic control system. pumps: pumping theory, pump classification, gear pumps- external and internal type, vane pumps- simple, balanced, pressure compensated types, piston pumps- radial and axial (both swash plate and bent axis type), pump performance.

Hydraulic Actuators and Motors: Linear hydraulic actuators - single acting, double acting, tandem cylinder, telescopic rod cylinder, mechanics of hydraulic cylinder loading, cylinder cushioning, hydraulic rotary actuators,

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Creating real time stations in classroom discussions, Giving activities &assignments.

Module-2

Control Components in Hydraulic Systems: directional control valves (DCV), constructional features, 2/2,3/2,4/2,4/3 DCV, center configuration in 4/3 DCV- open, closed, tandem, regenerative, floating centre configuration, actuation of DCVs- manual, mechanical, solenoid, and indirect actuation, relays for the solenoid operation, check valve, pilot check valve, pressure control valves – direct and pilot operated types, pressure reducing valve, flow control valves- fixed throttle, and variable throttle, throttle check.

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Creating real time stations in classroom discussions, Giving activities &assignments.

Module-3

Hydraulic Circuit Design and Analysis: control of single and double acting hydraulic cylinder, regenerative circuit, counter balance valve application, cylinder sequencing circuits, cylinder synchronizing circuits, speed control of hydraulic cylinder – meter in and meter out, speed control of hydraulic motors, relay circuit design for the operation of solenoid directional control valve- single and double solenoid relay circuit.

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Creating real time stations in classroom discussions, Giving activities &assignments.

Module-4

Introduction To Pneumatic Control: choice of working medium, characteristics of compressed air, structure of pneumatic control system , supply, signal generators, signal processor, final control elements , actuators, production of compressed air – compressors - reciprocating and rotary type, preparation of compressed air – driers, filters, regulators,

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Creating real time stations in classroom discussions, Giving activities &assignments.

Module-5

Pneumatic Actuators , Valves: linear cylinder – types, conventional type of cylinder – working, directional control valve, shuttle valve, quick exhaust value, twin pressure valve, direct and indirect actuation of pneumatic cylinder, memory valve, time delay valve.

Pneumatic circuits and logic circuits: supply air and exhaust air throttling, will dependent circuits, travel dependent controls – types – construction – practical applications, cylinder sequencing circuits, travel step diagrams, practical examples involving two or three cylinders, use of logic functions – OR, AND, NOR, NAND,YES, NOT functions in pneumatic applications, practical examples involving the use of logic functions

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Creating real time stations in classroom discussions, Giving activities &assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Recall the basic concept of fluid mechanics; identify different components of hydraulic system
- Analyze the requirement of control components and their selection

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

4. The question paper will have ten questions. Each question is set for 20 marks.
5. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
6. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Textbooks

1. Fluid Power with applications, Anthony Esposito Pearson edition 2000
2. Oil Hydraulics Majumdar, S.R., TalaMcGRawHllL, 2002
3. Pneumatic systems- "Principles and Maintenance" ,Majumdar S.R ata McGraw-Hill, New Delhi 2005
4. Hydraulics and pneumatics Andrew Par Jaico Publishing House 2005
5. Industrial Hydraulics John Pippenger, Tyler Hicks McGraw Hill International Edition, 1980.
6. Hydraulic Control Systems Herbert E. Merritt, John Wiley and Sons,

Web links and Video Lectures (e-Resources):

- https://www.engineering.com/hydraulic-pumps/amp
- https://hydraulicsonline.com/technical-knowledge-hub-news/an-introduction-to-hydraulic-pumps/
- https://www.powermotiontech.com/hydraulics/hydraulic-pumps-motors/article/21884136/engineering-essentials-fundamentals-of-hydraulic-pumps
- https://www.globalspec.com/reference/45968/203279/chapter-6-control-components-in-a-hydraulic-system
- https://whyps.com/hydraulic-system-components-and-their-functions
- https://engineeringlearn.com/pneumatic-control-system/
- https://www.youtube.com/watch?v=YlmRa-9zDF8
  https://www.youtube.com/watch?v=HzaWOFWV
  https://www.youtube.com/watch?v=HzaWOFWVz6E
- https://www.youtube.com/watch?v=HzaWOFWVz6E
- https://www.processindustryforum.com/article/what-is-a-pneumatic-actuator
- https://www.powermotiontech.com/fluid-power-basics/pneumatics/article/21155572/automationdirect-4-basic-pneumatic-circuits
  https://www.electronics-tutorials.ws/combination/comb_1.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Contents related activities (Activity-based discussions)
2. For active participation of students, instruct the students to prepare Exercise problems
3. Organizing Group wise discussions and machineries issues based activities
4. Quizzes and Discussions
5. Seminars and assignments

Energy Engineering Lab			
Course Code	**21IPL55**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03

Course objectives:

- To Study the fundamentals of Hydraulic Power Pumps, Actuators and Motors.
- To develop a sound knowledge of control components in Hydraulic Systems.
- To have basic skills to design Hydraulic Circuits and analyze them.
- To acquire the fundamental knowledge on pneumatic control

Sl.NO	**Lab Experiments**
1	a) Study of components of Hydraulic circuit. b) Study of symbols for components in hydraulic circuits
2	To study the performance of Ruston oil engine and to draw it's characteristics curves.
3	To study the performance of vertical oil engine and to draw its characteristics curves.
4	Determination of viscosity of lubricating oil using Say bolt – Viscometers and torsional viscometer
5	Study of flow through pipes for fluid transport a) minor loses b) major loses
6	Valve timing diagram for 4 stroke vertical oil engine and 4 stroke horizontal oil engine.
7	To measure the volumetric flow rate of the fluid by using a)Orifice meter b) venturimeter
8	To measure the area of plane figure by tracing its boundary line by using planimeter.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Understand the properties of a fluid.
- Will be able to handle and design complex hydraulic circuits
- Understand the various parameters affecting a engine

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources:

- https://learnmech.com/components-fuctions-hydraulic-syste/
- https://blogmech.com/valve-timing-diagram/
- https://www.machinerylubrication.com/Read/411/oil-viscosity
- https://www.hkdivedi.com/2015/12/major-and-minor-losses-in-pipes.html

Research Methodology & Intellectual Property Rights			
Course Code	**21RMI56**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:0:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	02

Environmental Studies			
Course Code	**21CIV57**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Elements of Developing Management Skills			
Course Code	**21IP/IM581**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	1	Exam Hours	01

Course objectives:

- To help the students gain understanding of the functions and responsibilities of managers.
- To provide them tools and techniques to be used in the performance of the managerial job.
- To enable them to analyse and understand the environment of the organization.
- To help the students to develop cognizance of the importance of management principle

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Video/animation films to explain concepts
3. Encourage collaborative (Group Learning) Learning in the class
4. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develops thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Topics will be introduced in multiple representations.
7. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
8. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.

Module-1

INTRODUCTION

THE CRITICAL ROLE OF MANAGEMENT SKILLS

The Importance of Competent Managers, The Skills of Effective Managers, Essential Management Skills, What Are Management Skills?, Improving Management Skills, An Approach to Skill Development, Leadership and Management.

PERSONAL SKILLS

DEVELOPING SELF-AWARENESS

SKILL LEARNING : Key Dimensions of Self Awareness, The Enigma of Self Awareness, The Sensitive Line,

Understanding and Appreciating Individual. **SKILL PRACTICE**:Exercises for Improving Self Awareness Through Self-Disclosure-Through the Looking Glass.	
Teaching-Learning Process	To understand the critical role of manager through Chalk and Talk method Theory and practice through presentation To develop the personal skill of managerthrough g through live examples and videos

Module-2

MANAGING PERSONAL STRESS

SKILL LEARNING

Improving the management of stress and time, Major elements of stress, Managing stress, Eliminating stressors.

SKILL PRACTICE

Exercises for long-term and short- run stress management,

SOLVING PROBLEMS ANALYTICALLY AND CREATIVELY

SKILL LEARNING: Problem-solving, creativity and innovation, Steps in analytical problem-solving, Limitations of the analytical problem-solving model.

SKILL PRACTICE: Individual assignment Analytical problem-solving, Team assignment creative problem-solving, Moving up in the rankings, Creative problem-solving practice

Teaching-Learning Process	To develop the personal skill of managerthrough live examples and videos Theory and practice through presentation

Module-3

INTERPERSONAL SKILLS

BUILDING RELATIONSHIPS BY COMMUNICATING SUPPORTIVELY

SKILL LEARNING: Building positive interpersonal relationships, The importance of effective communication, The focus on accuracy

SKILL PRACTICE: Exercises for diagnosing communication problems and fostering understanding

GAINING POWER AND INFLUENCE

SKILL LEARNING: Building a strong power base and using influence wisely.

SKILL PRACTICE: Exercise for gaining power, Repairing power failures in management Circuits.

MOTIVATING OTHERS

SKILL LEARNING**:** Increasing motivation and performance, Diagnosing work performance problems.

Skill practice: Exercises for diagnosing work performance problems.

Teaching-Learning Process	To develop interpersonal skill of managerthrough live examples and videos Theory and practice through presentation

Module-4

GROUP SKILLS

EMPOWERING AND DELEGATING

SKILL LEARNING: Empowering and delegating, A management dilemma involving empowerment.

Exercises for empowerment, Executive development associates.

BUILDING EFFECTIVE TEAMS AND TEAMWORK

SKILL LEARNING: Developing teams and teamwork, the advantages of teams.

SKILLS PRACTICE

Exercises in building effective teams, Team diagnosis and team development exercise.

LEADING POSITIVE CHANGE

SKILL LEARNING: Leading positive change, Ubiquitous and escalating change.

SKILL PRACTICE: Exercises in leading positive change, Reflected Best self-portrait

Teaching-Learning Process	To develop group skill of managersthrough live examples and videos Theory and practice through presentation

Module-5

SPECIFIC COMMUNICATION SKILLS

MAKING ORAL AND WRITTEN PRESENTATIONS

SKILL LEARNING: Making oral and written presentations, Essential elements of effective presentation

SKILL PRACTICE: Exercises for making effective oral and written presentations, Speaking as a leader

CONDUCTING INTERVIEWS

SKILL LEARNING: Planning and conducting interviews, Specific types of organizational interviews

SKILL PRACTICE: Evaluating a new employee orientation programme

CONDUCTING MEETINGS

SKILL LEARNING: Conducting effective meetings: a short guide, For meeting managers and meeting participants, The five Ps of effective meetings, suggestions for group members

SKILL PRACTICE: Exercises for conducting meeting.

Teaching-Learning Process	To develop specific communication skillsthrough meetings and interviews Presentation by the students on oral and written presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the concepts related to Business.
2. Demonstrate the roles, skills and functions of management.
3. Analyse effective application of PPM knowledge to diagnose and solve organizational problems and develop optimal managerial decisions.
4. Understand the complexities associated with management of human resources in the organizations and integrate the learning in handling these complexities.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour)**

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Text Books

3. David A. Whetten, Kim S. Cameron, “Developing management skills”,(eastern economy edition)Eighth edition, 2013.
4. Baker, W. Achiving success through social capital. San Rrancisco:Jossy-Bass.(2000)

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=nFSeS1MeSeY
- https://www.youtube.com/watch?v=cx_RXvE1qic
- https://www.youtube.com/watch?v=NNeNNpiD-rQ
- https://www.youtube.com/watch?v=zJxVBovpKls
- https://www.youtube.com/watch?v=uSSHDCgq-4k
- https://www.youtube.com/watch?v=kOs8-8UUlls
- https://www.youtube.com/watch?v=j-i6JOgFk1E
- https://www.youtube.com/watch?v=1jsBVAFnc1c
- https://www.youtube.com/watch?v=akUdyh8ERvQ
- https://www.youtube.com/watch?v=BJiDr-wrdzk
- https://www.youtube.com/watch?v=jvc_ETgS6xk
- https://www.youtube.com/watch?v=lZ41JRjDu5Q
- https://www.youtube.com/watch?v=2xlumuCc8gE
- https://www.youtube.com/watch?v=iAzPjqGo4d8

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Group discussions on management skills.

Basics of Rapid Prototyping

Course Code	**21IP/IM582**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- To provide knowledge on different types of Rapid Prototyping systems. and its applications in various fields.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction:

Need for the compression in product development, history of RP systems, Survey of applications, Growth of RP industry, and classification of RP systems.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-2

Stereo Lithography Systems:

Principle, Process parameter, Process details, Data preparation, data files and machine details, Application.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-3	
Selective Laser Sintering: Type of machine, Principle of operation, process parameters, Data preparation for SLS, Applications.	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations.
Module-4	
Fusion Deposition Modelling: Principle, Process parameter, Path generation, Applications.	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning.
Module-5	
Solid Ground Curing: Principle of operation, Machine details, Applications. **Laminated Object Manufacturing:** Principle of operation, LOM materials. Process details, application.	
Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand and use techniques for processing of CAD models for rapid prototyping.
2. Understand and apply fundamentals of rapid prototyping techniques.
3. Use appropriate tooling for rapid prototyping process.
4. Use rapid prototyping techniques for reverse engineering.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

1. **Stereo lithography and other RP & M Technologies -**Paul F. Jacobs - SME, NY1996.
2. **Rapid Manufacturing -** Flham D.T &Dinjoy S.S - Verlog London2001.
3. **Rapid automated -** Lament wood - Indus press NewYork

Web links and Video Lectures (e-Resources):

- https://www.midaspattern.co.uk/news/the-history-of-rapid-prototyping#:~:text=Who%20Invented%20Rapid%20Prototyping%3F,include%20various%20forms%20of%20manufacture.
- https://www.youtube.com/watch?v=yW4EbCWaJHE
- https://www.youtube.com/watch?v=yiUUZxp7bLQ
- https://www.youtube.com/watch?v=7px1fl41cA4
- https://www.youtube.com/watch?v=ZZzDLQ-KoQ4
- https://www.youtube.com/watch?v=m0b3WIS2nqw

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Introduction to Maintenance Engineering			
Course Code	**21IP/IM583**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:0:0:0	SEE Marks	50
Total Hours of Pedagogy	15	Total Marks	100
Credits	01	Exam Hours	01

Course objectives:

- To understand the fundamentals Maintenance and Safety Engineering.
- To learn the concepts of Accident Preventions and safety acts.
- To analyze the Principles and Practices of Maintenance Planning and Maintenance Policies.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction to the Development of Industrial Safety and Management:

History and development of Industrial safety: Implementation of factories act, Safety and productivity, Safety organizations. Safety committees and structure.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-2

Accident Preventions and Protective Equipments: Personal protective equipment, Survey the plant for locations, Part of body to be protected, Education and training in safety, Prevention causes and cost of accident, Housekeeping, First aid, Firefighting equipment, Accident reporting.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-3

Safety Acts: Features of Factory Act, Introduction of Explosive Act, Boiler Act, ESI Act, Industrial hygiene, Occupational safety, Diseases prevention, Ergonomics, Occupational diseases, stress, fatigue, safety and the physical environment, Engineering methods of controlling chemical hazards.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations.

Module-4

Principles and Practices of Maintenance Planning: Basic Principles of maintenance planning – Objectives and principles of planned maintenance activity, Sound Maintenance systems – Reliability and machine availability, Equipment Life cycle.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning.

Module-5

Maintenance Policies and Preventive Maintenance: Maintenance categories – Merits of each category – Preventive maintenance, Maintenance schedules: Repair cycle, Principles and methods of lubrication, Fault Tree Analysis, Total Productive Maintenance: Methodology and Implementation.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain comprehensively the Maintenance and Safety Engineering.
2. Apply the techniques required to Accident Preventions
3. Perform Maintenance Policies and Preventive Maintenance

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous internal Examination (CIE)

Three Tests (preferably in MCQ pattern with 20 questions) each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

1. First assignment at the end of 4th week of the semester
2. Second assignment at the end of 9th week of the semester

Quiz/Group discussion/Seminar, any two of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

The sum of total marks of three tests, two assignments, and quiz /seminar/ group discussion will be out of 100 marks and shall be **scaled down to 50 marks**

Semester End Examinations (SEE)

SEE paper shall be set for 50 questions, each of 01 mark. The pattern of the question paper is MCQ (multiple choice questions). The time allotted for SEE is **01 hour.** The student has to secure minimum of 35% of the maximum marks meant for SEE.

Suggested Learning Resources:

Books

- Industrial Maintenance Management Srivastava, S.K. - S. Chand andCo.
- Occupational Safety Management and Engineering Willie Hammer - PrenticeHall
- Installation, Servicing and Maintenance Bhattacharya, S.N. - S. Chand andCo.

Web links and Video Lectures (e-Resources):

- https://study.com/academy/lesson/workplace-accident-definition-types-effects.html
- https://www.ehs.washington.edu/workplace/accident-prevention-plan
- https://www.youtube.com/watch?v=ssLQ7sLnIJ8
- https://www.prometheusgroup.com/posts/6-maintenance-planning-principles-for-success-in-planning-scheduling
- https://www.fiixsoftware.com/blog/putting-your-tpm-plan-into-action-a-step-by-step-guide/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

VI SEMESTER

Management and Entrepreneurship			
Course Code	**21IP/IM61**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Understand the basic concepts of management, planning, organizing and staffing.
- Acquire the knowledge to become entrepreneur.
- Comprehend the requirements towards the small-scale industries and project preparation.

Teaching-Learning Process (General Instructions)
These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

Module-1

MANAGEMENT: Introduction - Meaning - nature and characteristics of Management, Scope and Functional areas of management - Management as a science, art of profession - Management & Administration - Roles of Management, Levels of Management, and Development of Management Thought -early management approaches - Modem management approaches.
PLANNING: Nature, importance and purpose of planning process Objectives - Types of plans (Meaning Only) - Decision making Importance of planning - steps in planning & planning premises - Hierarchy of plans

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-2

ORGANIZING AND STAFFING: Nature and purpose of organization Principles of organization - Types of organization - Departmentation Committees Centralization Vs Decentralization of authority and responsibility Nature and importance of staffing Process of Selection & Recruitment.

DIRECTING & CONTROLLING: Meaning and nature of directing Leadership styles, Motivation Theories, Communication - Meaning and importance - coordination, meaning and importance and Techniques of Co Ordination. Meaning and steps in controlling.

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-3

ENTREPRENEUR: Meaning of Entrepreneur; Evolution of .the Concept; Functions of an Entrepreneur, Types of Entrepreneur, Entrepreneur - an emerging. Class. Concept of Entrepreneurship - Evolution of Entrepreneurship, Development of Entrepreneurship; Stages in entrepreneurial process; Role of entrepreneurs in Economic Development t; Entrepreneurship in India; Entrepreneurship – its Barriers.	
Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.
Module-4	
SMALL SCALE INDUSTRIES: Definition; Characteristics; Need and rationale; Objectives; Scope; role of SSI in Economic Development. Advantages of SSI Steps to start and SSI - Government policy towards SSI; Different Policies of SSI; Government Support for SSI during 5 year plans. Impact of Liberalization, Privatization, Globalization on SSI Effect of WTO/GA TT Supporting Agencies of Government for SSI, Meaning, Nature of support; Objectives; Functions; Types of Help; Ancillary Industry and Tiny Industry	
Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.
Module-5	
INSTITUTIONAL SUPPORT: Different Schemes; TECKSOK; KIADB; KSSIDC; KSIMC; DIC Single Window Agency; SISI; NSIC; SIDBI; KSFC**.** **PREPARATION OF PROJECT:** Meaning of Project; Project Identification; Project Selection; Project Report; Need and Significance of Report; Contents; Formulation; Guidelines by Planning Commission for Project report; Network Analysis; Errors of Project Report; Project Appraisal. Identification of business opportunities: Market Feasibility Study; Technical Feasibility Study; Financial Feasibility Study & Social Feasibility Study.	
Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Explain about the management and planning.
- Apply the knowledge on planning, organizing, staffing, directing and controlling.
- Describe the requirements towards the small-scale industries and project preparation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Books

1. Principles of Management, P. C.Tripathi,P.N. Reddy, Tata McGraw Hill,
2. Dynamics of Entrepreneurial Development & Management, Vasant Desai, Publishing House.
3. Entrepreneurship Development, Poornima. M.Charantimath, Small Business Enterprises –Pearson, 2006 (2 & 4).
4. Management Fundamentals-Concepts, Application , Skill , RobersLusier –Thomson
5. Entrepreneurship Development, S.S.Khanka, S.Chand& Co
6. Management, StephenRobbins, Pearson Education/PHI, 17th Edition, 2003

Web links and Video Lectures (e-Resources):

- www.nptel.ac.in
- https://www.smartzworld.com/notes/management-and-enterpreneurship-notes-me-vtu/
- https://www.maggubhai.com/management-process-organising-and-staffing/
- https://tutorstips.com/difference-between-directing-and-controlling/
- https://cleartax.in/s/small-scale-industries-ssi#:~:text=Small%20Scale%20Industries%20(SSI)%20are,50%20crore.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Work Study and Ergonomics			
Course Code	**21IP62**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 8-10 Lab slots	Total Marks	100
Credits	04	Exam Hours	03

Course objectives:

- To develop concepts related to principles of productivity & work study as a tool for increasing the efficiency and effectiveness in organizational systems.
- To study the existing method, compare and propose a new method.
- To provide the usage of the various tools and techniques used in work measurement.
- To develop basic ideas of ergonomics and its design.
- To develop concepts related Man-Machine Interfaces and Design of Displays and controls

Teaching-Learning Process (General Instructions)

These are sample Strategies; which teachers can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Discuss how every concept can be applied to the real world thus helping to improve the students understanding.
6. Individual teachers can device innovative pedagogy to improve teaching-learning.

MODULE-1 (8 HOURS)

Productivity: Introduction, Basic work content, Design defects, Proper selection of process, Role of Management, Role of workers, Benefits of higher productivity: productivity measurement approaches at the enterprise level: productivity of materials, land, buildings, machines and man power:

Techniques for productivity improvement: Introduction: work content and ineffective time: Improving productivity by reducing work content & by reducing inefficient time: Management of productivity.

Work study: Definition, objectives, Basic procedure, the human factor in the application of work study. The influence of working conditions on work study (Safety and health, fire prevention, Layout, environment conditions)

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-2(8 HOURS)

Method study I / work simplication: Definition and objectives procedures, Selection of jobs.

Recording Tools and Techniques: Operation process chart, flow process charts (Man type-Material type) , Flow diagram, critical examination, Develop the improved method.

Method study II/ Work simplication II: Tools for recording the movement of workers: String diagram, travel chart, multiactivity chart, and Man & Machine process chart, Gang process chart, Two handed process chart (operator process chart), principles of motion economy.

Motion study/ work simplication II : Cyclograph and chrinocyclograph Therbling, micrometer study, SIMO chart; Define, install and maintain the improved method.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-3 (8 HOURS)

Work measurement / Time study: Objectives, purpose/use techniques, Time study equipments**,** selection of job and operator for time study. Basic steps recording the information, examination of data, measurement of operation, rating and levelling, allowances, standard time.

Work Sampling: Procedure, sample size determination, estimation of standard time, advantages and disadvantages.

Synthetic data: Development of standard data, machine time calculation, practical systems of PMTS (work factor system, motion time measurement system, basic motion time study) advantages.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE-4(8 HOURS)

Ergonomics: Introduction, definition, objectives, benefits, types, applications; Industrial engineering ergonomics: musculoskeletal disorders (MSD), characteristics, how to control MSD.

Physical Ergonomics: human anatomy, and some of the anthropometric, physiological and bio mechanical characteristics as they relate to physical activity.

Cognitive Ergonomics: mental processes, such as perception, memory, reasoning, and motor response, mental workload, and decision-making.

Organizational ergonomics: optimization of socio-technical systems, including their organizational structures, policies, processes. Communication, work design, design of working times, teamwork, cooperative work, and new work programs.

Environmental ergonomics: human interaction with the environment- characterized by climate, temperature, pressure, vibration, light.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

MODULE 5 (8 HOURS)

Man-Machine Interaction; Man-Machine interaction cycle, Man-machine interfaces;

Displays: Factors that control choice of display; **visual displays**: qualitative displays (moving pointer displays, moving scale displays, digital displays Indicators), Quantitative displays, check- reading displays; **auditory displays.** Factors affecting effectiveness of displays. Types of controls and their integration with displays.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

24.09.2022

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Preparing the Outline process chart and Multiple Activity Chart
2	Construct the Flow process chart for various applications
3	Experiments on the principle of motion economy by Two handed process chart.
4	Draw the Flow diagram and String diagram for various applications.
5	Rating practice using: pin board assembly, dealing a deck of cards and marble collection activity
6	Determining the standard time for simple operations using stopwatch time study
7	Measurement of parameters (heart beat rate, calorie consumption) using walking simulator
8	Measurement of parameters (heart beat rate, calorie consumption, revolutions per minute) using ergonometer.
Demonstration only	
9	Exercises on conducting method study for assembling simple components and office work.
10	Development of Layout plans using SLP technique. Experiments on Line balancing.
11	Determination of standard time using PDA device and time study software
12	Exercises on estimating standard time using PMTS

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

- Recollect the basic concepts of productivity, work content and work study and define the objective an scope of Work Study.
- Define the various charts and to construct the charts on the basis of present method and develop a new / proposed method and identify the unnecessary movements.
- Explain the basic work measurement techniques and to gain knowledge of measurement of work, rating and imbibe the concept of allowance in estimating Standard Time.
- Determine the basic concepts of Ergonomics and demonstrate a sound knowledge of Ergonomics in engineering applications.
- Demonstrate a sound knowledge of Man-Machine Interfaces and design of displays and controls in engineering systems

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

CIE for the theory component of IPCC

Two Tests each of **20 Marks (duration 01 hour**)

- First test at the end of 5th week of the semester

- Second test at the end of the 10th week of the semester

Two assignments each of **10 Marks**

- First assignment at the end of 4th week of the semester
- Second assignment at the end of 9th week of the semester

Scaled-down marks of two tests and two assignments added will be CIE marks for the theory component of IPCC for **30 marks**.

CIE for the practical component of IPCC

- On completion of every experiment/program in the laboratory, the students shall be evaluated and marks shall be awarded on the same day. The**15 marks** are for conducting the experiment and preparation of the laboratory record, the other **05 marks shall be for the test** conducted at the end of the semester.
- The CIE marks awarded in the case of the Practical component shall be based on the continuous evaluation of the laboratory report. Each experiment report can be evaluated for 10 marks. Marks of all experiments' write-ups are added and scaled down to 15 marks.
- The laboratory test **(duration 03 hours)** at the end of the 15th week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 05 marks**.**

Scaled-down marks of write-up evaluations and tests added will be CIE marks for the laboratory component of IPCC for **20 marks**.

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SEE for IPCC

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE component only. Questions mentioned in the SEE paper shall include questions from the practical component).

- The minimum marks to be secured in CIE to appear for SEE shall be the 12 (40% of maximum marks-30) in the theory component and 08 (40% of maximum marks -20) in the practical component. The laboratory component of the IPCC shall be for CIE only. However, in SEE, the questions from the laboratory component shall be included**.** The maximum of 04/05 questions to be set from the practical component of IPCC, the total marks of all questions should not be more than the 20 marks.
- SEE will be conducted for 100 marks and students shall secure 35% of the maximum marks to qualify in the SEE. Marks secured will be scaled down to 50.

Suggested Learning Resources:

Books

- Introduction to Work Study, ILO, 4th edition, 1992
- Human Factor in Engineering and Design by Mark. S. Sanders and Ernest. J, McCornick McGraw-Hill Book Co., Inc., New York, 1993
- Work Study and Ergonomics by S. Dalela and Sourabh, Standard publishers, 2013
- Human Factors Design Handbook by Wesley Woodson,Peggy Tillman and Barry Tillman, McGraw-Hill, 2nd edition, 1992
- Motion and Time Study by Ralph M. Barnes, Wiley International, 7th Edition

- Work study and ergonomics by Lakhwinder pal singh, Cambridge university press, 2016

Web links and Video Lectures (e-Resources):

- www.nptel.ac.in
- https://youtu.be/gJDYV2SmFeY
- https://youtu.be/KktqRSxfTxo
- https://youtu.be/b05FPBjFH6A?list=PL6mZDY1bMAzhknOcAfFy_FI9vb5rzJzUv
- https://youtu.be/DlCDzSzsCDk
- https://youtu.be/nDUN_Kndxbc
- https://youtu.be/Fh6S5anFnbg
- https://youtu.be/pHc89bejapU
- https://youtu.be/wYvqHJ7FNAM
- https://youtu.be/1sb548iiuPY
- https://youtu.be/kQ-A9zvi7kA
- https://youtu.be/dVFtAEDlnRA
- https://youtu.be/ZrgYdAQ68T4

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Design of a reading table.
- Watering the garden.
- College layout for constructing flow diagram, string diagram.
- At the end of the lecture/presentation, exercises are to be taken up to solve problems related to the topics covered. Additional assignments are to be given under each of the topics covered.

Operations Research			
Course Code	**21IP63**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To enable the students to understand the scientific methods of providing various departments of an organization with a quantitative basis of decision making.
- To enable the students to understand the importance of various tools and techniques in finding optimal solutions to problems involving limited resources in the form of Men, Materials, and Machinery
- To enable the students to understand the various tools and techniques of Project Management

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the students' understanding.
8. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction: Evolution of OR, definition of OR, scope of OR, application areas of OR, steps (phases) in OR study, characteristics and limitations of OR, models used in OR, linear programming problem (LPP) -formulation and solution by graphical method.

Solution of Linear Programming Problems: The Simplex method, canonical and standard form of an LPP, slack, surplus and artificial variables, big M method and concept of duality, dual simplex method.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-2

Transportation Problem: Formulation of transportation problem, types, initial basic feasible solution using different methods, optimal solution by MODI method, degeneracy in transportation problems, application of transportation problem concept for maximization cases. Least Time Transportation Problems.

Assignment Problem: Formulation, types, application to maximization cases and Travelling Salesman Problem, Flight scheduling problem.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-3

Project Management using Network Techniques: Introduction, network construction - rules, Fulkerson's rule for numbering the events, AON and AOA diagrams; Critical path method (CPM) to find the expected completion time of a project, floats; Programme evaluation and review technique (PERT) for finding expected duration of an activity and project, determining the probability of completing a project in specified time, predicting the completion time of project; crashing of simple projects (network construction by AOA approach can be used for all the cases).

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-4

Queuing Theory: Queuing systems and their characteristics, Pure-birth and Pure-death models (only equations), empirical queuing models – (M/M/1) and (M/M/C) models (no derivations) and their steady state performance analysis.

Game Theory: Formulation of games, types, solution of games with saddle point, graphical method of solving mixed strategy games, dominance rule for solving mixed strategy games.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-5

Sequencing: Basic assumptions, sequencing 'n' jobs on single machine using priority rules, sequencing using Johnson's rule-'n' jobs on 2 machines, 'n' jobs on 3 machines, 'n' jobs on 'm' machines. Sequencing 2 jobs on 'm' machines

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain the meaning, definitions, scope, need, phases and techniques of OR.
2. Formulate LPP and derive optimal solutions by graphical method, Simplex method, Big-M method and Dual Simplex method.
3. Formulate Transportation, Assignment, and Travelling salesman problems and derive optimum solution.
4. Formulate game theory problems with competitive situations and derive solutions.
5. Explain waiting line problems and derive solution for (M/M/1) and (M/M/C) queuing models.
6. Construct network diagrams and determine critical path, slacks, and floats with deterministic (CPM) and Probabilistic (PERT) activity times. Obtain optimum time Networks through crashing.
7. Obtain optimum time sequences for n jobs with a single machine, n jobs-2 machines, n jobs-3 machines, n jobs-m machines and 2 jobs-n machines.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Operations Research by P K Gupta and D S Hira, S Chand Publishing.
2. Operations Research: Theory and Applications by J K Sharma, Pearson Education Pvt. Ltd.
3. Introduction to Operations Research by H A Taha, PHI/Pearson Education Pvt. Ltd.
4. Operations Research by Pannerselvan, PHI/Pearson Education Pvt. Ltd.
5. Operations Research by S D Sharma, Kedarnath, Ramnath & Co.

Web links and Video Lectures (e-Resources):

- https://www.bbau.ac.in/dept/UIET/EME-601%20Operation%20Research.pdf
- https://www.youtube.com/watch?v=FdKgeeb4q3w
- https://www.youtube.com/watch?v=jemAWA_WQCE
- https://www.youtube.com/watch?v=gbL3vYq3cPk
- https://www.youtube.com/watch?v=M8POtpPtQZc
- https://www.youtube.com/watch?v=-YBlR1UF-UY
- https://www.youtube.com/watch?v=rCLlyT547MY
- https://www.youtube.com/watch?v=lwX8HvF7DYM
- https://www.youtube.com/watch?v=JxnPBrNccqY
- https://www.youtube.com/watch?v=Wgkcrtjrr7s
- https://www.youtube.com/watch?v=v5ZfvATEoDY
- https://www.youtube.com/watch?v=xGkpXk-AnWU
- https://www.youtube.com/watch?v=YueJukoFBMU
- https://www.youtube.com/watch?v=fSuqTgnCVRg
- https://www.youtube.com/watch?v=KUskbAasVCY
- https://www.youtube.com/watch?v=Z-YqfAA9lew
- https://www.youtube.com/watch?v=_g0Aw99V2Dc
- https://www.youtube.com/watch?v=Nrmr8mfELcY
- https://www.youtube.com/watch?v=USr10xc98II
- https://www.youtube.com/watch?v=4OdutS9mSZA
- https://www.youtube.com/watch?v=j8CbEoF9c6Y

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Kinematics of Machines			
Course Code	**21IP641**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To understand the concept of machines, mechanisms and related terminologies.
- To expose the students to various mechanisms and motion transmission elements.
- To analyze a mechanism for displacement, velocity and acceleration at any point in a moving link.
- To understand the theory of cams, gears and gear trains.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

- Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
- Chalk and Talk method for Problem Solving.
- Arrange visits to show the live working models other than laboratory topics.
- Adopt collaborative (Group Learning) Learning in the class.
- Adopt Problem Based Learning (PBL), which fosters students Analytical skills and develops thinking skills such as evaluating, generalizing, and analyzing information.
- Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Introduction: Definitions; Link or element, kinematic pairs, Degrees of freedom, Grubler's criterion (without derivation), Kinematic chain, Mechanism, Structure, Mobility of Mechanism, Inversion, Machine. Kinematic Chains and Inversions: Inversions of Four bar chain; Single slider crank chain and Double slider crank chain and their inversions	
Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. Creating real time stations in classroom discussions, creating real time stations in classroom discussions. Giving activities & assignments.
Module-2	
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 wheel mechanism and Ratchet and Pawl mechanism.	
Teaching-Learning Process	Chalk and talk methods, Power Point presentation and YouTube videos, Animation videos methods. Creating real time stations in classroom discussions. Giving activities and assignments.
Module-3	
Velocity and acceleration analysis of mechanisms: Velocity and acceleration analysis of Four Bar mechanism, slider crank mechanism and Simple Mechanisms by vector polygons: Relative velocity and acceleration of particles in a common link, relative velocity and accelerations of coincident Particles on separate links- Coriolis component of acceleration. Angular velocity and angular acceleration of links.	
Teaching-Learning Process	Chalk and Talk method for Problem Solving and enhance experiential skills, creating real time stations in classroom discussions. YouTube videos, Animation videos methods, Video demonstration or Simulations, Giving activities & assignments.
Module-4	
Gears : Gear terminology, Law of gearing, Characteristics of involute action, Path of contact, Arc of contact, Contact ratio of Spur, Helical, Bevel and Worm gears, Interference in involute gears. Methods of avoiding interference, Back lash. Comparison of involute and cycloidal teeth. **Gear trains**: Types of Gear trains, velocity ratio, Train value, Algebraic and tabular methods of finding velocity ratio of epicyclic gear trains. Tooth load and torque calculations in epicyclic gear trains.	
Teaching-Learning Process	Chalk and talk are used for Problem Solving, Group Learning, PowerPoint presentation and Animations andyou tube videos, enhance experiential skills, creating real time stations in classroom discussions. Giving activities &assignments.
Module-5	
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-face follower, Disc cam with oscillating roller follower. Follower motions including SHM, Uniform velocity, uniform acceleration and retardation and Cycloidal motion.	
Teaching-Learning Process	Creating real time stations in classroom discussions. Chalk and talk are used for Problem Solving,Group Learning, enhance experiential skills,Animations andyou tube videos. Giving activities & assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Knowledge of mechanisms and their motion.
- Understand the inversions of four bar mechanisms.
- Analyse the velocity, acceleration of links and joints of mechanisms.
- Analysis of cam follower motion for the motion specifications.
- Analyse the gear trains speed ratio and torque.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Theory of Machines by Rattan S. S. Tata McGraw-Hill Publishing Company Ltd., New Delhi 3rd edition 2009
2. Theory of Machines by Sadhu Singh Pearson Education (Singapore) Pvt. Ltd, Indian Branch New 2006
3. Theory of Machines & Mechanisms J. J. Uicker, , G.R. Pennock, J.E. Shigley, OXFORD 3rd Ed., 2009
4. Mechanism and Machine theory Ambakar, PHI

Web links and Video Lectures (e-Resources):

- https://www.slideshare.net/taruian/module-1-introduction-to-kinematics-of-machinery
- https://www.youtube.com/watch?v=U_IhtlI9mlo
- https://www.youtube.com/watch?v=U5ahwRUuAtA
- https://www.youtube.com/watch?v=Co4YlavCpeQ
- https://www.slideshare.net/Mohd_Limdi/kinematics-of-machines-gear-and-gear-trains
  https://www.youtube.com/watch?v=IlCeurr9wKI

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Contents related activities (Activity-based discussions)
2. For active participation of students, instruct the students to prepare Exercise problems
3. Organizing Group wise discussions and Mechanism based activities
4. Quizzes and Discussions
5. Seminars and assignments

Composite Materials			
Course Code	**21IP/IM642**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Foundation for understanding of composite materials.
- Exposure to the fabrication of composites.
- To impart the knowledge of structural applications of composites.
- To learn Micro analysis of unidirectional lamina.
- To learn the study properties of MMC's.
- To impart the knowledge for applications of natural composites

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

Module-1

Introduction to composite materials

Definition, classification and characteristics of composite materials: Fibrous, laminate, particulate, flake composites. Properties and types of reinforcement and matrix materials. Fibre reinforced plastic processing: basic steps in manufacturing of a composite, impregnation, lay-up, consolidation and solidification. Open and closed mould process, hand lay-up techniques, structural laminate vacuum bag and autoclave processing, filament winding, pultrusion, pulforming, thermo-forming, injection molding, resin transfer molding.

Teaching-Learning Process	Chalk and Talk, Power point presentation and animated videos.

Module-2

Fabrication of composites

Cutting: machining, drilling, mechanical fasteners and adhesive bonding: design guidelines for adhesive bonding.

Mechanical joining: design parameters for bolted joints, waterjet and laserjet cuttings. Challenge during machining of composites, failure mode during machining. Cutting tools and fabrication equipment.

Teaching-Learning Process	Chalk and Talk, Power point presentation and animated videos.

Module-3

Structural application of composites

Aerospace, air craft and military, medical, sporting goods and recreation, automotive. Marine, infrastructure.

Micro analysis of a uni-directional lamina: definition of volume and mass fractions, density and void content. Derivation for longitudinal, transverse and shear modulus. Major and minor Poission'sratio's. Numerical problems

Teaching-Learning Process	Chalk and Talk, Power point presentation and animated videos.

Module-4

Study properties of MMC's

Physical Mechanical, wear, machinability and other properties. Effect of size, shape and distribution of particulate on properties. Advanced composites such as Polymer based Sandwich structures. Introduction to shape memory alloys.

Teaching-Learning Process	Chalk and Talk, Power point presentation and animated videos.

Module-5

Study of composite materials from natural resources

Introduction to natural composites: classification of natural fibers: plant, animal, mineral fibers and their sources; silk, human, feather, jute, sisal, flax, cotton, bamboo fibres. Advantages and disadvantages of natural fibres. Characteristics of natural fibres. Extraction of plant fibres. Recent developments in natural fibre composites, feature potential of natural fibre composites.

Teaching-Learning Process	Chalk and Talk, Power point presentation and animated videos.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the basics of composite materials.
2. Understand the differences between different compositions.
3. Find properties of composite materials and its impact.
4. To fabricate composite material
5. Define about natural composites.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

- Composite Science and Engineering, K.K.Chawla, Springer Verlag, 1998
- Introduction to composite materials, Hull and Clyne, Cambridge University Press, 2nd Edition 1990
- Composite Materials hand book, MeingSchwaitz, McGraw Hill Book Company, 1984
- Mechanics of composites, Autar K kaw, CRC Press,2002.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=H1SIpk0h4-Q
- https://www.youtube.com/watch?v=slgtMk8k4lk
- https://www.science.org.au/curious/technology-future/composite-materials
- https://www.spiedigitallibrary.org/conference-proceedings-of-spie/10596/1059603/Current-and-future-needs-and-research-for-composite-materials-NDE/10.1117/12.2291921.full?SSO=1
- https://www.youtube.com/watch?v=_m29-u37TI8

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Make the students to fabricate composite material using available resources in respective lab.
- Take the students to nearest composite industry.
- Group discussion and quiz on the subject in class.

Engineering Economy			
Course Code	**21IP643**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To acquire a clear understanding of the fundamentals of engineering economics.
- To learn the concepts of decision making, problem solving, and comparison of the alternatives and elements of cost.
- To inculcate an understanding of concept of money and its importance in the evaluation of projects.
- To illustrate concept of money and its importance in evaluating the projects.
- To evaluate the alternatives based on the present annual worth and equivalent annual worth methods

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
4. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
5. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction: engineering decision – makers, engineering and economics, problem solving, intuition and analysis, tactics and strategy with an example.

Interest and Interest Factors: Interest rate, simple interest compound interest, interest formulae, time value equivalence exercises, problems and discussion

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-2

Present Worth Comparison: Conditions for present worth comparisons, rule 72, and basic present worth comparisons, present worth equivalence, net present worth, assets with equal and unequal lives, comparison of assets assume to have infinite lives, exercises and problems.

Equivalent Annual Worth Comparisons: Situations for equivalent annual worth comparison, net annual worth of a single project, comparison of net annual worth's, definitions of asset life, comparison of assets with equal and unequal lives, exercises and problems.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-3

Depreciation: Introduction, Reasons for Depreciation, Various methods of depreciation, Numerical Problems on all the methods of Depreciation

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-4

Replacement Analysis: Introduction, Reasons for Replacements - Deterioration, obsolescence, inadequacy, replacement criteria problems, Replacements of assets considering and ignoring time value of money. Group Replacements. Numerical Problems on the above types of Replacement Problems.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-5

Estimating and Costing: components of costs such as direct material cost, direct labour cost, Fixed, over – heads, factory costs, administrative – over heads, first cost, selling price, calculation of the total cost of various components, mensuration, estimation of simple components.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Recall the basic concepts of decision making, problem solving, tactics and strategy.
- Defining the time value of money concept, interest formulae.
- Explain the comparison by present worth method for different lives of the asset. Compare the asset on the basis of EAW comparison.
- Explain the concepts of depreciation and replacement criteria.
- Calculate the total cost of a component and explain the process for estimating simple components

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

- Engineering economy Riggs J.L. McGraw Hill 2002
- Engineering economy Paul Degarmo Macmillan Pub, Co. 2001
- Engineering Economy NVR. Naidu, KM Babu and New Age International Pvt. Ltd 2006
- Industrial Engineering and Management O.P Khanna DhanpatRai and Sons 2000
- Engineering Economy Theusen G. PHI 2000

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=9yj6CtMUsYU
- https://www.investopedia.com/terms/c/compoundinterest.asp
- https://www.youtube.com/watch?v=ZSoLPCHsknA
- https://www.youtube.com/watch?v=r0aDjTLxy5c
- https://www.youtube.com/watch?v=r0aDjTLxy5c

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Advanced Machining Processes

Course Code	**21IP/IM644**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

1. To learn the fundamental concepts of Non-Traditional Machining and their Mechanical Processes
2. To have a good knowledge of Abrasive Jet Machining and its application
3. To learn the fundamental principles of Electrochemical Machining Process (ECM)
4. To have basic exposure to Chemical Machining (CHM) and Chemical Milling
5. To imbibe a the basic principles of Thermal Metal Removal Processes, Plasma Arc Machining (PAM)and Laser Beam Machining (LBM)

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

Module-1

Introduction: History, need for non-traditional machining processes, classification, process selection.

Mechanical Process: Ultrasonic Machining (USM): Introduction, equipment, tool material and tool size, abrasive slurry, Magnetostriction assembly, tool cone (concentrator), exponential concentrator of circular cross section and rectangular cross sections, effect of parameters, amplitude, frequency, grain diameter, applied static load and slurry, tool and work material. USM process characteristics: material removal rate, tool wear, accuracy, surface finish, applications, advantages and disadvantages of USM.

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-2	
Abrasive Jet Machining (AJM): Introduction, equipment, variables in AJM: carrier gas, size of abrasive grain, velocity of the abrasive jet, mean no. abrasive particles per unit volume of the carrier gas, work material, stand-off distance (SOD), process characteristics-material removal rate. Nozzle wear, Accuracy and surface finish, Applications, advantages and disadvantages of AJM.	
Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.
Module-3	
Electrochemical Machining Process (ECM): Introduction, elements of ECM process: Cathode tool, anode work piece, source of DC power, electrolyte, chemistry of the process, ECM process characteristics – material removal rate, accuracy, surface finish, tool and insulation materials, tool size, electrolyte flow arrangement, applications, simple problems.	
Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.
Module-4	
Chemical Machining (CHM): Introduction, elements of the process, chemical blanking process: preparation of work piece, preparation of masters, masking with photo resists, etching for blanking, accuracy of chemical blanking. **Chemical Milling** (Contour machining):- Process steps-masking, etching, etc. process characteristics of CHM: - material removal rate, accuracy, surface finish, application of CHM.	
Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.
Module-5	
Thermal Metal Removal Processes: Electrical Discharge Machining (EDM) - Introduction, mechanism of metal removal, dielectric fluid, spark generator, EDM tool (electrode), electrode material selection, machining time, flushing: suction flushing, side flushing, pulsed flushing synchronized with electrode movement, EDM process characteristics: metal removal rate, accuracy, surface finish, heat affected zone, machine tool selection, applications, electric discharge grinding, travelling wire EDM. **Plasma Arc Machining (PAM):** Principle of generation of plasma, equipment, non-thermal generation of plasma, selection of gas, mechanism of metal removal, PAM parameters, process characteristics. **Laser Beam Machining (LBM):** Principle of generation of lasers, equipment and machining procedure, types of lasers, process characteristics, applications	
Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the need for advanced manufacturing process and explain the principle of operation of ultrasonic machining process.
2. Explain the characteristic features of Abrasive Jet Machining (AJM)
3. Define the process parameters influence the material removal rate with the help of characteristics curves.
4. Explain the principle of chemical machining and chemical milling process.
5. Summarize the various aspects of Electric discharge machining (EDM).Explain the principle of
6. Generation plasma and laser and their application in machining

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Modern Machining Process, P C Pandey and H S Shan, Tata McGraw Hill, 2008
2. New Technology, Bhattacharaya, Institution of Engineering Publication
3. Production Technology, HMT, Tata McGraw Hill
4. Modern Machining Methods, Dr. M.Adithan, Khanna Publishers, 2008
1. Non-conventional Machining, P K Mishra, Narosa publishing House, New – Delhi.2006

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=tPS6uTWySTs
- https://www.youtube.com/watch?v=1MkWjVjNFhY&list=PLYY-vaDZXAyxyB8EY_-4FYfAXfHeNY0Li
- https://www.youtube.com/watch?v=i-PgeWbDgq4
- https://www.youtube.com/watch?v=Jg6YXvTO5FE&list=PLSGws_74K019wxc495SU84wTQ1u1ACvFR
- https://www.youtube.com/watch?v=jhM01_mwygg

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Total Quality Management			
Course Code	**21IP / IM651**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

1. Understand various approaches to TQM
2. Understand the characteristics of quality leader and his role.
3. Develop feedback and suggestion systems for quality management.
4. Enhance the knowledge in Tools and Techniques of quality management

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

Module-1

Principles and Practice: Definition, basic approach, gurus of TQM, TQM Framework, awareness, defining quality, historical review, obstacles, benefits of TQM. Quality Management Systems: Introduction, benefits of ISO registration, ISO 9000 series of standards, ISO 9001 requirements.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-2

Leadership: Definition, characteristics of quality leaders, leadership concept, characteristics of effective people, ethics, the Deming philosophy, role of TQM leaders, implementation, core values, concepts and framework, strategic planning communication, decision making,

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-3

Customer Satisfaction and Customer Involvement: Customer Satisfaction: customer and customer perception of quality, feedback, using customer complaints, service quality, translating needs into requirements, customer retention, case studies. Employee Involvement – Motivation, employee surveys, empowerment, teams, suggestion system, recognition and reward, gain sharing, Performance appraisal, unions and employee involvement, case studies.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-4

Continuous Process Improvement: process, the Juran trilogy, improvement strategies, types of problems, the PDSA Cycle, problem-solving methods, Kaizen, reengineering, six sigma, case studies.

Statistical Process Control : Pareto diagram, process flow diagram, cause and effect diagram, check sheets, histograms, statistical fundamentals, Control charts, state of control, out of control process, control charts for variables, control charts for attributes, scatter diagrams, case studies.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-5

Tools and Techniques: Benching marking, information technology, quality management systems, environmental management system, and quality function deployment, quality by design, failure mode and effect analysis, product liability, total productive maintenance.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Explain the various approaches of TQM
- Infer the customer perception of quality
- Analyze customer needs and perceptions to design feedback systems.
- Apply statistical tools for continuous improvement of systems
- Apply the tools and technique for effective implementation of TQM.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Total Quality Management Dale H. Besterfield, Pearson Education India ISBN:8129702606, Edition 03.
2. Total Quality Management, Engineers, M. Zairi head, Publishing.
3. Managing for Quality and Performance Excellence, James R. Evans and W M, Cengage Learning, 9th edition,
4. A New American TQM, four revolutions in management, Shoji Shiba,Alan Graham, Productivity press, Oregon, 1990.
5. Engineering Optimization Methods and Applications

6. Organizational Excellence through TQM, H. Lal, New age Publications, 2008.
7. Introduction to Operations Research- Concepts and Cases, F.S. Hillier. G.J. Lieberman, Tata McGraw Hill, 9th Edition, 2010

Web links and Video Lectures (e-Resources):

- https://www.investopedia.com/terms/t/total-quality-management-tqm.asp
- https://www.youtube.com/watch?v=VD6tXadibk0
- https://aboutthree.com/blog/five-important-factors-in-total-quality-management/
- https://www.youtube.com/watch?v=renlXcpK9sk
- https://www.youtube.com/watch?v=umqtSNPp5Dk
- https://study.com/academy/lesson/five-principles-of-total-quality-management-tqm.html
- https://www.greenlight.guru/blog/total-quality-management-principles

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Value Engineering

Course Code	**21IP / IM652**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Be able to relate value engineering to costs, and its application to decision making.
- Be able to use value engineering as an economic analysis tool.
- Be able to apply SMART methodology in group decision environment.

Teaching-Learning Process (General Instructions)

- Lectures and discussions
- Self study assignments
- Case studies and group discussions.

Module-1

INTRODUCTION TO VALUE ANALYSIS: Definition of Value, Value Analysis, Value Engineering, Value management, Value Analysis versus Value Engineering, Value Analysis versus Traditional cost reduction techniques, uses, Applications, advantages and limitations of Value analysis. Symptoms to apply value analysis, Coaching of Champion concept.

TYPE OF VALUES: Reasons for unnecessary cost of product, Peeling cost Onion concept, unsuspected areas responsible for higher cost, Value Analysis Zone, attractive features of value analysis. Meaning of Value, types of value & their effect in cost reduction. Value analysis procedure by simulation. Detailed case studies of simple products

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-2

FUNCTIONAL COST AND ITS EVALUATION: Meaning of Function and Functional cost, Rules for functional definition, Types of functions, primary and secondary functions using verb and Noun, Function evaluation process, Methods of function evaluation. Evaluation of function by comparison, Evaluation of Interacting functions, Evaluation of function from available data, matrix technique, MISS technique, Numerical evaluation of functional **relationships and case studies.**

PROBLEM SETTING & SOLVING SYSTEM: A problem solvable stated is half solved, Steps in problem setting system, Identification, Separationand Grouping of functions. Case studies.

PROBLEM SETTING & SOLVING SYSTEM: Goods system contains everything the task requires. Various steps in problem solving, case studies.

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-3

VALUE ENGINEERING JOB PLAN: Meaning and Importance of Value Engineering Job plan. Phases of job plan proposed by different value engineering experts, Information phase, Analysis phase, Creative phase, Judgment phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal.

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-4

VALUE ENGINEERING TECHNIQUES: Result Accelerators or New Value Engineering Techniques, Listing, Role of techniques in Value Engineering, Details with Case examples for each of the Techniques.

ADVANCED VALUE ANALYSIS TECHNIQUES: Functional analysis system technique and case studies, Value analysis of Management practice (VAMP), steps involved in VAMP, application of VAMP to Government, University, College, Hospitals, School Problems etc., (service type problems).

TOTAL VALUE ENGINEERING: Concepts, need, Methodology and benefits.

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-5

APPLICATION OF VALUE ANALYSIS: Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Able to understand the importance of value of a product
2. Find out unnecessary cost/ function involved in the product
3. Conduct value engineering methodology
4. Do value analysis using advanced value engineering techniques
5. Become a certified value engineer with additional course /training

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

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3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

- Techniques of Value Analysis and Engineering, Lawrence D.Miles, 2nd Edn.
- Value engineering for Cost Reduction and Product, M.S. Vittal, Systems Consultancy Services Edn, 1991.
- Value anagement, Value Engineering and Cost Reduction, Edward D Heller, Addison Wesley Publishing Company, 1991
- Value Analysis for Better Management, Warren J Ridge, American Management Association Edn, 1969.
- Getting More at Less Cost (The Value Engineering Way), G.Jagannathan, Tata Mcgraw Hill Pub.Comp. Edn, 1995.
- Value Engineering, Arther E Mudge, McGraw Hill Book Comp.Edn, 1981

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=L-TfAfip1ME
- https://www.youtube.com/watch?v=mJoaZ4GewyI
- http://www.simplynotes.in/e-notes/mbabba/productivity-management/value-analysis/
- https://www.youtube.com/watch?v=mJoaZ4GewyI
- https://www.value-eng.org/page/AboutVM

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Management Information Systems			
Course Code	**21IP / IM653**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To elevate students' awareness of information Technology and develop an in-depth and systematic understanding of key aspects of IT management.
- To help students gain a strategic perspective on business.
- To evaluate the value of emerging technologies and their competitive advantage.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Fundamentals of Information Systems: Information systems in business, fundamentals of information systems solving business problems with information systems.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-2

Information Systems for Business Operations: Business information systems, Transaction processing systems, management, information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

Teaching-Learning Process	. Chalk and talk, Videos, PowerPoint Presentation, Animations

Module-3

Issues in Managing Information Technology: Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations

Module-4

E-Business Model: E-commerce frame work, Architectural frame work for e-commerce, Application services and transaction, Models – B2C Transactions, B2B Transactions, Intra-Organizational Transactions**.**

WWW Architecture: Client server structure of the web, e-Commerce architecture, Technology behind the web.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-5

Consumer Oriented E-Commerce: Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.
Electronic Data Interchange (EDI): EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the awareness of information Technology and develop an in-depth and systematic understanding of key aspects of IT management.
2. Explain the gain a strategic perspective on business.
3. Evaluate the value of emerging technologies and their competitive advantage.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Management Information systems- managing information technology in the internet worked. Jams. A O'Brien. Tata McGraw Hill publishing company limited. 2002.
2. Management Information Systems. Laaudon & Laudo. PHI. ISBN 81-203-1282.
3. Management Information Systems. S. Sadogopan. PHI 1998Edn. ISBN 81-203- 1180-9.
4. Information systems for modern management G.R. Murdick PHI 2nd Edition..4. Human Resources

Management – Ravi Dharma Rao

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=xisFrwLkR58
- https://www.youtube.com/watch?v=T7eyTJA1qQ4
- https://www.nibusinessinfo.co.uk/content/examples-artificial-intelligence-use-business
- https://planningtank.com/computer-applications/strategic-information-system
- https://www.itproportal.com/features/ten-challenges-facing-it-managers-right-now-and-how-to-overcome-them/
- https://www.geeksforgeeks.org/ethical-issues-in-information-technology-it/
- https://www.bigcommerce.com/articles/ecommerce-website-development/ecommerce-frameworks/
- https://learn.financestrategists.com/finance-terms/b2c/?gclid=Cj0KCQjwmuiTBhDoARIsAPiv6L-s-GL7tTYIaXqdEzWojJv0k1wJVlN4VG0xJycy3nlsCf-aMUgDPRUaAgH0EALw_wcB
- https://www.boddunan.com/articles/computers-technology/37-new-technologies/14798-fundamentals-of-consumer-oriented-e-commerce.html
- https://www.edibasics.com/what-is-edi/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Industrial Hygiene & Occupational Safety and Health			
Course Code	**21IP/IM654**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Identify the occupational health safety and hygiene hazards in workplace
- Explain the effects of chemicals such as organic solvents.
- Discuss the Biological and Ergonomical Hazards.
- Describe the Occupational health and toxicology.
- Discuss First aid & antidotes.
- Explain how work affect health and health affects work.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

Module-1

Physical hazards : Noise, compensation aspects, noise exposure regulation, properties of sound, occupational damage, risk factors, sound measuring instruments, octave band analyzer, noise networks, noise surveys, noise control program, industrial audiometry, OSHA standardnon-ionizing radiations, effects, types, radar hazards, microwaves and radio-waves, lasers, TLVcold environments, hypothermia, wind chill index, control measures-hot environments, thermal comfort, heat stress indices, acclimatization, estimation and control.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation

Module-2

Chemical hazards : Introduction to chemical hazards – Dangerous properties of chemicals, dust, gases, fumes, mist, vapors, smoke and aerosols – Route of entry to human system, recognition, evaluation and control of basic hazards – Degree of hazards – Concept of threshold limit values – Air sampling strategies. Personal exposure monitoring and Work environment monitoring of chemical hazards – Biological sampling & analysis – Industrial hygiene control methods: Substitution, changing the process, isolation, wet method, local exhaust ventilation,

Teaching-Learning Process	. Chalk and talk, videos, PowerPoint Presentation

Module-3

Biological and Ergonomical Hazards: Classification of Biohazardous agents –bacterial agents, rickettsial and chlamydial agents, viral agents, fungal, parasitic agents, infectious diseases - Biohazard control program, employee health program-laboratory safety program-animal care and handling-biological safety cabinets - building design. Work Related Musculoskeletal Disorders – carpal tunnel syndrome CTS- Tendon pain disorders of the neck- back injuries.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation

Module-4

Occupational health and toxicology : Concept and spectrum of health - functional units and activities of occupational health services, pre-employment and post-employment medical examinations - occupational related diseases, levels of prevention of diseases, notifiable occupational diseases such as silicosis, asbestosis, pneumoconiosis, siderosis, anthracosis, aluminosis and anthrax, lead-nickel, chromium and manganese toxicity, gas poisoning (such as CO, ammonia, coal and dust etc) their effects and prevention – cardio pulmonary resuscitation, audiometric tests, eye tests, vital function tests.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation

Module-5

First aid & antidotes: Fundamentals of first – aid burns, fractures, suffocation, toxic ingestion – bleeding wounds artificial respiratory, techniques – Bandaging, Antidotes. Industrial toxicology, local, systemic and chronic effects, temporary and cumulative effects, carcinogens entry into human systems. Work physiology: Physiology of respiration, cardiac cycle, muscle contraction, nerve conduction system, etc. Anthropometry and fundamental of Bio-mechanics – Assessment of workload based on Human Physiological reactions – energy cost of work – Assessment of work capacity fatigue and rest allowances – Physiological test for assessment of occupational health – Nutritional values of diets for exercise and work – Nutrition and physical fitness relationship – Environmental Physiology.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the basic concepts of Industrial Hygiene , Occupational Health & Environment Toxicology.
2. Understand the benefits of Industrial Hygiene.
3. Understand the functions of Occupational Health Center.
4. Understand the Occupational Health related problems and its control in workplace.
5. Understand the Effects of various Toxicants in body

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Handbook of Occupational Health and Safety, NSC Chicago, 1982
2. Encyclopedia of Occupational Health and Safety, Vol. I & II, International Labour Organisation, Geneva, 1985.
3. McCornick, E.J. and Sanders, M.S., Human Factors in Engineering and Design, Tata McGraw-Hill, 1982.
4. R.K.Jain & Sunil S Rao- Industrial Safety, Health and Environment Management System, Khannan Publisheres. New Delhi (2006).

Web links and Video Lectures (e-Resources):

- https://www.osha.gov/sites/default/files/training-library_industrial_hygiene.pdf
- https://kuliahdianmardi.files.wordpress.com/2016/03/human-factors-and-ergonomics-national-safety-council-handbook-of-occupational-safety-and-health-national-safety-council-crc-press-2010.pdf
- https://www.healthsafety.co/assets/docs/Industrial_Safety_syllabus.pdf
- https://www.ilo.org/safework/events/safeday/lang--en/index.htm
- https://www.unglobalcompact.org/take-action/safety-andhealth
- https://www.ehs.ufl.edu/departments/occupational-safety-risk/industrial-hygiene-occupational-safety/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Industrial Robotics			
Course Code	**21IP655**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To understand the basic concepts associated with the design and Functioning and applications of Robots
- To study about the drives and sensors used in Robots
- To learn about analyzing robot kinematics and robot programming

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

Module-1

FUNDAMENTAL CONCEPTS OF ROBOTICS: History, present status and future trends, Robotics. Robot, Definition. Robotics Systems and Robot Anatomy, Specification of Robotics. Resolution, Repeatability and Accuracy of a Manipulator.

ROBOT DRIVES: Power transmission systems and control Robot drive mechanisms, hydraulic-electric-penumatic drives. Mechanical transmission method – Rotary-to-Rotary motion conversion. Rotary-to-linear motion conversion end effectors – types-grip pind problem Remote-Centered compliance Devices- Control of Actuators in Robotic Mechanisms.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos

Module-2

SENSORS AND INTELLIGENT ROBOTS: Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and non-contact type- Touch and slip sensors – Force and Torque Sensors – AI and Robotics.

COMPUTER VISION FOR ROBOTICS SYSTEMS: Robot vision systems – Imaging components – Image representation – Hardware aspects-Picture coding – Object Recognition and Categorization Visual inspection – software considerations – applications – commercial – Robotics vision systems.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos

Module-3

COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS: Computer architecture for robts, hardware, Computational elements in robotic applications – Robot programming – sample programs path planning – Robot's

computer system.	
Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos

Module-4

TRANSFORMATIONS AND KINEMATICS: Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse probleme of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos

Module-5

ROBOT CELL DESIGN AND CONTROL: Specifications of Commerical Robots – Robot Design and Process specifications – motor selection in the design of a robotic joint – Robot Cell layouts – Economic and Social aspects of robotics.

APPLICATIONS OF ROBOTS:

Capabilities of Robots – Robotics Applications – Obstacle avoidance – Robotics in India – The future of Robotics

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos

Course outcome (Course Skill Set)

- At the end of the course the student will be able to :
- Analyze the manipulator design including actuator, drive and sensor issues
- Calculate the forward kinematics, inverse kinematics and Jacobian for serial and parallel robots
- Identify different types of end effectors and sensors required for specific applications
- Develop programming principles and languages for a robot control system
- Discuss various applications of industrial robot systems

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Robotics Engineering An integrated approach - Richard D Klafter, Thomas A Chmielewski, Michael Negin – Prentice Hall of India Pvt. Ltd. - Eastern Economy Edition, 1989
2. Robotics: Control Sensing, Vision, intelligence - Fu KS Gomaler R C, Lee C S G – McGraw Hill Book Co. - 1987.
3. Handbook of Industrial Robotics - Shuman Y. Nof - John Wiley & Sons, New York - 1985.
4. Robotics Technology and Flexible Automation - Deb SR - McGraw Hill BookCo. - 1994.

Web links and Video Lectures (e-Resources):

- https://intelitek.com/fundamentals-of-robotics/
- https://www.brainkart.com/article/Introduction-Robot-Drive-Systems_5132/
- https://www.electronicsforu.com/technology-trends/tech-focus/sensors-robotics-artificial-intelligence
- https://www.moldmakingtechnology.com/articles/10-considerations-for-choosing-a-robot
- https://onlinecourses.nptel.ac.in/noc20_me53/preview

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Software Applications Lab			
Course Code	**21IPL66**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	0:0:2:0	SEE Marks	50
Credits	01	Exam Hours	03

Course objectives:

- The course aims at building capabilities in the students for analyzing different situations in the industrial/ business scenario involving limited resources and finding the optimal solution within constraints.

Sl.NO	Experiments
1	Regression analysis using any of the statistical packages.
2	Correlation analysis using any of the statistical packages.
3	Use of software package to solve LPP problems.
4	Use of software package to solve assignment and transportation problems.
5	Use of software package to solve PERT problems.
6	Use of software package to solve CPM problems.
7	Plotting Quality Control chart for attributes using Software Packages. Plotting appropriate charts and diagrams relevant to various industrial Applications
8	Plotting Quality Control chart for variables using Software Packages. Plotting appropriate charts and diagrams relevant to various industrial Applications
Demonstration Experiments (For CIE)	
9	Development of simple MIS application programs for use in Library.
10	Development of simple MIS application programs for use in Bank.
11	Development of simple MIS application programs for use in Business shop.
12	Development of simple MIS application programs for use in Hospital.

Course outcomes (Course Skill Set):

At the end of the course the student will be able to:

1. Analyse any real life system with limited constraints and depict it in a model form.
2. Convert the problem into a mathematical model.
3. Solve mathematical model manually as well as using software such as TORA, etc.
4. Understand variety of problems such as assignment, transportation, travelling salesman, etc.
5. Solve the problems using linear programming approach using software.
6. Solve the problems on PERT and CPM using software.
7. Solve Quality Control chart for attributes and variables using Software Packages

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each course. The student has to secure not less than 35% (18 Marks out of 50) in the semester-end examination(SEE).

Continuous Internal Evaluation (CIE):

CIE marks for the practical course is **50 Marks**.

The split-up of CIE marks for record/ journal and test are in the ratio **60:40**.

- Each experiment to be evaluated for conduction with observation sheet and record write-up. Rubrics for the evaluation of the journal/write-up for hardware/software experiments designed by the faculty who is handling the laboratory session and is made known to students at the beginning of the practical session.
- Record should contain all the specified experiments in the syllabus and each experiment write-up will be evaluated for 10 marks.
- Total marks scored by the students are scaled downed to 30 marks (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 02 tests for 100 marks, the first test shall be conducted after the 8th week of the semester and the second test shall be conducted after the 14th week of the semester.
- In each test, test write-up, conduction of experiment, acceptable result, and procedural knowledge will carry a weightage of 60% and the rest 40% for viva-voce.
- The suitable rubrics can be designed to evaluate each student's performance and learning ability. Rubrics suggested in Annexure-II of Regulation book
- The average of 02 tests is scaled down to **20 marks** (40% of the maximum marks).

The Sum of scaled-down marks scored in the report write-up/journal and average marks of two tests is the total CIE marks scored by the student.

Semester End Evaluation (SEE):

SEE marks for the practical course is 50 Marks.

SEE shall be conducted jointly by the two examiners of the same institute, examiners are appointed by the University

All laboratory experiments are to be included for practical examination.

(Rubrics) Breakup of marks and the instructions printed on the cover page of the answer script to be strictly adhered to by the examiners. **OR** based on the course requirement evaluation rubrics shall be decided jointly by examiners.

Students can pick one question (experiment) from the questions lot prepared by the internal /external examiners jointly.

Evaluation of test write-up/ conduction procedure and result/viva will be conducted jointly by examiners.

General rubrics suggested for SEE are mentioned here, writeup-20%, Conduction procedure and result in -60%, Viva-voce 20% of maximum marks. SEE for practical shall be evaluated for 100 marks and scored marks shall be scaled down to 50 marks (however, based on course type, rubrics shall be decided by the examiners)

Change of experiment is allowed only once and 15% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Rubrics suggested in Annexure-II of Regulation book

Suggested Learning Resources: Oracle / MS SQL Server (back-end) VB6.0 / Developer2000 (frontend tools)
Statistical Package like: SPSS, or Minitab, or SAS, or Systat, or MATLAB, or Statistica, etc.
OR Packages: TORA, or LINDO, or KETRON, or ABACUS, etc.

Mini Project			
Course Code	**21IPMP67**	CIE Marks	100
Contact Hours/Week	02	SEE Marks	--
Total Hours of Pedagogy	--	Total Marks	100
Credits	02	Exam Hours	--

Innovation/Entrepreneurship /Societal Internship			
Course Code	**21INT68**	CIE Marks	100
Teaching Hours/Week (L:T:P: S)	--	SEE Marks	--
Total Hours of Pedagogy	--	Total Marks	100
Credits	03	Exam Hours	--

VII SEMESTER

Artificial Intelligence and Manufacturing			
Course Code	**21IP71**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To understand the modern manufacturing concepts.
- To learn the concept of AI based methods for process controls.
- To analyse the automated material handling systems.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
4. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
5. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction to Modern Manufacturing and AI Based Applications:

Introduction to Modern Manufacturing Process, Industry 4.0, Introduction to AI and its applications in manufacturing, Design in Manufacturing and AI Requirements.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-2

AI based Methods for Process Control & Monitoring:

Machine Learning methods, AI based Monitoring and control of discrete manufacturing process, Online process monitoring in additive manufacturing, Industrial Machine Vision, Development of Digital Twins.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation.

Module-3

AI based Design Space Exploration:

Multi objective heuristic search for DSE, Algorithms for Customizable Manufacturing, Allocation and Layout, Scheduling for flexible manufacturing systems.

Teaching-Learning	Chalk and talk, videos, PowerPoint Presentation, Animations, AI lab visit, Activity based learning.

Process	

Module-4

AI & Robotics:
AI based Robot Architecture & Applications in Automated Manufacturing, Robot Vision & Motion, Multi agent and swarm robotics, Robot to Robot and Robot to human coordination (Cobots - collaborative robotics) Reliable & Trusted AI in Robotics.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning.

Module-5

Automated material Handling Storage: Material functions, types of material handling equipment, analysis of material handling systems, design of system, conveyor system, automated guided vehicle systems, automated storage/retrieval systems, caroused storage systems work in process storage, interfacing handling & storage with manufacturing.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation, Animations, Activity based learning.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain the fundamentals of Artificial Intelligence In smart manufacturing.
2. Understand the AI based Monitoring and control of discrete manufacturing process.
3. Understand the automated material handling and storage concepts.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, 3rd Edition, Prentice Hall, 2009.
2. Deep Learning - Ian Goodfellow, Yoshua Bengio, Aaron Courville, MIT Press, 2018
3. Additive manufacturing of Metals: The Technology, Materials , Design and Production; Ed. Li Yang, et al.; Springer International Publishing AG 2017
4. Laser Materials Processing, by W M Steen, J. Mazumder, 4th Ed. Springer
5. Handbook of Industrial Robotics by Shimon Y. Nof (Editor), ISBN 9788126540303.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=lTsvhSYstAE
- https://www.forbes.com/sites/bernardmarr/2018/09/02/what-is-industry-4-0-heres-a-super-easy-explanation-for-anyone/?sh=162dc3409788
- https://professional.mit.edu/news/articles/4-ways-ai-will-change-design-and-manufacturing
- https://www.hpe.com/in/en/what-is/machine-learning.html?jumpid=ps_u8bvx1ziqh_aid-520061736&ef_id=Cj0KCQjwmuiTBhDoARIsAPiv6L9QsMm4otXbOHvIYNeBMp2VcsEEtY3bvg3k77Xbh_JHpT8f4l48jPMaAiuMEALw_wcB:G:s&s_kwcid=AL!13472!3!558204153004!e!!g!!types%20of%20machine%20learning!14386686693!128518518145&
- https://theconversation.com/five-ways-artificial-intelligence-can-help-space-exploration-153664
- https://aibusiness.com/author.asp?section_id=789&doc_id=773741#:~:text=Robotics%20and%20artificial%20intelligence%20are%20two%20related%20but%20entirely%20different,'
- https://www.systema.com/automated-material-handling-systems#:~:text=Automated%20material%20handling%20systems%20ensure,even%20in%20two%20separate%20buildings.

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Micro Economic Theory			
Course Code	**21IP / IM72**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:2:0:0	SEE Marks	50
Total Hours of Pedagogy	25	Total Marks	100
Credits	02	Exam Hours	03

Course objectives:

- To understand the fundamentals Micro-economic theory
- To learn the concepts and tools and techniques of Micro-economic theory
- To analyze the micro-economic situation to arrive at an appropriate decision

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the students' understanding.
8. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

INTRODUCTION:

The purpose of theory, The problem of scarcity, The functions of micro economic theory, Markets, Functions, and Equilibrium, Comparative Statics and Dynamics. Partial Equilibrium and General Equilibrium Analysis, Positive Economics, and Normative economics.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-2	
DEMAND AND SUPPLY: The individual's demand, Law of negatively sloped demand, Shift in demand curve, Market demand, The individual's supply, The shape of the supply curve, Shift in supply curve, Market supply, Numerical exercises	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-3	
MARKET EQUILLIBRIUM: Definition of market equilibrium, Types of equilibrium, Shifts in demand and supply, and Equilibrium, Numerical exercises	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-4	
MEASUREMENT OF ELASTISITIES: Price elasticity of demand, Arc and point elasticity, Point elasticity and Total expenditures, Income elasticity of demand, Cross elasticity of demand, Price elasticity of Supply, Numerical exercises.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-5	
MARKET STRUCTURE: Determinants of market structure, Definition and characteristics of the following markets structures: Perfect competition, Monopoly, Monopolistic competition, and Oligopoly (Basic concepts only and no numerical exercises)	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain comprehensively the modern microeconomic concepts;
2. Apply the tools and techniques required to formalize economic concepts and ideas;
3. Perform high-level microeconomic analysis.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation (CIE):

At the beginning of the semester, the instructor/faculty teaching the course has to announce the methods of CIE for the course.

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1.Theory and Problems of Micro economic theory, Dominick Salvatore, Schaum's Outline Series (For module, I to IV)

2. Managerial Economics, H.C Peterson and W.C Lewis, Prentice Hall India, Eastern Economy Edn., (For Module V)

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=Uo35Clb6G7k
- https://www.youtube.com/watch?v=kIFBaaPJUO0
- https://www.youtube.com/watch?v=720uyg0Dd_M
- https://www.youtube.com/watch?v=zPQyInnqvrI
- https://www.youtube.com/watch?v=HHcblIxiAAk
- https://www.youtube.com/watch?v=FBWJYH8DZ1g
- https://www.youtube.com/watch?v=z7g6rFjvvkU
- https://www.youtube.com/watch?v=bC0m3RFCGTY
- https://www.youtube.com/watch?v=frHyR9FiKt4
- https://www.youtube.com/watch?v=eylEJ8OKFKE
- https://www.youtube.com/watch?v=9Hxy-TuX9fs

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Non-Destructive Testing			
Course Code	**21IP/IM731**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To inspect a component in a safe, reliable and cost effective manner without causing damage to the equipment
- To weld inspectors can determine whether a weld is strong or has potential defects that could compromise it integrity
- Ultrasonic testing is to detection of defect, measurement of their parameters assessment of their hazard assessment feasibility operation of the particular tested objected
- Liquid penetrant testing is to provide visual evidence of surface discontinuities in solid non-porous materials
- Magnetic Particle inspection is a NDT method, to detect surface and subsurface flaws in ferromagnetic Materials

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby sites to give brief information about the Industrial and Production Engineering structures.
3. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
4. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
5. Encourage collaborative (Group Learning) Learning in the class.
6. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
7. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
8. Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Introduction: Definition of Non-destructive testing,Need for NDT techniques and its applications, Types of NDT techniques, benefits from Non-destructive Testing, nature of flaws ,various steps involved in NDT, uses of Non-destructive techniques. **Non-Destructive Testing of Welds:** Definition of weld, types of weld joints, Welding processes; Gas welding,shielded metal arc welding, TIG spot welding, submerged arc welding, Defects in welded joints, Defects associated with residual stresses, Testing, measurement and control (TMC) of welds, Testing of welded joints; destructive test, Non-destructive tests,	
Teaching-Learning Process	Introduction about Non-destructive testing, and NDT of welds, Chalk and talk used for draw figures and Power Point presentation and YouTube videos, Animation videos, creating right time in classroom discussions. Giving activities &assignments.
Module-2	
Ultrasonic Testing : Introduction frequency of ultrasonic Waves, Generation of Ultrasonic waves, Piezo-electric materials for Ultrasonic Transducers, Types of Ultrasonic Waves, Different kinds of Ultrasonic Transducers,Types of ultrasonic waves, Reflection, Refraction and scattering of Ultrasonic beam, working of ultrasonic Flaws detectors, industrial application, Pulse-echo and through transmission Testing, Scanner assemblies for transmission and pulse-echo techniques, types of scan, shear wave and surface wave applications, Resonance techniques, use of Ultrasonic for thickness measurements.	
Teaching-Learning Process	Discussed about ultrasonic testing and Chalk and talk used for draw figures and Power Point presentation and YouTube videos, Animation videos, creating right time in classroom discussions. Giving activities &assignments.
Module-3	
Liquid Penetrant Testing: Types of Penetrants, Types of developers, Penetration time, Inspection, Post-emulsifiable fluorescent penetrants system, Water washable fluorescent penetrants, Low and High temperature penetrants, High sensitivity fluorescence penetrant examination, Advanced LPT techniques; Ultrasonic pumping to enhance performance, ultrasonically enhanced penetrant inspection of small weldments, Mechanised remote liquid penetrant testing of piping of reactors.	
Teaching-Learning Process	Discussed about liquid penetrant testing and Chalk and talk method and Power Point presentation and YouTube videos, Animation videos, creating right time in classroom discussions. Giving activities &assignments.
Module-4	
Eddy current Testing: instrumentation of ECT, inspection of welds, advanced eddy current testing,Multi-frequency ECT, 3D phase array ECT, Remote field ECT, Magnetically based eddy current. Flux leakage, Computer modelling of ECT, Digital signal Processing, Eddy current imaging; eddy current imaging system, imaging and characterisation of defects, Eddy current array instrumentation for fixed position scanning.	
Teaching-Learning Process	Discussed about liquid Eddy current testing and Chalk and talk method and Power Point presentation and YouTube videos, Animation videos, creating right time in classroom discussions. Giving activities &assignments.
Module-5	
Magnetic particle Flaws detection: Principle of Magnetic Flaw detection, Types and methods of Magnetisation, Magnetic particles, Dry and Wet methods of Magnetic Particles inspection, Use of fluorescent Coated Magnetic particles, Industrial applications, Working of a Few Commercially available Magnetic Crack Detectors, Flaw detection in Rods, pipes and a short work piece, Precautions, Limitations, Residual magnetism, Need for Demagnetisation Research Techniques using Magnetic Particle Methods.	
Teaching-Learning Process	Discussed about liquid Magnetic particle Flaws detection and Chalk and talk method and Power Point presentation and YouTube videos, Animation videos, creating right time in classroom discussions. Giving activities &assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Students be able to inspect a component in a safe, reliable and cost effective manner without causing damage to the equipment
2. Students will understand the weld inspectors can determine whether a weld is strong or has potential defects that could compromise it integrity
3. Ultrasonic testing is to detection of defect, measurement of their parameters assessment of their hazard assessment feasibility operation of the particular tested objected
4. Liquid penetrant testing is to provide visual evidence of surface discontinuities in solid non-porous materials
5. Magnetic Particle inspection is a NDT method, to detect surface and subsurface flaws in ferromagnetic materials

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Non-Destructive Testing Techniques Ravi Prakash 3rd Edition 2010 New Age International (P) Ltd., publishers
2. Non-destructive Testing of Welds Baldev Raj C.V. Subramanian T. Jayakumar Revised Edditon 2000Narosa Publishing House
3. Welding Technology O.P. KhannaDhanpatRai Publication 2008

Welding and welding Technology Richard Little Tata McGraw hill 2005

Web links and Video Lectures (e-Resources):

- https://www.asnt.org/MajorSiteSections/About/Introduction_to_Nondestructive_Testing.aspx#:~:text=Nondestructive%20testing%20(NDT)%20is%20the,part%20can%20still%20be%20used.
- https://www.youtube.com/watch?v=tlE3eK0g6vU
- https://www.youtube.com/watch?v=9qw0Dka_YcU
- https://www.youtube.com/watch?v=qpgcD5k1494
  https://www.youtube.com/watch?v=bHTRmTQDZzg

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Contents related activities (Activity-based discussions)
2. For active participation of students to learnt about welds, Ultrasonic, Liquid Penetrant, Eddy current and some other testing of demonstration in Labs
3. Instruct the students individual to prepare module wise ppt
4. Organizing Group wise discussions and NDT based activities
5. Quizzes and Discussions.

Operations Management			
Course Code	**21IP732**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Learn about historial begining associated with operations management.
- Develop the forecasting of demands.
- Impart models used in decision making, Recognize and apply basic appropriate analytics.
- Interpret material scheduling and controlling of production activities.
- Develop schedules on single machine, flow shop and job shop.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

Module-1

OPERATIONS MANAGEMENT CONCEPTS: Introduction, Historical development, The trend: Information and Non-manufacturing systems, Operations management, Factors affecting productivity.
OPERATIONS DECISION MAKING: Introduction, Management as a science, Characteristics of decisions, and Framework for decision making, Decision methodology, Decision support systems, Economic models, and Statistical models.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos.

Module-2

FORECASTING DEMAND: Forecasting objectives and uses, Forecasting variables, Opinion and Judgmental methods, Time series methods, Exponential smoothing, Regression and correlation methods.

Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos and solve the problems using SPSS, or Minitab, or SAS, or Systat, or MATLAB, or Statistica, etc. in lab.

Module-3

AGGREGATE PLANNING AND MASTER SCHEDULING: Introduction- planning and scheduling, Objectives of aggregate planning, Aggregate planning methods, Master scheduling objectives, Master scheduling methods.	
Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos.
Module-4	
MATERIAL AND CAPACITY REQUIREMENTS PLANNING: Overview: MRP and CRP, MRP:Underlying concepts, System parameters, MRP logic, System refinements, Capacity management, CRP activities. **SCHEDULING AND CONTROLLING PRODUCTION ACTIVITIES**: Introduction, PAC, Objectives and Data requirements, Scheduling strategy and guide lines, Scheduling methodology, priority control, capacity control.	
Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos.
Module-5	
SINGLE MACHINE SCHEDULING: Concept, measures of performance, SPT rule, Weighted SPT rule,EDD rule, minimizing the number of tardy jobs. **FLOW -SHOP SCHEDULING:** Introduction, Johnson's rule for 'n' jobs on 2 and 3 machines, CDS heuristic. JOB-SHOP SHEDULING: Types of schedules, Heuristic procedure, scheduling 2 jobs on 'm' machines.	
Teaching-Learning Process	Chalk and Talk, Power point presentation, animated videos.

Course outcome (Course Skill Set)

- At the end of the course the student will be able to :
- Apply the concepts of operations management by knowing the Historical development, Physical and information flows in a production system, and contribution of James Watt, Charles Babbage, Robert Owen, Thomas Alva Edition, Frederick Winslow Taylor, Henry Ford in development of production systems.
- Solve problems using appropriate techniques of forecast.
- Apply models used in decision making, Recognize and apply basic appropriate analytics.
- Apply material scheduling and controlling of production activities.
- Develop schedules on single machine,flow shop and job shop.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Operations Management Monks J.G McGraw Hill International Editions - 1987.
2. Production and Operations Management Pannerselvam. R PHI 2nd edition
3. Production and Operations Management Chary, S.N TataMcGraw Hill. 3rd edition

Web links and Video Lectures (e-Resources):

- https://www.investopedia.com/terms/o/operations-management.asp
- https://www.youtube.com/watch?v=Hy48AFKEepo
- https://www.shipbob.com/blog/demand-forecasting/
- https://www.youtube.com/watch?v=IDITxCjlyFE
- https://decisions.com/videos/scheduling-job-flow/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Just In Time Manufacturing			
Course Code	**21IP/IM733**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Eliminate waste that is, minimise the amount of equipment, materials, parts, space, and worker's time, which adds a great value to the product
- Increase productivity
- To produce and deliver what is needed, when it is needed, at all stages of the production process.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Discuss how every concept can be applied to the real world thus helping to improve the student's understanding.
6. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1	
INTRODUCTION: Speed of JIT movement, the new production system research association of Japan, some definitions of JIT, core Japanese practices of JIT, enabling JIT to occur, basic element of JIT, benefits of JIT. **MODERN PRODUCTION SYSTEM**: Key feature of Toyota's production system, basic framework of Toyota production system. **KANBAN SYSTEM** other types of kanban's, kanban rules, determining the number of kanban's in Toyota production system.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-2	
PRODUCTION SMOOTHING IN TOYOTA PRODUCTION SYSTEM: production planning, production smoothing, adaptability to demand fluctuations, sequencing method for the mixed model assembly line to realize smoothed production. EDP system for support of the Toyota Production system. **GLOBAL IMPLEMENTATION OF JIT**: JIT in automotive industry, JIT in electronics, computer, telecommunication and instrumentation, JIT in process type industry, JIT in seasonal demand industry, other manufacturing industries, conclusion.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-3	
JIT IMPLEMENTATION SURVEYS: JIT implementation in US manufacturing firms-analysis of survey results, just in time manufacturing industries, just in time production in West Germany, just in time production in Hong Kong electronics indu8stry, conclusion. DESIGN, DEVELOPMENT AND MANAGEMENT OF JIT MANUFACTURING SYSTEMS: plant configurations and flow analysis for JIT manufacturing, comparison of JIT's "demand pull" system with conventional "push type" planning and control systems, quality management system for JIT, product design for JIT human resource management in JIT, flexible workforce system at Toyota.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-4	
SUPPLY MANAGEMENT FOR JIT: JIT purchasing-the Japanese way, some studies in JIT purchasing, experience of implementation organizations, surveys of JIT purchasing, buyer-seller relationship in JIT purchasing, Quality certification of suppliers in JIT purchasing, some problems in implementation of JIT purchasing, reduction freight costs in JIT purchasing, monitoring supplier performance for JIT purchasing, audit in JIT purchasing, implementation of JIT to international sourcing.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-5	
FRAMEWORK FOR IMPLEMENTATION OF JIT: Implementation risk, risks Due to inappropriate understanding of JIT, risks due to technical, operational and people problems, risks associated with kanban system, some important activities to be performed during implementation, steps in implementation, a project work to approach to implementation, conclusion.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

5. Produce an overview on lean / just-in-time and repetitive manufacturing.
6. Explain the lean / just-in-time concept in detail.
7. Describe the Kanban technique.
8. Identify the cumulative production figures principle.
9. Disclose an implementing procedure and a comparison of techniques.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Just In Time Manufacturing M.G. Korgaonker Macmillan India Ltd., 1992.
2. Japanese Manufacturing Techniques Richard J. SchonbergerThe Free Press – Macmillan Pub. Co., Inc. New York, 1988.

Web links and Video Lectures (e-Resources):

- www.nptel.com
- https://youtu.be/zCTmN17ZDek
- https://youtu.be/cAUXHJBB5CM
- https://youtu.be/6y3qrOla9Tc
- https://youtu.be/OXVi7dOF3jU
- https://youtu.be/9onMrDbDKaM
- https://study.com/academy/lesson/jit-lean-implementation-uses-drawbacks.html
- https://www.investopedia.com/terms/j/jit.asp
- https://youtu.be/9OL7BMBa4ys

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, assignments are to be given under each of the topics covered.

Facility Planning and Design			
Course Code	**21IP734**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To know the importance of location, layouts and material handling
- To know and distinguish between different approaches to layout and draw activity relationship chart
- To compute space requirement and demonstrate skills in area allocation and construct the layout.
- To examine the quantitative approaches to facility planning and identify the different models.
- To know the different computerized techniques and model appropriate design.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby sites to give brief information about the Industrial and Production Engineering structures.
3. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
4. Encourage collaborative (Group Learning) Learning in the class.
5. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
6. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Plant Location: Factors influencing plant location, theories of plant location, plant layout objectives of plant layout, principles of plant layout, types of plant layout, their merits and demerits, facilities design function: objectives. Simple exercises on layouts.

Introduction to Material Handling: Objectives and principles of material handling, unit load concept, Basic handling equipment types, Common material handling equipments

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. Creating real time stations in classroom discussions. Giving activities and assignments.

Module-2

Plant Design: Layout procedure, study of some approaches (Immer, Nadler, Muther, Apple James and Reed's approach), systematic layout planning, the activity relationship chart, Constructing the activity relationship chart, Activity relationship diagram.

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities and assignments.

Module-3

Space Determination and 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, area allocation factors to be considered, expansion, flexibility, aisles column, area allocation procedure, the plot plan.

Construction of the Layout: Methods of constructing the layout, evaluation of layout, efficiency indices, presenting layout to management.

Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities and assignments.

Module-4

Quantitative approaches to facilities planning: Deterministic models, single and multi facility models, Conventional layout model: Block stacking, location allocation models, **Layout Models:** Warehouse layout models, waiting line models, Storage models.	
Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities and assignments.
Module-5	
Computerized Layout Planning: Computerized relative allocation of facility techniques (CRAFT), Plant layout Evaluation Techniques (PLANET), Computerized Relationship Layout Planning (CORELAP), Comparison of computerized layout techniques.	
Teaching-Learning Process	Chalk and talk method, Power Point presentation and YouTube videos, Animation videos methods. creating real time stations in classroom discussions. Giving activities and assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Identify the planning strategies for implementation, evaluation and maintaining the facility.
- Arrive at suitable layout for given situations having understand different approaches.
- Demonstrate the Space determination and area allocation procedure, construction of the layout.
- Analyze the quantitative methods and models to determine for the plant location. Explain the
- Warehouse and waiting line models.
- Demonstrates the ideas on various types of layout and evaluation techniques using computers.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Textbooks

1. Plant layout and material handling, James M. Apple John, Wiley and sons 3 edition, 1991.
2. Facility layout and location Françoise, R.L.and White, J.A, McGraw Hill 2nd edition, 1994.
3. Practical layout, Muther Richard, McGraw Hill, 1956
4. Plant layout design, James.M Moore, Mac Millon 1962
5. Facilities design, SundereshHerag, u PWS publishingcompany, ISBN-0-534-95183,August 2008
6. Facilities planning, Tompkins white, wiley India Pvt ltd 3rd edition.
7. Facility Layout and Location, Richard L Francies PHI learning Pvt. Ltd 2nd Edition

Web links and Video Lectures (e-Resources):

- . https://www.coursehero.com/file/10902415/Plant-Location/
- http://arts.brainkart.com/article/plant-location---introduction-to-operations-management-1098/
- https://www.businessmanagementideas.com/project-management/plant-location/plant-location-importance-techniques-and-procedure/6658
- https://www.wisdomjobs.com/e-university/production-and-operations-management-tutorial-295/introduction-and-meaning-9445.html
- https://books.google.com/books/about/Introduction_to_Materials_Handling.html?id=SwFaOAAACAAJ
- https://www.vskills.in/certification/tutorial/space-determination-and-area-allocation-2/
- https://www.youtube.com/watch?v=-aGk5-yx340
- https://www.youtube.com/watch?v=3OtGymbhbwo

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Contents related activities (Activity-based discussions)
2. For active participation of students, instruct the students to prepare Exercise problems
3. Organizing Group wise discussions and machineries issues based activities
4. Quizzes and Discussions
5. Seminars and assignments

Tool Engineering and Design			
Course Code	**21IP/IM735**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40 hours	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To develop capability to design and select single point and multipoint cutting tools for various machining operations.
- Exposure to variety of locating and clamping methods available
- To enable the students to design jigs and fixtures for simple components
- To expose the students to the design/selection procedure of press tools and die casting dies.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.

2. Show Videos/animation films to explain the content, wherever possible.

3. Encourage collaborative Learning (Group Learning) in the class.

4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

5. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as

the ability to evaluate, generalize, and analyze information rather than simply recall it.

6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.

7. Discuss how every concept can be applied to the real world thus helping to improve the students understanding.

8. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1	
Introduction: Concept, meaning and definitions of tool, tool design and tool engineering. Tools-types, classification, features & applications. **Design of Single Point Tool:** Tool Signature, Selection of Tool Angles, Design of shank section for single point tool to account for strength and rigidity. Design of Multi Point Tools – Drill, Reamers.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-2	
DESIGN of peripheral Milling cutters, Design of Broach. **Location and Clamping:** General principles of location, 3-2-1 Principle of Location, Principle of Radial location, General study of locating devices. General principles of clamping, Study of various Clamping devices.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-3	
Design of Fixtures: Difference between a Jig and a Fixture, Design of Milling fixture, Study of other fixtures like Lathe fixture, Inspection fixture. Study of different types of Drill jigs. **Design of Gauges:** Types of gauges. Factors to be considered in the design of gauges, Design of Plug gauge,Design of Snap gauge.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-4	
Design of Press Tools: A General study of Press operations. Elements of a Die, Strip layout, calculation of center of pressure. Design of Blanking Die, Design of Piercing Die, Design of Progressive Die**.**	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-5	
Design of Forming Dies: Study of Drawing and Bending process, Design of Drawing Die, Design of Bending Die **Tool Layout and Cam Design of Single Spindle Automats:** Classification of Automats and their applications. Tool layout and Cam design for automatic screw cutting machine.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Select appropriate cutting tools required for producing a component.
- Understand and interpret cutting tool and tool holder designation systems
- Select suitable locating and clamping devices for a given component for various operations.
- Students should get the knowledge of Jigs and Fixtures so as to utilize machine capability for variety of operations.
- Identify various process parameters and their effect on machining processes.
- Analyze and design a jig/fixture for a given simple component.
- Understand various press tools and press tool operations.
- Classify and explain various die casting and injection moulding dies.

Student should be able to design and analyze various machining processes and tooling.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

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3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Text book of Production Engineering by P. C. Sharma, Chorotar Publishing house.
2. Tool Design by Donaldson and Golding, Tata McGraw Hill, New Delhi.
3. Fundamentals of Tool Design, ASTME.

4. Jigs and Fixtures by P.H.Joshi, McGraw Hill Education, 3rd edition, 2010.
5. An introduction to Jig and Tool design by Kempester M.H.A., VIVA Books Pvt. Ltd, 2004.

Web links and Video Lectures (e-Resources):

- www.nptel.ac.in
- https://youtu.be/bUrp8JMRwx4
- https://youtu.be/hheFVuUBpxo
- https://youtu.be/K39bnxmIz7Q
- https://youtu.be/Hs_Pz80DD5Y
- https://youtu.be/HVbbSl5WreA
- https://youtu.be/SVo5ETboDTQ
- https://youtu.be/nfoUdm9WdE4
- https://youtu.be/6ZfAfjJTvvA
- https://youtu.be/nuCQTABjHLQ
- https://youtu.be/J_d8IRT9r7E
- https://youtu.be/LKEG3p3yx1g
- https://youtu.be/coLiMQ-hPvA

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- Strip layout for few structures in A4 sheet.
- Pressing operation by clay.
- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Simulation and Modeling of Manufacturing Systems			
Course Code	**21IP/IM741**	CIE Marks	50
Teaching Hours/Week (L:T:P:S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- Define the basics of simulation modeling and replicating the practical situations in organizations
- Generate random numbers and random variates using different techniques.
- Develop simulation model using heuristic methods.
- Analysis of Simulation models using input analyzer, and output analyzer
- Explain Verification and Validation of simulation model.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborativeLearning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the students

understanding.

8. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1	
Principle of Computer Modelling and Simulation: Monte Carlo simulation. Nature ofcomputer- modeling and simulation. Limitations of simulation, areas of applications.System andEnvironment: Components of a system - discrete and continuous systems, Models of a system –avariety of modeling approaches. Simulation Software: Selection of simulation software,simulation packages.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises,Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-2	
Discrete Event Simulation: Concepts in discrete event simulation, manual simulation using event scheduling, single channel queue, too server queue, simulation of inventory problem. **Statistical Models in Simulation:** Discrete distributions, continuous distributions. **Discrete Event Simulation:** Concepts in discrete event simulation, manual simulation usingevent scheduling, single channel queue, too server queue, simulation of inventory problem. **Statistical Models in Simulation:** Discrete distributions, continuousdistributions.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises,Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-3	
Random Number Generation: Techniques for generating random numbers- Mid square method -the mod product method -Constant multiplier technique -Additive congruential method –Linear congruential method -Tests for random numbers -The Kolmogorov-Smimov test -the Chi-square test.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises,Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-4	
Random Variable Generation: Inversion transforms technique-exponential distribution. uniform distribution, weibul distribution, continuous distribution, generating approximate normal variates-Erlang distribution.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises,Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-5	
Empirical Discrete Distribution: Discrete uniform -distribution poisson distribution –geometricdistribution - acceptance -rejection technique for Poisson distribution gamma distribution **Designand Evalution of Simulation Experiments:** variance reduction techniques -antithetic variables, variables-verification and validation of simulation models.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises,Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Describe the role of important elements of discrete event simulation and modeling paradigm.
- Conceptualize real world situations related to systems development decisions, originating from source requirements and goals.
- Develop skills to apply simulation software to construct and execute goal-driven system models.
- Interpret the model and apply the results to resolve critical issues in a real world environment.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

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3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

TEXT BOOKS:

1. **Discrete Event System Simulation** - Jerry Banks & .John S Carson II - Prentice Hall Inc.-1984.
2. **Systems Simulation** - Gordan. G. - Prentice Hall India Ltd - 1991.
3. **System Simulation with Digital Computer** - NusingDeo - Prentice Hall of India - 1979.
4. **Computer Simulation and Modeling** - Francis Neelamkovil - John Wilely& Sons - 1987.
5. **Simulation Modeling with Pascal -** RathM.Davis& Robert M O Keefe - Prentice Hall Inc. - 1989.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=gbOn3jRc_Wc
- https://www.youtube.com/watch?v=Wp3jyLkfBQs
- https://www.youtube.com/watch?v=WfEZMhpzsT8
- https://www.youtube.com/watch?v=DBmYYpxjqvM
- https://www.youtube.com/watch?v=O46ZlKEjjHE
- https://www.youtube.com/watch?v=OH8MRT8eqRI
- https://www.youtube.com/watch?v=yN6cvjtlQtY
- https://www.youtube.com/watch?v=pt4v5l8-Pjw
- https://www.youtube.com/playlist?list=PL3l_ZG2nBXNLoPB26LeNRVDP6oG6Sz8tu
- https://www.youtube.com/watch?v=Oomz_iZ5d-0

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Marketing Management			
Course Code	**21IP/IM742**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To analyze markets and identify appropriate segmentation criteria to discover promising market niches.
- To develop an effective marketing strategy, including a marketing mix, for a product/service.
- To list and explain the critical components of a marketing plan.
- To demonstrate an awareness of the opportunities and challenges of marketing in a global environment.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Discuss how every concept can be applied to the real world thus helping to improve the student's understanding.
6. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

INTRODUCTION: Historical development of marketing management, Definition of Marketing, Coremarketing concepts, Marketing Management philosophies, Micro and Macro Environment, importance ofmarketing in the India Socio – economic system.

CONSUMER MARKETS AND BUYING BEHAVIOR: Characteristics affecting consumer behaviour, Types of buying decisions, Buying decision process, Classification of consumer products, Marketsegmentation.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-2

MARKETING INFORMATION SYSTEMS AND RESEARCH: Components of marketing informationsystem–benefits & uses marketing research system, marketing research procedure, measurement of market demand.

MARKETING OF INDUSTRIAL GOODS: Nature and importance of the Industrial market, classification of industrial products, participants in the industrial buying process, major factors influencing industrial buying behaviour, haracteristics of industrial market demand. Determinants of industrial market demand Buying

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Module-3

PRODUCT PLANNING AND DEVELOPMENT: The concept of a product, features of a product,classification of products, product policies – product planning and development, product line, product mix –factors influencing change in product mix, product mix strategies, meaning of New – product; major stages innew – product development, product life cycle.

BRANDING: Branding, Reasons for branding, functions of branding,features and types of brands, kinds of brand name.

LABELLING: Types, functions, advantages and disadvantages **PACKAGING:** Meaning, growth of packaging, function of packaging, kinds of packaging	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-4	
PRICING: Importance of Price, pricing objectives, factors affecting pricing decisions, procedure for pricedetermination, kinds of pricing, pricing strategies and decisions. DISTRIBUTION: Marketing channels – functions, types of channels of distribution, number of channel levels. Physical distribution – importance, total systems concept, strategy, use of physical distribution.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments
Module-5	
PERSONAL SELLING: Objectives of personal selling, establishing the Sales force objectives, sales – forcestrategy, sales force structure and size, salesmanship, qualities of good salesman, types of salesman, major stepsin effective selling.	
Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Identify market and appropriate segmentation criteria to discover promising market niches.
- Describing the benefits and the emerging trends of marketing research.
- Apply steps of research design in marketing research for a product and list out the source of research data in collecting data needed to the market research.
- Construct the structured format for preparing the questionnaire to analyse the market.
- Evaluate the optimum sample size required for hypothesis testing.
- Plan a research report by synthesizing the marketing information and applying it to the real world.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

TEXT BOOKS:

1. Principles of Marketing, Philip Kotler, Prentice Hall, 11th Edn.
2. Marketing Management, Philip Kotler, Prentice Hall, 11th Edn.
3. Fundamentals of Marketing, Wiliam J Stanton, McGraw Hill, 1984
4. Marketing Management Text & Cases, Rajagopal, Vikas Publishing House, ISBN 81-259-0773-4
5. Marketing Management, Michael R Czinkota, Vikas Publishing House, 2nd Edition ISBN 981-240-366-3.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=Io_mSvKptdc
- https://www.youtube.com/watch?v=Y3nq53BQC-E
- https://www.youtube.com/watch?v=IBHD6xebid8
- https://www.youtube.com/watch?v=podqXzkZHJU
- https://www.youtube.com/watch?v=LrG63GTXq4M
- https://www.youtube.com/watch?v=8771jY9BXp8
- https://www.youtube.com/watch?v=WAd5bpkNTQU
- https://www.youtube.com/watch?v=Yqodce5-Ucs
- https://www.youtube.com/watch?v=eU-EQjg7Y9g
- https://www.youtube.com/watch?v=S95nSdqVzhc

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, assignments are to be given under each of the topics covered.

Human Resource Management			
Course Code	**21IP/IM743**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To enable the students to understand the HR Management and system at various levels in general and in certain specific industries or organizations.
- To help the students focus on and analyse the issues and strategies required to select and develop manpower resources.
- To develop relevant skills necessary for application in HR related issues.
- To Enable the students to integrate the understanding of various HR concepts along with the domain concept in order to take correct business decisions

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

INTRODUCTION: Evolution of HRM, Objectives, Functions and Policies.

HUMAN RESOURCE PLANNING: Uses and benefits, Man Power Inventory, Man Power Forecasting, Methods of Man Power Forecasting, job Description, Job Specification.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-2

RECRUITMENT: Sources of Man power, Advertisement, Short Listing of Candidates calling Candidates for selection Process.

SELECTION: Selection procedure – Written Test, Group Discussion. Interview – Different methods, advantages and limitations, Psychological testing – Advantages and limitations, Induction procedure, transfers, promotion, exit interview, (Tutorial on written test, Group Discussion, Interviews)

Teaching-Learning Process	. Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-3

TRAINING AND DEVELOPMENT: Identification of Training needs, Training Evaluation, Training Budget, Executive Development – Different Approaches, Non-executive development – Different methods.

PERFORMANCE APPRAISAL: Components (all round performance appraisal), Methods. Advantages and limitations of different methods, Personal Counseling based on Annual Confidential Reports.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-4

COUNSELLING AND HUMAN RESOURCE ACCOUNTING: Characteristics, Need, Function, Types, Suggestions for personnel development, communication function, communication process, effective communication. Human resource records, Advantages of HR accounting, Various methods of accounting.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation

Module-5

INDUSTRIAL RELATIONS: Indian trade union act, standing orders act, Indian factories act
INDUSTRIAL DISPUTES AND SETTLEMENT: Indian Industrial Disputes act, Industrial disputes settlement machinery. Works committee, Board of Conciliation, Voluntary Arbitration, Compulsory arbitration, Court of inquiry, Industrial tribunal, Adjudication.

Teaching-Learning Process	Chalk and talk, videos, PowerPoint Presentation

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Synthesize information regarding the effectiveness of recruiting methods & selection procedures
2. Identify the various training methods and design a training program
3. Design a job description and job specification for various levels of employees.
4. List out the regulations governing employee benefit practices.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Human Resources Management – Dr. K Ashwathappa – Tata McGraw Hill - Edition 1999.
2. Management of Human Resources – CB Mamoria – Himalaya Publication House – 2003.
3. Personnel / Human resource Management – Decenoz and robbins- PHI - 2002
4. Industrial Relations – Arun Monappa – TMH - ISBN – 0-07-451710-8.
5. Human Resources Management – VSP Rao
6. Human Resources Management – Ravi Dharma Rao

Web links and Video Lectures (e-Resources):

- https://www.lkouniv.ac.in/site/writereaddata/siteContent/20200407095112659 9shaile_Evolution_of_Human_Resource_Management.pdf
- https://www.investopedia.com/terms/h/human-resource-planning.asp
- https://www.hrhelpboard.com/recruitment.htm
- https://www.accountingnotes.net/human-resource-management/selection-process/selection-process-in-hrm/17676
- https://www.hrhelpboard.com/training-development.htm
- https://www.startuphrtoolkit.com/performance-appraisal-in-hrm/
- https://backup.pondiuni.edu.in/storage/dde/downloads/hrmiv_hra.pdf
- https://www.legalserviceindia.com/legal/article-956-industrial-and-national-tribunal.html

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Advanced Joining Processes			
Course Code	**21IP/IM744**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To know the different types of welding and describe welding and cladding of dissimilar metal
- To distinguish the weldability of metal
- To identify the welding design principles and compute welding design parameters
- To illustrate the symbols used in welding practice and identify the adhesive bonding applications

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby sites to give brief information about the Industrial and Production Engineering structures.
3. Adopt different types of teaching methods to develop the outcomes through PowerPoint presentations and Video demonstrations or Simulations.
4. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
5. Encourage collaborative (Group Learning) Learning in the class.
6. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
7. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
   Conduct Laboratory Demonstrations and Practical Experiments to enhance experiential skills.

Module-1

Types of Welding: Forge welding, Electro Slag Welding, Electron Beam Welding, Plasma arc Welding, Laser Beam Welding, Explosion Welding, Diffusion Welding, Ultrasonic Welding, Friction welding.
Welding and Cladding of Dissimilar Materials: Overlaying and surfacing, different methods and applications, thermal –Spray coating or metalizing.

Teaching-Learning Process	Discussed about Joining process, Chalk and talk used for draw figures and Power Point presentation and YouTube videos, Animation videos, creating real time stations in classroom discussions. Giving activities &assignments.

Module-2

Weldability of Metals: like stainless steel, Cast iron, Copper, and Aluminium. Advanced soldering and brazing processes-different types. Welding of plastics- different methods.

Teaching-Learning Process	Discussed about weldability of metals, Power Point presentation, demonstration or Simulations, Chalk and Talk are used for diagrams; enhance experiential skills, creating real time stations in classroom discussions. Giving activities &assignments.

Module-3

Welding design: Basic principles of sound welding design, welding joint design, welding positions, Allowable strength of welds under steady loads, allowable fatigue strength of welds, Design of welds subjected to combined stresses, Numerical examples.	
Teaching-Learning Process	Chalk and Talk are used for Draw welding designs and diagrams enhance experiential skills and Power Videodemonstration or Simulations, creating real time stations in classroom discussions. Giving activities &assignments.
Module-4	
Welding Symbols: Need for representing the welds, Basic weld symbols, location of weld, supplementary symbols, dimensions of weld, examples. **Adhesive Bonding:** Adhesive materials and properties, non-structural and special adhesives, surface preparation and joint design considerations.	
Teaching-Learning Process	Discussed about welding symbols and Adhesive bonding, Chalk and Talk are used for diagrams, enhance experiential skills and Power Point presentation and Videodemonstration or Simulations, creating real time stations in classroom discussions. Giving activities &assignments
Module-5	
Welding of Aluminium and Its Alloys: Introduction, Welding characteristics of Al and its alloys, Weldabilityof Al and its alloys, Processes used for welding Al and its alloys, Oxy-gas, Metallic arc, MIG TIG, Resistance, Solid state, Carbon arc and Atomic hydrogen welding, Brazing of aluminium alloys, welding of aluminium casting.	
Teaching-Learning Process	Discussed bout aluminium and alloys, chalk and talk used for writing the points of weldability, right time stations in classroom discussions. Giving activities &assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain the importance of grain size control, methods to avoid distortion and residual stresses; also know the techniques of surfacing and cladding of surfaces.
2. Understand the advantages and limitations of different advanced welding process
3. Explain the weld ability of engineering materials including plastics and the advanced soldering and brazing processes.
4. Design welds subjected to for various loading conditions.
5. The symbols used to represent the welds also be able to learned the methods of adhesive bonding of materials.
6. Inspect the welds in accordance with ASTM standards employing both destructive and non-destructive Methods.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Welding Technology O.P. KhannaDhanpatRai Publication 2008
2. Welding and welding Technology Richard Little Tata McGraw hill 2005
3. Welding Engineering Handbook A.W.S. Ninth Edition
4. Advanced Welding processes G. Nikolaev and N. Olshansky MIR Publications 1977
5. ASM handbook on welding, brazing and soldering Vol 6, 2005.

Web links and Video Lectures (e-Resources):

- https://monroeengineering.com/blog/joining-vs-forming-manufacturing-processes-whats-the-difference/
- https://www.cruxweld.com/blog/types-of-welding-processes/
- https://doi.org/10.31399/asm.hb.v06.a0001442
- https://www.hardfacingfty.com/cladding-welding/
- https://www.twi-global.com/technical-knowledge/faqs/faq-how-can-i-assess-the-weldability-of-a-material
- https://www.slideserve.com/gavan/weldability
- https://www.nrc.gov/docs/ML1215/ML12157A631.pdf
- https://weldguru.com/welding-symbols/

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Contents related activities (Activity-based discussions)
2. For active participation of students to learn about demonstration in lab
3. Instruct the students individual to prepare for module wise ppt
4. Suggest them to Group wise discussions and weldability based activities
5. Quizzes on various types of Joining process and Discussions

Mechatronics			
Course Code	**21IP/IM745**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To acquire a strong foundation in science and focus in mechanical, electronics, control, software, and computer engineering, and a solid command of the newest technologies.
- To understand the evolution and development of Mechatronics as a discipline.
- To substantiate the need for interdisciplinary study in technology education
- Understand the applications of microprocessors in various systems and to know the functions of each element.
- To demonstrate the integration philosophy in view of Mechatronics technology
- To be able to work efficiently in multidisciplinary teams.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

INTRODUCTION: Definition of Mechatronics, Multi-disciplinary scenario, Evaluation of Mechatronics, Objectives, Advantages & Disadvantages of Mechatronics, An Overview of Mechatronics, Microprocessor Based Controllers, Principle of Working of Automatic Camera, Automatic Washing Machine & Engine Management System.

REVIEW OF SENSORS AND TRANSDUCERS: Definition and Classification of Transducers, Definition & Classification of Sensors, Working Principle and Application of Displacement, Position & Proximity, Velocity and Motion, Force, Fluid pressure, Liquid flow, Liquid level, Temperature, Light sensors, Selection of transducers.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-2

DIGITAL PRINCIPLES: Introduction, Digital Number System, Range and Weight of Binary Number System, Octal and Hexadecimal Number Systems, Conversion, BCD Number Systems, Gray Code, Boolean Algebra, Logic gates, Logic Functions, More Logic Gates, Universal Gates, Exclusive-OR Gate, Combinational and Sequential Logic Circuits, Flip- Flops.

MICROPROCESSOR: Intel 8085, ALU, Timing and Control Unit, Registers, Data and Address Bus, Pin Configuration, Intel 8085 Instructions, Op code and Operands, Instruction Word Size, Instruction Cycle, Fetch Operation, Execute Operation, Machine Cycle and State, Instruction and Data Flow, Timing Diagram, Timing Diagram for Op code Fetch Cycle.

Teaching-Learning Process	. Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-3

MICRO CONTROLLER: Introduction to microcontrollers, Intel 8051 Microcontroller Architecture and Pin diagram, Selection and Application of Microcontroller.
PLC: Programmable Logic Controllers, Basic Structure, Input/Output Processing, Programming, Mnemonics, Timers, Internal Relays and Counters, Shift Registers, Master and Jump controls, Data handling, Analogue input/output, Selection of a PLC.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-4

ACTUATORS: Definition, Classification of Actuators, Brief survey of Electromechanical actuators, Drive requirements for cutting movements, Requirements of feed drives, Calculation of drive requirements on feed motor shaft, DC motors & Control of DC motors, AC motors, DC & AC servomotors, Stepper motors- types, Characteristics, advantages, limitations and applications.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-5

SYSTEM MODELS: Mathematical models, Mechanical system building blocks, Electrical system building blocks, Fluid system building blocks, Thermal system building blocks.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Illustrate various components of Mechatronics systems.
2. Assess various control systems used in automation.
3. Develop mechanical, hydraulic, pneumatic and electrical control systems.
4. Design and conduct experiments to evaluate the performance of a Mechatronics system or component with respect to specifications, as well as to analyze and interpret data.
5. Function effectively as members of multidisciplinary teams.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks.

Suggested Learning Resources:

Books

1. Mechatronics - W. Bolton – Pearson Education Asia - 2nd Edition, 2001.
2. Fundamentals of Microprocessor and Micro Computer - B. Ram - Dhanpat Rai and Sons - 4th Revised Edition.
3. Mechatronics Principles, Concepts and Application - Nitaigour and Premchand, Mahilik – Tata McGraw Hill - 2003.
4. Mechatronics by HMT - TMH.

Web links and Video Lectures (e-Resources):

- http://engineering.nyu.edu/gk12/amps-cbri/pdf/Intro%20to%20Mechatronics.pdf
- http://ggn.dronacharya.info/EEEDept/Downloads/QuestionBank/VIISem/AI/SectionB/sectionB.pdf
- https://www.iitmanagement.com/images/Gallery/DIP-EE-4TH%20SEM%20-%20DE.pdf
- https://www.youtube.com/watch?v=I78iyzXQrP4
- https://www.tutorialspoint.com/microprocessor/microcontrollers_8051_architecture.htm#:~:text=8051%20microcontroller%20is%20designed%20by,addressable%20as%20per%20the%20requirement.
- https://www.youtube.com/watch?v=PbAGl_mv5XI
- https://www.youtube.com/watch?v=LHn7O6PUaoY

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Project Management			
Course Code	**21IP/IM751**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To enable the students to understand the project management and its types.
- To help the students focus on and analyse the issues and strategies required to Project Selection and Prioritization
- To develop relevant skills necessary for Resourcing Projects and Budgeting the Projects.
- To enable the students to integrate the understanding of various Network Analysis.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction: Definition of project, characteristics of projects, understand projects, types of projects, scalability of project tools, project roles.

Project Selection and Prioritization: Strategic planning process, Strategic analysis, strategic objectives, portfolio alignment – identifying potential projects, methods of selecting projects, financial mode / scoring models to select projects, prioritizing projects, securing and negotiating projects.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-2

Planning Projects: Defining the project scope, Project scope checklist, Project priorities, Work Breakdown Structure (WBS), Integrating WBS with organisation, coding the WBS for the information system.

Scheduling Projects: Purpose of a project schedule, historical development, how project schedules are limited and created, develop project schedules, uncertainty in project schedules, Gantt chart.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations.

Module-3

Resourcing Projects: Abilities needed when resourcing projects, estimate resource needs, creating staffing management plant, project team composition issues.

Budgeting Projects: Cost planning, cost estimating, cost budgeting, establishing cost control.

Project Risk Planning: Risk Management Planning, risk identification, risk analysis, risk response planning.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Group discussion.

Module-4

Performing Projects: Project supply chain management: - Plan purchasing and acquisitions, plan contracting, contract types, project partnering and collaborations, project supply chain management.
Project Progress and Results: Project Balanced Scorecard Approach, Internal project, customer, financial issues.
Finishing the project: Terminate project early, finish projects on time, secure customer feedback and approval, knowledge management, perform administrative and contract closure.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Module-5

Network Analysis: Introduction, network construction - rules, Fulkerson's rule for numbering the events.
AON and AOA diagrams: Critical path method (CPM) to find the expected completion time of a project.
Floats: PERT for finding expected duration of an activity and project, determining the probability of completing a Project.
Predicting the completion time of project: Crashing of simple projects.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Creating conducive environment in classroom for discussions and understanding through peer learning.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Understand the selection, prioritization and initiation of individual projects and strategic role of project management.
2. Understand the work breakdown structure by integrating it with organization.
3. Understand the scheduling and uncertainty in projects.
4. Students will be able to understand risk management planning using project quality tools.
5. Understand the activities like purchasing, acquisitions, contracting, partnering and collaborations related to performing projects.
6. Determine project progress and results through balanced scorecard approach
7. Draw the network diagram to calculate the duration of the project and reduce it using crashing.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Project Management by Timothy J Kloppenborg Cengage Learning, Edition 2009.
2. Project Management, A systems approach to planning scheduling and controlling by S Choudhury, McGraw Hill Education (India) Pvt. Ltd. New Delhi, 2016.
3. Project Management Pennington Lawrence McGraw hill.
4. Project Management A Moder Joseph and Phillips New Yark Van Nostrand, Reinhold.
5. Project Management Bhavesh M. Patal Vikas publishing House.

Web links and Video Lectures (e-Resources):

- https://www.youtube.com/watch?v=BOU1YP5NZVA
- https://www.simplilearn.com/project-selection-methods-article
- https://www.youtube.com/watch?v=DFL9FkIrXLI
- https://www.techtarget.com/searchcio/definition/project-planning
- https://www.ecosys.net/knowledge/scheduling-project-management-project-scheduling/
- https://www.workbreakdownstructure.com/
- https://docs.oracle.com/en/cloud/saas/project-management/22a/oapjs/how-project-progress-is-calculated.html
- https://www.youtube.com/watch?v=ljtGERVLF5U

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Enterprise Resource Planning			
Course Code	**21IP752**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning Technology.
- To focus on a strong emphasis upon practice of theory in Applications and Practical oriented approach.
- To train the students to develop the basic understanding of how ERP enriches the business organizations in achieving a multidimensional growth.
- To aim at preparing the students technological competitive and make them ready to self-upgrade with the higher technical skills.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.

Module-1

INTRODUCTION TO ERP: Introduction, Evolution of ERP, What is ERP, Reasons for the growth of the ERP market, The advantages of ERP, Why do Man ERP Implementations Fail? Why are ERP packages being used now?
ENTERPRISE – AN OVERVIEW: Introduction, Integrated Management Information, Business modelling, Integrated Data Model

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-2

ERP AND RELATED TECHNOLOGIES: Introduction, Business Process Reengineering, Management Information System, Decision Support System, Executive Information Systems, Data Warehousing, Data Mining, On-line Analytical Processing, Supply Chain Management
ERP- MANUFACTURING PERSPECTIVE: Introduction, ERP. CAD/CAM, Materials Requirements Planning, Bill of Material, Closed Loop MRP. Manufacturing Resource Planning, Distribution Requirements Planning

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-3

KANBAN: JIT and Kanban, Product Data Management, Benefits of PDM, Make-to-order, and Make-to Stock, Assemble to order, Engineer to order, Configure-to order.
ERP MODULES: Introduction, Finance, Plant Maintenance, Quality Management, Materials Management

Teaching-	

Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-4

BENEFITS OF ERP: Introduction, Reduction of Lead time, On-time shipment, Reduction in Cycle Time, Improved Resource Utilisation, Better Customer Satisfaction, Improved Suppler Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Decision – making capability.
ERP PACKAGES: Overview of ERP Software Introduction, SAP AG, Baan Company, Oracle Corporation, PeopleSoft, JD Edwards World Solutions Company, System Software Associates, Inc. QAD

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Module-5

ERP Implementation Life Cycle: Pre-Evaluations Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation of Team Training, Testing, Going Live, end user Training, Post Implementation
VENDOR, CONSULTANTS AND USERS: Introduction, In-house implementation – Pros and Cons, Vendors, Consultants, End-users.
ERP- Case studies

Teaching-Learning Process	Chalk and Talk, Power point presentation and Lab Visit.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Make use of Enterprise software, and its role in integrating business functions
2. Analyze the strategic options for ERP identification and adoption. L
3. Design the ERP implementation strategies.
1. Create reengineered business processes for successful ERP implementation.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Enterprise Resource Planning, Alexis Leon, Tata McGraw Hill Publishing Company Ltd, 1999
2. Enterprise esource Planning Concept and Practice, Vinod Kumar Garg and Venkitakrishnan, Prentice Hall, India 2nd Edition.
3. Manufacturing Planning & Controls Thomas Volloman, et,al.

Web links and Video Lectures (e-Resources):

- https://www.projectmanager.com/guides/resource-management
- https://www.youtube.com/watch?v=igssKXYS23A
- https://www.youtube.com/watch?v=1N9WbIP9S_g
- https://www.youtube.com/watch?v=1N9WbIP9S_g&list=RDCMUCObs0kLIrDjX2LLSybqNaEA&index=1
- https://www.youtube.com/watch?v=ssg6DTVfTSY

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Automation in Manufacturing			
Course Code	**21IP753**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To understand the concepts of automation in manufacturing systems
- To impart the knowledge of a line balancing and assembly systems
- To explore the idea of robotics and understand the computerized manufacturing planning
- To gain the knowledge of automated inspection and shop floor control
- To understand the concepts of additive manufacturing and latest trends in manufacturing

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Arrange visits to nearby sites to give brief information about the Industrial and Production Engineering structures.
3. Show Video/animation films to explain the infrastructures and the mechanism involved in the principle.
4. Encourage collaborative (Group Learning) Learning in the class.
5. Ask at least three HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
6. Adopt Problem Based Learning (PBL), which fosters students' Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
7. Topics will be introduced in multiple representations.
8. Show the different ways to solve the same problem and encourage the students to come up with their own creative ways to solve them.
9. Discuss how every concept can be applied to the real world - and when that's possible, it helps improve the students' understanding.
10. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction: Production system facilities, Manufacturing support systems, Automation in production systems, Automation principles &strategies Manufacturing Operations: Manufacturing operations, Product/production relationship, Production concepts and Mathematical models & costs of manufacturing operations. Problems on mathematical models

Teaching-Learning Process	Discussed about automation Manufacturing, Chalk and talk used for draw figures and solving problems , Power Point presentation and YouTube videos, Animation videos, creating real time stations in classroom discussions. Giving activities &assignments.

Module-2

Line Balancing: Methods of line balancing, Numerical problems on largest candidate rule, Kilbridge's and Wester's method, and ranked positional weights method, computerized line balancing methods. Automated Assembly System: Design for automated assembly, types of automated assembly system, Parts feeding devices, Analysis of single and multi station assembly machines.

Teaching-Learning Process	Power Point presentation and Animation videos methods, Videodemonstration or Simulations, Chalk and Talk are used for Draw block digrams, enhance experiential skills, creating real time stations in classroom discussions. Giving activities &assignments.

Module-3

Computerized Manufacture Planning and AGVS: Computer aided process planning (CAPP), Retrieval and Generative systems, and benefits of CAPP. Material requirement planning, Inputs to MRP system, working of MRP,

Outputs and benefits. Automated Guided Vehicles System: Applications, Guidance and routing, Industrial Robotics: Definition, Robot anatomy, Joints and links, Robot configurations, Robot control systems, Accuracy and repeatability, End effectors, Sensors in robotics. Industrial robot applications: Material handling, Processing, assembly and inspection.	
Teaching-Learning Process	Chalk and Talk are used for Draw block diagrams, enhance experiential skills and Power Point presentation and Animation videos methods, Video demonstration or Simulations, creating real time stations in classroom discussions. Giving activities &assignments.
Module-4	
Inspection Technologies: Automated inspection, coordinate measuring machines construction, Operation &programming, Software, application &benefits, Flexible inspection system, Inspection probes on machine tools, Machine vision, Optical inspection techniques & Non-contact Non-optical inspection technologies. Shop Floor Control and Automatic Identification Techniques: Shop floor control, Factory data collection system, Automatic identification methods, Bar code technology, Automatic data collection systems. An Introduction to QR Code Technolog	
Teaching-Learning Process	Chalk and Talk are used for Draw block diagrams, enhance experiential skills and Power Point presentation and Animation videos methods, Videodemonstration or Simulations, creating real time stations in classroom discussions. Giving activities &assignments.
Module-5	
Additive Manufacturing Systems: Basic principles of additive manufacturing, Slicing CAD models for AM, Advantages and limitations of AM technologies, Recent trends in manufacturing, Hybrid manufacturing. Future of Automated Factory: Trends in manufacturing, the future automated factory, Human workers in future automated factory, Social impact.	
Teaching-Learning Process	Discussed bout additive manufacturing process, automation technology, how to get product by hybrid manufacturing and chalk and talk used for block diagrams, points, creating real time stations in classroom discussions. Giving activities &assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

1. Explain the basics of productions, automation system and manufacturing operations. Solve the simple problems on mathematical model.
2. Analyze and solve problems on line balancing
3. Explain CAPP and MRP system and analyze the AGVS
4. Understand the inspection technologies and shop floor control
5. Explain the modern trends in additive manufacturing and automated factory

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Automation, Production Systems and Computer-Integrated Manufacturing MikellPGroover PHI Learning 3rd Edition, 2009
2. CAD / CAM Principles and Applications P N Rao, Tata McGrawHill. 3rd Edition, 2015
3. Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, Ian Gibson, David W. Rosen, BrentStucker2nd Ed. (2015)
4. Understanding Additive Manufacturing Andreas GebhardtHanser Publishers 2011
5. Systems Approach to ComputerIntegrated Design and Manufacturing Dr.Nanua Singh, Wiley 1996
6. CAD/CAM/CIM P. Radhakrishnan, S. Subramanyan, U.RajuNew Age International Revised Third Edition 2007

Web links and Video Lectures (e-Resources):

- https://www.slideshare.net/kiran555555/automation-in-manufacturing-five-unit-notes
- https://tulip.co/glossary/what-is-line-balancing-how-to-achieve
- https://www.isa.org/intech-home/2018/july-august/features/automated-guided-vehicles-improve-production
- https://new.siemens.com/global/en/products/automation.html?gclid=EAIaIQobChMIufvd3KL89gIVljMrCh1BHwevEAMYAiAAEgINJ_D_BwE
- https://www.automate.org/userAssets/riaUploads/file/Additive_Manufacturing_and_Automation.pdf
  https://www.youtube.com/watch?v=v-3TmN4HhLc&list=PLwdnzlV3ogoW31clPN6Dn6c8Ia-n36vXk

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

1. Contents related activities (Activity-based discussions)
2. For active participation of students
3. Instruct the students individual to prepare module wise ppt
4. Organizing Group wise discussions and Automation based activities
5. Quizzes and Discussions

Design of Experiments			
Course Code	**21IP754**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

- To learn how to plan, design and conduct experiments efficiently and effectively, and
- Analyze the resulting data to obtain objective conclusions.
- Both design and statistical analysis issues are discussed.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Show Videos/animation films to explain the content, wherever possible.
3. Encourage collaborative Learning (Group Learning) in the class.
4. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
5. Adopt Problem Based Learning (PBL), which fosters student's Analytical skills, develop thinking skills such as the ability to evaluate, generalize, and analyze information rather than simply recall it.
6. Show the different ways to solve the same problem and encourage the students to adopt creative ways to solve them.
7. Discuss how every concept can be applied to the real world thus helping to improve the students' understanding.
8. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

Introduction: Strategy of Experimentation, Typical applications of Experimental design, Basic Principles, Guidelines for Designing Experiments. Basic Statistical Concepts: Concepts of random variable, probability, density function cumulative distribution function. Sample and population, Measure of Central tendency; Mean median and mode, Measures of Variability, Concept of confidence level. Statistical Distributions: Normal, Log Normal & Weibull distributions. Hypothesis testing, Probability plots, choice of sample size. Illustration through Numerical examples.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Module-2

Experimental Design: Classical Experiments: Factorial Experiments: Terminology: factors, levels, interactions, treatment combination, randomization, Two-level experimental designs for two factors and three factors. Three-level experimental designs for two factors and three factors, Factor effects, Factor interactions, Fractional factorial design, Saturated Designs, Central composite designs. Illustration through Numerical problems.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Module-3

Analysis And Interpretation Methods: Measures of variability, Ranking method, Column effect method & Plotting method, Analysis of variance (ANOVA) in Factorial Experiments: YATE's algorithm for ANOVA, Regression analysis, Mathematical models from experimental data. Illustration through Numerical examples.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Module-4

Quality By Experimental Design: Quality, Western and Taguchi's quality philosophy, elements of cost, Noise factors causes of variation. Quadratic loss function & variations of quadratic loss function. Robust Design: Steps in Robust Design: Parameter design and Tolerance Design. Reliability Improvement through experiments, Illustration through Numerical examples. Experiment Design Using Taguchi's Orthogonal Arrays: Types of Orthogonal Arrays, selection of standard orthogonal arrays, Linear graphs and Interaction assignment, Dummy level Technique, Compound factor method, Modification of linear graphs. Illustration through Numerical examples.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Module-5

Signal To Noise Ratio: Evaluation of sensitivity to noise. Signal to Noise ratios for static problems: Smallerthe-better type, Nominal-the –better-type, Larger-the-better type. Signal to Noise ratios for Dynamic problems. Illustration through Numerical examples. **Parameter And Tolerance Design**: Parameter and tolerance design concepts, Taguchi's inner and outer arrays, parameter design strategy, tolerance design strategy. Illustration through Numerical examples.

Teaching-Learning Process	Chalk and talk, Videos, PowerPoint Presentation, Animations, Analytical methods, Problem solving, Numerical exercises, Creating conducive environment in classroom for discussions and understanding through peer learning, promoting self learning activities and Giving assignments.

Course outcome (Course Skill Set)

At the end of the course the student will be able to :

- Appreciate the advantages and disadvantages of a design for a particular experiment.
- Construct optimal or good designs for a range of practical experiments.
- Understand the potential practical problems in its implementation.
- Describe how the analysis of the data from the experiment should be carried out.

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

1. First test at the end of 5th week of the semester
2. Second test at the end of the 10th week of the semester
3. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

4. First assignment at the end of 4th week of the semester
5. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

6. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

1. The question paper will have ten questions. Each question is set for 20 marks.
2. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
3. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100, shall be proportionally reduced to 50 marks

Suggested Learning Resources:

Books

1. Design and Analysis of Experiments Douglas C. Montgomery Wiley India Pvt. Ltd 5th Edition, 2007
2. Quality Engineering using Robust Design Madhav S. Phadke Prentice Hall PTR, Englewood Cliffs, New Reference Books Jersy
3. Quality by Experimental Design Thomas B. Barker, Marcel Inc ASQC Quality Press.1985.
4. Experiments Planning, analysis, and parameter Design optimization, C.F. Jeff Wu Michael Hamada John Wiley Editions 2002
5. Taguchi Techniques for Quality Engineering Phillip J. Ross McGraw Hill International Editions 2nd Edn. 1996

Web links and Video Lectures (e-Resources):

- www.nptel.ac.in
- https://youtu.be/pTAUa6qXV6E
- https://youtu.be/_Rgue-7KDww
- https://youtu.be/6DYtC7lrVuY
- https://youtu.be/Xg7ng3-Pm-8
- https://youtu.be/6o7wyyh8Lu8
- https://youtu.be/10ikXret7Lk

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

- At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Supply Chain Management			
Course Code	**21IP755**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	2:2:0:0	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course objectives:

1. To develop an understanding of basic concepts and role of Logistics and supply chain management in business.
2. To understand how supply chain drivers play an important role in redefining value chain excellence of Firms.
3. To develop analytical and critical understanding & skills for planning, designing and operations of supply chain.
4. To understand, appraise and integrate various supply chain strategies.

Teaching-Learning Process (General Instructions)

These are sample Strategies, which teacher can use to accelerate the attainment of the various course outcomes.

1. Lecturer method (L) does not mean only the traditional lecture method, but a different type of teaching method may be adopted to develop the outcomes.
2. Encourage collaborative Learning (Group Learning) in the class.
3. Ask HOTS (Higher-order Thinking) questions in the class, which promotes critical thinking.
4. Individual teachers can device innovative pedagogy to improve teaching-learning.

Module-1

BUILDING A STRATEGIC FRAME WORK TO ANALYSE SUPPLY CHAINS: Supply chain stages and decision phase, process view of a supply chain. Supply chain flows. Examples of supply chains. Competitive and supply chain strategies. Achieving strategic fit. Expanding strategic scope. Drivers of supply chain performance. Framework for structuring drivers – Inventory, Transportation, Facilities, Information. Obstacles to achieving fit, Case discussions.
DESIGNING THE SUPPLY CHAIN NETWORK: Distribution Networking – Role, Design. Supply Chain Network (SCN) – Role, Factors, Framework for Design Decisions.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-2

FACILITY LOCATION AND NETWORK DESIGN: Models for facility location and capacity allocation. Impact of uncertainty on SCN – discounted cash flow analysis, evaluating network design decisions using decision trees. Analytical problems.
PLANNING AND MANAGING INVENTORIES IN A SUPPLY CHAIN: Review of inventory concepts., Concepts of Safety Inventory, Concept of Aggregation of Inventory, Concept of product availability.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-3

SOURCING, TRANSPORTATION AND PRICING PRODUCTS: Role of sourcing, supplier – scoring & assessment, selection and contracts. Design collaboration. Role of transportation, Factors affecting transportation decisions. Modes of transportation and their performance characteristics. Designing transportation network. Trade-off in transportation design. Tailored transportation, Routing and scheduling in transportation. International transportation. Analytical problems. Role of Revenue Management in the supply chain, Revenue management for: Multiple customer segments, perishable assets, seasonal demand, bulk and spot contracts.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-4

COORDINATION AND TECHNOLOGY IN THE SUPPLY CHAIN: Co-ordination in a supply chain: Bullwhip effect. Obstacles to coordination. Managerial levers to achieve coordination, Building strategic partnerships. The role of IT supply Chain, The Supply Chain IT framework, CRM, Internal SCM, SRM. The role of ebusiness in a supply chain, The e-business framework, e-business in practice. Case discussion.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Module-5

APPLICATION OF VALUE ANALYSIS: Application of Value analysis in the field of Accounting, Appearance Design, Cost reduction, Engineering, manufacturing, Management, Purchasing, Quality Control, Sales, marketing, Material Management Etc., Comparison of approach of Value analysis & other management techniques.

Teaching-Learning Process	Chalk and Talk, Power point presentation

Course outcome (Course Skill Set)
At the end of the course the student will be able to :

1. Recall the elements involved in strategic frame work and analysis of supply chains.
2. Demonstrate the elements involved in the design of supply chain networks
3. Demonstrate the facilities location for designing the supply chain network
4. Evaluate the inventories for supply chains.
5. Identify emerging concepts for supply chain networks

Suggested Learning Resources:
Books

- Supply Chain Management – Strategy, Planning, Sunil Chopra & Peter Meindl, Pearson Education Asia ISBN: 81-7808-272-1. – 2001
- Supply Chain and Logistics Management, UpendraKachuru
- Supply Chain Redesign –Transforming Supply Chains into Integrated Value Systems, Robert B Handfield, Ernest L Nichols, Jr. – Pearson Education Inc, ISBN: 81-7808- 272-1. – 2001.
- Modelling the Supply Chain, Jeremy F Shapiro, uxbury, Thomson Learning, McGraw Hill
- Designing & Managing the Supply Chain, David Simchi Levi, Philip Kaminsky& Edith Simchi Levi , McGraw Hill

Assessment Details (both CIE and SEE)

The weightage of Continuous Internal Evaluation (CIE) is 50% and for Semester End Exam (SEE) is 50%. The minimum passing mark for the CIE is 40% of the maximum marks (20 marks out of 50). A student shall be deemed

to have satisfied the academic requirements and earned the credits allotted to each subject/ course if the student secures not less than 35% (18 Marks out of 50)in the semester-end examination(SEE), and a minimum of 40% (40 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together

Continuous Internal Evaluation:

Three Unit Tests each of **20 Marks (duration 01 hour**)

13. First test at the end of 5th week of the semester
14. Second test at the end of the 10th week of the semester
15. Third test at the end of the 15th week of the semester

Two assignments each of **10 Marks**

16. First assignment at the end of 4th week of the semester
17. Second assignment at the end of 9th week of the semester

Group discussion/Seminar/quiz any one of three suitably planned to attain the COs and POs for **20 Marks** (**duration 01 hours**)

18. At the end of the 13th week of the semester

The sum of three tests, two assignments, and quiz/seminar/group discussion will be out of 100 marks and will be **scaled down to 50 marks**

(to have less stressed CIE, the portion of the syllabus should not be common /repeated for any of the methods of the CIE. Each method of CIE should have a different syllabus portion of the course).

CIE methods /question paper is designed to attain the different levels of Bloom's taxonomy as per the outcome defined for the course.

Semester End Examination:

Theory SEE will be conducted by University as per the scheduled timetable, with common question papers for the subject (**duration 03 hours)**

10. The question paper will have ten questions. Each question is set for 20 marks. Marks scored shall be proportionally reduced to 50 marks
11. There will be 2 questions from each module. Each of the two questions under a module (with a maximum of 3 sub-questions), **should have a mix of topics** under that module.
12. The students have to answer 5 full questions, selecting one full question from each module. Marks scored out of 100 shall be reduced proportionally to 50 marks

Web links and Video Lectures (e-Resources):

- https://www.gartner.com/en/topics/supply-chain-management
- https://www.youtube.com/watch?v=Mi1QBxVjZAw
- https://www.youtube.com/watch?v=TTojGYDDR18
- https://www.youtube.com/watch?v=AB7kmDmEbMI
- https://www.youtube.com/watch?v=o8APky4PGJA

Activity Based Learning (Suggested Activities in Class)/ Practical Based learning

At the end of the lecture/presentation, numerical exercises are to be taken up to solve problems related to the topics covered. Additional problems are to be given for practice and also as assignments under each of the topics covered.

Project work			
Course Code	**21IPP76**	CIE Marks	100
Contact Hours/Week	02	SEE Marks	100
Total Hours of Pedagogy	--	Total Marks	200
Credits	10	Exam Hours	03

VIII SEMESTER

Technical Seminar			
Course Code	**21IPS81**	CIE Marks	100
Contact Hours/Week	01	SEE Marks	--
Total Hours of Pedagogy	--	Total Marks	100
Credits	01	Exam Hours	--

Research Internship/Industry Internship			
Course Code	**21INT82**	CIE Marks	100
Contact Hours/Week	02	SEE Marks	100
Total Hours of Pedagogy	--	Total Marks	200
Credits	15	Exam Hours	03

National Service Scheme (NSS)/ Physical Education (PE) (Sports and Athletics)/ Yoga			
Course Code	**21NS83/21PE83/21YO83**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	--	SEE Marks	50
Total Hours of Pedagogy	--	Total Marks	100
Credits	00	Exam Hours	03