Semester - II

PRESS TOOL DESIGN			
Course Code	MMTE201	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	4	Exam Hours	3

Course objectives:

- Understand press tool types,
- Knowledge of design and press tool operations which makes them aware of type applications,
- To know the force calculations in drawing,
- Awareness' of lubrications in drawing
- Knowledge of typical design of form tools.

MODULE-1 (08 Hrs)

Introduction: Elements of press tools, classification of press, High speed presses, press brakes, shearing theory, cutting force, elements of press tool, clearance between punch and die, shut height and daylight, press tonnage calculation.

Strip Layout: Basic rules, economic layout, bridge size, calculation of plug point/center of pressure.

Press Tool Operations: Piercing, blanking, slitting, cropping, trimming, shaving, lancing, bending, curling, calibrating, drawing, embossing, coining, flanging, fine blanking.

MODULE-2 (08 Hrs)

Design of Press Tool Elements: Die plates, punches, punch holder plates, stripper plates, and calculation of stripping force, bolster plates, pilots, ejectors, shedders, materials ops, pillar, bush, slender punches, stock guides, stock feeding device and die sets.

Types of Press Tools: Progressive tools, stage tools, compound tools, combination tools, cam actuated die, horn dies, sub press dies, inverted dies, bulging dies, levering dies, trimming dies, shaving dies, riveting dies, assembly dies, lamination dies.

Extrusion: Forward, backward, combined extrusion, modem metal forming techniques.

MODULE-3 (08 Hrs)

Bending and Forming Dies: Theory of bending, development of bend, spring back, correcting spring back, bending tools, U - bending, V -bending, forming tools, bending on press brake, bending force calculation.

MODULE-4 (08 Hrs)

Drawing: Theory of drawing, blank development, strain factor, calculation of number of stages of drawing, circular draw, rectangular draw, draw force calculation, lubrication. Defects and remedies, ironing.

MODULE 5 (08 Hrs)

Preparation and Presentation of Typical Designs in the Form of Drawings for the Following

1. Piercing & blanking tool.
2. Progressive tool
3. Stage tool
4. Bending tool
5. Compound tool.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Preparation and Presentation of Typical Design in the Form of Drawing for Piercing & blanking tool
2	Preparation and Presentation of Typical Design in the Form of Drawing for Progressive tool
3	Preparation and Presentation of Typical Design in the Form of Drawing for Stage tool

4	Preparation and Presentation of Typical Design in the Form of Drawing for Bending tool
5	Preparation and Presentation of Typical Design in the Form of Drawing for Compound tool

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 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

1. Two Tests each of **25 Marks**
2. Two assignments each of **25 Marks/One Skill Development Activity of 50 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **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 at the end /after completion of all the experiments 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 the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. 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.
4. 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 15 (50% of maximum marks-30) in the theory component and 10 (50% 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 40% of the maximum marks to

Suggested Learning Resources:

Books

1. Basic die design, D. Eugene Ostergaard, McGraw Hill, 1963
2. Die Design Fundaments, J. R. Paquin, R.E Crowley Industrial Press Inc. 2nd edition
3. Press Tools, Prakash. H Joshi Wheeler Publisher
4. Progressive Dies, Dallas B. Daniel,Springer, publication, 2005.
5. Mining Engineering Handbook, Michigan -SME 3rd Edition by peter darling, 2011.
6. Die Design Hand Book -SMITH A. DAVID.SME 3rd edition, 1990.

Web links and Video Lectures (e-Resources):

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

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the press tool types,	L2
CO2	Discuss the press tool design and operations which makes them aware of type applications,	L2
CO3	Calculate the force in drawing	L3
CO4	Describe the awareness of lubrications in drawing	L2
CO5	Exhibit the knowledge of typical design of form tools.	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1	3	**1**	**1**	**1**	**2**	**1**	**1**			
CO2	3	**1**	**1**	**2**	**2**	**1**	**1**			
CO3	3	**1**	**1**	**2**	**2**	**1**	**1**			
CO4	3	**1**	**1**	**2**	**2**	**1**	**1**			
CO5	3	**1**	**1**	**1**	**2**	**1**				

Semester - II

PLASTIC MOULD DESIGN			
Course Code	MMTE202	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	3:2:0	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Students will get an understanding of various types of moulds and mould design,
- Understanding the various behaviour of plastic used for moulds
- Study the manufacturing concepts of plastics in moulds.
- Understand the special moulds especially used in thread components.
- Expose to exercise of mould designs with working drawings.

MODULE-1 (08 Hrs)

Introduction to Plastics: Monomer, Polymer, Degree of Polymerisation, classification of Plastics, General review of properties, Application and Processing, Behaviours of various PE, PP, PYC, PPMA, ABS, NYLON, Polyacetal, Polycarbonate, PTFE, PF, UF & MF.

Mould Construction: Parting surface: Straight, stepped, curved parting surface, Design of various Injection mould elements, cores, cavities, and inserts, fitting core and cavity inserts, pillars and bushes.

MODULE-2 (08 Hrs)

Feed and Ejector System: Design of optimum Gates, Impressions, Layout, Sprue pullers, mould shrinkage. Types of ejection, Ejector grids, ejection methods, Ejection Pin, Sleeve ejection, plate ejection, Blade ejection, Air ejection, Ejection from fixed half, Double ejection, Delayed ejection.

MODULE-3 (08 Hrs)

Cooling System: Need for cooling, cooling and solid cores and cavities, insert cooling, cooling long cores, cooling elements, baffles, bubblers etc., and cooling calculation.

Parting Surfaces: Straight, stepped, curved parting surface.

MODULE-4 (08 Hrs)

Modules with External Under Cuts: Split moulds, Actuation of splits, Guiding of splits, side cores.

Special Moulds: Form pins Moulds for threaded components: External threads, internal threads, Moulds with loose cores, Automatic unscrewing type of moulds, Under feed moulds, 3 plate moulds, hot runner moulds (Runner less moulds), Multi color moulding tools, Defects in moulding and its remedies, Compression moulding tools, transfer moulding tools.

MODULE 5 (08 Hrs)

Moulds with internal under cuts: Form pins

Moulds for threaded components: External threads, internal threads, Moulds with loose cores, Automatic unscrewing type of moulds.

Under Feed mould: 3 Plate moulds, hot runner moulds (Runner less moulds)

Multi color moulding tools: Defects in moulding and its remedies, Compression moulding tools, transfer moulding tools.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments
1	Design of Two Plate moulds with pin ejection and edge gate
2	Design of Two plates moulds with sleeve ejection and submarine gate
3	Design of Two plate moulds with stripper plate ejection
4	Design of Two plate moulds with internal undercut

5	Design of Two plate moulds with split mould and mould with side core.
6	Design of Two plate moulds for threaded parts (loose core and automatic rack & pinion design)
7	Design of Three plate moulds with multi impressions
8	Design of Compression moulds.
9	Design of Transfer moulds
NOTE: Draw proportionate sketches of the designed moulds on graph sheets or plain sheets	

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 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

4. Two Tests each of **25 Marks**
5. Two assignments each of **25 Marks/One Skill Development Activity of 50 marks**
6. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **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 at the end /after completion of all the experiments 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 the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

5. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
6. The question paper will have ten questions. Each question is set for 20 marks.
7. 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.
8. 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 15 (50% of maximum marks-30) in the theory component and 10 (50% 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 40% of the maximum marks to

Suggested Learning Resources:

Text Books:

(1) Injection Mould Design, Pye. R. G. W., New York- John Wiley & Sons
(2) Hand book of Plastic Processes, Charles A. Harper.
(3) Injection Mould Design, Pye R. G. W., New York- John Wiley & Sons 12th Ed. 1989.

Reference Books

(1) Injection Moulding Theory & Practice, Rubin. J. Irvin, New York- John Wiley & Sons 1976.
Injection Mould 108 Proven Design, Gastro, London-Applied Science Pub. 9th Ed. 1982

Web links and Video Lectures (e-Resources):

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

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the various types of moulds and mould design,	L2
CO2	Discuss the various behaviour of plastic used for moulds	L3
CO3	Explore manufacturing concepts of plastics in moulds	L2
CO4	Understand the special moulds especially used in thread components.	L3
CO5	Expose to exercise of mould designs with working drawings.	L3

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

Semester - II

Die casting and Die Design			
Course Code	MMTE203	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Get an understanding of various types of dies for castings,
- Understanding the construction and design of dies,
- Knowledge of die casting machine and mechanism of different productions,
- Understand the concept of die constructions with specific cooling systems and
- Prepare drawings of various dies and demonstrate its design

MODULE-1 (05 Hrs)

Introduction: Classification of casting, Sand casting, Metal mould casting, Plastic moulds casting, Investment casting, Gravity die casting, Pressure die casting, Advantages of Die casting, Die casting process, Vacuum casting. Die casting Alloys Low fusion alloys, High fusion alloys, Properties.

MODULE-2 (05 Hrs)

Die casting Machines: History of Die casting ,machines, Hot chamber, Cold chamber machine, Horizontal machine, Vertical machine, Die locking, Toggle locking, Hydraulic locking, Injection systems, knock out pins and plates, ejector system furnaces, loading of metal into hot chamber.

MODULE-3 (05 Hrs)

Feed Systems: Gates, Runners, Taper tangent runner system, Precession layout, Spreader, shot sleeve, shot weight, PQ2 Diagram and calculations etc.

Die Construction: Cores, Cavities, pillars and bushes, ejectors, bolster plates.

Cooling System: Core cooling, Cavity cooling, cooling of shot sleeve, cooling of spreader, baffles, cooling calculations.

MODULE-4 (05 Hrs)

Types of Dies: Single cavity and Multi cavity Dies, combination dies, unit dies, trimming and finishing of components, Inspection of components, safety, SPC & visual control techniques.

Dies with Side core: Construction, Actuation of side cores, Die casting, defects and remedies.

MODULE 5 (05 Hrs)

Preparation and Presentation of typical Designs in the Form of Drawings of the following:

1. Old chamber Die casting dies
2. Cold chamber die casting dies
3. Single cavity die casting dies
4. Multi cavity die casting dies
5. Dies with side cores and splits

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 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

1. Two Tests each of **25 Marks**
2. Two assignments each of **25 Marks/One Skill Development Activity of 50 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **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 at the end /after completion of all the experiments 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 the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. 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.
4. 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 15 (50% of maximum marks-30) in the theory component and 10 (50% 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 40% of the maximum marks to

Suggested Learning Resources:

Books

1. Die casting, Do Ehler H.A New York-McGraw Hill Book Co-Inc. Industrial student Ed. 1951.
2. The Die casting Books, Street, C. Arthur, Surrey, England- Portcullis Press Ltd., 2nd Edition 1986.
3. Die casting and Die designing, E.A Herman, Society of Die Casting Engineers
4. Die casting process control By E A Herman NADCA
5. High Pressure Die casting: H. L. Harvill, Paul Roe Jordan

Web links and Video Lectures (e-Resources):

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

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the various types of dies for castings,	L2
CO2	Describe the construction and design of dies,	L2
CO3	Discuss the die casting machine and mechanism of different productions,	L2
CO4	Narrate the concept of die constructions with specific cooling systems	L2
CO5	Prepare drawings of various dies and demonstrate its design	L4

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

Semester - II

Jigs and Fixtures Design			
Course Code	MMTE214A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Acquiring the knowledge on various jigs and fixtures,
- Understand the designs of clamping methods,
- Gaining the knowledge of indexing and methods,
- Study the different applications of fixtures and
- Drawing exercises of different typical jigs and fixtures.

MODULE-1 (05 Hrs)

Introduction: Definition of Jigs and Fixtures, Difference between jigs and fixtures, Advantages, Steps for design. Location Degree of freedom, 3-2-1 principles, Choice of location, redundant location, Diamond pin calculation, Locating methods and chip control.

MODULE-2 (05 Hrs)

Locating Devices: Surface location, Rest blocks, pins, V-blocks, Equalizers, Profile locators, Vee locaters, Nesting locaters, Diamond Pins, adjustable Locaters.

Clamping Devices: Basic principles, cutting forces, Rigid clamping, wedge clamping, cam clamping, quick action clamps, strap clamps, screw clamps, swing clamps, Toggle clamps, simultaneously acting clamps.

MODULE-3 (05 Hrs)

Guiding Elements, Drill Bushings: Standard Drill Bushing types**,** Jig bushes Installation, Standards, Tool Setting gauges. **Indexing Jigs and Fixtures:** Indexing methods, Linear, Rotary, Indexing jigs, Indexing fixtures. Assembly and Welding Fixture – Principles.

MODULE-4 (05 Hrs)

Design of Jigs and Fixture Bodies, other Elements, types of Jigs and Fixtures: Plate Jigs. Box Jigs, Indexing Jigs, Milling Fixtures and Indexing milling Fixtures, Turning Fixtures, Grinding Fixtures, Universal Jigs & Fixtures, Welding fixtures, Broaching fixtures and assembly fixtures, Modular Fixturing.

MODULE-5 (05 Hrs)

Preparation and Presentation of typical designs in the form of drawings for the following

1. Drill Jig
2. Drilling and Reaming Jigs
3. Milling Fixtures
4. Indexing Jigs
5. Indexing Milling Fixtures.
6. Turning Fixtures.

PRACTICAL COMPONENT OF IPCC

Sl.NO	Experiments

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 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

1. Two Tests each of **25 Marks**
2. Two assignments each of **25 Marks/One Skill Development Activity of 50 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **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 at the end /after completion of all the experiments 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 the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. 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.
4. 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 15 (50% of maximum marks-30) in the theory component and 10 (50% 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 40% of the maximum marks to

Suggested Learning Resources:

Books

1. Jigs & Fixtures - JOSHI P .H.- New Delhi -Tata McGraw Hill Pub. Co. Ltd., 11th print 1999.
2. Jigs. & Fixtures & Gauges -BOYES E. WILLIAM-Michigan -SME 1st Ed. 1986.
3. Jigs and Fixture Design Manual- by Erik k Henriksen, Industrial Press Inc.
4. An Introduction to Jig and Tool Design -KEMPSTER M.H.A.- Bristol- ELBS 3rd Ed. 1974.
5. Jigs and Fixture Hand book by A.K. Goroshkin, MIR publications.
6. Jigs and Fixture Hand book by Carr Lane Mfg Com.

Web links and Video Lectures (e-Resources):

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

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the acquired knowledge on various jigs and fixtures,	L2
CO2	Discuss the designs of clamping methods,	L2
CO3	Apply the knowledge for different indexing methods,	L3
CO4	Illustrate the different applications of fixtures and Jigs	L2
CO5	Demonstrate the different typical jigs and fixtures.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

VALUE ENGINEERING			
Course Code	MMTE214B	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- To inculcate specialized knowledge and skill in advanced manufacturing processes using the principles and methods of engineering analysis and design.

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, 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. 10 Hrs

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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, Separation and Grouping of functions. Case studies. 10Hrs

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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, Judgement phase, Development planning phase, and case studies. Cost reduction programs, criteria for cost reduction program, Value analysis change proposal.

10Hrs

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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). 10 Hrs	
Teaching-Learning Process	Chalk and talk method / PowerPoint 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. 10Hrs	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks**or**oneSkill Development Activity of 40 marks**to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions)

Suggested Learning Resources:

Books

- Techniquesof Value Analysis and Engineering– Lawrence D. Miles, McGraw – Hill Book Company,2ndEdn.
- Value engineering for Cost Reduction and Product Improvement – M.S. Vittal, Systems Consultancy Services Edn 1993
- Value Management, Value Engineering and Cost Reduction – Edward D Heller Addison Wesley Publishing Company 1971
- 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):

- VTU e-Shikshana Program
- VTU EDUSAT Program

Skill Development Activities Suggested

- Quizzes
- Assignments
- Seminars

Activities

- Mini project on live working model/ Problems.
- Seminar
- Assignment

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	To understand the concepts of value engineering, identify the advantages, applications.	
CO2	To understand various phases of value engineering. Analyze the function, its approach and evaluation.	

Sl. No.	Description	POs
PO1	An ability to independently carry out research /investigation and development work to solve practical problems.	
PO2	An ability to write and present a substantial technical report/document.	
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	
PO4	Understand contemporary issues in manufacturing engineering and develop relationship between product design and manufacturability to create safe, reliable, and cost-effective products.	

PO5	Understand the process of converting customer needs into engineering specifications to create product designs that are sensitive to user needs and robust against unanticipated uses and misuse	

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**3**	**2**	**2**	**2**	**3**	**3**	**3**
CO2	**3**	**2**	**2**	**2**	**3**	**2**	**3**
CO3	**2**	**2**	**2**	**2**	**2**	**2**	**3**
CO4	**2**	**3**	**2**	**3**	**3**	**3**	**2**
CO5	**3**	**3**	**3**	**2**	**2**	**2**	**2**

Mapping of COS and Pos (indicative only)

TESTING OF MATERIALS			
Course Code	**MMTE214C**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	**2:0:2**	SEE Marks	50
Total Hours of Pedagogy	**40**	Total Marks	100
Credits	**03**	Exam Hours	03

Course Learning Objectives:

- Understand and correlate various materials testing methods used in industries.
- Understanding the concept of importance of calibration in testing instruments.
- Gain knowledge on materials testing microscopes,
- Understanding the strain rate testing knowledge and
- Knowledge of lubrication and method of testing the lubrications.

Module-1 **(05 Hrs)**	
Testing machines and sensors: types of Universal Testing machines and principles of operations, Machine stiffness, load and strain measurement. Calibration and verification of UTM. **Friction, wear and surface testing:** Testing of sliding contact, damage, abrasive wear, adhesive wear, erosive wear. Testing and determination of surface characteristics of solid materials. (Surface roughness measurements	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-2 **(05 Hrs)**	
Importance of calibration of Testing Instruments: Calibration methods and standards. Tests/ experiments based on methods with active reference to various codes and standard for each test. **Failure Analysis**: Principles and Approaches of Failure analysis, objectives, scope, planning, preparation. Failure Analysis, procedures, examination of damages and materials evaluation. Tools and Techniques in FA – An overview. Appearances of fracture in common conditions like uni axial loads, tensional and shear loads, fatigue and creep loading.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-3 **(07 Hrs)**	
Microscopy: Optical microscope, scanning electron microscope. Preparation of Specimens for microscopic study. **Speed & Control of Testing:** Background, Developments in testing Machine Technology, Effects of testing rates on properties, Results before servo control, Results from servo controlled machines.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-4 **(03 Hrs)**	
Strain Rate Testing: Aim of Recommendations, Abbreviations and Symbols, Test Machine Requirements. Specimens Measurements, Data Processing, General Definitions Strength Hardening Constitutive Relations to Model Material Strain Rate Dependency.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-5 **(05 Hrs)**	
Lubrication & Determination of characteristics of lubricants: Introduction, Types of lubricants, characteristics of lubricants Methods of lubrication, four ball testing.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Tutorial/Activity Sessions:

- 10-12 tutorial/activity sessions need to be planned, which may be distributed among all the modules to cover entire portion of the syllabus/curriculum within nearly 40 hours.

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks. The question paper will have ten full questions carrying equal marks.
2. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
3. Each full question will have a sub-question covering all the topics under a module.
4. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1 Testing of Metallic Materials – A.V.K. Suryanarayan, Prentice Hall of India.
2 Inspection of Materials, Vol. II – Destructive Methods, R.C. Andersen, ASM 1988.
3 ASM - Testing of materials.
4 Workability Testing Techniques, G.E. Dieter, ASM 1984.
5 Relevant Codes and Standards.

Web links and Video Lectures (e-Resources):

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the various materials testing methods used in industries.	L2
CO2	Discuss the concept of importance of calibration in testing instruments.	L2
CO3	Demonstrate the knowledge on materials testing microscopes,	L2
CO4	Apply the strain rate testing knowledge	L3
CO5	Discuss the knowledge gained on lubrication and method of testing the lubrications.	L2

Mapping of COS and POs

(Below table is only indicative and hence course teacher can revise it)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

CNC MACHINING and PROGRAMMING			
Course Code	**MMTE214D**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	**2:0:2**	SEE Marks	50
Total Hours of Pedagogy	**40**	Total Marks	100
Credits	**03**	Exam Hours	03

Course Learning Objectives:

- Understand evolution, classification and principles of CNC machine tools
- Learn constructional details of CNC machine tools, selection of standard components used for CNC machine tools for accuracy and productivity enhancement.
- Study on selection of drives and positional transducers for CNC machine tools.
- Learn how to apply CNC programming concepts for two axis turning centers and three axis vertical milling centres to generate programs different components.
- Generate CNC programs for popular CNC controllers.
- Learn on how to Analyse and select tooling and work holding devices for different components to be machined on CNC machine tools.

Module-1 **(05 Hrs)**

INTRODUCTION TO CNC MACHINE: Evolution of CNC Technology, principles, features. Advantages, applications, CNC and DNC concepts, classification of CNC machines- turning centre, machining centre, grinding machine, EDM, types of control systems, CNC controllers, characteristics, interpolators- Computer Aided Inspection.

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-2 **(05 Hrs)**

CONSTRUCTIONAL DETAILS OF CNC MACHINE: CNC Machine building, structural details, configuration and design, guide ways- Frictions, Anti friction and other types of guide ways, elements used to convert the rotary motion to a linear motion – Screw and nut, recirculating ball screw, planetary roller screw, recirculating roller crew, rack and pinion, spindle assembly, torque transmission elements- gears, timing belts, flexible couplings, Bearings.

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-3 **(05 Hrs)**

DRIVE CONTROLS AND WORK HOLDING DEVICES: Spindle drives-DC shunt motor, 3 phase AC induction motor, feed drives- stepper motor, servo principle, DC and AC servomotors, Open loop and closed loop control, Axis measuring system- synchro, synchro-resolver, gratings, moire fringe gratings, encoders, inductosysn, laser interferometer.

Introduction to cutting tool materials- Carbides, ceramics, CBN, PCD-inserts classification, qualified, semi qualified and pre- set tooling, tooling system for machining centre and turning=g centre, work hold devices for rotating and fixed work parts.

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-4 **(05 Hrs)**

CNC PROGRAMMING: Coordinate system, structure of a part program, G & M codes, tool length compensation, cutter radius and tool nose radius compensation, do loops, subroutines, canned cycles, mirror image, parametric programming ,machining cycles cycles , manual part programming for machining centre and turning.

Computer aided CNC part programming: Need for computer aided part programming, Tools for computer aided part programming, APT/ CAD/CAM based part programming for well –known controllers such as Fanuc, Heidenhain, sinumerik etc., and generation of CNC codes from CAM packages

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-5 **(05 Hrs)**

CNC PROGARMMING LATH AND MILLING: Plan and optimize programmes CNC turning operations. Calculate parameters like speed feed etc and set references for the various operations. Prepare operations and operations sequence for the lath operations like turning, grooving etc.

Plan and optimize programmes CNC milling operations. Calculate parameters like speed, feed depth of cut etc and set a references for the various operations. Various methods of work process like edge finding black centre etc. Prepare and sets CNC milling operations.

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Tutorial/Activity Sessions:

- 10-12 tutorial/activity sessions need to be planned, which may be distributed among all the modules to cover entire portion of the syllabus/curriculum within nearly 40 hours.

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks. The question paper will have ten full questions carrying equal marks.
2. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
3. Each full question will have a sub-question covering all the topics under a module.
4. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

1 Mechatronics, HMT, Tata MCGraw-Hill publishing company limited , New Delhi, 2005
2 Computer control of manufacturing systems, Koren Y, McGraw Hill, 1986
3 Computer numerical control Machines, Radhakrishnan P , New centre Book Agency, 2002
4 CNC Machining Hand Book, James Madison, Industrial Press Inc, 1996
5 Programming of CNC Machines Ken Evans, John Polywka and Stanley Gabrel, Industrial Press Inc, New York, Second edition 2002
6 CNC Programming Hand book, peter Smid, industrial Press Inc, 2000
7 CAD/CAM , Rao P.N. Tata McGraw-Hill publishing company limited, 2002
8 Computer Numerical , Warren S. Seames, Thomson Delmar , Fourth Edition 2002

Web links and Video Lectures (e-Resources):

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the evolution, classification and principles of CNC machine tools.	L2
CO2	Discuss on details of CNC machine tools, selection of standard components used for CNC machine tools for accuracy and productivity enhancement.	L3
CO3	Select drives and positional transducers for CNC machine tools.	L3
CO4	Apply CNC programming concepts of for two axis turning centers and three axis vertical milling centres to generate programs different components.	L3

CO5	Generate CNC programs for popular CNC controllers.	L3
CO6	Analyse and select tooling and work holding devices for different components to be machined on CNC machine tools.	L4

Mapping of COS and POs

(Below table is only indicative and hence course teacher can revise it)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										
CO6										

Semester – II

Gauges and Measurements			
Course Code	MMTE215A	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	3	Exam Hours	3

Course objectives:

- Understand specification of limits, fits and tolerance,
- Study the design knowledge of different gauges and their uses,
- Understand the Interference of fits and their needs in calculations,
- Know the different types of Geometric dimensioning and tolerance and
- Awareness of design knowledge in different gauges in manufacturing.

MODULE-1 (05 Hrs)

Introduction: Definition and objectives of metrology, Linear measurement: neutral axis significance, imperial standard yard, international standard meter, airy points, Basel points, Line, End & Wave length standards, Slip Gages.

Angular Measurement: introduction, comparisons with linear measurement, sine bar: principle, types, advantages & limitations, uses, problems on sine bar, practical uses, material, construction, limitations problems on angle blocks (angle gauges).

MODULE-2 (05 Hrs)

Limits, Fits and Tolerance: Definitions, need of tolerance, types of tolerance, tolerance analysis (addition & subtraction of tolerances) interchangeability & selective assembly, representation of holes & shaft as per I.S. class & grade of tolerance, -difference between allowance & tolerance.

MODULE-3 (05 Hrs)

Fits: Definition, types of fits, (clearance, interference & transition), tolerance disposition chart, problems (calculation of fits) hole base system & shaft base system, procedure for solving on finding the hole & shaft tolerance upper & lower limits.

MODULE-4 (05 Hrs)

Design Of Gauges: Taylor's principle, MMC & LMC of hole & shaft types of gauges (plain, threaded, limit, single end, double end, progressive, position, etc.,) important points for gauge design, limitations of gauges, - problems on gauge design.

MODULE 5 (05 Hrs)

Geometric Dimensioning & Tolerancing (Gd&T) Introduction, ANSI, ASME & ISO systems of Gd&T, functional dimensioning, feature & feature of size, advantages & limitations, feature control frame, fourteen characteristic symbols, form controls, profile controls, orientation controls, location controls, run-out controls, datum.

Design Exercise: Design of Plug Gauge, Ring Gauge, Snap Gauge, Indicator Gauge, Taper plate Gauge, Taper Plug Gauge, Thread Gauge and Position Gauge.

PRACTICAL COMPONENT OF IPCC

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 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

1. Two Tests each of **25 Marks**
2. Two assignments each of **25 Marks/One Skill Development Activity of 50 marks**
3. Total Marks of two tests and two assignments/one Skill Development Activity added will be CIE for 60 marks, marks scored will be proportionally scaled down to **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 at the end /after completion of all the experiments 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 the University as per the scheduled timetable, with common question papers for the course (duration 03 hours)

1. The question paper will be set for 100 marks and marks scored will be scaled down proportionately to 50 marks.
2. The question paper will have ten questions. Each question is set for 20 marks.
3. 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.
4. 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 15 (50% of maximum marks-30) in the theory component and 10 (50% 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 40% of the maximum marks to

Suggested Learning Resources:

Books

1 Engineering Metrology - R.K. Jain
2 Westermann Tables for metal trade – Juts Scharkus, New age international Publishers
3 Engineering Metrology, K. J. Hume.
4 Geometric Dimensioning and Tolerancing -A Self Study Workbook By Alex Krulikowski
5 Fundamentals of Geometric Dimensioning and Tolerancing. ASME Y 14.5 M-1994, By Alex Krulikowski
6 Geometric Dimensioning and Tolerancing for Mechanical Design. McGraw Hill

Web links and Video Lectures (e-Resources):

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

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the specification of limits, fits and tolerance,	L2
CO2	Discuss the design knowledge of different gauges and their uses,	L2
CO3	Apply the knowledge on the Interference of fits and their needs in calculations,	L3
CO4	Demonstrate the different types of Geometric dimensioning and tolerance	L3
CO5	Explain the design knowledge of different gauges in manufacturing.	L2

Mapping of COS and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

DESIGN FOR MANUFACTURE			
Course Code	**MMTE215B**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	**2:0:2**	SEE Marks	50
Total Hours of Pedagogy	**40**	Total Marks	100
Credits	**03**	Exam Hours	03

Course Learning Objectives:

- Understand issues & challenges in implementing & developing lean manufacturing techniques from TPS & its contribution for improving organizational performance.
- Learn how to apply lean techniques to bring competitive business culture for improving organization performance.
- Study for analyzing how lean techniques can be applied to manufacturing & service industry
- Understand how to develop lean management strategy for Supply chain management.
- Study on Analyzing how lean technique can create value generation for organization

Module-1 **(05 Hrs)**	
Just in time production system. JIT Logic -Pull system Japanese approach to production elimination of waste - JIT implementation requirements JIT application for job shops, Case studies.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-2 **(05 Hrs)**	
Kanban System: -Kanban rules supplier Kanban and sequence schedule used by supplier. Monthly information & daily information. Later replenish system by Kanban sequenced withdrawal P system by sequence schedule table - problems & counter measures in applying Kanban system to subcontractors - Supplier Kanban circulation in the paternal manufacturer - structure of supplier Kanban sorting office.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-3 **(05 Hrs)**	
Electro Chemical and Chemical Processes: Electro chemical machining (ECM), Classification ECM process- **The rise of lean production: -** Birth place, concrete example, company as community, Final assembly plant, product development and engineering. Changing customer demand, dealing with the customer, future of lean production. **Shortening of production lead times:** reduction of setup times, practical procedures for reducing setup time.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-4 **(05 Hrs)**	
Standardization of operations: Machine layout, multi-function workers and job rotation. Improvement activities to reduce work force and increase worker morale -foundation for improvements. **Elements of lean production viz G M Framingharn:** Toyota Takaoka Mass Production V /s lean production, diffusing lean production.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-5 **(05 Hrs)**	
Managing Lean Enterprise: -Finance, Career ladders, geographic spread and advantages of global enterprise. **Prospects for catching up. Simplicity in the natural state:** institutional factors -life time employment - educational commodities -quality & productivity in full circle.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Tutorial/Activity Sessions:

- 10-12 tutorial/activity sessions need to be planned, which may be distributed among all the modules to cover entire portion of the syllabus within nearly 40 hours.

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks. The question paper will have ten full questions carrying equal marks.
2. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
3. Each full question will have a sub-question covering all the topics under a module.

Suggested Learning Resources:

Books

1. Productions and Operations Management-ChaselAquilino – Dreamtech latest edition.
2. Toyoto Production System -An integrated approach to Just in Time – YasuhiroMonden - Engineering aild Management Press -Institute of Industrial Engineers Norcross Georgia -1983.
3. The Machine that changed the World. The Story of Lean Production- James PWomack - Daniel TJones - and Daniel Roos -Harper Perennial – editionpublished 1991.

Web links and Video Lectures (e-Resources):

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Explain the issues & challenges in implementing & developing lean manufacturing techniques from TPS & its contribution for improving organizational performance.	L2
CO2	Apply lean techniques to bring competitive business culture for improving organization performance.	L3
CO3	Analyze how lean techniques can be applied to manufacturing & service industry	L4
CO4	Explore the lean management strategy for Supply chain management.	L3
CO5	Analyse how lean technique can create value generation for organization	L4

Mapping of COS and POs

(Below table is only indicative and hence course teacher can revise it)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

INDUSTRY 4.0			
Course Code	MMTE215C	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40	Total Marks	100
Credits	03	Exam Hours	03

Course Learning objectives:

- To impart basic idea in Industry 4.0.
- To provide students with good depth of knowledge of designing Industrial 4.0 Systems for various application
- Learn the concepts of Robotics and Augmented Reality

Module-1

Introduction to Industry 4.0: Introduction, core idea of Industry 4.0,origin concept of industry 4.0,Industry 4.0 production system, current state of industry 4.0, Technologies, How is India preparing for Industry 4.0 05Hrs

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-2

A Conceptual Framework for Industry 4.0: Introduction, Main Concepts and Components of Industry 4.0, State of Art, Supportive Technologies, Proposed Framework for Industry 4.0. 05Hrs

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-3

Technology Roadmap for Industry 4.0 : Introduction, Proposed Framework for Technology Roadmap, Strategy Phase, Strategy Phase, New Product and Process Development Phase.

05Hrs

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-4

Advances in Robotics in the Era of Industry 4.0: Introduction, Recent Technological Components of Robots-Advanced Sensor Technologies, Internet of Robotic Things, Cloud Robotics, and Cognitive Architecture for Cyber-Physical Robotics, Industrial Robotic Applications- Manufacturing, Maintenance and Assembly. 05Hrs

Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

Module-5

Obstacles and Framework Conditions for Industry 4.0 : Lack of A Digital Strategy alongside Resource Scarcity, Lack of standards and poor data security, Financing conditions, availability of skilled workers, comprehensive broadband infra- structure, 05Hrs	
Teaching-Learning Process	Chalk and talk method / PowerPoint Presentation

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs

The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50.
2. The question paper will have ten full questions carrying equal marks.
3. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
4. Each full question will have a sub-question covering all the topics under a module.
5. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources:

Books

- Alp Ustundag and Emre Cevikcan,"Industry 4.0: Managing the Digital Transformation".
- Bartodziej, Christoph Jan,"The Concept Industry 4.0".
- Klaus Schwab,"The Fourth Industrial Revolution".
- Christian Schröder ,"The Challenges of Industry 4.0 for Small and Medium-sized Enterprises".

Web links and Video Lectures (e-Resources):

- VTU e-Shikshana Program
- VTU EDUSAT Program

Skill Development Activities Suggested

- Quizzes
- Assignments
- Seminars
- Industrial Visit
- Case study

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Describe Industry 4.0 and scope for Indian Industry	
CO2	Demonstrate conceptual framework and road map of Industry 4.0	
CO3	Describe Robotic technology and Augmented reality for Industry 4.0	

Sl. No.	Description	POs
PO1	An ability to independently carry out research /investigation and development work to solve practical problems.	
PO2	An ability to write and present a substantial technical report/document.	
PO3	Students should be able to demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program	
PO4	Understand contemporary issues in manufacturing engineering and develop relationship between product design and manufacturability to create safe, reliable, and cost-effective products.	
PO5	Understand the process of converting customer needs into engineering specifications to create product designs that are sensitive to user needs and robust against unanticipated uses and misuse	
PO6	Employ advanced prototyping methods to shorten design cycles and narrow alternatives without restricting innovation.	
PO7	Understand and debate the roles and responsibilities of a product designer/manufacturer	

Mapping of COS and Pos (indicative only)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**3**	**3**	**2**	**3**	**2**	**3**	**3**
CO2	**2**	**3**	**3**	**2**	**3**	**3**	**3**
CO3	**3**	**3**	**2**	**3**	**2**	**3**	**3**

INDUSTRIAL ROBOTICS			
Course Code	**MMTE215D**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	**2:0:2**	SEE Marks	50
Total Hours of Pedagogy	**40**	Total Marks	100
Credits	**03**	Exam Hours	03

Course Learning Objectives:

- Understand the concept of robotics and its drives.
- Understand the sensors applications and images recognition mechanism.
- Study to program robot and analyse the computational element ofrobot computer system.
- Learn how to transform robot manipulator using knowledge kinematics and mathematical methods.
- Study the design and control robot cells and understand the application of robots.

Module-1 **(08 Hrs)**

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 electropneumatic 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 / Use of ICT like Power Point Presentations etc

Module-2 **(08 Hrs)**

SENSORS AND INTELLIGENT ROBOTS: Sensory devices – Non-optical-Position sensors – Optical position sensors – velocity sensors – proximity sensors: Contact and noncontact type-Touch and slip sensors – Force and Torque Sensors – AI and Robotics

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-3 **(08 Hrs)**

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.
COMPUTER CONSIDERATIONS FOR ROBOTIC SYSTEMS:
Computer architecture for robts, hardware, Computational elements in robotic applications – Robot programming – sample programspath planning – Robot"s computer system.

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-4 **(08 Hrs)**

TRANSFORMATIONS AND KINEMATICS: Homogeneous Co-ordinates – Co-ordinate Reference Frames – Homogeneous Transformations for the manipulator – the forward and inverse problem of manipulator kinematics – Motion generation – Manipulator dynamics – Jacobian in terms of D.H.Matrices controller architecture.

Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

Module-5 **(08 Hrs)**

ROBOT CELL DESIGN AND CONTROL: Specifications of Commercial 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 / Use of ICT like Power Point Presentations etc

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 marks out of 100) in the sum total of the CIE (Continuous Internal Evaluation) and SEE (Semester End Examination) taken together.

Continuous Internal Evaluation:

3. **Three Unit Tests each of 20 Marks**
4. **Two assignments each of 20 Marks or one Skill Development Activity of 40 marks to attain the COs and POs The sum of three tests, two assignments/skill Development Activities, will be scaled down to 50 marks**

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:

5. **The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks. The question paper will have ten full questions carrying equal marks.**
6. **Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.**
7. **Each full question will have a sub-question covering all the topics under a module.**
8. **The students will have to answer five full questions, selecting one full question from each module**

Suggested Learning Resources:

Books

2. **Robotics Engineering An integrated approach - Richard D Klafter, Thomas AChmielewski, Michael Negin – Prentice Hall of India Pvt. Ltd. - Eastern Economy Edition, 1989.**
3. **Robotics: Control Sensing, Vision, intelligence - Fu KS Gomaler R C, Lee C S G -McGraw Hill Book Co. - 1987.**
4. **Handbook of Industrial Robotics - Shuman Y. Nof - John Wiley & Sons, New York- 1985.**
5. **Robotics Technology and Flexible Automation - Deb SR - McGraw Hill BookCo. -1994**

Web links and Video Lectures (e-Resources):

Sl. No.	Description	Blooms Level
CO1	Explain the concept of robotics and its drives.	L2
CO2	Describe the sensors applications and images recognition mechanism.	L2
CO3	Program robot and analyse the computational element of robot computer system.	L4
CO4	Transform robot manipulator using knowledge kinematics and mathematical methods.	L3
CO5	Design and control robot cells and understand the application of robots.	L4

Course outcome (Course Skill Set)

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

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

Mapping of COS and POs

(Below table is only indicative and hence course teacher can revise it)

ADVANCED MOULDING TECHNIQUES			
Course Code	**MMTE206**	CIE Marks	50
Teaching Hours/Week (L:P:SDA)	2:0:2	SEE Marks	50
Total Hours of Pedagogy	40 hours Theory + 10-12 Lab slots	Total Marks	100
Credits	**03**	Exam Hours	03

Course Learning Objectives:

- Learn on how to demonstrate their knowledge in the field of advanced moulding methods.
- Understand the process and consideration in extrusion process.
- Learning the techniques in PTEF moulding.
- Learning the advanced Reaction Injection Moulding
- Knowledge of advance techniques like, Resin transfer mould, electro plating etc.

Module-1 **(08 Hrs)**	
Injection Moulding Technology : Microprocessor control injection moulding machine, close loop control, open loop control, CNC control, multi color injection moulding, rotary injection moulding, structural foam moulding, sandwich injection moulding**.** **Metal injection moulding:** contact injection moulding, moulding of cellular product like EPS, steam chest moulding, future trends in injection moulding like external & internal inter locking alignment of large moulds, processing of specialty polymers.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc
Module-2 **(08 Hrs)**	
Extrusion: General consideration during extrusion process like specific heat, latent heat, internal conductivity, shape & size of granular hygroscopic nature over temperature, effect of flow property like relaxation time & defects like shark skin, elastic turbulence, influence of TG, TM & crystal growth rate, cooling rate, impact strength, manufacturing of woven sacks etc. co extrusion, co extruded pipe, muilt layer pipe, foam pipe, biaxial oriented pipe.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc
Module-3 **(08 Hrs)**	
Lamination: Lamination by extrusion coating, twin screw extrusion, co-rotating & counter rotating, feeding mechanism in twin screw extruder, roll of side feede injection feeder, principles of compounding, mixing mechanism etc**.** **PTFE Moulding:** Processing techniques used for PTFE, Material consideration, sintering, Ram extrusion, and Paste extrusion, lso statistic. Moulding and skewing technique for PTFE processing.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc
Module-4 **(08 Hrs)**	
Blow Moulding: Micro processor / CNC controlled blow moulding machine, injection stretch blow moulding of PET, precut moulding, multi layer blow moulding, Parission programming. **Reaction Injection Moulding (RIM):** RIM of Polyurethane, material for RIM, liquid RIM & its advantages over conventional injection moulding, RRIM**.**	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc
Module-5 **(08 Hrs)**	
Advancement in Other Processing Technique: New techniques like Resin transfer moulding, Pultrusion. Filament winding, multi layer rotation moulding, Electro plating and printings, Centrifugal casting, Shrink film, Clink film.	
Teaching-Learning Process	Chalk and Talk / Use of ICT like Power Point Presentations etc

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 50% of the maximum marks. Minimum passing marks in SEE is 40% of the maximum marks of SEE. 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 50% (50 marks out of 100) in the sum total of the CIE (Continuous
Internal Evaluation) and SEE (Semester End Examination) taken together.

Semester - II

Continuous Internal Evaluation:

1. Three Unit Tests each of **20 Marks**
2. Two assignments each of **20 Marks** or **one Skill Development Activity of 40 marks** to attain the COs and POs The sum of three tests, two assignments/skill Development Activities, will be **scaled down to 50 marks**

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:

1. The SEE question paper will be set for 100 marks and the marks scored will be proportionately reduced to 50 marks. The question paper will have ten full questions carrying equal marks.
2. Each full question is for 20 marks. There will be two full questions (with a maximum of four sub-questions) from each module.
3. Each full question will have a sub-question covering all the topics under a module.
4. The students will have to answer five full questions, selecting one full question from each module

Suggested Learning Resources: Books

1. Injection Moulding, by Rubin.
2. Extrusion –Berln.
3. Injection Mold by Glavin & Denton
4. Extrusion Die Design, M. V. Joshi.
5. Polymer Chemistry, Gowriker.

Web links and Video Lectures (e-Resources):

Course outcome (Course Skill Set)

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

Sl. No.	Description	Blooms Level
CO1	Demonstrate their knowledge in the field of advanced moulding methods.	L2
CO2	Explain the process and consideration in extrusion process.	L2
CO3	Describe the techniques in PTEF moulding.	L2
CO4	Apply the advanced Reaction Injection Moulding technics	L3
CO5	Apply the advance techniques like, Resin transfer mould, electro plating etc.	L3

Mapping of COS and POs

(Below table is only indicative and hence course teacher can revise it)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO1										
CO2										
CO3										
CO4										
CO5										

Semester - II

Tool Design Engineering Laboratory			
Course Code	MTEL207	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	1:2:0	SEE Marks	50
Credits	2	Exam Hours	3

Course objectives:

- Study on design, assembly and drafting of combination tool, simple drill jig, leaf Jig
- Study on design, Assembly, drafting and analysis of milling fixture
- Study the design, assemble and drafting of stage and progressive press tool.
- Study on design, assembly and drafting of compound tool and bending tool
- Study to Design, assembly and Drafting of a cavity injection moulding tool for a simple component
- Learn to Design, assembly, drafting and Analysis of cavity cold and hot chamber die casting tool.

Sl.NO	Experiments
1	Design, Assembly, and detail drawings of simple drill jig
2	Design, Assembly, drafting and analysis of a leaf Jig
3	Design, Assembly, drafting and analysis of milling and Turning fixture
4	Design, assembly and drafting of simple stage tool
5	Design, assembly, drafting and Analysis of progressive press tool
6	Design, assembly and drafting of compound tool and combination tool
7	Design, assembly and Drafting of a single cavity injection moulding tool for a simple component
8	Design, assembly, drafting and Analysis of a two-cavity injection molding tool for a given component
9	Design, assembly, drafting and Analysis of a single cavity cold chamber die casting tool for a simple component
10	Design, assembly, drafting and Analysis of a two-cavity hot chamber die casting tool for a given component.

Course outcomes (Course Skill Set):

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

- . Design, assembly and Drafting of a cavity injection moulding tool for a simple component
- Design, assembly, drafting and Analysis of cavity cold and hot chamber die casting tool.
- Design, assembly and Drafting of simple drill jig
- Design, assembly and Drafting of press tool
- Design, assembly and Drafting of progressive bending tool

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 50% of the maximum 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 40% of maximum marks in the semester-end examination(SEE). In total of CIE and SEE student has to secure 50% maximum marks of the course.

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 an 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 down to 30 marks** (60% of maximum marks).
- Weightage to be given for neatness and submission of record/write-up on time.
- Department shall conduct 01 tests for 100 marks, test shall be conducted after the 14th week of the semester.
- In 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.
- **The test marksis scaled down to 20 marks** (40% of the maximum marks).

The Sum of **scaled-down** marks scored in the report write-up/journal and marks of test 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 10% Marks allotted to the procedure part to be made zero.

The duration of SEE is 03 hours

Suggested Learning Resources:

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