DESIGN FOR MANUFACTURING			
CourseCode	MMPD201	CIEMarks	50
TeachingHours/Week(L:P:SDA)	3:2:0	SEEMarks	50
TotalHoursofPedagogy	25theory+10-12activities	TotalMarks	100
Credits	04	ExamHours	03

CourseLearningobjectives:

- Understandingthebasicrulesfordesignformanufacturingandmaterialselection.
- Applyingtheguidelinesforeaseofdesign,manufacturingandassembly.
- Analyzefactorsforselectionofmaterialandprocess,relationshiptomanufacturingprocesses
- Applytheconceptsofdesignformanufacturingandassemblyforproductmanufacturing.
- Comparevariousmanufacturingprocessesandassemblytechniquesrequiredforproductdevelopmenttooptimisetheprocess.

Module-1

Materialandprocessselection–Introduction,AdvantagesofapplyingDFMA,Generalrequirementsofearlymaterialsandprocessselection,SelectionofManufacturingprocesses,Selectionofmaterials.EngineeringDesign features.–Dimensioning,Tolerances,GeneralTolerance,GeometricTolerances. 05Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-2

Assemblylimits,Datumfeatures.
Componentdesign– MachiningConsiderations–Drills,Millingcutters,Drilling,Keyways,Dowels,Screws,Reductioninmachiningareas,Simplificationbyseparationandamalgamation,workpieceholding,surfacegrinding,Examples. 05Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-3

Componentdesign–CastingConsiderations–Pattern,Mould,partingline,castholes,machinedholes,identifying partingline,specialsandcores,designingtoobviatesandcores.Examples 05Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-4

DesignforInjectionmoldingandSheetmetalworking–Injectionmoldingmaterials,Moldingcycle,Systems,molds,machinesize,cycletime,Costestimation,Insertmolding,Design guidelines,Introductiontosheetmetalworking.
05Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5

DesignforDiecastingandPowdermetalprocessing–Diecastingalloys,cycle,machines,dies,finishing, Designprinciples,Powdermetallurgyprocessing,stages,compactioncharacteristics,Tooling,Sintering,Designguidelines. 05Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

- ThreeUnitTestseachof**20Marks**
- Twoassignmentseachof**20Marks**or**oneSkillDevelopmentActivityof40marks**toattaintheCOsandPOs

Thesumofthreetests,twoassignments/skillDevelopmentActivities,willbe**scaleddownto50marks**

CIEmethods/questionpaperisdesignedtoattainthedifferentlevelsofBloom'staxonomyaspertheoutcomedefinedforthecourse.

SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.
5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

- ProductDesignforManufactureandAssembly–GeoffreyBoothroyd-PeterDewhurst-WinstonKnight
- DesigningforManufacturing–HarryPeck-PitmanPublications–1983
- DimensioningandTolerancingforQuantityProduction–MerhyleFSpotts–Inc.EnglewoodCliffs-NewJersey-PrenticeHall,5thedition.

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	Understandtheprinciplesofmanufacturabilityanddesignformanufacture	
CO2	Designcastingforeconomicproduction.	
CO3	Understandtheconceptofeasyassembly,basedonrulesofDFMAtoreducethetimeofassembly.	
CO4	RedesignthepartsforeasymanufacturingbasedonrulesofDFMAtoreducethetimeofmanufacturingandenhancecosteffectiveness.	
CO5	Designguidelinesandbackgroundforpowdermetallurgypartsandreviewingofformedparts.	

ProgramOutcomeofthiscourse

Sl.No.	Description	POs
PO1	Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworkto solvepracticalproblems.	
PO2	Anabilitytowriteandpresentasubstantialtechnicalreport/document.	
PO3	Studentsshouldbeabletodemonstrateadegreeofmasteryoverthareaasperthe specialization of the program. The mastery should be at a level higher than the requirementsintheappropriatebachelorprogram	
PO4	Understandcontemporaryissuesinmanufacturingengineeringanddeveloprelationship betweenproductdesignandmanufacturabilitytocreatesafe,reliable,andcost-effective products.	
PO5	Understandthe process of converting customerneeds intoengineeringspecifications to createproductdesignsthataresensitivetouserneedsandrobustagainstunanticipated usesand misuse	
PO6	Employadvancedprototypingmethodstoshortendesigncyclesandnarrowalternatives withoutrestrictinginnovation.	
PO7	Understandanddebatetherolesandresponsibilitiesofaproductdesigner/manufacturer on society.	

MappingofCOSandPOs(indicativeonly)

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

Note:High-1,Medium–2,andLow–3

INDUSTRIAL DESIGN AND ERGONOMICS			
CourseCode	**MMPD202**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	3:0:0	SEEMarks	50
TotalHoursofPedagogy	40hoursTheory+10-12Labslots	TotalMarks	100
Credits	03	ExamHours	03

Courseobjectives:

- Toincreaseawarenessoftheneedforandroleofergonomicsinoccupationalhealth.
- Toobtainknowledgeintheapplicationofergonomicprinciplestodesignofindustrialworkplacesandthepreventionofoccupationalinjuries
- Tounderstandthebreadthandscopeofoccupationalergonomics.

MODULE-1

Introduction:Anapproachtoindustrialdesign-elementsofdesignstructureforindustrialdesigninengineeringapplicationinmodernmanufacturingsystems.Ergonomics andIndustrialDesign:Introduction-generalapproach totheman-machinerelationship-workstationdesign-workingposition. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE-2

ControlandDisplays:Shapesandsizesofvariouscontrolsanddisplays-multiple,displaysandcontrolsituations-designofmajorcontrolsinautomobiles,machinetoolsetc.ErgonomicsandProduction:ergonomicsandproductdesign-ergonomicsinautomatedsystems-expertsystemsforergonomicdesign.Anthropometricdataandits applicationsinergonomic,designlimitationsofanthropometricdata-useofcomputerizeddatabase. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE-3

VisualEffectsofLineandForm:Themechanicsofseeingpsychologyofseeinggeneralinfluencesoflineandform.Colour:Colourandlight-colourandobjects-colourandtheeye-colourconsistency-colourterms-reactionstocolourandcolourcontinuation–colouronengineeringequipments. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE-4

AestheticConcepts:Conceptofunity-conceptoforderwithvariety-conceptofpurposestyleandenvironment-Aestheticexpressions.Style-componentsofstyle-housestyle,observationstyleincapitalgoods,casestudy08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE5

IndustrialDesigninPractice:Generaldesign-specifyingdesignequipments-ratingtheimportanceofindustrial design-industrialdesigninthedesignprocess. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

PRACTICALCOMPONENTOFIPCC*(Maycoverall/majormodules)*

Sl.NO	Experiments
1	DevelopmentofErgonomicChairforvariousapplications(office&Resting)
2	Designtheworkspaceareasuchthattheworkefficiencycanbeenhanced
3	Designaproductusingathleticsandergonomicswhichisusefulindaytotoday'slife.
4	Applytheergonomicsinimprovingtheexistingproductandgivemin5improvementinit.
5	UsingHouseofstyleandgivinganideaontheproductdevelopment.
6	Implementvariousconceptsanddevelopnewproductconceptsandmakeareportonit.

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether

CIEforthetheorycomponentofIPCC

1. TwoTestseachof**20Marks**
2. Twoassignmentseachof**10Marks/OneSkillDevelopmentActivityof20marks**
3. TotalMarksoftwotestsandtwoassignments/oneSkillDevelopmentActivityaddedwillbeCIEfor60marks, marksscoredwillbeproportionallyscaleddownto**30marks**.

CIEforthepracticalcomponentofIPCC

- Oncompletionofeveryexperiment/programinthelaboratory,thestudentsshallbeevaluatedandmarksshallbeawardedonthesameday.The**15marks**areforconductingtheexperimentandpreparationofthelaboratoryrecord,theother**05marksshallbeforthetest**conductedattheendofthesemester.
- TheCIEmarksawardedinthecaseofthePracticalcomponentshallbebasedonthecontinuousevaluationofthelaboratoryreport.Eachexperimentreportcanbeevaluatedfor10marks.Marksofallexperiments' write-upsareaddedandscaleddownto15marks.
- Thelaboratorytestattheend/aftercompletionofalltheexperimentsshallbeconductedfor50marksandscaleddownto05marks**.**

Scaled-downmarksofwrite-upevaluationsandtestsaddedwillbeCIEmarksforthelaboratorycomponentofIPCCfor**20marks**.

SEEforIPCC

TheorySEEwillbeconductedbyUniversityasperthescheduledtimetable,withcommonquestionpapersforthecourse(duration03hours)

1. Thequestionpaperwillbesetfor100marksandmarksscoredwillbescaleddownproportionatelyto50marks.
2. Thequestionpaperwillhavetenquestions.Eachquestionissetfor20marks.
3. Therewillbe2questionsfromeachmodule.Eachofthetwoquestionsunderamodule(withamaximumof3sub-questions),**shouldhaveamixoftopics**underthatmodule.
4. Thestudentshavetoanswer5fullquestions,selectingonefullquestionfromeachmodule.

ThetheoryportionoftheIPCCshallbeforbothCIEandSEE,whereasthepracticalportionwillhaveaCIEcomponentonly.QuestionsmentionedintheSEEpapershallincludequestionsfromthepracticalcomponent).

- TheminimummarkstobesecuredinCIEtoappearforSEEshallbethe15(50%ofmaximummarks-30)inthetheorycomponentand10(50%ofmaximummarks-20)inthepracticalcomponent.ThelaboratorycomponentoftheIPCCshallbeforCIEonly.However,inSEE,thequestionsfromthelaboratorycomponentshallbeincluded**.**Themaximumof04/05questionstobesetfromthepracticalcomponentofIPCC,thetotalmarksofallquestionsshouldnotbemorethanthe20marks.
- SEEwillbeconductedfor100marksandstudentsshallsecure40%ofthemaximummarkstoqualifyintheSEE.Markssecuredwillbescaleddownto50.(Studenthastosecureanaggregate of50%ofmaximummarksofthecourse(CIE+SEE)

SuggestedLearningResources:

Books

- IndustrialDesignforEngineers-MayallW.H.-LondonHiffeebooksLtd.-1988.
- AppliedErgonomicsHandBook-BrainShakel(Edited)-Butterworthscientific.London
- IntroductiontoErgonomics-R.C.Bridger-McGrawHillPublications-1995.
- HumanFactorEngineering-Sanders&McCormick-McGrawHillPublications–6thedition,2002.

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

- Quizzes
- Assignments
- Seminars

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	UnderstandingtheconceptsofIndustrialdesignandman-machinerelationship.	
CO2	Designofoptimisticdisplayandcontroldevicesforvariousapplications.	
CO3	Applyingtheanthropomorphicdatainergonomicdesign	
CO4	Understandingthevisualeffectsoflines,formandcoloronengineeringequipments.	
CO5	Choosingappropriateaestheticaspectsfordesignofindustrialmachineryanddevices	

ProgramOutcomeofthiscourse

Sl.No.	Description	Pos
PO1	Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworkto solvepracticalproblems.	
PO2	Anabilitytowriteandpresentasubstantialtechnicalreport/document.	
PO3	Studentsshouldbeabletodemonstrateadegreeofmasteryoverthareaasperthe specialization of the program. The mastery should be at a level higher than the requirementsintheappropriatebachelorprogram	
PO4	Understandcontemporaryissuesinmanufacturingengineeringanddeveloprelationship betweenproductdesignandmanufacturabilityto createsafe,reliable,andcost-effective products.	
PO5	Understandthe process of converting customerneeds intoengineeringspecifications to createproductdesignsthataresensitivetouserneedsandrobustagainstunanticipated usesand misuse	
PO6	Employ advanced prototyping methods to shorten design cycles and narrow alternatives without restricting innovation.	
PO7	Understandanddebatetherolesandresponsibilitiesofaproductdesigner/manufacturer on society.	

MappingofCOSandPos(indicativeonly)

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

Note:High-1,Medium–2,andLow–3

LEAN MANUFACTURING SYSTEMS			
CourseCode	MMPD203	CIEMarks	50
TeachingHours/Week(L:P:SDA)	3:0:0	SEEMarks	50
TotalHoursofPedagogy	40	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- Thestudentwillbeequippedwiththebasicknowledgeofleanmanufacturing,tools,techniquesandimplementationoutcomes.

Module-1	
Justintimeproductionsystem.JITLogic-PullsystemJapaneseapproachtoproductioneliminationofwaste-JITimplementationrequirementsJITapplicationforjobshops,Casestudies 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-2	
Kanbansystem:-KanbanrulessupplierKanbanandsequencescheduleusedbysupplier.Monthlyinformation&dailyinformation.Laterreplenishsystembykanbansequencedwithdrawalpsystembysequencescheduletable-problems&countermeasuresinapplyingKanbansystemtosubcontractors-SupplierKanbancirculationinthepaternalmanufacturer-structureofsupplierKanbansortingoffice. 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-3	
Theriseofleanproduction:-Birthplace,concreteexample,companyascommunity,Finalassemblyplant,productdevelopmentandengineering.Changingcustomerdemand,dealingwiththecustomer,futureofleanproduction.Shorteningofproductionleadtimes:reductionofsetuptimes,practicalproceduresforreducing setuptime. 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-4	
Standardizationofoperations:Machinelayout,multifunctionworkersandjobrotation.Improvementactivitiestoreduceworkforceandincreaseworkermorale-foundationforimprovements.ElementsofleanproductionvizGM Framingharn:ToyotaTakaokaMassProductionV/sleanproduction,diffusingleanproduction. 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5	
Managingleanenterprise:-Finance,Careerladders,geographicspreadandadvantagesofglobalenterprise.Prospectsforcatchingup.Simplicityinthenaturalstate:institutionalfactors-lifetimeemployment-educationalcommodities-quality&productivityinfullcircle 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

1. ThreeUnitTestseachof**20Marks**
2. Twoassignmentseachof**20Marks**or**oneSkillDevelopmentActivityof40marks**toattaintheCOsandPOs

Thesumofthreetests,twoassignments/skillDevelopmentActivities,willbe**scaleddownto50marks**
CIEmethods/questionpaperisdesignedtoattainthedifferentlevelsofBloom'staxonomyaspertheoutcomedefinedforthecourse.

SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.

Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

- ProductionsandOperationsManagement–ChaselAquilino–Dreamtechlatestedition.
- ToyotoProductionSystem-AnintegratedapproachtoJustinTime-YasuhiroMonden-EngineeringaildManagementPress-InstituteofIndustrialEngineersNorcrossGeorgia-1983.
- TheMachinethatchangedtheWorld.TheStoryofLeanProduction-JamesPWomack-DanielTJonesandDanielRoos-HarperPerennial-editionpublished1991.
- LeanThinking-JamesWomack–ISBN0743249275–2003.
- JapaneseManufacturingTechniques.TheNineHiddenLessonsbysimplicity-RichardSchourberger-ASQCPress1991.
- QualityFunctionDevelopment-JamesBossert-ASQCPress1991

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- CaseStudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	Tounderstandissues&challengesinimplementing&developingleanmanufacturingtechniquesfromTPS&itscontributionforimprovingorganizationalperformance.	
CO2	Applyleantechniquestobringcompetitivebusinessculture forimprovingorganizationperformance.	
CO3	Analyzehowleantechniquescanbeappliedtomanufacturing&serviceindustry	
CO4	DevelopingleanmanagementstrategyforSupplychainmanagement.	
CO5	.Analyzinghowleantechniquecancreatevaluegenerationfororganization	

ProgramOutcomeofthiscourse

Sl.No.	Description	POs
PO1	Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworkto solvepracticalproblems.	
PO2	Anabilitytowriteandpresentasubstantialtechnicalreport/document.	
PO3	Studentsshouldbeabletodemonstrateadegreeofmasteryoverthareaasperthe specialization of the program. The mastery should be at a level higher than the requirementsintheappropriatebachelorprogram	
PO4	Understandcontemporaryissuesinmanufacturingengineeringanddeveloprelationship betweenproductdesignandmanufacturabilitytocreatesafe,reliable,andcost-effective products.	
PO5	Understandthe process of converting customerneeds intoengineeringspecifications to createproductdesignsthataresensitivetouserneedsandrobustagainstunanticipated usesand misuse	
PO6	Employadvancedprototypingmethodstoshortendesigncyclesandnarrowalternatives withoutrestrictinginnovation.	
PO7	Understandanddebatetherolesandresponsibilitiesofaproductdesigner/manufacturer on society.	

MappingofCOSandPos(indicativeonly)

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

Note:High-1,Medium–2,andLow–3

FINITE ELEMENT Methods			
CourseCode	**MMPD206**	CIEMarks	50
TeachingHours/Week(L:P:SDA)	3:0:0	SEEMarks	50
TotalHoursofPedagogy	30hoursTheory	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- UnderstandthemathematicalprinciplesbehindtheFiniteElementMethod:Anumericstrategytosolve partialdifferentialequations(PDEs).
- Understandconceptsforsolvingtrussstructuresandcontinuumstructures.
- UsethecommerciallyavailablesoftwarelikeANSYS.

MODULE-1

Introduction:Equationsofequilibrium,stress-strainrelationsfor2-Dand3-D,Potentialenergyandequilibrium,Boundaryconditions,VonMissesStresses.FEMfor1-DProblems:GeneralprocedureforFEA,RaleighRitzmethod,GalerkinApproach,shapefunctions,stiffnessmatrix,loadvectors,temperatureeffects,Applicationsof boundaryconditionsusingeliminationandpenaltyapproaches. 10Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE-2

FEMfor1Dand2-DProblems:Applicationproblems– 1-Dbarelement.Trussesandbeams,Shapefunctions(2Delement),stiffnessmatrix,strainmatrix,loadvectorsforCSTElementsandapplicationproblems. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE-3

FEMforAxisymmetricProblems:Axisymmetricformulation,triangularelements,PEapproach,Bodyforceterm,applicationproblems. 06Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE-4

FEMforScalarFieldProblems:1-DSteadystateheattransfer,torsion,andapplicationProblems. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

MODULE5

DynamicAnalysis:Equationsofmotionfordynamicproblemsconsistentandlumpedmassmatricesformulationofelementmassmatricesfreevibrationandforcedvibrationproblemsformulation. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether

CIEforthetheorycomponentof IPCC

- TwoTestseachof**20Marks**
- Twoassignmentseachof**10Marks/OneSkillDevelopmentActivityof20marks**

- TotalMarksoftwotestsandtwoassignments/oneSkillDevelopmentActivityaddedwillbeCIEfor60marks, marksscoredwillbeproportionallyscaleddownto**30marks**.

CIEforthepracticalcomponentof IPCC

- Oncompletionofeveryexperiment/programinthelaboratory,thestudentsshallbeevaluatedandmarksshallbeawardedonthesameday.The**15marks**areforconductingtheexperimentandpreparationofthelaboratoryrecord,theother**05marksshallbeforthetest**conductedattheendofthesemester.
- TheCIEmarksawardedinthecaseofthePracticalcomponentshallbebasedonthecontinuousevaluationofthelaboratoryreport.Eachexperimentreportcanbeevaluatedfor10marks.Marksofallexperiments' write-upsareaddedandscaleddownto15marks.
- Thelaboratorytestattheend/aftercompletionofalltheexperimentsshallbeconductedfor50marksandscaleddownto05marks**.**

Scaled-downmarksofwrite-upevaluationsandtestsaddedwillbeCIEmarksforthelaboratorycomponentofIPCCfor**20marks**.

.

SEEforIPCC

TheorySEEwillbeconductedbyUniversityasperthescheduledtimetable,withcommonquestionpapersforthecourse(duration03hours)

- Thequestionpaperwillbesetfor100marksandmarksscoredwillbescaleddownproportionatelyto50marks.
- Thequestionpaperwillhavetenquestions.Eachquestionissetfor20marks.
- Therewillbe2questionsfromeachmodule.Eachofthetwoquestionsunderamodule(withamaximumof3sub-questions),**shouldhaveamixoftopics**underthatmodule.
- Thestudentshavetoanswer5fullquestions,selectingonefullquestionfromeachmodule.

The theory portion of the IPCC shall be for both CIE and SEE, whereas the practical portion will have a CIE componentonly.QuestionsmentionedintheSEEpapershallincludequestionsfromthepracticalcomponent).

- TheminimummarkstobesecuredinCIEtoappearforSEEshallbethe15(50%ofmaximummarks-30)inthetheorycomponentand10(50%ofmaximummarks-20)inthepracticalcomponent.ThelaboratorycomponentoftheIPCCshallbeforCIEonly.However,inSEE,thequestionsfromthelaboratorycomponentshallbeincluded.Themaximumof04/05questionstobesetfromthepracticalcomponentofIPCC,thetotalmarksofallquestionsshouldnotbemorethanthe20marks.
- SEEwillbeconductedfor100marksandstudentsshallsecure40%ofthemaximummarkstoqualifyin theSEE.Markssecuredwillbescaleddownto50.(Studenthastosecureanaggregateof50%ofmaximummarksofthecourse(CIE+SEE)

SuggestedLearningResources:

Books

- IntroductiontoFiniteElementsinEngineering– TirupathiR.-ChandrupatlaAshokDBelegundu-PrenticeHallIndiaPvt.Ltd.,NewDelhi– 3rdEdition,2003
- ConceptsandApplicationsoffiniteElementAnalysis-CookR.D-MalkusD.S&PleshaM.E–JohnWiley&Sons-1989.
- AppliedFiniteElementAnalysis-SegerlindL.J-JohnWiley&SonsEdition-1984
- TheFiniteElementMethodinEngineering,-RaoSSPergomonPress–Oxford–
- FiniteElementProceduresinEngineeringAnalysis-BatheK.J-PrenticeHallNewJersey-1982.
- EnergyandFiniteElementMethodsinStructuralmechanics-ShamesIII&DymCL-Wileyeasternltd– 1995.

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

ActivityBasedLearning(SuggestedActivitiesinClass)/PracticalBasedlearning

- Quizzes
- Assignments
- Seminars

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	Solvedifferentialequationsusingweightedresidual methods	
CO2	Developthefiniteelementequationstomodelengineeringproblemsgovernedbysecond orderdifferentialequations	
CO3	Applythebasicfiniteelementformulationtechniquestosolveengineeringproblemsby usingonedimensionalelements	
CO4	Apply the basic finite element formulation techniques to find natural frequency of single degree of vibration system	

ProgramOutcomeofthiscourse

Sl.No.	Description	Pos
PO1	Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworkto solvepracticalproblems.	
PO2	Anabilitytowriteandpresentasubstantialtechnicalreport/document.	
PO3	Studentsshouldbeabletodemonstrateadegreeofmasteryoverthareaasperthe specialization of the program. The mastery should be at a level higher than the requirementsintheappropriatebachelorprogram	
PO4	Understandcontemporaryissuesinmanufacturingengineeringanddeveloprelationship betweenproductdesignandmanufacturabilitytocreatesafe,reliable,andcost-effective products.	
PO5	Understandtheprocessofconvertingcustomerneedsintoengineeringspecificationsto createproductdesignsthataresensitivetouserneedsandrobustagainstunanticipated uses and misuse	
PO6	Employadvancedprototypingmethodstoshortendesigncyclesandnarrowalternatives withoutrestrictinginnovation.	
PO7	Understandanddebatetherolesandresponsibilitiesofaproductdesigner/manufacturer on society.	

MappingofCOSandPos(indicativeonly)

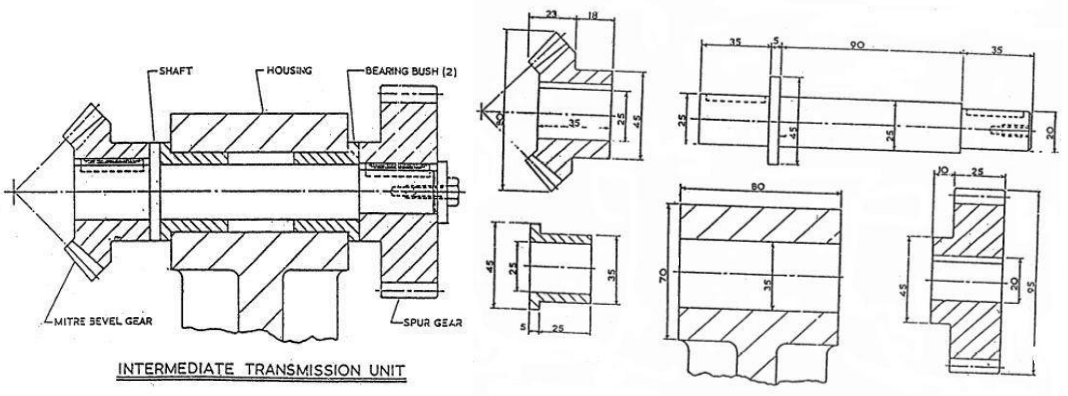
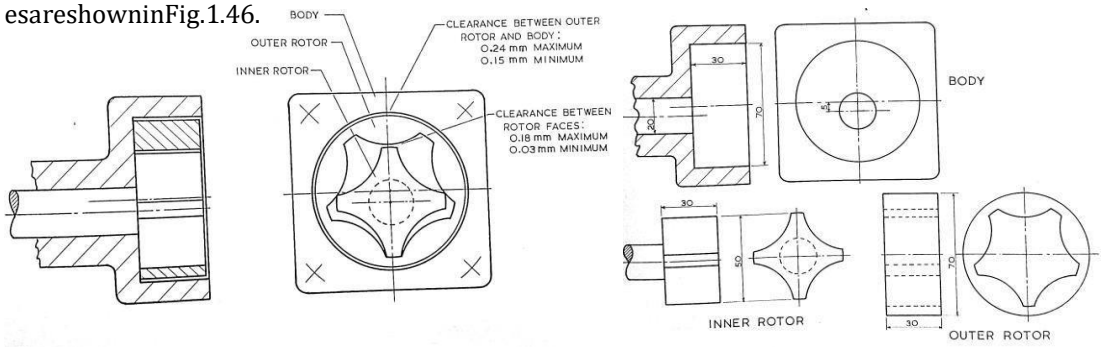
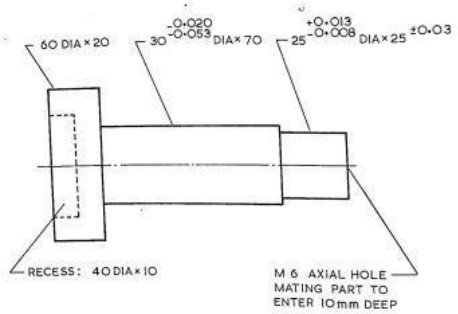
	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**2**	**2**	**1**	**3**	**3**	**3**	**3**
CO2	**2**	**1**	**2**	**2**	**2**	**3**	**3**
CO3	**1**	**2**	**1**	**3**	**2**	**3**	**2**
CO4	**1**	**2**	**1**	**3**	**2**	**3**	**2**

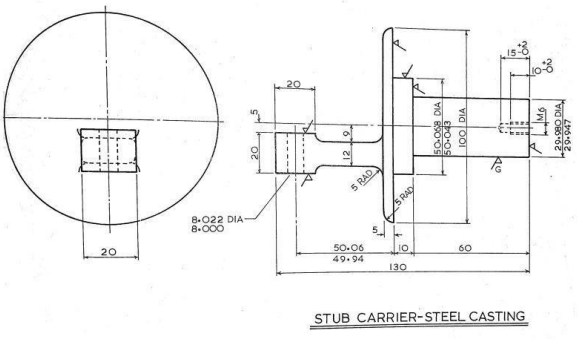
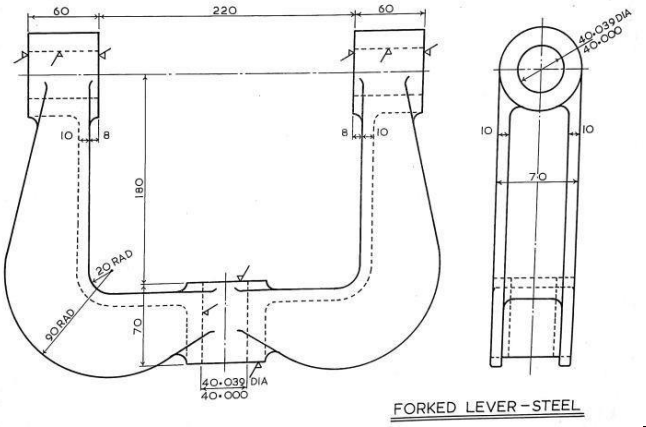
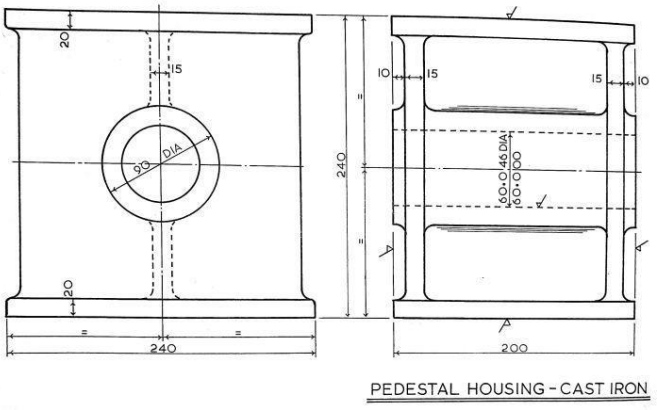
Note:High-1,Medium–2,andLow–3

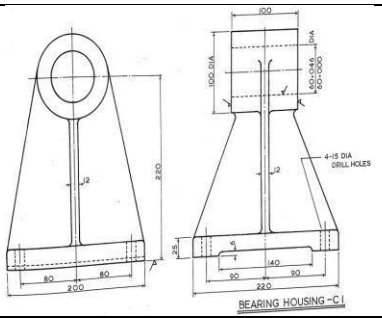
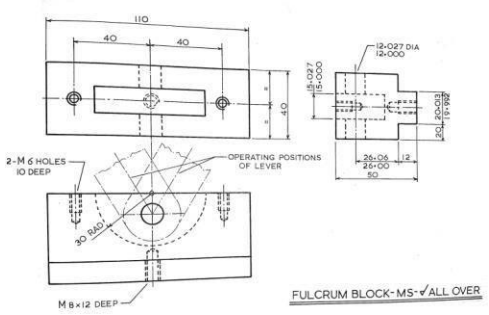
PRODUCT DESIGN VISUALIZATION ENGG LAB-II			
CourseCode	MMPDL207	CIEMarks	50
TeachingHours/Week(L:T:P:S)	0:0:2:0	SEEMarks	50
Credits	02	ExamHours	100

Courseobjectives:

1. Tolearnbasicprinciplesoffiniteelementanalysisprocedure.
2. Tolearnthetheoryandcharacteristicsoffiniteelementsthatrepresentengineeringstructures.
3. Tolearnandapplyfiniteelementsolutionstostructural,thermal,dynamicproblemtodeveloptheknowledgeandskillsneededtoeffectivelyevaluatefiniteelementanalyses

Sl.NO	Experiments
1	Theshaftassemblyoftheintermediatetransmissionunitshowninfig.1(a)isrequiredtohaveanaxialfreedomofmaximum0.18mmandminimum0.06mmwhenassembledinworkingcondition.Usingthenominalsizesspecifiedforthemeterbevelgear,shaft,housing,bearingbushesandspurgear,showninFig.1(b),drawonlytherelevantcomponentsandstateonlytheappropriatelimitstoachievetherequiredaxialfreedom  Figure1(a)Shaftassemblingspecifiedaxialfreedom Figure1(b)componentnominalsize
2	Thepartialassemblyofanoilpumpisshowninfig.1.45.Afourlobeinnerrotorismountedoffsettothebodyborein whichafivelobeouterrotorrotates,drivenbytheinnerrotor.Boththespecifiedclearancesaretobemeasuredbyafeelergaugewhenthepartsareassembled.Takingthisprocedureintoaccount,andalsothefactthattheouterrotorcan“float” radially,statetheappropriatelimitsfortherelevantdimensionswhichwillensurethatthespecifiedclearancelimitsarenotexceeded.Assumezeroclearancebetweeninnerrotorstemandbodybore(20mmdiameter).Nominalsizesareshowninfig.1.46. 
3	Theshaftistobemanufacturedfrom0.4%carbonsteeltothesizesshowninFig.2.31.The30mmandthe25mmdiameteraretobeground.Prepareaproductiondetaildrawingfortheshaft. 

4	Asuitablesequenceforoperationthestubcarriershowninfig.4.40andredrawthecomponentincorporatingfeaturestofacilitatemanufacture.Thecarrieristobeproducedfromasteelcastingandthesymbol„G" indicates a ground surface for the 30 mm diameter limits 
5	Indicatethepartinglineforthesteelforkedlevercastingseeninfig.5.27,andalsothenecessarysandcores.Maintainingasnearlyaspossible,theexistingweightofthecasting,offeradesignmodificationthatwillalleviatethesandcorerequirements. 
6	ForthepedestalshowninFig.5.28indicatetheprobablepartinglineandanyunnecessarysandcores,acceptingthattheprobablepartinglineistheoneinvolvingtheminimumsandcores.Showadesignmodificationtoreduceoreliminatetheneedforsandcores;maintainapproximatelysameweightofcastinginthemodifieddesign. 
7	Abearingbracket,showninfigure5.32,canhavetwopossiblepartinglines,eachrequiringthesamesandcores.Indicateeachofthesepartinglines,andthesandcores,andcommentonanundesirablecastingfeaturesinvolved.
8	Acastironbearingbracketisshowninfigure5.26.Indicatethepreferredpartinglineandanynecessary sandcores.Offeradesignmodificationthatwillreduceoreliminatetheneedforsandcores.

	
9	Inthefulcrumblock,showninfigure4.39,alever,mountedonahingepin,oscillates30degreeeachsideofthevertic alcentreline;thisleverisshown,chaindotted,inthetwoextremesofposition.Commentonthemachininginvolved andshowdesignmodificationstofacilitatethemachining. 
10	

Courseoutcomes(CourseSkillSet):

Attheendofthecoursethestudentwillbeableto:

- Solvebasicproblemsusingfiniteelementmethods
- Performstructuralanddynamicproblemsusingfiniteelementmethods

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminim umpassingmarkfortheCIEis50%ofthemaximummarks.Astudentshallbedeemedtohavesatisfiedtheacademic requirementsandearnedthecreditsallottedtoeachcourse.Thestudenthastosecurenotlessthan40%ofmaximu mmarksinthesemester-endexamination(SEE).IntotalofCIEandSEEstudenthastosecure50%maximummarksofthecourse.

ContinuousInternalEvaluation(CIE):

CIEmarksforthepracticalcourseis50Marks.

Thesplit-upofCIEmarksforrecord/journalandtestareintheratio60:40.

- Eachexperimenttobeevaluatedforconductionwithobservationsheetandrecordwrite-up.Rubricsfortheevaluationofthejournal/write-upforhardware/softwareexperimentsdesignedbythefacultywhoishandlingthelaboratorysessionandismadek nowntostudentsatthebeginningofthepracticalsession.
- Recordshouldcontainallthespecifiedexperimentsinthesyllabusandeachexperimentwrite-upwillbeevaluatedfor10marks.
- Totalmarksscoredbythestudentsarescaleddownedto30marks(60%ofmaximummarks).
- Weightagetobegivenforneatnessandsubmissionofrecord/write-upontime.
- Departmentshallconduct02testsfor100marks,thefirsttestshallbeconductedafterthe8thweekofthesemester andthesecondtestshallbeconductedafterthe14thweekofthesemester.
- Ineachtest,testwrite-up,conductionofexperiment,acceptableresult,andproceduralknowledgewillcarryaweightageof60%andthere st40%forviva-voce.
- Thesuitablerubricscanbedesignedtoevaluateeachstudent'sperformanceandlearningability.
- Theaverageof02testsisscaleddownto20marks(40%ofthemaximummarks).

TheSumofscaled-downmarksscoredinthereportwrite-up/journalandaveragemarksoftwotestsisthetotalCIEmarksscoredbythestudent.

SemesterEndEvaluation(SEE):

- SEEmarksforthepracticalcourseis50Marks.
- SEEshallbeconductedjointlybythetwoexaminersofthesameinstitute,examinersareappointedbythe

University.

- Alllaboratoryexperimentsaretobeincludedforpracticalexamination.
- (Rubrics)Breakupofmarksandtheinstructionsprintedonthecoverpageoftheanswerscripttobestrictlyadheredtobytheexaminers.ORbasedonthecourserequirementevaluationrubricsshallbedecidedjointlybyexaminers.
- Studentscanpickonequestion(experiment)fromthequestionslotpreparedbytheinternal/externalexaminersjointly.
- Evaluationoftestwrite-up/conductionprocedureandresult/vivawillbeconductedjointlybyexaminers.
- GeneralrubricssuggestedforSEEarementionedhere,writeup-20%,Conductionprocedureandresultin-60%,Viva-voce20%ofmaximummarks.SEEforpracticalshallbeevaluatedfor100marksandscoredmarksshallbescaleddownto50marks(however,basedoncoursetype,rubricsshallbedecidedbytheexaminers)
- Changeofexperimentisallowedonlyonceand10%Marksallottedtotheprocedureparttobemadezero.
- ThedurationofSEEis03hours

SuggestedLearningResources:

-

04082022/V3

ABILITY/SKILL ENHANCEMENT COURSE (OFFLINE/ONLINE)

PRODUCT ANALYSIS AND COST OPTIMIZATION

CourseCode	MMPD258A	CIEMarks	50
TeachingHours/Week(L:P:SDA)	1:0:0	SEEMarks	50
TotalHoursofPedagogy	16	TotalMarks	100
Credits	01	ExamHours	03

CourseLearningobjectives:

- Tounderstandthebasicknowledgeofaccounting,typesofaccountingandimportanceofaccounting.
- Tounderstandvariousfinancialratiosandtheirapplicationsindecisionmaking.
- Tolearnaboutvariouselementsandmethodsofcosting.
- Toprepareengineeringstudentstoanalyzecost/revenuedata.
- Tocarryoutormakeeconomicanalysesinthedecisionmakingprocess.
- Tojustifyorrejectalternatives/projectsonaneconomicbasis.

Module-1

Introduction:Newproducts,newproductstrategy-marketdefinitionIdeagenerationintroductiontothedesignprocess-forecastingsalespotential-productengineeringandmarkets-monopolycompetitive.ManufacturingPlanning:Selectionofoptimumprocess,standardization.Breakevenanalysis-applicationandareaofuse-problems-multi-productanalysis. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-2

ValueAnalysis:Stepsinselection,analysisandimplementation,Selectionofcuttingspeedforoptimumcost-problems.CostAccounting:Costestimation-difference-types-stepsinvolvedincostestimation 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-3

TypesofCost:CostCentres,Direct–indirect,materialcost-directindirectmaterialcostOverheadcost,Elements inoverheads:Preparationofcostsheet,machinehourrate,apportioningmethods 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-4

VarianceAnalysis–Labourvariance,MaterialvarianceandOverheadvariance,Activitybasedcosting-Introductiontotargetcosting. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5

CostCalculation:Costcalculationformachinedcomponents,welding,castingandforgedcomponentsillustrations-calculationofsalescost.

Cost Optimization Techniques: Analytical, Graphical and incremental methods Learning curves 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

1. ThreeUnitTestseachof**20Marks**
2. Twoassignmentseachof**20Marks**or**oneSkillDevelopmentActivityof40marks**toattaintheCOsandPOs

Thesumofthreetests,twoassignments/skillDevelopmentActivities,willbe**scaleddownto50marks**
CIEmethods/questionpaperisdesignedtoattainthedifferentlevelsofBloom'staxonomyaspertheoutcomedefinedforthecourse.

SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.
5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule6.

SuggestedLearningResources:

Books

- DesignandMarketingofNewProducts-GlenLUrban-JohnRHauser-PrenticeHall.NewJersey,1980.
- ProductionandCosting-NarangCBS&KumarV-KhannaPublishers-2001
- CostmanagementintheNewManufacturingAge-YasuhiroMonden,ProductivityPress-1992
- TechniqueforValueAnalysisAndEngineering-MilesLewrence.D-McGrawHill,Newyork-1972

WeblinksandVideoLectures(e-Resources):

- .VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- CaseStudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	AnalysetheSelectionofoptimumprocess,standardization.Breakevenanalysis	
CO2	UnderstandtheStepsinselection,analysisandimplementation,Costestimation.	
CO3	Understandthedifferenttypesofcost.	
CO4	UnderstandthedifferenttypesVarianceAnalysis.	
CO5	AnalysethevariousCostOptimizationTechniques.	

ProgramOutcomeofthiscourse

Sl.No.	Description	POs
PO1	Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworkto solvepracticalproblems.	
PO2	Anabilitytowriteandpresentasubstantialtechnicalreport/document.	
PO3	Studentsshouldbeabletodemonstrateadegreeofmasteryoverthareaasperthe specialization of the program. The mastery should be at a level higher than the requirementsintheappropriatebachelorprogram	
PO4	Understandcontemporaryissuesinmanufacturingengineeringanddeveloprelationship betweenproductdesignandmanufacturabilityto createsafe,reliable,andcost-effective products.	
PO5	Understandtheprocess of converting customerneeds intoengineeringspecifications to createproductdesignsthataresensitivetouserneedsandrobustagainstunanticipated usesand misuse	
PO6	Employadvancedprototypingmethodstoshortendesigncyclesandnarrowalternatives withoutrestrictinginnovation.	
PO7	Understandanddebatetherolesandresponsibilitiesofaproductdesigner/manufacturer on society.	

MappingofCOSandPos(indicativeonly)

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

Note:High-1,Medium–2,andLow–3

PO2	Anabilitytowriteandpresentasubstantialtechnicalreport/document.	
PO3	Studentsshouldbeabletodemonstrateadegreeofmasteryoverthareaasperthe specialization of the program. The mastery should be at a level higher than the requirementsintheappropriatebachelorprogram	
PO4	Understandcontemporaryissuesinmanufacturingengineeringanddeveloprelationship betweenproductdesignandmanufacturabilityto createsafe,reliable,andcost-effective products.	
PO5	Understandthe process of converting customerneeds intoengineeringspecifications to createproductdesignsthataresensitivetouserneedsandrobustagainstunanticipated usesand misuse	
PO6	Employadvancedprototypingmethodstoshortendesigncyclesandnarrowalternatives withoutrestrictinginnovation.	
PO7	Understanddebatetherolesandresponsibilitiesofaproductdesigner/manufacturer on society.	

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

ABILITY/SKILL ENHANCEMENT COURSE (OFFLINE/ONLINE)			
INDUSTRIAL ROBOTICS AND AUTOMATION			
CourseCode	MMPD258B	CIEMarks	50
TeachingHours/Week(L:P:SDA)	1:0:0	SEEMarks	50
TotalHoursofPedagogy	16	TotalMarks	100
Credits	01	ExamHours	03

CourseLearningobjectives:

- Thiscoursewillprovideexposureabouttherobotsandexpertsystemswhicharethetwomaincomponentsofanadvancedmanufacturingsystem.
- Thisexposurewillhelpthestudentinselection,designandsimulationofrobotsandexpertsystems.

Module-1	
IntroductionandRobotKinematicsDefinitionneedandscopeofIndustrialrobots– Robotanatomy– Workvolume– Precisionmovement– Endeffectors– Sensors.RobotKinematics– Directandinversekinematics– Robottrajectories– Controlofrobotmanipulators–Robotdynamics–Methodsfororientationandlocationof objects. 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation
Module-2	
RobotsensorsTransducersandSensors– Tactilesensor– Proximityandrangesensors– Sensingjointforces– Roboticvisionsystem– ImageRepresentation-ImageGrabbing–Imageprocessingandanalysis– EdgeEnhancement– ContrastStretching– BandRationing-Imagesegmentation– Patternrecognition– Trainingofvisionsystem. 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation
Module-3	
RobotdrivesandcontrolControllingtheRobotmotion– Positionandvelocitysensingdevices– Designofdrivesystems– HydraulicandPneumaticdrives– Linearandrotaryactuatorsandcontrolvalves– Electrohydraulicservovalves,electricdrives– Motors– Designingofendeffectors– Vacuum,magneticandairoperatedgrippers. RobotCellDesignandApplicationRobotworkcelldesignandcontrol–SafetyinRobotics. 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation
Module-4	
MethodsofRobotProgrammingRobotProgramming,ArtificialIntelligenceandExpertSystems-Characteristicsoftasklevellanguagesleadthroughprogrammingmethods– Motioninterpolation. 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation
Module-5	
ArtificialintelligenceArtificialintelligence–Basics–Goalsofartificialintelligence–AItechniques–problemrepresentationinAI–Problemreductionandsolutiontechniques-ApplicationofAIandKBESinRobots 08Hrs	
Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

1. ThreeUnitTestseachof**20Marks**
2. Twoassignmentseachof**20Marks**or**oneSkillDevelopmentActivityof40marks**toattaintheCOsandPOs

Thesumofthreetests,twoassignments/skillDevelopmentActivities,willbe**scaleddownto50marks**
CIEmethods/questionpaperisdesignedtoattainthedifferentlevelsofBloom'staxonomyaspertheoutcomedefinedforthecourse.

SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.
5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

- K.S.Fu,R.C.GonzalezandC.S.G.Lee,"RoboticsControl,Sensing,VisionandIntelligence",McGrawHill,1987.
- YoramKoren,"RoboticsforEngineers'",McGraw-Hill,1987.
- Kozyrey,Yu."IndustrialRobots",MIRPublishersMoscow,1985
- Richard.D,Klafter,Thomas,A,Chmielewski,MichaelNegin,"RoboticsEngineering–AnIntegratedApproach",Prentice-HallofIndiaPvt.Ltd.,1984.
- Deb,S.R."RoboticsTechnologyandFlexibleAutomation",TataMcGraw-Hill,1994.
- Mikell,P.Groover,MitchellWeis,Roger,N.Nagel,NicholasG.Odrey,"IndustrialRoboticsTechnology,ProgrammingandApplications",McGraw-Hill,Int.1986.
- TimothyJordanidesetal,"ExpertSystemsandRobotics",Springer–Verlag,NewYork,May1991.

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- CaseStudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	Explainabouttherobotsandexpertsystemswhicharethetwomaincomponentsofanadvancedmanufacturingsystem.	
CO2	Select,designandsimulaterobotsandexpertsystems.	

ProgramOutcomeofthiscourse

Sl.No.	Description	POs
PO1	Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworkto solvepracticalproblems.	
PO2	Anabilitytowriteandpresentasubstantialtechnicalreport/document.	
PO3	Studentsshouldbeabletodemonstrateadegreeofmasteryoverthareaasperthe specialization of the program. The mastery should be at a level higher than the requirementsintheappropriatebachelorprogram	
PO4	Understandcontemporaryissuesinmanufacturingengineeringanddeveloprelationship betweenproductdesignandmanufacturabilityto createsafe,reliable,andcost-effective products.	
PO5	Understandthe process of converting customerneeds intoengineeringspecifications to createproductdesignsthataresensitivetouserneedsandrobustagainstunanticipated usesand misuse	
PO6	Employadvancedprototypingmethodstoshortendesigncyclesandnarrowalternatives withoutrestrictinginnovation.	
PO7	Understandanddebatetherolesandresponsibilitiesofaproductdesigner/manufacturer on society.	

MappingofCOSandPos(indicativeonly)

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

Note:High-1,Medium–2,andLow–3

ABILITY/SKILL ENHANCEMENT COURSE (OFFLINE/ONLINE)			
PROJECT MANAGEMENT			
CourseCode	MMPD258C	CIEMarks	50
TeachingHours/Week(L:P:SDA)	1:0:0	SEEMarks	50
TotalHoursofPedagogy	16	TotalMarks	100
Credits	01	ExamHours	03

CourseLearningobjectives:

Studentsareable to

1. Understandtheprinciplesandcomponentsofproject management.
2. Appreciatetheintegrated approachtomanagingprojects.
3. Elaboratetheprocesses ofmanagingproject costandproject procurements.

Applythe projectmanagement tools andtechniques.

Module-1

Introduction: Project, Project management, relationships among portfolio management, program management,projectmanagement,andorganizationalprojectmanagement,relationshipbetween projectmanagement,operationsmanagementandorganizationalstrategy,businessvalue,role of the project manager, project management body of knowledge. 08Hrs

Teaching-LearningProcess	Chalkandtalkmethod/PowerPointPresentation

Module-2

Generation and Screening of Project Ideas: Generation of ideas, monitoring the environment, corporate appraisal, scouting for project ideas, preliminary screening, project rating index, sources of positive net present value. Project costing,

ProjectScope Management: Project scopemanagement, collect requirements define scope, create WBS, validate scope, control scope.

Organizational influences & Project life cycle: Organizational influences on projectmanagement, project state holders & governance, project team, project life cycle. 08Hrs

Teaching-LearningProcess	Chalkandtalkmethod/PowerPointPresentation

Module-3

Project Integration Management: Develop project charter, develop project management plan, direct & manage project work, monitor & control project work, perform integrated change control, close project or phase.

Project Quality management: Plan quality management, perform quality assurance, control quality. 08Hrs

Teaching-LearningProcess	Chalkandtalkmethod/PowerPointPresentation

Module-4

ProjectRiskManagement: Planriskmanagement,identifyrisks,performqualitativeriskanalysis, perform quantitative risk analysis, plan risk resources, control risk.

ProjectScheduling: Projectimplementationscheduling,Effectivetimemanagement,Different scheduling techniques, Resources allocation method, PLM concepts. Project life cycle costing. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5

Tools&TechniquesofProjectManagement: Bar(GANTT)chart,barchartforcombinedactivities, logicdiagramsandnetworks,Projectevaluationandreview Techniques(PERT) Planning,Computerizedproject management. 08Hrs	
Teaching-Learning gProcess	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

3. ThreeUnitTestseachof**20Marks**
4. Twoassignmentseachof**20Marks**or**oneSkillDevelopmentActivityof40marks**toattaintheCOsandPOs

Thesumofthreetests,twoassignments/skillDevelopmentActivities,willbe**scaleddownto50marks**
CIEmethods/questionpaperisdesignedtoattainthedifferentlevelsofBloom'staxonomyaspertheoutcomedefinedforthecourse.

SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.
5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

- ProjectManagementInstitute,"AGuidetotheProjectManagementBodyofKnowledge(PMBOK Guide)", 5th Edition, 2013, ISBN: 978-1-935589-67-9
- HaroldKerzner,"ProjectManagementASystemapproachtoPlanningScheduling&Controlling", John Wiley & Sons Inc., 11th Edition, 2013, ISBN 978-1-118-02227-6.
- PrasannaChandra, "Project PlanningAnalysis Selection FinancingImplementation&Review", Tata McGraw Hill Publication, 7th Edition, 2010, ISBN 0-07-007793-2.
- RoryBurke,"ProjectManagement–PlanningandControllingTechniques",JohnWiley& Sons, 4th Edition, 2004, ISBN: 9812-53-121-1

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- CaseStudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	Explaintheprocessofprojectmanagementanditsapplicationindelivering successfulprojects.	
CO2	Illustrateprojectmanagementprocessgroupsforvariousproject/functionalapplications.	

ProgramOutcomeofthiscourse

Sl.No.	Description	POs
PO1	Appraise various knowledge areas in the project management framework.	
PO2	Developprojectplansandapplytechniquestomonitor,reviewandevaluateprogressfor different types of projects.	
PO3	Explaintheprocessofprojectmanagementanditsapplicationindeliveringsuccessfulprojects.	
PO4	Illustrateprojectmanagementprocessgroupsforvariousproject/functionalapplications.	

MappingofCOSandPos(indicativeonly)

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

Note:High-1,Medium–2,andLow–3

Ability/Skill Enhancement Course (Offline/Online)			
RAPID PROTOTYPING			
CourseCode	MMPD258D	CIEMarks	50
TeachingHours/Week(L:P:SDA)	1:0:0	SEEMarks	50
TotalHoursofPedagogy	16	TotalMarks	100
Credits	01	ExamHours	03

CourseLearningobjectives:

- Describeproductdevelopment,conceptualdesignandclassifyrapidprototypingsystems;explainstereolithography processandapplications
- Applyingofmeasurementandscalingtechniqueforprototypemanufacturing.
- IdentifyTheprocessphotopolymers,photopolymerization,layeringtechnology,laserandlaserscanning

Module-1

Introduction:Needforthecompressioninproductdevelopment,historyofRPsystems,Surveyofapplications, GrowthofRPindustry,andclassificationofRPsystems.StereoLithographySystems:Principle,Processparameter,Process details,Datapreparation,datafilesandmachinedetails,Application 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-2

SelectiveLaserSinteringandFusionDepositionModelling:Typeofmachine,Principleofoperation,processparameters,DatapreparationforSLS,Applications,PrincipleofFusiondepositionmodelling,Processparameter, Pathgeneration,Applications. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-3

SolidGroundCuring:Principleofoperation,Machinedetails,Applications.LaminatedObjectManufacturing:Principleofoperation,LOMmaterials.Processdetails,application. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-4

RapidTooling:IndirectRapidtooling-Siliconerubbertooling–AluminumfilledepoxytoolingSpraymetaltooling, Castkirksite,3Qkeltool,DirectRapidToolingDirect.AIM,Quickcastprocess,Copperpolyamide,RapidTool,DMILS,Prometal,Sandcastingtooling,LaminatetoolingsoftToolingvs.hardtooling. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5

RPProcessOptimization:factorsinfluencingaccuracy.Datapreparationerrors,Partbuildingerrors,Errorinfinishing,influenceofbuildorientation. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

1. ThreeUnitTestseachof**20Marks**
2. Twoassignmentseachof**20Marks**or**oneSkillDevelopmentActivityof40marks**toattaintheCOsandPOs

Thesumofthreetests,twoassignments/skillDevelopmentActivities,willbe**scaleddownto50marks**
CIEmethods/questionpaperisdesignedtoattainthedifferentlevelsofBloom'staxonomyaspertheoutcomedefinedforthecourse.

SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.
5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

- StereolithographyandotherRP&MTechnologies-PaulF.Jacobs-SME,NY1996
- RapidManufacturing-FlhamD.T&DinjoyS.S-VerlogLondon2001.
- Rapidautomated-Lamentwood-InduspressNewYork(4)Wohler'sReport2000-TerryWohlers-Wohler'sAssociation-2000

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- Casestudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

Sl.No.	Description	BloomsLevel
CO1	Describeproductdevelopment,conceptualdesignandclassifyrapidprototypingsystems; explainstereolithographyprocessandapplications.	
CO2	Explaindirectmetallasersintering,LOMandfusiondepositionmodellingprocesses.	
CO3	Demonstratesolidgroundcuringprincipleandprocess.	
CO4	DiscussLENS,BPMprocesses;pointouttheapplicationofRPsysteminmedicalfielddefinevirtualprototypingandidentifysimulationcomponents.	
CO5	UnderstandtheRPProcessOptimizations.	

ProgramOutcomeofthiscourse

Sl.No.	Description	POs
PO1	Anabilitytoindependentlycarryoutresearch/investigationanddevelopmentworkto solvepracticalproblems.	

MappingofCOSandPos(indicativeonly)

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

Note:High-1,Medium–2,andLow–3

ROBUSTDESIGN

ELECTIVE GROUP 3)

CourseCode	MMPD214A	CIEMarks	50
TeachingHours/Week(L:P:SDA)	3:0:0	SEEMarks	50
TotalHoursofPedagogy	30	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- Tounderstandtheimportanceofdesignofexperiments
- Todescribehowtodesignexperiments,carrythemoutandanalysethe data they yield
- To investigate the logic of hypothesis testing including analysis of varianceanddetailedanalysisofexperimentaldata.Createdesignsthat have a minimal sensitivity to input variation
- Determinewhichdesignparametershavethelargestimpacton variation.
- Optimizedesignswithmultipleoutputs.

Module-1

1. **Robust Design :**Steps in robust design : parameter design and tolerance design, reliability improvement through experiments, illustration through numericalexamples, QualitybyExperimentalDesign,Quality,westernand Taguchi quality philosophy, Elements of cost, Noise factors causes of variation, Quadratic loss function and variation of quadratic loss functions. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-2

Experimental Design: Classical experiments: factorial experiments, terminology, factors. Levels, Interactions, Treatment combination, randomization, 2-level experimental design for two factors and threefactors. 3-level experiment deigns for two factors and three factors, factor effects, factor interactions, Fractional factorial design, Saturated design, Central composite designs, Illustration through numerical examples**.** 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-3

Measures of Variability: Why analyze variability, Measure of Variability Mean absolute deviation,Sum of square, Variance and Standard deviation. Numerical example on two level design to minimize variability.

Analysis and interpretation of experimental data: Measures of variability, Ranking method, column effect method and plotting method, Analysis of variance (ANOVA), in factorial experiments: YATE'salgorithm for ANOVA, Regression analysis, Mathematical models from experimental data, illustration through numerical examples.08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-4

Taguchi's Orthogonal Arrays : Types orthogonal arrays, Selection of standard orthogonal arrays, Linear graphs and interaction assignment, dummy level technique, Compound factor method, modification of linear graphs, Column merging method, Branching design, Strategies for constructing orthogonal arrays.

Signal to Noise ratio (S-N Ratios) : Evaluation of sensitivity to noise, Signal to noise ratios for static problems, Smaller the better types, Nominal the better type, larger the better type. Signal to noise ratios for dynamic problems, Illustrations through numerical examples.

08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5

ParameterDesignandToleranceDesign: Parameterandtolerancedesign concepts, Taguchi's inner and outer arrays, Parameter design strategy, Tolerance deign strategy, Illustrations through numerical examples**.**

Reliability Improvement Through Robust Design: Role of S-N ratios in reliabilityimprovement,Casestudy;illustratingthereliabilityimprovement of routing process of printed wiring boards using robust design concepts.

08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

3. ThreeUnitTestseachof**20Marks**
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SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.
5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

- QualityEngineeringusingRobustDesign-MadhavS.Phadake: Prentice Hall, Englewood Clifts, New Jersey 07632, 1989
- Designandanalysisofexperiments -DouglasMontgomery:Willey India Pvt. Ltd., V Ed., 2007.
- TechniquesforQualityEngineering -PhillipJ.Ross:Taguchi2nd edition. McGraw Hill Int. Ed., 1996.
- QualitybyExperimentalDesign -ThomasB.Barker:MarcelDekker Inc ASQC Quality Press, 1985
- Experimentsplanning,analysisandparameterdesignoptimization- C.F.JeffWu,MichaelHamada:JohnWilleyEd.,2002.
- ReliabilityimprovementbyExperiments -W.L.Condra,Marcel Dekker: Marcel Dekker Inc ASQC Quality Press, 1985

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- Casestudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

CO1. Describehowtodesigntheexperiments,carrythemoutand analyze the data they yield

CO2. Designanexperimentincludingfactorialandfractionalfactorial designs

CO3. Formulatetheproblemsincludingexperimentationinthesocialand economic sciences.

NON TRADITIONAL MACHINING PROCESS ELECTIVE GROUP 3)			
CourseCode	MMPD214B	CIEMarks	50
TeachingHours/Week(L:P:SDA)	3:0:0	SEEMarks	50
TotalHoursofPedagogy	30	TotalMarks	100
Credits	03	ExamHours	03

CourseLearningobjectives:

- Tounderstand and identifyofthe need for non-conventional machining processes.
- To understand and identifying the characteristics of non-conventional machining and basic mechanism of material removal in non- conventional machining.
- Tounderstand the theoretical knowledge and workingprinciple ofnon- conventional machining processes and applications and limitations of non-conventional machining processes.
- To provide the students with a proper understanding of non traditional machining processes.

Module-1

Introduction: Need for non-traditional machining processes. Processes selection c1assification on – comparative study of different processes. Mechanical Process, Ultrasonic Machining-Definition-Mechanism of metal elements of the process- Tool feed mechanism. Theories of mechanics of causing effect of parameter applications.
Abrasive Jet Machining: Principles - parameters of the process applications-advantages and advantages.
08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-2

Thermal Metal Removal Process: Electric discharge machining Principle of operation – mechanism of meta removal basic EDM circuitry-spark erosiongetAnalysisofrelaxationtypeofcircuitmaterialremovalrateinrelaxation circuits- critical resistance parameters in Ro Circuit-Die electric fluids- Electrodes for spare surface finish. Applications. 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-3

Electro Chemical and Chemical Processes: Electro chemical machining (ECM) Classification ECM process-principle of ECM Chemistry of the ECM parameters of the processes-determination of the metal removal rate - dynamics of ECM process-Hydrodynamics of ECM process-polarization. ToolDesign-advantagesand disadvantages - applications. Electro Chemical Grinding-Electro Chemical holding Electrochemical deburring.
Chemical Machining: Introduction-fundamental principle types ofchemical machining Maskants- Etchants-Advantages and disadvantages- applications.
08 HRS.

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-4

Plasma Arc Machining: Introduction-Plasma-Generation of Plasma and equipment Mechanism of metals removal, PAN parameters-process characteristics - type of torches applications. Electron Beam Machining (EBM),-Equipment for production of Electron beam - Theory of electron beam machining Thermal & Non thermal types characteristics -applications 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5

Laser Beam Machining (LBM): Introduction-principle of generation of lasers Equipment and Machining procedure-Types of Lasers-Process characteristics-advantages and limitations-applications, Ion Beam Machining, Introduction-Mechanism of metal removal and associated equipment-process characteristics applications.
High Velocity Forming Process: introduction - development of specific process selection-comparison of conventional and high velocity forming methods - Types of high velocity forming methods- explosion forming process-elector hydraulics forming magnetic pulse forming.
08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

ContinuousInternalEvaluation:

5. ThreeUnitTestseachof**20Marks**
6. Twoassignmentseachof**20Marks**or**oneSkillDevelopmentActivityof40marks**toattaintheCOsandPOs

Thesumofthreetests,twoassignments/skillDevelopmentActivities,willbe**scaleddownto50marks**
CIEmethods/questionpaperisdesignedtoattainthedifferentlevelsofBloom'staxonomyaspertheoutcomedefinedforthecourse.

SemesterEndExamination:

1. TheSEEquestionpaperwillbesetfor100marksandthemarksscoredwillbeproportionatelyreducedto50.
2. Thequestionpaperwillhavetenfullquestionscarryingequalmarks.
3. Eachfullquestionisfor20marks.Therewillbetwofullquestions(withamaximumoffoursub-questions)fromeachmodule.
4. Eachfullquestionwillhaveasub-questioncoveringallthetopicsunderamodule.
5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

1. ProductionTechnology-HMT -TataMcGrawHill-ISBN-10; 0070964432
2. ModernMachiningProcess-P.CPandey&H.S.Shan–TataMcGraw Hill - ISBN: 0070965536 – Publishing
3. NewTechnologyInstitutionofEngineers-Bhattacharya– India
4. MetalsHandBook-ASM-Vol-3.
5. HighVelocityFormingofMetals-F.MWilson-ASTMEPreticeHall.
6. ModernManufacturingMethod -Adithan-NewAgeInternational(p) Limited - ISBN:8122408176, 2007.
7. ModernMachiningProcesses-P.K.Mishra-NarosaPublishing House, New Delhi- 997.

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- Casestudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

CO1. Identify oftheneedfornon-conventionalmachiningprocessesinthe industry.
CO2. Understandtheworkingprincipleofnon-conventionalmachiningprocesses with limitations of non-conventional machining processes.
CO3. StudythedifferentnonconventionalmachiningMechanicalProcess with design parameters.
CO4. UnderstandthedifferentPAN,EBMandLBM,how they occur,and how to analyse & interpret machining-related problems.
CO5. Understand and appreciate the use of an Electro Discharge Machine asa non traditional method of machining complex and hard materials.

MATERIALSANDPROCESSESFOR DESIGN (ELECTIVE GROUP 3)						
CourseCode	**:**	**MMPD214C**		**CIE Marks**	**:**	**100**
Hours /Week	**:**	**L:T:P:S**	**3:0:0:0**	**SEE Marks**	**:**	**100**
Credit	**:**	**3**		**SEE Duration**	**:**	**3 Hours**

CourseLearning Objectives:

Studentshallbeable to

(1) Explainthepropertiesofdifferentmaterialsandmanufacturingprocess

(2) Applythe manufacturingprocess basedon material and product

(3) Distinguishbetweenthemanufacturingprocessesforpolymers,metalsand ceramics

(4) Evaluatethedesign considerationsbasedonmaterial& process

Unit-I — **10Hrs**

ThermoplasticPolymers&ItsManufacturingProcesses

Polyethylene, Polypropylene, Polystyrene, Polyester, Polyvinyl Chloride, Acrylic,Polyamides, Polycarbonates, Review of Properties, Extrusion process, injection moulding process, compression moulding and blow moulding process, Applications of thermoplastics

Unit-II — **10Hrs**

ThermosetPolymers&ManufacturingProcessesforComposites

Epoxyresins, Polyester Resins, Vinyl Esters Resin, High Temperature Resin systems (PMR-15), Handlayup,Vacuum Baggging,ThermalCuring, ResinTransferMouding, Auto-ClaveFilament winding and pultrusion Process

Micro&Macro MechanicalAnalysis

Rule of mixture- density, Poisson ratio, Lateral and Longitudinal Modulus, Ultimate Tensile Strength,ComplianceandStiffnessmatrixfor2Dlamina,andanglelamina,designconsiderationsforselectionofmaterialandprocess, numerical

Unit-III — **10Hrs**

DieCasting Processes

Die casting alloys, classification of castings, hot and cold chamber pressure die casting, investment casting, horizontal and vertical machines, feed system layout, Single and multicavity moulds, inspection of casting, defects in castings, numerical on mould design.

PowderMetallurgy Processes

Metallic powders – synthesis – ball milling, spray process, atomization, and characterization, preparation of green compact, pressureless and pressure-assisted sintering, finishing process, applications of PM, numerical on PM mould design,

Unit-IV — **10Hrs**

CeramicMaterials&Processing Technologies

Ceramic materials - Silicate & Non-silicate Ceramics, Alumina, Zirconia; Pressing, casting, extrusion of ceramics, role of additives, industrial, domestic and medical applications ofceramics

Unit-V — **9Hrs**

Materials& Processfor Design

Introduction,NatureoftheSelectionProcess,AnalysisoftheMaterialPerformance RequirementsandCreatingAlternativeSolutions,InitialMaterialScreeningofSolutions,ComparingandRankingAlternativeMaterials,DesignConsiderationsforCastComponents,MoldedPlastic Components,PowderMetallurgyParts,DetailDesignandSelectionofMaterials andProcesses.

Self study

The student will have to choose a topic ofhis/her interest within the scope of the course and pursue a studyin that domain. This will be for 20 marks which will be evaluated in TWO phases by a committee consisting of two faculty members including the course faculty. The student has to demonstrate his/her capability of understanding, analyzing and applying the knowledge to solve problems. The study could be a theoretical one involving simulation and analysis or could be an experimental one or even involve building a prototype system.

Course Outcomes:

CO1:Explainthepropertiesofdifferentmaterials ,compositesmanufacturingprocesses.

CO2;Select the manufacturing process based on material and product

CO3:Distinguishbetweenprocesses ofdesignforpolymers,metalsandceramics

CO4:Evaluatethedesignconsiderationsbasedonmaterial&process

ReferenceBooks

(1) AutarKaw,"MechanicsofCompositeMaterials",Taylor&Francis,ISBN8870-1-118- 02227-6.
(2) AKSinha,"PowderMetallurgy",2nd Edn,DhanpathRaiPublications,ISBN1-118-04527-6.
(3) DoEhlerHA,"DieCasting",McGrawHillPublications,ISBN1056-1-118-06.
(4) PhillippeBoch,"CeramicMaterials&Process",2010,WileyPublication,ISBN1-118-02425-8

SchemeofContinuousInternalEvaluation (CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The totalmarks for CIE (Theory) will be 100 marks.

SchemeofSemesterEndExamination(SEE) ThequestionpaperwillhaveFIVEquestions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks

Mappingof CourseOutcomes(CO)to ProgramOutcomes(PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1		M	M	H		H	L				
CO2	L		L				L		M		
CO3		M			M					L	
CO4	L	H	H	H		H	L		H		L

MappingofCourseOutcomes(CO)to ProgramSpecificOutcomes(PSO)

	PSO1	PSO2
CO1		M
CO2		L
CO3	M	
CO4	H	L

QUALITY BY DESIGN ELECTIVE GROUP 3)			
CourseCode	MMPD214D	CIEMarks	50
TeachingHours/Week(L:P:SDA)	3:0:0	SEEMarks	50
TotalHoursofPedagogy	30	TotalMarks	100
Credits	03	ExamHours	03

- **CourseLearningobjectives:**Thestudentstodevelopanunderstandingoftotalqualitymanagement principles, frameworks, tools and techniques for effective real life applications in both manufacturing and services.
- To gain how to determine the voice of the customer and the impact of qualityon economic performance and long-termbusiness success of an organization;
- Toapplyandevaluatebestpracticesfortheattainmentoftotalquality.

Module-1

BasicConcepts: QualityEngineeringandManagement:Statistical process control, SPC tools
Total Quality Management: perspective, methodologies and procedures; Roadmap to TQM, ISO 900008Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-2

KAIZEN,QualityModelsfororganizationalexcellence. **QualityCircles,**CostofQuality**,**SixSigmaConcepts,StepsandTools 08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-3

DMAIC-Define, Measure, Analyze, Improve and Control**-** Methodology of Six Sigma implementation
08 HRS.

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-4

DMADV-Define,Measure,Analyze,DesignandVerify-the methodology for creating high performance designs
08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

Module-5

QualityFunctionDeployment,ProcessevaluationandImprovementsby Design of Experiments**,** ANOVA
Value Engineering- Failure**-**Analysis (FMEA), TQM v/s Six Sigma –the Contrast
08Hrs

Teaching-Learning Process	Chalkandtalkmethod/PowerPointPresentation

AssessmentDetails(bothCIEandSEE)

TheweightageofContinuousInternalEvaluation(CIE)is50%andforSemesterEndExam(SEE)is50%.Theminimumpassingmarkforthe CIEis50%ofthemaximummarks.MinimumpassingmarksinSEEis40%ofthemaximummarksofSEE.Astudentshallbedeemedtohavesatisfiedtheacademicrequirementsandearnedthecreditsallottedtoeachsubject/courseifthestudentsecuresnotlessthan50%(50marksoutof100)inthesumtotaloftheCIE(ContinuousInternalEvaluation)andSEE(SemesterEndExamination)takentogether.

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5. Thestudentswillhavetoanswerfivefullquestions,selectingonefullquestionfromeachmodule

SuggestedLearningResources:

Books

1. AnIntroductiontoSixSigmaandProcessImprovement -Evans,J R and W M Lindsay (2005), CENGAGE.
2. TotalQuality:Management,OrganizationandStrategy-Evans,J R and W M Lindsay (2005)., 4th ed, CENGAGE.
3. TheSixSigmaHandbook-RevisedandExpanded-Pyzdek, Thomas (2005)., Quality America Incorporated.
4. DesignandAnalysisofExperiments -Montgomery,DC(2007), 5th ed., Wiley.
5. FundamentalsofQualityControlandImprovement -Mitra, Amitava(2005), Pearson.

WeblinksandVideoLectures(e-Resources):

- VTUe-ShikshanaProgram
- VTUEDUSATProgram

SkillDevelopmentActivitiesSuggested

- Quizzes
- Assignments
- Seminars
- Casestudy

Courseoutcome(CourseSkillSet)

Attheendofthecoursethestudentwillbeableto:

CO1. Developanunderstandingonqualitymanagementphilosophiesand frameworks

CO2. Developin-depthknowledgeonvarioustoolsandtechniquesofquality management

CO3. Learntheapplicationsofqualitytoolsandtechniquesinboth manufacturing and service industry.

CO4. Developanalyticalskillsforinvestigatingandanalyzingquality management issues in the industry and suggest implement able solutions to those.

DESIGNOFMOULDSANDDIES
(ElectiveGroup4)

CourseCode	**:**	**MMPD215A**		**CIE Marks**	**:**	100
Hrs/Week	**:**	**L:T:P:S**	**3:0:0:0**	**SEE Marks**	**:**	100
Credits	**:**	**3**		**SEE Duration**	**:**	**3Hrs**

CourseLearningObjectives(CLO)

Studentshould beable to

1. Understandthemechanicsoftheusualsolutions topartdemolding difficulties.
2. Identifythe dimensionsof themold,runner systemand clampingdevices.
3. Analysemodel ofamould showingtheparting surfaces andrespective2D drawings.
4. Evaluatetheeffect of mould onthe component.

Unit– I **9Hrs**

Mould Construction: Parting Surfaces: Straight, stepped, curved parting surface. Design of various Injectionmould elements,cores, cavities, andinserts,fittingcoreandcavityinserts,pillars and bushes.

FeedandEjectorSystem: Design ofoptimumGates,Runners, Impressions, Layout,Sprue,sprue pullers, mould shrinkage. Types of ejection, Ejector grids, ejection methods, Ejector Pin, Sleeve ejection, plate ejection, Blade ejection, Air ejection, Ejection from fixed half, Double ejection, Delayed ejection.

Unit– II **9Hrs**

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

PartingSurfaces: Straight,stepped,curvedpartingsurface.

Mouldswith ExternalunderCuts: Splitmoulds,Actuation ofsplits, Guidingof splits,sidecores

Unit– III **9Hrs**

Extrusion: General consideration during extrusion process like specific heat, latent heat, internal conductivity, shape & size of granular hygroscopic nature over temperature, effect of flowproperty 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

Unit– IV **10Hrs**

Lamination: Lamination by extrusion coating, twin screw extrusion, co-rotating & counter rotating, feeding mechanism in twin screw extruder, roll of side feeder & injection feeder, principles of compounding, mixing mechanism etc

Blow Moulding: Microprocessor / CNC controlled blow moulding machine, injection stretchblow moulding of PET, precut moulding, multi-layer blow moulding, Parission programming.

Unit– V **10Hrs**

Special Moulds: Form pins Moulds for threaded components: External threads, internal threads, Mouldswithloosecores,Automaticunscrewingtypeofmoulds,Underfeedmoulds,3Plate

moulds, hot runnermoulds (Runnerless moulds),Multi colormouldingtools, Defects in moulding and its remedies, Compression moulding tools, transfer moulding tools. Moulds with internalunder cuts, Moulds for threaded components, 3 Plate moulds, hot runner moulds, Multi-color moulding tools, Defects in moulding and its remedies, Compression moulding tools, transfer moulding tools

Course Outcomes:

Aftergoingthroughthiscoursethestudentwillbe able to:

CO1UnderstandthedifferentInjectionmoulding,Extrusion,Lamination,Blow moulding and Special moulding technique.
CO2:Analysetheplasticcomponents,andchallengesinselectionoffeedsystem,ejection, cooling and parting surface.
CO3:Applytheengineeringknowledgefortheselectionoftypeofmouldforplastic components.
CO4:Designandevaluatetheeffectsofmouldonthecomponent.

ReferenceBooks:

1. Pye.R,.G.W.NewYork,"InjectionMouldDesign",JohnWiley&Sons,ISBN: 20:04523668257
2. CharlesA.Harper, "Hand bookofPlasticProcesses",ISBN10:0495668257
3. Extrusion–Berln, ISBN:60:06668957
4. DallasB.Daniel,"ProgressiveDies",Springerpublication,2005.ISBN8:03953374987

Schemeof ContinuousInternalEvaluation (CIE)

CIEwillconsistofTWOTests,TWOQuizzesandONEassignment.Thetestwillbefor30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks

SchemeofSemesterEndExamination(SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marksfor SEE (Theory) will be 100 marks.

Mappingof CourseOutcomes(CO)to ProgramOutcomes(PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	L			H				M	M		
CO2										M	
CO3	M	M		H			M				L
CO4			M		H			L			

MappingofCourseOutcomes(CO)to ProgramSpecificOutcomes(PSO)

	PSO1	PSO2
CO1	M	
CO2		L
CO3	M	
CO4	H	

DESIGNOFMACHINE TOOLS (ElectiveGroup4)						
CourseCode	**:**	**MMPD215B**		**CIE Marks**	**:**	**100**
Hrs/Week	**:**	**L:T:P:S**	**3:0:0:0**	**SEE Marks**	**:**	**100**
Credits	**:**	**03**		**SEE Duration**	**:**	**3 Hrs.**

CourseLearningObjectives(CLO):

Studentshall beable to

1. Understandthe fundamentalsofMachineToolDesign
2. DemonstratetheprinciplesofMachine Tool Designconcepts
3. DeveloptheDesignIntricacies
4. SolvethedesignproblemsofMachine Tool
5. Applytheconceptsto designthe Machine Tool

Unit– I	**08 Hrs**

INTRODUCTION: Working and Auxiliary Motion, Parameters Defining Working Motion Of Machine Tool, Machining time problems, Machine Tool Drives, Hydraulic Transmission And Its Elements,Mechanical Transmission AndIts Elements, GeneralRequirements,Layout OfMachine
Tool,AimofSpeed andFeedRateRegulation

Unit– II	**10 Hrs**

REGULATIONOFSPPEDANDFEEDRATES: SteppedRegulationofSpeed,DesignofFeed Box, Machine Tool Drives Using Multiple Speed Motors, Special Cases of Gear Box Design, DeterminingTheNumberofTeethofGears,ClassificationofSpeedandFeedBoxes,Functions andRequirements

Unit– III	**10 Hrs**

DESIGN OF MACHINE TOOL STRUCTURES: Design Criteria, Materials, Static Stiffness,ProfileofMachineToolStructures,BasicDesignProcedure,DesignofBeds,DesignofColumns,
Design of Housing, Design of Bases and Tables, Design of Cross Rails, Arms, Saddles, Carriages and Rams.

Unit– IV	**10 Hrs**

DESIGNOF GUIDEWAYSANDPOWERSCREWS: FunctionandTypesGuideways,Design ofSlideways,DesignCriteriaandCalculationsSlideways,guidewaysoperatingunderliquid friction conditions, Design of Power Screws.

Unit– V	**10 Hrs**

DESIGNOFSPINDLESANDSPINDLESUPPORTS: FunctionsofSpindlesUnitand requirements, Materials of Spindles, Effect of Machine Tool Compliance on Machining accuracy, Design Calculation of Spindles, Anti-friction Bearings, Sliding Bearings.

Course Outcomes:

Aftergoingthroughthis coursethe student willbe able to:

CO1:Describethefundamentalsof Machine Tool Design

CO2:Analyzethemeritsanddemeritsofdifferentmachinetool designtechniques

CO3:Apply the numerical equations in designing the Machine Tool

CO4:Demonstratethe designingskill ofMachineTool

ReferenceBooks

1. NKMehta,"MachineToolDesignandNumericalControl",TataMcGrawHill,3rdEd, ISBN: 978-1-25-900457-5
2. N.AcherkanVPush,NicholasWeinstein,"MachineToolDesign"UniversityPress,2000, ISBN: 9780898750485
3. NicholasLisitsyn,AlexanderGavryusin,OlegTrifonov,AlexanderKudryashov,"Machine Tool Design" ,Ardent Media Inc. ISBN: 9780829014761
4. CMTI,"MachineToolDesignHandbook",TataMcGraw-Hill,2008,ISBN:978-0-07-451564-8

Schemeof ContinuousInternalEvaluation(CIE)

CIE will consist of TWO Tests, TWO Quizzes and ONE assignment. The test will be for 30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The totalmarks for CIE (Theory) will be 100 marks.

Schemeof SemesterEndExamination (SEE)

The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marksfor SEE (Theory) will be 100 marks.

MappingofCourseOutcomes(CO)to ProgramOutcomes(PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	L	H								
CO2	M	M	L	M							
CO3		L	M	H	M						
CO4			L	M	H						

MappingofCourseOutcomes(CO)to ProgramSpecificOutcomes(PSO)

	PSO1	PSO2
CO1	L	L
CO2	L	
CO3		M
CO4		H

DESIGNFOR QUALITY
(ElectiveGroup4)

CourseCode	**:**	**MMPD215C**		**CIE Marks:**	**:**	**100**
Hours /Week	**:**	**L:T:P:S**	**3:0:0:0**	**SEE Marks**	**:**	**100**
Credit	**:**	**3**		**SEE Duration**	**:**	**3Hours**

CourseLearning Objectives

Studentshould beable to

1. Defineasuitableprocessanalyticaltoolfora givenmanufacturing environment.
2. Identifythe tools forscientificprocess characterization
3. Applybasicrisk analysisand experimentdesigntechniquesintopractical cases
4. Evaluatethetoolsforrisk management and Designof Experiments

Unit– I **9Hrs**

DESIGNFUNDAMENTALS,METHODSANDMATERIAL SELECTION

Morphology of Design – The Design Process – Computer Aided Engineering – Concurrent Engineering–CompetitionBenchMarking–Creativity–Theory ofProblemsolving-Value Analysis - Design for Manufacture, Design for Assembly – Design for casting, Forging, MetalForming, Machining and Welding

Unit-II **9Hrs**

DESIGNFOR QUALITY

QualityFunctionDeployment -HouseofQuality-Objectivesand functions-Targets-Stakeholders- Measures and Matrices-design process-Identification of control factors, noise factors, and performancemetrics-developingtheexperimentalplan.Runningtheexperiments–Conducting theanalysis-Selectingandconformingfactor-Set points-reflectingandrepeating

Unit-III **10Hrs**

DESIGN OF EXPERIMENTS: Importance of Experiments, Experimental Strategies, Basic principles of Design, Terminology, ANOVA, Steps in Experimentation, Sample size, Single Factor experiments - Completely Randomized design, Randomized Block design, Statistical Analysis, Multifactor experiments - Two and three factor full Factorial experiments,Fractional factorialdesign,Taguchi'sapproach-Stepsinexperimentation,DesignusingOrthogonal Arrays,DataAnalysis,RobustDesign-ControlandNoisefactors,S/Nratios

Unit-IV **10Hrs**

FAILUREMODEEFFECTANALYSISAND DESIGNFORSIXSIGMA::DesignFailure Mode&Effect Analysis,Process Failure Mode & EffectAnalysis,ProductReliabilityAnalysis, Processcapabilityanalysis,Measurementsystemanalysis.BasisofSixsigma–Projectselection forSixsigma,sixsigma problemsolving-sixsigmainserviceandsmall organization.

Unit-V **10Hrs**

STATISTICAL CONSIDERATION AND RELIABILITY Frequency distributions and Histograms- Run charts –stem and leaf plots- Pareto diagrams-Cause and Effect diagrams-Box plots- Probability distribution-Statistical Process control–Scatter diagrams – Multivariable charts –Matrix plots and 3-D plots.-Reliability-Survival and Failure-Series and parallel systems-Mean time between failure-Weibull distribution

Course Outcomes:

CO1.Describesuitableprocessanalysistoolsforagivenmanufacturing environment

CO2.Analyseandimplement,fromqualitypointofview,thebasicdesignofexperiments approach

CO3.Comparethecritical qualityattributesandcriticalprocess parameters

CO4.DevelopQualitybydesignprinciplesasacost-efficientapproachtodeliveringhigh quality products and services.

ReferenceBooks

1. Dieter,GeorgeE,"EngineeringDesign-AMaterialsandProcessingApproach", McGraw Hill International Editions, Singapore, ,ISBN : 1:0337-32-0033
2. kevinotto&kristinwood,"ProductDesignTechniquesinReverseEngineeringand New Product Development" , Pearson Education (LPE),ISBN : 56:0257-02-4501
3. JamesR.Evens,WilliamM,"TheManagementandcontrolofQuality",6thedition-Lindsay Publications,ISBN : 670:0257-02-0225
4. GlenLUrban,JohnRHauser,"DesignandMarketingofNewProducts",PrenticeHall. New Jersey, 1980,ISBN : 40:0257-02-0001

SchemeofContinuousInternalEvaluation (CIE)

CIEwillconsistofTWOTests,TWOQuizzesandONEassignment.Thetestwillbefor30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks

SchemeofSemesterEndExamination(SEE)

ThequestionpaperwillhaveFIVEquestionswithinternalchoicefromeachunit.Eachquestion will carry 20 marks. Student will have to answer one question from each unit. The total marks for SEE (Theory) will be 100 marks

Mappingof CourseOutcomes(CO)to ProgramOutcomes(PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	H	M					L				
CO2	M	M		L	L					L	
CO3	L		L	M	L					L	L
CO4	L	M				L		L	L		L

MappingofCourseOutcomes(CO)to ProgramSpecificOutcomes(PSO)

	PSO1	PSO2
CO1	H	
CO2		M
CO3	M	M
CO4	L	

OPTIMIZATIONTECHNIQUES
(ElectiveGroup4)

CourseCode	**:**	**MMPD215D**		**CIE Marks**	**:**	**100**
Hours /Week	**:**	**L:T:P:S**	**3:0:0:0**	**SEE Marks**	**:**	**100**
Credit	**:**	**3**		**SEE Duration**	**:**	**3 Hours**

CourseLearningObjectives (CLO) Studentshallbeable to 1. Understandthetools usedinoptimization technique 2. Analyseoptimizationalgorithms,thetheoretical principlesthatunderpinthem. 3. Applyspecific methodstosolveoperations related problems 4. Develop modelling skills necessary to describe and formulate optimization problems and their use for solving several types of practicallyrelevant optimization problems arising in process systems engineering	
Unit-I	**10Hrs**
ClassicalOptimizationTechniques:Introduction,Reviewofsingleandmultivariable optimizationmethodswithandwithoutconstraints,linearone-dimensionalminimization problems,Examples	
Unit-II	**10Hrs**
Nonlinearprogramming:Convexsetsandconvexfunctions,Kuhn-Tuckerconditions.Convex quadraticprogramming: Wolfe'sandPivotcomplementaryalgorithms.Separableprogramming	
Unit-III	**10Hrs**
Geometric Programming: Introduction, Unconstrained minimization problems, solution of unconstrained problem from arithmetic-geometric inequality point of view, Constrained minimizationproblems,Generalizedpolynomialoptimization,Applicationsofgeometric problems,Introductiontostochastic optimization	
Unit-IV	**10Hrs**
InventoryModels: Introductiontoinventorycontrol,componentinventory,dependentandinde ndentdemand,inventoryclassification,deterministicinventorymodel,EOQmodelswith quantitydiscount.	
Unit-V	**8Hrs**
Replacement & Maintenance Models: Replacement of items, subject to deterioration of items subjecttorandomfailuregroupvs.individualreplacementpolicies.Masterscheduling-objectivesand methods	

Course Outcomes:
after goingthroughthis coursethestudent willbe able to:
CO1.DescribedifferenttypesoftestofHypotheses CO2.
Analysevarious optimization techniques
CO3.ApplyvariousmultivariableoptimizationproblemsarisinginprocesssystemsengineeringCO4. Evaluatethe optionsof a particular method to achieve required operational goal.

ReferenceBooks

1) HillerandLiberman,"IntroductiontoOperationsResearch",McGrawHill8thEdn. 2008, ISBN: 9780070600928
(2) Taha.H.A,"IntroductiontoOperationsResearch",McMillan7thEdn,2006,ISBN: 8177585835
(3) JosephGMonks,"OperationsManagement–Theory&Problems",McGrawHill,3rdEdn 1987, ISBN:0070427275
(4) RamamurthyP,"ProductionandOperationsManagement",2ndEdn,NewAge International, 2006, ISBN:812241558

SchemeofContinuousInternalEvaluation (CIE)
CIEwillconsistofTWOTests,TWOQuizzesandONEassignment.Thetestwillbefor30 marks each and the quiz for 10 marks each. The assignment will be for 20 marks. The total marks for CIE (Theory) will be 100 marks.

SchemeofSemesterEndExamination(SEE)
The question paper will have FIVE questions with internal choice from each unit. Each question will carry 20 marks. Student will have to answer one question from each unit. The total marksfor SEE (Theory) will be 100 marks.

Mappingof CourseOutcomes(CO)to ProgramOutcomes(PO)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	M	H			L					L	L
CO2	M	H	L	L							
CO3						L	L				
CO4								M	L	M	

MappingofCourseOutcomes(CO)to ProgramSpecificOutcomes(PSO)

	PSO1	PSO2
CO1		M
CO2		L
CO3	M	
CO4	H	L