Course Type	CourseCode	Nameof the Course	L	T	P	Credits
DC	NMEC525	**Additive Manufacturing**	3	1	0	4

Course Objective
Toprovidedetailedunderstandingofadditivemanufacturingprocesses.Theprospectoffutureresearchwillalso be discussed inthe coursewhich willencourage the PG students tocarryoutresearch in the advancearea.

Learning Outcomes
Upon successful completion ofthis course,studentswill: • Broadunderstandingof AdditiveManufacturing processesusing different technologies. • StudentswillbeabletothinkaboutthepossibilityofcombiningdifferentprocesstodevelopmoreefficientAMprocess. • It willhelp thestudents to select the best process among various alternative.

Unit No	Topics to be Covered	Lecture Hours + Tutorial Houirs	Learning Outcome
1	Introduction, ASTM classification, and development of Additive Manufacturing, Applicationsofadditivemanufacturinginrapidprototyping, rapid manufacturing, rapid tooling, repairingand coating. Generalized AM Process Chain,	6 + 2	Understanding the evolution and need ofAM processes. It will develop the ability of select the process for particular application.
2	VAT Photopoymerization Process (VPP): Introduction,VPP materials, Photopolymerization process modelling, Vector scan VPP machines, Scan Patterns, Mask Projection VPP processes, 2-p VPP, Process Benefits and drawbacks, Numericals	6 + 2	Understanding the basic principle of curingtype AM process. The students will learn the pros & consoftheseprocessesandtheir applications.
3	Powder Bed Fusion (PBF): Introduction, Materials, Powder Fusion Mechanisms, Metal and ceramic part fabrication, process parameters and analysis, Powder handling, PBF process varients, Process Benefits and drawbacks, Numericals Directed Energy Deposition (DED): Introduction, Process description, Material Delivery, different DED systems, process parameters, Process-structure-properties relationship Process Benefits and drawbacks, Numericals	10 + 2	Understandingofthermalbasedam processes The students will learn the importance of controlled high energy sourcetomanufacturethecomplexprofilecomponents.
4	Material Extrusion Process (MX): Introduction, Basic principle, Plot and path control, Materials, Different machine configurations, BioExtrusion, Process Benefits and drawbacks, Numericals.	4 + 2	Understanding the basic principle of extrusion based AM process. The students will learn the basic path control during FFF.

5	Material Jetting: Introduction, materials for material jetting, material process fundamentals, cold spray, process modelling, process parameters, Process Benefits and drawbacks, Numericals. Binder Jetting: Introduction, Materials, Process variations, BJT machines, Process Benefits and drawbacks,	6 + 2	Understanding the basic principle of jetting based AM process. The students will lcarn thc basic rprinciple of both material and binder jetting process.
6	Sheet Lamination Process: Introduction, Materials, Material Processing fubdamentals, Ultrasonic AM, Friction Stir AM, Process Benefits and drawbacks, Numericals	4 + 2	Understanding the basic principle of solidlaminatedbased AM process. The students will learn the varient of process based on material type.
7	Pre-Processing in Additive Manufacturing: Prcparation of3D-CADmodel,ReverseengineeringandReconstruction of 3D-CAD model, Part orientation andsupportgeneration, different file formats, problems with STL files, STLerrordiagnostics,Slicingand Generationof codesfortoolpath,. Post-ProcessinginAdditiveManufacturing:Supportmaterialremoval,improvementofsurfacetexture,accuracy and aesthetic; property enhancements.	6 + 2	The students willlearn aboutthe pre and postprocessing requirements of different AM processes.
	TOTAL	**42 + 14T**	

Textbooks:

1.Gibson, I, Rosen, D W., and Stucker, B., Additive Manufacturing Methodologies: Rapid Prototyping to Direct DigitalManufacturing, Springer, 2015

2. RafiqNoorani,RapidPrototypingPrinciples andApplications,WileyJohnWiley&Sons Inc.

Reference books:

1.Chee Kai Chua, Kah Fai Leong, 3D Printing and Additive Manufacturing: Principles and Applications:Fourth EditionofRapid Prototyping,World Scientific Publishers,2014

2.ChuaC.K.,LeongK.F.,andLimC.S.,"Rapidprototyping:Principlesandapplications",ThirdEdition, World Scientific Publishers, 2010

3.GebhardtA.,"Rapidprototyping",HanserGardenerPublications,2003

4.LiouL.W. andLiouF.W., "RapidPrototypingandEngineeringApplications:Atoolboxforprototype development", CRC Press, 2007