	National Institute of Technology Meghalaya An Institute of National Importance	CURRICULUM

Programme	**Master of Technology in Mechanical Engineering**	Year of Regulation	**2018**
Department	**Mechanical Engineering**	Semester	**II**

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
ME 502	**Convective Heat Transfer and Mass Transfer**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	To introduce the concept of convective heat transfer	Course Outcomes	CO1	Illustrate the mechanisms of modes of heat and mass transfer.
	To teach the mechanisms of convective heat transfer under various conditions		CO2	Analyze problems involving heat convection in one external and internal flows
	To develop an ability and skill to design a thermal system		CO3	Analyze and evaluate thermally developing and developed flow
	To develop an ability to analyse various industrial thermal system		CO4	Analyze system involving free convection
			CO5	Understand the concept of boiling and condensation

SYLLABUS

No.	Content	Hours	COs
I	**Introduction to Convection** Derivation of governing equations of momentum, energy and species transport, Order of magnitude analysis, Reynolds analogy.	**03**	**CO1**
II	**Convective Heat Transfer in External and Internal Flows** Derivation of hydrodynamic and thermal boundary layer equations, Similarity solution techniques, Momentum and energy integral methods and their applications in flow over flat plates with low and high Prandtl number approximations. Introduction to turbulence, Reynolds averaging, Eddy viscosity and eddy thermal diffusivity. Concept of developing and fully developed flows.	**10**	**CO2**
III	**Thermally Developing Flows** Graetz problem, Concept of thermally fully developed flow and its consequences under constant wall flux and constant wall temperature conditions, Steady forced convection in Hagen Poiseuille flow, Plane Poiseuille flow, and Couette flow and analytical evaluation of Nusselt numbers in limiting cases.	**08**	**CO3**
IV	**Free Convection** Free convection boundary layer equations: order of magnitude analysis, similarity and series solutions, Concept of thermal stability and Rayleigh Benard convection.	**05**	**CO4**
V	**Concept of Boiling Heat Transfer and Regimes in Pool Boiling Condensation** Nusselt film condensation theory, drop wise condensation and condensation inside tubes, effects of non-condensable	**10**	**CO5**
	Total Hours	**36**	

Text Books and References

16. L. C Burmeister,"Convective Heat Transfer", John Wiley and Sons
17. F. P. Incropera and D. P. Dewitt, "Fundamentals of Heat and Mass Transfer", John Wiley and Sons
18. Y. Cengel& A. Ghajar, "Heat and Mass Transfer", McGraw Hill (India) Pvt. Ltd

Supplementary Readings

1. A. Bejan,"Convective Heat Transfer", John Wiley and Sons
2. W.M. Kays& E.M. Crawford, "Convective Heat and Mass Transfer", McGraw Hill
3. R.L. Panton, "Incompressible Flow", Wiley