	National Institute of Technology Meghalaya1 An Institute of National Importance	CURRICULUM

Programme	Bachelor of Technology in Mechanical Engineering	Year of Regulation	2018
Department	Mechanical Engineering	Semester	IV

Course Code	Course Name	Credit Structure				Marks Distribution			
		L	T	P	C	INT	MID	END	Total
ME 204	**Engineering Materials**	**3**	**0**	**0**	**3**	**50**	**50**	**100**	**200**

Course Objectives	Familiarisation with the basic understanding of Engineering Materials.	Course Outcomes	CO1	Compare between the behaviours of different types of engineering materials. (Understanding)
			CO2	Analyse the crystal structure of different class of engineering materials. (Analysing)
	Elaborates the atomic structures, crystal theory & imperfections, deformation & strengthening of materials, phase diagrams, heat treatment & transformation of ferrous alloys. Application and processing of metal alloys and non-ferrous metal.		CO3	Analyse the phase diagram for different types of alloying systems. (Analysing)
			CO4	Apply the concept of heat treatment process to improve the properties of engineering materials. (Applying)
			CO5	Select the suitable application areas of different class of engineering materials. (Applying)

No.	COs	Mapping with Program Outcomes (POs)												Mapping with PSOs	
		PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
1	CO1	3	0	0	0	0	0	0	0	0	0	0	0	3	0
2	CO2	3	0	0	0	0	0	0	0	0	0	0	0	3	0
3	CO3	0	2	0	0	0	0	0	0	0	0	0	0	3	0
4	CO4	0	0	0	0	3	0	0	0	0	0	0	0	3	0
5	CO5	2	0	0	0	0	0	0	0	0	0	0	0	3	0

SYLLABUS

No.	Content	Hours	COs
I	**Atomic structure and interatomic bonding:** Fundamental concepts, electrons in atoms, periodic table, bonding forces and energies, primary interatomic bonds, secondary bonding or Van der Waals Bonding.	**04**	**CO1 CO2**
II	**Structure of crystalline solids:** Metallic crystal structures, polymorphism and allotropy, crystal systems, point coordinates, crystallographic directions, crystallographic planes, linear and planar densities, close-packed crystal structures, single crystals, polycrystalline materials, X-ray diffraction: determination of crystal structures, noncrystalline solids.	**07**	**CO2**
III	**Imperfections in solids:** Vacancies and self-interstitials, impurities in solids, dislocations–linear Defects, interfacial defects, bulk or volume defects.	**07**	**CO1 CO2**
IV	**Dislocations and strengthening mechanisms:** Characteristics of dislocations slip systems, plastic deformation of polycrystalline materials, deformation by twinning, strengthening by grain size reduction, solid-solution strengthening, strain hardening, mechanical working, recrystallization, grain growth.	**06**	**CO1 CO3**
V	**Phase diagrams and phase transformation:** Phases, microstructure, phase equilibrium, one-component (or unary) phase diagrams, binary eutectic systems, ternary phase diagrams, Gibbs phase rule, iron carbon equilibrium phase diagrams, TTT and CCT diagrams, pearlitic, martensitic and bainitic transformations.	**07**	**CO3 CO4**
VI	**Applications and processing of metal alloys, ceramics, polymer and composites:** Properties and applications of ferrous alloy, tool steels, stainless steels, cast irons, copper base alloys, aluminum base alloys, nickel base alloys, ceramics, polymers and composites.	**05**	**CO4 CO5**
	Total Hours	**36**	

Essential Readings

1. G.E. Dieter, “Mechanical Metallurgy”, McGraw Hill, 3rd Edition, 1986.
2. W. D. Callister, “Material Science and Engineering and Introduction”, Wiley, 5th Edition, 1999.

Supplementary Readings

1. S.R. Askland, P.P. Phule and W.J. Wright, The Science And Engineering of Materials, CL Engineering; 6th Edition, 2010.
2. V. Singh, Physical Metallurgy,Standard Publishers Distributors, 2010.
3. W.F. Smith, Principles of Materials Science & Engineering, McGraw Hill, 2nd Edition, 1990.
4. T.V. Rajan, C.P. Sharma and A. Sharma, Heat Treatments: Principles and Techniques, Prentice Hall, 2nd Edition, 2012.