



RAMA UNIVERSITY UTTAR PRADESH, KANPUR

(vide U.P. Act No. 1 of 2014 as passed by State Legislature and recognized by UGC U/s 2(f))



MEOE 001 INTRODUCTION TO MATERIAL SCIENCE

L T P Credit
3 0 0 3

Course Outcomes: At the end of the course, the student will be able to:

MEOE-001.1	UNDERSTAND [III] Understanding of the correlation between the internal structure of materials
MEOE-001.2	UNDERSTAND[III] Various methods to quantify their mechanical integrity and failure criteria
MEOE-001.3	DISCUSS [III] To provide a detailed interpretation of equilibrium phase diagrams
MEOE-001.4	APPLY [III] Learning about different phases
MEOE-001.5	UNDERSTAND [III] Heat treatment methods to tailor the properties of Fe- C alloys

Mapping of course outcomes with program outcomes

CO	PO1: Engineering knowledge	PO2 Problem analysis	PO3:Design/development of solutions	PO4:Conduct investigations of complex problems	PO5:Modern tool usage	PO6: The engineer and society	PO7:Environment and sustainability	PO8:Ethics	PO9:Individual and team work	PO10:Communication	PO11:Project management and finance	PO12:Life-long learning
MEOE-001.1	1	-	2	1	-	1	-	-	-	1	1	1
MEOE-001.2	2	3	3	2	2	1	-	-	-	1	1	1
MEOE-001.3	2	3	3	2	3	2	1	1	-	1	1	2
MEOE-001.4	3	2	2	3	3	2	-	-	-	1	2	2
MEOE-001.5	3	3	3	3	3	2	2	2	-	1	3	2

UNIT 1 Crystal Structure

- 1.1 Metallic crystal structures
- 1.2 Imperfection in solids
- 1.3 Point, line, interfacial and volume defects
- 1.4 Dislocation strengthening mechanisms
- 1.5 Critically resolved shear stress
- 1.6 Mechanical Property measurement

UNIT 2 Static failure theories

- 2.1 Ductile and brittle failure mechanisms
- 2.2 Fracture with fatigue
- 2.3 Introduction to non-destructive testing (NDT)

UNIT 3 Alloys, substitution and interstitial solid solution

- 3.1 Phase diagrams
- 3.2 Eutectic, peritectic, peritectoid and monotectic reactions
- 3.3 Iron Iron-carbide phase diagram



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- 3.4 Austenite, ferrite and cementite, cast iron
- 3.5 Microstructure development

UNIT 4 Heat treatment of Steel

- 4.1 Annealing, tempering, normalizing and spheroidising
- 4.2 Iso- thermal transformation diagrams for Fe-C alloys
- 4.3 Continuous cooling curves

UNIT 5 Alloying of steel

- 5.1 Properties of stainless steel & tool steels
- 5.2 Cast irons- grey, white, malleable and spheroidal cast irons
- 5.3 copper and copper alloys
- 5.4 Aluminum and Al-Cu – Mg alloys
- 5.5 Nickel based super alloys and Titanium alloys

Books and References:

1. W. D. Callister, 2006, “Materials Science and Engineering-An Introduction”, 6th Edition, Wiley India.
2. Kenneth G. Budinski and Michael K. Budinski, “Engineering Materials”, Prentice Hall of India Private Limited, 4th Indian Reprint, 2002.
3. V. Raghavan, “Material Science and Engineering”, Prentice Hall of India Private Limited, 1999.
4. Mechanics of materials by James M.Gere.
5. Introduction to engineering materials by B.K. Agarwal.
6. Physical metallurgy and advanced materials by R.E. Smallman.
7. Engineering mechanics of composite materials by Isaac M. Daniel.
8. U. C. Jindal, “Engineering Materials and Metallurgy”, Pearson, 2011.