DEPARTMENT OF MECHANICAL ENGINEERING

NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Course Title	**ENGINEERING MATERIALS**		
Course Code	**MEPC20**	No. of Credits	**4**
Course Code of Pre-requisite subject(s)	**NIL**		
Session	**Jan 2018**	Section (if, applicable)	**A (IV Semester)**
Name of Faculty	**Dr. U.S.HAKEEM NIYAS**	Department	**MECHANICAL ENGINEERING**
Email	**hakeem@nitt.edu**	Telephone No.	**9976677804**
Name of Course Coordinator(s) (if, applicable)	–		
Course Type	☑ **Core course** ☐ **Elective course**		

Syllabus (approved in BoS)

Atomic arrangement and Phase diagrams – Structure of metals and alloys: Phase diagram: phase rules.

Phase diagrams and Ferrous alloys, Fe-FeC diagram, Critical temperature – Plain carbon steel and other steels.

Heat Treatment of steel, CCT diagrams, austempering, martempering, ausforming. Surface hardening process – nonferrous alloys.

Testing of Materials I - Properties evaluated by tensile testing procedure, Engineering stress strain curve vs. true stress-strain curve, stress strain curve for typical materials. Hardness testing.

Testing of Materials II - Impact testing, Fracture toughness. Fatigue testing: Creep testing.

COURSE OBJECTIVES

1. To impart knowledge on the atomic arrangement and structure of metals and alloys.
2. To acquire sound knowledge on phase diagram and heat treatment of materials.
3. To understand the various material testing methods.

COURSE OUTCOMES (CO)	
Course Outcomes	**Aligned Programme Outcomes (PO)**
Upon completing this course, students will be able to:	
1. Know the basics of atoms, plane indices and mechanical properties of engineering materials.	**1,2,3,5**
2. Understand the properties of materials and able to suggest suitable material for given application.	**1,2,4,5,6,7**
3. Identify the suitable heat treatment process for achieving the desired properties of material.	**1,2,4,5,6**
4. Develop the basic knowledge on metallography specimen preparations for identifying the microstructure of material.	**2,3,4,5,6,10**

COURSE PLAN – PART II

COURSE OVERVIEW

The purpose of this course is to introduce the students to the field of material science through exposition of its disciplines, engineering materials, failure mechanisms, material behaviours, heat treatment process and corrosion properties. By the lectures, students will get comprehensive knowledge about principles and methods involved in material engineering field.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Weeks	Topic	Mode of Delivery
1	1 – 3	**Atomic and molecular structure of materials:** Bonding between atoms – primary, secondary, interatomic forces. **Packing of atoms in solids:** Crystallography, Plane indices, Direction indices, other important crystal structures. **Imperfections in materials:** vacancies, impurities, defects. **Diffusion:** diffusion mechanism, steady state and non-steady state diffusions, factors affecting diffusion.	Lecture C & T PPT
2	4 – 6	**Mechanical properties of materials:** Young's modulus, Moduli of crystals, yield strength, tensile strength and ductility, linear and non-linear elasticity, Inelastic behavior, Load extension curves for non-elastic (plastic) behavior, True stress – strain curves for plastic flow – Plastic work, Tensile testing, hardness test.	
3	7 – 9	**Dislocations:** Strength of a perfect crystal, dislocation in crystal, force acting on a dislocation, other properties of dislocation. **Strengthening mechanisms:** Solid solution strengthening, precipitate and dispersion strengthening, work hardening, dislocation yield strength.	

4	10	**Failure of engineering materials:** ductile fracture, brittle fracture, principles of fracture mechanics, Cyclic stresses, Fatigue failure, Creep behaviour.	Lecture C & T PPT
5	11 – 12	**Phase diagram and Phase transformation:** Fe-FeC equilibrium diagram, TTT diagram, cooling curves. Heat treatment and types of heat treatment.	
6	13	**Characteristics, applications and processing of other materials:** ceramics, polymers and composites. **Other properties:** Corrosion and thermal properties	

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test 1	6th Week	60 min	20
2	Cycle Test 2	11th Week	60 min	20
3	In Class Quizzes (using Kahoot application)	2 Surprise Quizzes	30 min	10
CPA	Compensation Assessment*	13th Week	60 min	Corresponding Weightage
4	Final Assessment *	14th Week	180 min	50

*mandatory; refer to guidelines on page 6

ESSENTIAL READINGS: Textbooks, reference books.

Text Books

1. Smith, W.F., Hashemi, J. and Prakash, R., Materials Science and Engineering, 5th Edition, McGraw-Hill Education, 2014.
2. Callister Jr, W.D., Rethwisch, D.G. and Balasubramaniam, R., Callister's Materials Science and Engineering, 2nd Edition, Wiley, 2014.

Reference Books

1. Avner, S.H., Introduction to Physical Metallurgy, 2nd Edition, Tata McGraw-Hill, 1997.
2. Dieter, G.E., Mechanical Metallurgy, 3rd Edition, McGraw-Hill, 2013.
3. Clark, D.S. and Varney, W.E., Physical Metallurgy for Engineers, CBS Publishers and Distributors, 2004.
4. Ashby, M.F., Jones, D.R.H, Engineering Materials 1: An introduction to their properties and applications, 4th Edition, Butterworth Heinemann, 2012.
5. Murthy, V.S.R., Jena, A.K., Gupta, K.P. and Murty, G.S., Structure and Properties of Engineering Materials, Tata McGraw-Hill, 2003.
6. Suriyanarayana, A.V.K, Testing of metallic materials, BS Publications, 2007.

COURSE EXIT SURVEY (mention the ways in which the feedback about the course shall be assessed)

- Feedback from the students during class committee meetings.
- Feedback on the achievement of Course Outcomes during the end of the course.

COURSE POLICY (preferred mode of correspondence with students, policy on attendance, compensation assessment, academic honesty, and plagiarism)

MODE OF CORRESPONDENCE

All the communication (schedule of assessment / course material /any other information regarding this course) will be intimated through the class representative.

ATTENDANCE

1. Attendance will be taken by the faculty in all the contact hours.
2. Every student should maintain minimum of 75 % physical attendance in these contact hours along with assessment criteria to attend the end semester examination.
3. Any student, who fails to maintain 75 % attendance are not eligible for attending the end semester examination and have to RE DO the course.

ASSESSMENT

1. Attending all the assessments are MANDATORY for every student.
2. If any student is not able to attend any of the Assessments due to genuine reason and prior intimation to the faculty, student is permitted to attend the compensation assessment (CPA) with the corresponding weightage.
3. The passing minimum shall be the $\left[\frac{\text{Class Mean}}{2}\right]$ or $\left[\frac{\text{Class Maximum}}{3}\right]$, whichever is lower.
4. Please refer B.Tech Regulations 2015 (B.12.1) for the corresponding grades.

ACADEMIC HONESTY & PLAGIARISM

1. All the students are expected to be genuine during the course work. Taking information by means of copying assignments, looking or attempting to look at another student's

paper or bringing and using study material in any form for copying during any assessments is considered as dishonest.

2. Preventing or hampering other students from pursuing their academic activities is also considered as academic dishonesty.

Any evidence of such academic dishonesty will result in the loss of marks on that assessment. Additionally, the names of those students so penalized will be reported to the class committee chairperson and HoD of the concerned department.

ADDITIONAL INFORMATION

The faculty is available for consultation at times as per the intimation given by the faculty. Queries (if required) to the course teacher shall be emailed to the course faculty directly at hakeem@nitt.edu

FOR APPROVAL

Dr. U.S. HAKEEM NIYAS	Dr. T. RAMESH	Dr. S.P. SIVAPIRAKASAM
Course Faculty	Class Committee Chairman	Head of Department
Mechanical Engineering	II Year Mechanical Engineering	Mechanical Engineering

Guidelines:

a) The number of assessments for a course shall range from 4 to 6.

b) **Every course shall have a final assessment on the entire syllabus with at least 30% weightage.**

c) **One compensation assessment for absentees in assessments (other than final assessment) is mandatory. This is not applicable for project work/industrial lectures/internship**.

d) The policy for attendance for the course should be clearly specified.

e) Necessary care shall be taken to ensure that the course plan is reasonable and is objective.