DEPARTMENT OF METALLURGICAL AND MATERIALS ENGINEERING
NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech.**		
Course Title	**Mechanical Behavior of Materials**		
Course Code	**MT612**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**MT611**		
Session	**July – Dec. 2021**	**Section (if, applicable)**	**NA**
Name of Faculty	**Dr K Sivaprasad**	**Department**	**MME**
Email	**ksp@nitt.edu**	**Telephone No.**	**0431-2503466**
Name of Course coordinator(s) (if, applicable)	**NA**		
E-mail	**---**	**Telephone No.**	**---**
Course Type	√ **Core course**		**Elective course**

Syllabus (approved in BoS)

Definition of stress, strain, transformation of coordinate systems, tensor notations, relationship between stress and strain in elastic materials, concept of principal stress and principal strain, stress invariants, modulus, Hook's law and understanding of stiffness and compliance tensors, elastic anisotropy,

Yield criteria, equivalent stress and plastic strain, Theoretical shear of perfect crystal, Mohs circle, concept of dislocations and dislocation theory, edge and screw dislocations, dislocation interactions, kink and jog, sessile and glissiles, partial dislocations, dissociation of dislocations, Thomson tetrahedral, Lomer-Cottress barriers.

Strengthening mechanisms, work hardening, solid solution strengthening, grain boundary strengthening, particle hardening, polymer elasticity and viscoelasticity, types of reinforcements and their influence, types of composites, high temperature degradation, creep and stress rupture, deformation mechanism maps, superplasticity and hot working.

Hardness, types of hardness measurements, comparison among hardness methods and scales, nanoindentation, compression testing, comparison between tension and compression studies of materials, shear testing, shear modulus, torsion and twist.

Fatigue of materials, S-N curves, life data presentation, influence of stress, linear elastic fracture

mechanics in fatigue, crack growth studies, Paris law, metallurgical aspects of fatigue failures, concepts of remedial measures, creep-fatigue interaction, theoretical strength, Griffith equation,

Brittle fracture, ductile fracture, fracture maps.

COURSE OBJECTIVES

To understand the concepts on materials failure and fracture analysis of materials and to design new materials that can with stand catastrophic failures at different environment.

COURSE OUTCOMES (CO)

Course Outcomes	**Aligned Programme Outcomes (PO)**
1. Define various mechanical properties of materials and their importance in materials selection criteria	**1, 2, 5**
2. Classify different mechanical properties and how they can influence the materials behavior with respect to applied load	**5**
3. Provide the microstructure-mechanical property correlation for the betterment of the materials performance	**1, 2, 11**
4. Select the appropriate processing route and alter the microstructures of various engineering materials to meet the design and application demands	**1**
5. Select the suitable processing route in order to achieve the superior strength of materials	**1, 5**
6. Analyze the various metallurgical factors affecting mechanical properties of different metals and alloys	**2, 1, 11**

COURSE PLAN – PART II

COURSE OVERVIEW

It is a 3-credit compulsory course in which some tutorial problems are combined so as to understand the concept with more examples.

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	1st week	Elastic and plastic deformation, stress-strain relationship; plastic deformation of metallic materials	PPT
2	**2nd week**	Mohr's circle, Yielding criterion- Von Misses, and maximum-shear-stress/Tresca yielding criterion	PPT
3	**3rd week**	failure criteria under combined stresses	PPT
4	**4th week**	Elements of theory of plasticity, dislocation theory properties of dislocation	PPT
5	**5th week**	stress fields around dislocations, elementary dislocation interactions	PPT

6	**6th week**	application of dislocation theory to work hardening and strengthening mechanisms	PPT
7	**7th week**	stress-strain curve, true stress-strain curve, instability in tension, stress distribution at the neck, ductility measurement	PPT
8	**8th week**	effect of strain rate and temperature on flow properties, testing machines	PPT
9	**9th week**	Tensile properties of important materials	PPT
10	**10th week**	Brinell, Vickers and Rock well hardness tests, Meyer hardness	PPT
11	**11th week**	analysis of indentation by an indenter, relationship between hardness and the flow curve	PPT
12	**12th week**	microhardness tests, hardness conversion; hardness at elevated temperatures	PPT
13	**13th week**	Introduction, mechanical properties in torsion, torsional stresses for large plastic strains	PPT
14	**14th week**	types of torsion failures torsion test vs. tension test, hot torsion testing	PPT

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Written test 1 - Objective	5th week	1 hr	20
2	Written test 2 - Descriptive	10th week	1 hr	20
3	Assignment - 1	12-14th weeks	2 weeks	15
4	Assignment-2	12-14th weeks	2 weeks	15
CPA	Compensation Assessment*	15th week	1 hr	20
5	Final Assessment *	16th week	3 hrs	30

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

Standard feedback as per institute norms.

COURSE POLICY (preferred mode of correspondence with students, compensation assessment policy to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)
Email (ksp@nitt.edu)
COMPENSATION ASSESSMENT POLICY
One compensation written test will be conducted for 20 marks only for written tests.

ATTENDANCE POLICY (A uniform attendance policy as specified below shall be followed)

- **At least 75% attendance in each course is mandatory.**
- **A maximum of 10% shall be allowed under On Duty (OD) category.**
- Students with **less than 65% of attendance** shall be prevented from writing the final assessment and **shall be awarded 'V' grade.**

ACADEMIC DISHONESTY & PLAGIARISM

- Possessing a mobile phone, carrying bits of paper, talking to other students, copying from others during an assessment will be treated as punishable dishonesty.
- Zero mark to be awarded for the offenders. For copying from another student, both students get the same penalty of zero mark.
- The departmental disciplinary committee including the course faculty member, PAC chairperson and the HoD, as members shall verify the facts of the malpractice and award the punishment if the student is found guilty. The report shall be submitted to the Academic office.

  The above policy against academic dishonesty shall be applicable for all the programmes.

ADDITIONAL INFORMATION

Only one compensation test would be conducted against missing one of the assessments from Sl.No.1 to 4 only.

FOR APPROVAL

Course Faculty _____
K.Sivaprasad

CC-Chairperson _____
Chairman, Welding Engineering

HOD _____
B.Ravisankar

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. Only genuine cases of absence shall be considered.**

d) The passing minimum shall be as per the regulations.

B.Tech. Admitted in				P.G.
2018	**2017**	**2016**	**2015**	
35% or class average/2 whichever is greater.		Peak/3 or class average/2 whichever is lower		40%

e) Attendance policy and the policy on academic dishonesty & plagiarism by students are uniform for all the courses.

f) Absolute grading policy shall be incorporated if the number of students per course is less than 10.

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