

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

COURSE PLAN – PART I			
Name of the programme and specialization	B.Tech.		
Course Title	Fatigue Creep and Fracture Mechanics		
Course Code	MTPE01	No. of Credits	3
Course Code of Pre-requisite subject(s)	MTPC23		
Session	Jan. – June 2020	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	<input type="checkbox"/> Core course	<input checked="" type="checkbox"/> Elective course	
<b>Syllabus (approved in BoS)</b>			
<p>Characteristics of fatigue failure, initiation and propagation of fatigue cracks; methods of improving fatigue behaviour, fatigue testing; analysis of fatigue data, fracture mechanics of fatigue crack propagation, corrosion fatigue, case studies</p> <p>Introduction to creep - creep mechanisms, creep curve, Presentation and practical application of creep data; accelerated creep testing, time-temperature parameters for conversion of creep data; creep resistant alloys, creep testing, stress rapture test,</p> <p>Introduction, types of fracture in metals, theoretical cohesive strength of metals, Griffith theory of brittle fracture, fracture of single crystals, metallographic aspects of fracture, fractography, fracture under combined stresses.</p> <p>Brittle fracture problems, notched bar impact tests, instrumented Charpy test, significance of transition temperature curve, metallurgical factors affecting transition temperature, drop-weight test and other large-scale tests, fracture analysis diagram,</p> <p>Introduction, strain energy release rate, stress intensity factor, fracture toughness and design, KIC plane strain toughness testing, plasticity corrections, crack opening displacement, J-integral, R curve, toughness of materials.</p>			
<b>COURSE OBJECTIVES</b>			
To develop the knowledge about the essential mechanical properties of engineering materials such as fracture, fatigue and creep and to apply them to design the materials for various load-bearing structural engineering applications.			
<b>COURSE OUTCOMES (CO)</b>			
<b>Course Outcomes</b>	<b>Aligned Programme Outcomes (PO)</b>		
1. Define the life assessment of various engineering materials and associated testing methods	1		

2. Describe basic mechanisms of fatigue and creep behavior of various engineering materials and their importance in materials design	1, 2
3. Analyze the various metallurgical factors influencing the fatigue and creep performance of materials for different structural engineering applications	1, 2, 5
4. Select the appropriate processing route and alter the microstructure for the life enhancement of materials at room and elevated temperatures	1, 10, 11
5. Provide suitable remedial measure to prevent premature failure and reduction in performance	1, 5
6. Describe the failure modes and root cause of the materials failure based on fracture mechanics and fractography approach	1, 11

### COURSE PLAN – PART II

#### COURSE OVERVIEW

It's a 3 credit elective 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	1 <sup>st</sup> week	Fatigue, Fatigue Life	Chalk & talk
2	2 <sup>nd</sup> week	Fatigue crack growth behavior, Fatigue testing, Fatigue data	Chalk & talk
3	3 <sup>rd</sup> week	Fracture mechanics in Fatigue, Corrosion Fatigue	Chalk & talk
4	4 <sup>th</sup> week	Creep Curve, Creep mechanisms	Chalk & talk
5	5 <sup>th</sup> week	Creep data presentation; Accelerated creep testing	Chalk & talk
6	6 <sup>th</sup> week	Creep resistant alloys, stress rupture testing, Fatigue-creep interaction	Chalk & talk

7	7 <sup>th</sup> week	Various types of fractures; fracture mechanisms,	Chalk & talk
8	8 <sup>th</sup> week	Fracture of single crystals, TCS	Chalk & talk
9	9 <sup>th</sup> week	Metallographic aspects of fracture, fractography; fracture under combined stress	Chalk & talk
10	10 <sup>th</sup> week	Notched bar tests, DBTT, Fracture limit	Chalk & talk
11	11 <sup>th</sup> week	Metallurgical factors affecting DBTT, drop weight test, fracture analysis diagram	Chalk & talk
12	12 <sup>th</sup> week	Introduction to fracture mechanisms; LEFM, EPFM and FPFM	Chalk & talk
13	13 <sup>th</sup> week	Standard method of evaluating K <sub>Ic</sub> ; correlation between other parameters	Chalk & talk
14	14 <sup>th</sup> week	Standard testing method of CTOD and J <sub>Ic</sub> ; R-curve	Chalk & talk

**COURSE ASSESSMENT METHODS (shall range from 4 to 6)**

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Written test 1	5 <sup>th</sup> week	1 hr	20
2	Written test 2	10 <sup>th</sup> week	1 hr	20
3	Assignment	12-14 <sup>th</sup> weeks	2 weeks	10
CPA	Compensation Assessment*	15 <sup>th</sup> week	1 hr	20
6	Final Assessment *	16 <sup>th</sup> week	3 hrs	50

\*mandatory; refer to guidelines on page 4

**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**


**NIL**

**FOR APPROVAL**

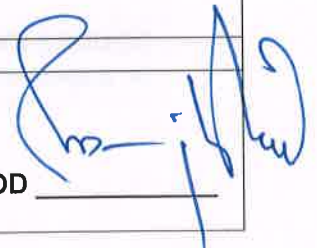
Course Faculty

  
12.01.2022

CC-Chairperson

  
12.01.2022

HOD



**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.