NATIONAL INSTITUTE OF TECHNOLOGY, TIRUCHIRAPPALLI

DEPARTMENT OF PRODUCTION ENGINEERING

COURSE PLAN – PART I			
Name of the programme and specialization	**M.Tech Manufacturing Technology**		
Course Title	Lasers in Manufacturing		
Course Code	PR 615	**No. of Credits**	03
Course Code of Pre-requisite subject(s)	-		
Session	**Jan. __2019___**	**Section (if, applicable)**	**N/A**
Name of Faculty	Dr. M. DURAI SELVAM	**Department**	Production Engineering
Email	**durai@nitt.edu**	**Telephone No.**	**04312503509**
Name of Course Coordinator(s) (if, applicable)			
E-mail		**Telephone No.**	
Course Type	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

- Fundamentals of laser –lasing action- properties - spectrum and wavelength –wave length chart types of laser- modes of operation-continuous mode-pulsed mode-laser components - interaction of laser radiation with materials-long pulse and short pulse interaction.
- Laser surface treatment –forms of laser surface treatment-laser transformation hardening - advantages - laser surface melting - laser alloying - laser cladding-co-axial powder feeding lateral powder feeding-laser texturing-case examples-.
- Laser welding-process arrangement - mechanisms - applications –modes of welding-conduction limited welding-key hole welding-heat flow theory - one dimensional heat flow - model for stationary and moving point source - simulation of laser welding.
- Laser cutting –process characteristics-theoretical models of cutting - practical performance applications - process variations - drilling –single pulse drilling-percussion drilling- trepanning applications.
- Fiber Laser and UV Laser based marking - micromachining solutions - laser shock loading - basics - applications - laser safety - danger - safety limits - eye and skin - class four safety arrangements - electric hazards - fume hazard

COURSE OBJECTIVES
• To understand the fundamental properties of laser beams as advanced materials processing and manufacturing tool. • To describe the various types of operation in laser surface treatment, welding and drilling in different materials. • To develop skills necessary to effectively analyse laser based physical processes and their implications in material processing and manufacturing processes.

MAPPING OF COs with POs	
Course Outcomes	**Aligned Programme Outcomes (PO)**
1. Compare the types of lasers and its applications.	1,3,5
2. Employ laser for surface engineering, welding, cutting and drilling.	1,2,4
3. Analyze the micro machining processes by Laser	1

COURSE PLAN – PART II

COURSE OVERVIEW

- Studies the fundamentals of laser and mode of operations.
- Learn about Laser surface hardening and cladding techniques.
- Study of Laser micro welding with key hole effect.
- Understanding laser cutting and types of micro drilling.
- Analysis of fibre and UV laser marking.
- Identify the protective methods from laser hazards

COURSE TEACHING AND LEARNING ACTIVITIES

S.No.	Week/Contact Hours	Topic	Mode of Delivery
Units I Introduction of Lasers			
1.	1st Week	Fundamentals of laser	Lecture C&T/ PPT
2.	1st Week	Properties of laser	
3.	1st Week	Spectrum, Wavelength and charts	

4.	2nd Week	Types of Laser	
5.	2nd Week	Mode of laser operation	
6.	2nd Week	Laser components	
7.	3rd Week	Interaction of laser radiation with materials	
8.	3rd Week	Long and short pulse interaction	
UNIT – II Laser surface treatment			
9.	3rd Week	Introduction of LST	Lecture C&T/ PPT
10.	4th Week	Advantages and Forms of LST	
11.	4th Week	Laser transformation hardening	
12	4th Week	Laser surface melting	
13	5th Week	Laser alloying and types	
14.	5th Week	Laser cladding	
15	5th Week	Powder feeding system in Laser	
16	6th Week	Laser texturing and case study	
UNIT- III Laser Welding			
17	6th Week	Laser welding and process	Lecture C&T/ PPT
18	6th Week	Laser welding mechanism and application	
19	7th Week	Mode of welding operation	
20	7th Week	Conduction and key-hole welding	
21	7th Week	Heat flow theory	
A	4th Week Feb.	CYCLE TEST 1	
22.	8th Week	One dimensional heat flow	
23.	8th Week	Model for stationary and moving point source	
24.	9th Week	Laser welding simulation	

UNIT- IV Laser Cutting			
25.	9th Week	Introduction of laser cutting operation	Lecture C&T/ PPT
26.	9th Week	Process characteristic of laser cutting	
27.	10th Week	Theoretical models of laser cutting	
28.	10th Week	Practical performance of laser cutting	
29.	10th Week	Applications and process variations	
30.	11th Week	Introduction of laser drilling and operation	
31.	11th Week	Single pulse, percussion and trepanning drilling.	
32.	11th Week	Application of laser Drilling	
UNIT- V Laser Micro machining and Safety			
33.	12th Week	Introduction of fiber laser and UV laser based marking	
34.	12th Week	Laser micro-machining operation	
35.	12th Week	Laser shock loading	
A	4th Week Mar.	CYCLE TEST 2	
36.	14th Week	Application of laser micro-machining	Lecture C&T/ PPT
37.	14th Week	Laser safety and danger	
38.	14th Week	Class four safety arrangements	
39.	15th Week	Limitation of laser safety	
40.	15th Week	Electric hazards - fume hazards	

Text Books

1. William M. Steen, "Laser Material Processing", Springer Verlag, 2003.
2. M.Young, "Optics and Lasers", Springer, 1993.

Reference Books

1. J.F. Reddy, "Industrial Applications of Lasers", Academic Press, New York, 1978.

2. S. S. Charschan, "Lasers in Industry", Wiley & Sons Inc., 1974.
3. Michael Bass, "Laser Materials Processing", Elsevier Science, 1983.

COURSE ASSESSMENT METHODS (shall range from 4 to 6)

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Assignment 1/ Seminars			5
2	Cycle Test 1	4th Week Feb.	60 Minutes	20
3	Assignment 2/ Seminars			5
4	Cycle Test 2	4th Week Mar.	60 Minutes	20
CPA	Compensation Assessment*	1st Week Apr.	60 Minutes	Refer course policy
5	Final Assessment *	3rd Week Apr.	180 Minutes	50

***mandatory; refer to guidelines on page 4**

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

- Feedback from the students during class committee meetings
- Anonymous feedback through questionnaire

COURSE POLICY (including compensation assessment to be specified)

MODE OF CORRESPONDENCE (email/ phone etc)

1. All the students are advised to check their NITT WEBMAIL regularly. All the correspondence (schedule of classes/ schedule of assessment/ course material/ any other information regarding this course) will be done through their webmail only.
2. Queries (if required) to the course teacher shall only be emailed to the email id specified by the teacher.

COMPENSATION ASSESSMENT POLICY

- Absentees in cycle tests with genuine reasons only permitted for the re-test as compensation assessment.
- Re-test covers whole syllabus with the weightage of 20 marks.

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

The faculty is available for consultation at times as per the intimation given by the faculty

FOR APPROVAL

Course Faculty _____ **CC-Chairperson** _____ **HOD** _____

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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.