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	**PR 613 – Heat Treatment**		
Course Code	**PR 613**	**No. of Credits**	**3**
Course Code of Pre-requisite subject(s)	**-**		
Session	**January 2021**	**Section (if, applicable)**	**-**
Name of Faculty	**Dr. C. Sathiya Narayanan**	**Department**	**PRODUCTION ENGINEERING**
Official Email	**csathia@nitt.edu**	**Telephone No.**	**0431-250-3511**
Name of Course Coordinator(s) (if, applicable)	**-**		
Official E-mail	**-**	**Telephone No.**	**-**
Course Type (please tick appropriately)	☐ **Core course**	☑ **Elective course**	

Syllabus (approved in BoS)

Iron - Carbon Equilibrium Diagram: Effect of alloying element on properties of steel and heat treatments. Types and application of heat treatments in manufacturing Industries. TTT & CCT diagram for steels-Various heating media used for heat treatment, furnaces, Temperature and atmosphere control- Selection of furnace for heat treatment.
Heat Treatment Processes: Annealing - Normalising, Hardenability studies, Jominy end quench test, Grossman's experiments - Tempering, Austempering and Martempering. Thermomechanical treatments.
Surface Modification Techniques: Induction hardening, flame hardening, electron beam hardening and Laser beam hardening. Carburising, nitriding, Carbonitriding, CVD and PVD processes, Ion implantation.
Heat Treatment of Non-Ferrous Metals and Specific Alloy steels: Heat treatment of gray irons, white irons (malleabilising) and S.G.Irons. Austempering of S.G.Iron. Defects: Defects in heat treated parts, causes and remedy Design for heat treatment.

COURSE OBJECTIVES

To Identify the effect of heat treatment in various alloying elements.
To study about the application of surface modification techniques.
To find the defects occurring in heat treated parts.

MAPPING OF COs with POs

Course Outcomes	**Programme Outcomes (PO)** (Enter Numbers only)

1. Identify the effect of heat treatment in alloying elements	**1, 3**
2. Apply surface modification techniques	**1, 5, 6**
3. Find the defects occurring in heat treated parts	**1, 2**

COURSE PLAN – PART II			
COURSE OVERVIEW			
Study about the effect of alloying elements on properties of steel and its application in manufacturing industries. **TTT and CCT diagram for steels and furnace for heat treatment.** **Various surface modification techniques and heat treatment processes.** **Defects in heat treated parts, causes and remedy for heat treatment.**			
COURSE TEACHING AND LEARNING ACTIVITIES			**(** Add more rows)
S.No.	**Week/Contact Hours**	**Topic**	**Mode of Delivery**
1	1st	Iron – Carbon Equilibrium Diagram	Online
2		Effect of Alloying Elements	Online
3		Alloying properties of Steel	Online
4		Heat Treatments-Types	Online
5	2nd	Heat Treatments Application	Online
6		TTT diagram for steels	Online
7		CCT diagram for steels	Online
8		Heat Treatment-Various Heating Media	Online
9	3rd	Heat Treatments-Furnaces	Online
10		Heat Treatments-Temperature and Atmospheric control	Online
11		Selection of Furnaces for Heat treatment	Online
12		Introduction to Heat Treatment Processes	Online
13	4th	Annealing-Normalising	Online
14		Hardenability Studies	Online
15		Jominy End Quench test	Online
16		Grossman's experiments	Online

17	5th	Tempering, Austempering Martempering	Online
18		Thermo mechanical treatments	Online
19		Surface Modification techniques	Online
20		Induction, Flame Hardening	Online
21	6th	Electron Beam Hardening	Online
22		Laser Beam Hardening	Online
23		Carburising, nitriding,	Online
24		Carbonitriding	Online
25	7th	CVD & PVD processes	Online
26		Ion implantation	Online
27		Heat Treatment of Non-Ferrous Metals	Online
28		Heat Treatment of Specific Alloy steels	Online
29	8th	Heat treatment of gray irons	Online
30		Heat treatment of white irons	Online
31		Heat treatment of S.G.Irons	Online
32		Austempering S.G.Iron	Online
33	9th	Defects in heat treated parts	Online
34		Causes of defects	Online
35		Remedy for defects	Online
36		Design for heat treatment.	Online

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

S.No.	Mode of Assessment	Week/Date	Duration	% Weightage
1	Cycle Test-1	After 4th week	60 Minutes	30
2	Cycle Test-2	After 8th week	60 Minutes	30
3	Assignment	Once in 4 weeks	-	10
CPA	Compensation Assessment*	After 9th week	60 Minutes	30
4	Final Assessment *	After 9th week	180 Minutes	30

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

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

1. Feedback from the students during class committee meeting.
2. End semester feedback on course outcomes

COURSE POLICY (including compensation assessment to be specified**)**

60 minutes examination including all syllabus.

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, IF ANY

FOR APPROVAL

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

Guidelines

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

b) Every theory 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.