ACADEMIC AFFAIRS OFFICE
INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

No. Acd./7007/IAPC-71 Dated: July 16, 2019

Head, Department of Metallurgical & Materials Engg.
(through e-mail)

The IAPC in its 71st meeting held on 27.06.2019 vide **Item No. 71.2.2** considered the proposal of Department of Metallurgical & Materials Engg. to introduce a new PEC course **MTN-555 "Advanced and Stainless Steels"** for B.Tech. (4th year) and M.Tech. (1st year) students.

The IAPC accepted the proposal with modifications. Duly modified syllabus is attached as **Appendix-B.**

In the view of above, you are requested to kindly take necessary action accordingly.

Assistant Registrar (Curriculum)

Encl: as above

Copy to (through e mail):-
1. All faculty
2. All Heads of Departments/ Centres
3. Dean Academic Affairs
4. Associate Dean of Academic Affairs(Curriculum)
5. Channel I/ Academic webpage of iitr.ac.in

INDIAN INSTITUTE OF TECHNOLOGY ROORKEE

NAME OF DEPARTMENT: **Department of Metallurgical and Materials Engineering**

1. Subject Code: **MTN-555** Course Title: **Advanced and Stainless Steels**
2. Contact Hours: **L: 3** **T: 1** **P: 0**
3. Examination Duration (Hrs.): **Theory 3** **Practical 0**
4. Relative Weightage**: CWS 20-35 PRS 0 MTE 20-30 ETE 40-50 PRE 0**
5. Credits**: 4** 6. Semester**: Autumn/Spring** 7. Subject Area**: PEC**
8. Pre-requisite**:** Phase transformation and Mechanical working or their equivalent at UG level
9. Objective: To understand the fundamentals of phase transformation in steels and apply it in domains where steel is the primary material of choice.
10. Details of the Course:

Sl. No.	Contents	Contact Hours
1.	**Introduction** Fe-C phase diagram, TTT/CCT diagram, basic heat treatment processes, basics of alloy steel, Thermo-mechanical processing, Quenched and tempered steel, surface treatments, High temperature steels, steels for super-critical thermal and boiler plants, creep behaviour and its characterisation	**10**
2.	**Speciality steels** Design of steel, Strengthening mechanisms, Different types of automotive steels (HS-IF, BH, DP, TRIP, TWIP, bainitic, martensitic, precipitation hardened), Microalloyed steel, processing in industry, application in different sector	**6**
3.	**Phase transformation in stainless steel** Characteristics of stainless steel, alloying elements and their effect, Cost implications of alloy addition and substitutes, relevance of Nickel and Chromium equivalent, inadequacy of Fe-C diagram, role of deformation induced transformation	**8**
4.	**Stainless steel making, processing and fabrication** Stainless steel making (Electric Arc Furnace, Argon oxygen decarburisation, Ladle refining, Vacuum Oxygen Decarburisation, Vacuum degassing, Ingot casting), Industrial processing of stainless steel (continuous casting, hot rolling, annealing & pickling, cold rolling, final annealing and pickling, skin pass mill, Strip grinding line), Various finishes in stainless steel, colour coating of stainless steel, Cold roll forming (CRF) process mechanism, cutting of stainless steel, welding of stainless steel, tools and equipment, issues faced during fabrication of stainless steel and their solutions	**10**
5.	**Corrosion in stainless steel** Major types of corrosion, galvanic corrosion: mechanism and prevention, pitting corrosion: mechanism and prevention, interpretation of PREN, crack propagation mechanisms	**4**
6.	**Applications of stainless steel in various segments** Automotive, Railways & transport, Architecture, Building & construction, Reinforcement bars, Roofing sheets, Material handling applications, Process industries, Life cycle cost analysis	**4**
	Total	**42**

11.Suggested Books

Sl. No.	Authors/ Title/ Publisher	Year of Publication/ Reprints
1.	Reed-Hill R.E., "Principles of Physical Metallurgy", Affiliated East-West Press	**2008**
2.	Bhadeshia H.K.D.H. and Honeycombe R., "Steels: Microstructure and Properties", 4th Ed., Butterworth-Heinemann	**2017**
3.	Rana R. and Singh S.B., "Automotive Steels: Design, Metallurgy, Processing and Application", Woodhead Publishing	**2016**
4.	Cola R. and Totten G.E., "Encyclopedia of Iron, Steel and Their Alloys", CRC Press	**2016**
5.	Fontana M.G. and Greene N.D., "Corrosion Engineering", 3rd Ed. McGraw-Hill	**2017**
6.	Handbook of Stainless Steels, Outokumpu Oyj	**2009**