

Branch-MME/Metallurgical Engineering

Seventh Semester							
Theory							
Sl No	Category	Course Code	Course Title	L-T-P	Credit	University Marks	Internal Evaluation
1	HS		Entrepreneurship Development	3-0-0	3	100	50
2	PE		Corrosion and Degradation of Materials	3-0-0	3	100	50
			Tribology of Engineering Materials				
			Advanced Phase Transformations				
3	PE		Alternative Routes of Iron making	3-0-0	3	100	50
			Powder Metallurgy				
			Physics of Metals				
4	OE		Internet of Things	3-0-0	3	100	50
			Intellectual Property Right				
			Production and Operation Management				
5	OE		Green Technology	3-0-0	3	100	50
			Artificial Intelligence & Machine Learning				
			Soft Computing				
6	OE		Industrial Safety Engineering	3-0-0	3	100	50
			Disaster Management				
			Mining Methods and Unit Operation				
7	MC*	RIK7F001	Essence of Indian Knowledge Tradition - II	3-0-0	0		100 (Pass Mark is 37)
Total Credit (Theory)					18		
Total Marks						600	300
Practical							
1	PSI		Minor Project	0-0-6	3		200
2	PSI		Seminar - I	0-0-3	1		100
3	PSI		Comprehensive Viva	0-0-3	1		100
Total Credit (Practical)					5		
Total Semester Credit					23		
Total Marks							400

7th Semester	RED7E001	Entrepreneurship Development	L-T-P 3-0-0	3 Credits
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Module I: **(10 hours)**

Entrepreneurship: Concept of entrepreneurship and intrapreneurship, Types of Entrepreneurs, Nature and Importance, Entrepreneurial Traits and Skills, Entrepreneurial Motivation and Achievement, Entrepreneurial Personality

Module II: **(8 hours)**

Entrepreneurial Environment, Identification of Opportunities, Converting Business Opportunities into reality. Start-ups and business incubation, Setting up a Small Enterprise. Issues relating to location, Environmental Problems and Environmental pollution Act, Industrial Policies and Regulations

Module III: **(10 hours)**

Need to know about Accounting, Working capital Management, Marketing Management, Human Resources Management, and Labour Laws. Organizational support services - Central and State Government, Incentives and Subsidies.

Module IV: **(12 hours)**

Sickness of Small-Scale Industries, Causes and symptoms of sickness, cures of sickness, Role of Banks and Governments in reviving industries.

Books:

- [1] Entrepreneurship Development and Management, Vasant Desai, HPH
- [2] Entrepreneurship Management, Bholanath Dutta, Excel Books
- [3] Entrepreneurial Development, Sangeeta Sharma, PHI
- [4] Entrepreneurship, Rajeev Roy, Oxford University Press

Digital Learning Resources:

Course Name: Entrepreneurship
 Course Link: <https://nptel.ac.in/courses/110/106/110106141/>
 Course Instructor: Prof. C Bhaktavatsala Rao, IIT Roorkee

Course Name: Entrepreneurship Essentials
 Course Link: <https://nptel.ac.in/courses/127/105/127105007/>
 Course Instructor: Prof. Manoj Kumar Mondal, IIT Kharagpur

7 th Semester	RMM7D001	Corrosion and Degradation of Materials	L-T-P 3-0-0	3 Credits
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Module I:**(09 hours)**

Introduction, importance of corrosion study, corrosion as non-equilibrium process, corrosion rate expressions, electrochemical principles of corrosion-cell analogy, concept of single electrode potential, reference electrodes, e.m.f. and galvanic series-their uses in corrosion studies, polarization, passivity.

Module II:**(10 hours)**

Different forms of corrosion-uniform attack, galvanic, crevice, pitting, intergranular, stress corrosion cracking -their characteristic features, causes and remedial measures. Principles of corrosion prevention-material selection control of environment including inhibitors

Module III:**(08 hours)**

Cathodic and anodic protection, coatings and design considerations. Corrosion testing methods. Introduction to high temperature corrosion, Pilling- Bedworth ratio, oxidation kinetics, oxide defect structures.

Module IV:**(09 hours)**

Considerations in high temperature alloy design, prevention of high temperature corrosion -use of coatings. Hydrogen Damage-Sources, Types of damage, Mechanisms and preventive methods, Liquid metal attack -liquid metal embrittlement, preventive measures.

Books:

- [1] M. G. Fontana : Corrosion Engineering , 3rd edition, Mc Graw Hill International, 1987.
- [2] U. K. Chatterjee, S. K. Bose and S. K. Roy: Environmental Degradation of Metals, Marcel Dekker, 2001

Digital Learning Resources:

Course Name: Introduction to Corrosion Failure and Analysis
 Course Link: <https://nptel.ac.in/courses/113/104/113104101/>
 Course Instructor: Prof. Kallol Mondal, IIT, Kanpur

Course Name: Advance Corrosion Engineering
 Course Link: <https://nptel.ac.in/courses/113/108/113108051/>
 Course Instructor: Prof. K.A. Natarajan, IISc Bangalore

7th Semester

PMT7J003 ALTERNATIVE ROUTES OF IRON MAKING 3-0-0

Module I (12 Hours)

Characteristics of raw materials and their preparation. Thermodynamics and Kinetics aspects. Direct Reduction Processes:

Reduction of Iron bearing materials in shaft furnace, rotary kiln, retort and fluidized bed with special reference to reductant, energy consumption and operational problems.

Module II (14 Hours)

Commercially available processes: like SL/RN, ACCAR, Krup-CODIR, Kingdon Meter, MIDREX, HyL, Purofer, Iron Carbide, etc.

Uses of DRI in steel making, iron making and foundries; effect on DRI on EAF performance and product characteristics.

Module III (12 Hours)

Smelting Reduction Processes:

COREX, ROMELT, Fluidized bed reactors, Hismelt etc. Present status of alternative methods of iron making in India.

Books for reference:

1. Alternative Routes to Iron Making by A.Sarangi and B.Sarangi, PHI-2016
2. Beyond the Blast Furnace by Amit Chatterjee.
3. Direct Reduction of Iron, Editors: Jerome Feinman & Donald R. Mac Rae, Allied Publishers Ltd.

7th Semester	RIT7D001	Internet of Things	L-T-P 3-0-0	3Credits
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Module-1

Introduction-Definition & Characteristics of IoT, Physical Design of IoT- Things in IoT, IoT Protocols, Logical Design of IoT- IoT Functional Blocks, IoT Communication Models, IoT Communication APIs , IoT Enabling Technologies- Wireless Sensor Networks , Cloud Computing, Big Data Analytics , Communication Protocols , Embedded Systems, IoT Levels & Deployment Templates.

Module-2**Domain Specific IoTs**

Home Automation: Smart Lighting, Smart Appliances, Intrusion Detection, Smoke/Gas Detectors, Cities-Smart Parking, Smart Lighting, Smart Roads, Structural Health Monitoring, Surveillance, Emergency Response,

Environment-Weather Monitoring, Air Pollution Monitoring, Noise Pollution Monitoring, Forest Fire Detection , River Floods Detection , **Energy**- Smart Grids , Renewable Energy Systems , Prognostics , Retail-Inventory Management , Smart Payments , Smart Vending Machines , **Logistics**-Route Generation & Scheduling , Fleet Tracking , Shipment Monitoring , Remote Vehicle Diagnostics, **Agriculture**-Smart Irrigation ,Green House Control ,**Industry** -Machine Diagnosis & Prognosis Indoor Air Quality Monitoring ,Health & Lifestyle -Health & Fitness Monitoring, Wearable Electronics

IoT and M2M Introduction, M2M-Difference between IoT and M2M, SDN and NFV for IoT-Software Defined Networking , Network Function Virtualization

Module-3**IoT Platforms Design Methodology**

IoT Design Methodology-Purpose & Requirements Specification, Process Specification, Domain Model Specification, Information Model Specification , Service Specifications , IoT Level Specification, Functional View Specification , Operational View Specification , Device & Component Integration , Application Development, Case Study on IoT System for Weather Monitoring, Motivation for Using Python

IoT Physical Devices & Endpoints

What is an IoT Device-Basic building blocks of an IoT Device, Exemplary Device: Raspberry Pi, About the Board, Linux on Raspberry Pi , Raspberry Pi Interfaces – Serial, SPI , I2C , Programming Raspberry Pi with Python-Controlling LED with Raspberry Pi , Interfacing an LED and Switch with Raspberry Pi ,Interfacing a Light Sensor (LDR) with Raspberry Pi , Other IoT Devices- pcDuino, Beagle Bone Black , Cubieboard

Module-3

IoT & Beyond : Use of Big Data and Visualization in IoT, Industry 4.0 Concepts. Overview of RFID, Low-power design (Bluetooth Low Energy), range extension techniques (data mining and mesh networking), and dataintensive IoT for continuous recognition applications. Overview of Android / IOS App Development tools & Internet Of Everything

Books:

1. Internet of Things, A Hands on Approach, by ArshdeepBahga& Vijay audisetti, University Press.
2. The Internet of Things, by Michael Millen, Pearson

7th Semester	RGT6A003	Green Technology	L-T-P 3-0-0	3 CREDITS
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Module I: (12 Hrs)

Global Warming and its effect:- Introduction and physical definition of global warming, the New Carbon Problem: Accumulation, Long Half-Life, Heating Potential, Carbon Emission Factors, Carbon Absorption in Nature, The Global Emission Situation and its effect in India, The Kyoto and Other Protocols and its view in India, Effect of climate change and its impact. Planning for the Future to reduce global warming:- Steps taken to Control Carbon Emissions universally, Use of Promotional and Punitive Mechanisms for Reducing Carbon in Atmosphere, The General Approach in Planning for the Future, Developing Countrywide Adaptive Measures for Safety of Local People, Developing Mitigative Measures for Global Reduction of Carbon, India's National Action Plan on Climate Change (NAPCC) till date, National Mission for a Green India, The MRV Debate.

Module II: (8 Hrs)

Opportunities in Control of Carbon Emissions and Accumulation:- Essential Steps for Control of Carbon Emissions and Accumulation, Procedure to develop own Priorities and Business Opportunities in India for control of carbon emissions and accumulation, Needs a Mix of Green and Traditional Power Sources in India, A Logical Approach for Carbon Reduction, Need in India —More Forests, Less Deforestation and payment rates procedure for controlling carbon emissions and its Promotional Mechanisms at India. Green Technologies for Energy Production: - Various Technologies Available for Energy Production, Cost Comparison of a Few Typical Systems for Power Generation, Sources of Energy Production Already in Use, Alternative Methods Ready for Use, Green Technologies Needing some Prior R&D Work.

Module III: (10 Hrs)

Green Technologies for Personal and Citywide Application: - Measures to be taken for Green city, Carbon Emission Reduction at Personal Level, Carbon Emission Reduction at Local Authority and Citywide Level, Carbon Emissions from Imports. Green Technologies for Specific Applications:- Promotion of 'Green' Buildings, Guidelines, The Energy Conservation Building Code (ECBC), Green Hotels and Hospitals, Green Technologies for Transport, Green Roads, Ports and Harbours, Industries, Carbon, Carbon Emissions from a Few Selected Industries in India, The Changing Scenario in Cities, Need for Wider Application to Town Planning and Area Re-Development Projects, 'Green' Infrastructure for Municipal Services, Bringing up Indian Villages, Green Services for Crematoria, Spreading Message to all Stakeholders.

Module IV: (10 Hrs)

Some High-tech Measures for Reducing Carbon Emissions: - Use of Solar Power with Satellite-Based Systems, Use of Carbon Capture and Storage (Sequestration), Microorganisms, A Quick SWOT Analysis. Recommended Plan of Action: - India's National Action Plan Take Us to a Low-Carbon Path, The Missions Help Develop Awareness, few case studies on Projects undertaken by Various Countries, Adaptive Measures Essential for Indian People to Cope with Climate Change

Books

- [1] Green Technologies, Soli J. Arceivala, McGraw Hill Education
- [2] Green Technologies and Environmental Sustainability edited by Ritu Singh, Sanjeev Kumar

Digital Learning Resources:

Course Name: Sustainable Materials and Green Buildings

Course Link: <https://nptel.ac.in/courses/105/102/105102195/>

Course Instructor: Dr. B. Bhattacharjee, IIT Delhi

7th Semester	RIS7B001	Industrial Safety Engineering	L-T-P 3-0-0	3 CREDITS
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Module-I:**(7 hours)**

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods.

Module-II**(7 hours)**

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy, Service life of equipment.

Module-III:(7 hours)

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods.

Module-IV:**(7 hours)**

Fault tracing: Fault tracing-concept and importance, decision tree concept, need and applications, sequence of faultfinding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic, automotive, thermal and electrical equipment's like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine, v. Boiler, vi. Electrical motors, Types of faults in machine tools and their general causes.

Module-V:**(8 hours)**

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii. Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept and importance

Books:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da Information Services.
2. Maintenance Engineering, H. P. Garg, S. Chand and Company.
3. Pump-hydraulic Compressors, Audels, McGraw Hill Publication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman & Hall London.