Metallurgical and Materials Engineering

Scheme of Teaching and Examination
B. Tech (Metallurgical and Materials Engineering)

Academic Semester VIII

S. No.	Subject Code	Board of Study	SUBJECT	Periods per week			Scheme of Examination and Marks				Credit L+(T+P)/2
				L	T	P	PRE**		ESE*	Total Marks	
							Mid Sem	TA			
1	MME4234	MME	Foundry Technology	3	1	0	30	20	50	100	4
2	MME4235 (01-04)	MME	**Professional Elective-IV (MME Annexure IV)**	3	1	0	30	20	50	100	4
3	OPE42 (01-38)	MME	**Open Elective-I (OE Annexure-I)**	3	0	0	30	20	50	100	3
4	MME4236	MME	Foundry Technology Lab	0	0	3	0	30	20	50	2
5	MME4237	MME	Major Project	0	0	10	0	50	50	100	7
6	PFD4208	PFD	Professional Development	0	0	1	0	15	10	25	1
			TOTAL	**9**	**2**	**14**	**90**	**155**	**230**	**475**	**21**

* End Semester Examination
** Progress Review Examination.

MME: Metallurgical and Materials Engineering

Professional Elective -IV (MME Annexure - IV)

S. No	Subject Code	Name of the Courses
1	MME4235(1)	Ceramics and Powder Metallurgy
2	MME4235(2)	Fracture Mechanics and Failure Analysis
3	MME4235(3)	Introduction to Nano-Science and Technology
4	MME4235(4)	Nuclear Metallurgy

Metallurgical and Materials Engineering

Open Elective (OE Annexure – I)

S. No	Subject code	Board of Study	Name of the Courses
1	OPE4201	CIE	Disaster Management
2	OPE4202	CIE	Construction Management
3	OPE4203	CIE	Ecology and Sustainable Development
4	OPE4204	CSE	Bio Informatics
5	OPE4205	CSE	Software Technology
6	OPE4206	CSE	Internet & Web Technology
7	OPE4207	CSE	Business Analysis and Optimization
8	OPE4208	CSE	IT Industry Management
9	OPE4209	CSE	IT Industry Entrepreneurship
10	OPE4210	CSE	Evolutionary Computations
11	OPE4211	CSE	E-Commerce & Strategic IT
12	OPE4212	CSE	Decision Support & Executive Information
13	OPE4213	CSE	Information Theory & Control
14	OPE4214	EEE	Distributed Generation
15	OPE4215	EEE	Non-Conventional Energy Sources
16	OPE4216	EEE	Energy Auditing and Management
17	OPE4217	HSS	Innovation, Entrepreneurship and Leadership
18	OPE4218	HSS	Technology Management
19	OPE4219	HSS	Knowledge Entrepreneurship
20	OPE4220	HSS	Finance Management
21	OPE4221	HSS	Project Planning, Management & Evaluation
22	OPE4222	HSS	Intellectual Property Rights
23	OPE4223	HSS	Engineering Economics
24	OPE4224	HSS	Human Relations Management
25	OPE4225	HSS	Entrepreneurship Development
26	OPE4226	HSS	Personnel Management and Industrial Engineering
27	OPE4227	MEE	Safety Engineering
28	OPE4228	MEE	Value Engineering
29	OPE4229	MEE	Energy Conservation & Management
30	OPE4230	MEE	Thermal Treatment of Metal and alloys
31	OPE4231	MEE	Simulation of Physical Processes
32	OPE4232	MEE	TQM and Reliability Engineering
33	OPE4233	MEE	Non Traditional Machining Techniques
34	OPE4234	MME	Nanotechnology
35	OPE4235	MME	Introduction to Nano-Technology applications
36	OPE4236	MME	Material Characterization
37	OPE4237	MME	Materials Management
38	OPE4238	MME	Manufacturing Strategies

Metallurgical and Materials Engineering

(8th Semester)

Detailed Syllabus

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Foundry Technology **Code: MME 4234**

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Course Description:

This course is designed to explore the various foundry practices and the theory behind solidification processes. Various foundry methods, theories and parameters will be discussed in detail. The existing casting technologies and the new insights in metal casting will be discoursed. Casting of various metals and alloys will also will explored.

Course Objectives:

1. To learn the basic principles of solidification of metals and foundry technology.
2. To utilize the knowledge for industrial application;
3. Apply basic scientific principles for technical problem solving in foundry to increase technical Skills.

Syllabus:

UNIT - 1
Solidification of pure metals and alloys, parameters affecting the solidification, concept of directional and controlled directional solidification and methods to attain directional solidifications, interdendritic shrinkage, center line shrinkage phenomenon in castings, Macro and Micro segregation, gases in castings.

UNIT – 2
Fluid flow principles for melts and Gating system and its design, design of ingate, sprue, runner, requirements of an ideal gating system, types of gates. Feeders requirements and functions of feeders, feeder design, Risers, risering methods, Caine's method, NRL method, Wlodawer's process, methods of riser design for various shapes of castings, construction and design of pattern, pattern allowances, pattern colours, evaluation of Chvorinov's equation and its importance in other calculation.

UNIT - 3
Patterns, moulding sands, general characteristic, ingredients and their effects on properties of moulding sands Testing of moulding sands, banking and facing sands, sand conditioning, cores- function, types, core sands, core binders, core preparation, core was, core supports.

UNIT – 4
Moulding and casting processes, various process of molding and casting like green and dry sand core sand, shell moulding, CO_2 process, permanent molds, centrifugal investment, die casting, moulding equipment, process details and applications.

UNIT - 5

Melting practice, principle of melting, construction and operation of hot and cold blast cupola, recent trends in cupola, melting of steel and alloy steels in arc and induction furnace, melting and casting practice of aluminum, copper and their alloys, S.G. Iron foundry finishing, inspection and quality control, defects in castings and their remedies. Heat treatment of castings.

Text Books:

1. Foundry Technology - P.R. Beeley
2. Foundry Engineering – O.P. Khanna

Reference Books:

1. Principles of metal casting, R.W. Heine, C.R. Loper and P.C. Rosenthal.
2. Solidification of casings – Institute of Metals, London – R.W. Ruddle.
3. Metal casing. – R.A. Flin.

Course Outcome:

1. Students will attain an ability to distinguish between various methods of foundry practice;
2. Acquire a concept to design the process as well as solving the practical problems encountered while metal processing.

Professional Elective -IV (MME Annexure - IV)

S. No	Subject Code	Name of the Courses
1	MME4235(1)	Ceramics and Powder Metallurgy
2	MME4235(2)	Fracture Mechanics and Failure Analysis
3	MME4235(3)	Introduction to Nano-Science and Technology
4	MME4235(4)	Nuclear Metallurgy

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Ceramics and Powder Metallurgy **Code: MME 4235(1)**

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Course Description:

This course has been intended to improve the students for careers in metallurgy engineering where knowledge to provide them with an insight into the emerging technology of powder metallurgy as an alternative route to conventional metal processing. This course describes the fundamental aspects of advanced ceramic powder preparation, densification and microstructure evolution during sintering procedure. The course provides thorough knowledge of powder production and processing as well as to choose the right technical method to suit application. The major goal is to establish the powder fabrication route as a technologically and economically viable means of materials production.

Course Objectives:

This course aims to build the necessary background of emergence and importance of:

1. Students to gain familiarity with fundamental concepts associated with powdered metals or nonmetals powders;
2. Explain the physical and physico-chemical phenomena underlying the processes of shaping of massive bodies from metal or ceramics powders via dry, wet, or plastic methods;
3. To assess of emergence and importance of powder metallurgy, scope and limitations;
4. To increase the knowledge of powder production techniques and characteristics;
5. To encourage the knowledge of knowledge of compaction and sintering techniques and related applications.

Syllabus:

UNIT- 1:
Ceramic raw materials, processing and beneficiation, synthesis of ceramic powders by mechanical methods, mechano-chemical methods, Sol-gel processing, casting processes, role of processing additives, processing of glass for formation of glass ceramics.

UNIT- 2
Importance of particulate materials and their processing, comparison of powder metallurgy with other manufacturing techniques, its scope and limitations, limitations and applications of powder metallurgy, basic steps for powder metallurgy, metal powder production methods: atomization, reduction from oxide, electrolysis, crushing, milling, condensation of metal vapour, hydride and carbonyl processes, mechanical alloying, new developments.

UNIT- 3
Particle size, shape and size distribution of powders, characteristics of powder mass such as apparent density, tap density, flow rate, friction index, surface area, porosity measurements properties of green compacts and sintered compacts.

UNIT- 4
Treatment of metal powders: powder mixing, mechanical milling, types of compaction presses, behavior of powder during compaction, isostatic pressing, roll compaction, powder extrusion, and forging, slip casting, hot pressing and hot isostatic pressing, modern methods of powder consolidation, compaction tooling and role of lubricants.

UNIT- 5
Definition of sintering, solid, stages of sintering, driving forces for sintering, mechanism of sintering, sintering atmospheres and furnaces, sintering zones, effect of variables, Powder metallurgy applications especially porous metals, cermets, cemented carbides, electrical and magnetic materials; dispersion strengthened materials.

Text Books:

1. Powder Metallurgy: Science, Technology, and Materials, Anish Upadhyaya, Gopal Shankar Upadhyaya, Universities Press.
2. Powder Metallurgy Science – RM German, MPIF, NJ, USA.
3. Introduction to Powder Metallurgy, A. K. Sinha, Dhanpatrai Publication.
4. Material Science and Metallurgy, Kodgire U. D, 37th edition, Everest Publishing House.
5. Sintering of Ceramics, Mohamed N. Rahaman, CRC Press.

Reference Books:

1. Powder Metallurgy, ASM Handbook, Vol-VII.
2. Handbook of Powder Metallurgy, H. H. Hausner.
3. Powder Metallurgy, W. D. Jones.
4. Sintering Theory and Practice, German, R. M., Metal Powder Industries Federation.
5. Principles of Powder Metallurgy, T. Shukerman.
6. Introduction to ceramics, W.D. Kingery, Wiley & Sons (second edition).

Course Outcome:

1. Students able to understanding the fundamental principles and properties of ceramics such as structure, physical and chemical properties;
2. Students will attain an ability to understand the fundamental principles of the powder metallurgy part production;
3. Students will acquire a knowledge of particular powders preparation, their properties, compaction techniques a sintering process analysis;
4. Students could have a conceptual blend between theory and practical knowledge especially understanding the key parameters of powder metal processing;
5. Work effectively as an individual member of a multidisciplinary team in any scientific team/industry.

Metallurgical and Materials Engineering

Semester: VII **Branch: Metallurgical and Materials Engineering**
Subject: Fracture Mechanics and Failure Analysis **Code: MME 4235(2)**

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Course Descriptions:

The focus of this course is to develop an understanding of the mechanics of fracture of engineering materials and structures under static and dynamic conditions. Students have been taught the principles of linear elastic and elastic-plastic fracture mechanics and their application to engineering design. This course will also introduce key applications of fracture mechanics in industry including damage detection, failure analysis, and experimental techniques.

Course Objectives:

1. Study about types of fracture;
2. Study the principles of fracture mechanics and their applications to structural design;
3. Fracture phenomena in metals and nonmetals will be discussed and testing methods will be highlighted;
4. In the end computer assisted techniques for fracture study will be discussed.

Syllabus:

UNIT – 1
Introduction to fracture, mechanisms of fracture, a crack in structure, the Griffith's criterion, stiffness and toughness, stress intensity approach, linear elastic fracture mechanics, crack tip stress and deformations, relation between stress intensity factor and fracture toughness, stress intensity based solutions.

UNIT – 2
Elastic – plastic fracture mechanics, elasto–plastic factor criteria, crack resistance curve, J-integral, crack opening displacement, crack tip opening displacement.

UNIT – 3
Dynamic stress intensity and elastic energy release rate, crack branching, the principles of crack arrest, the dynamic fracture toughness, fatigue loading, various stages of crack propagation, the load spectrum, approximation of the stress spectrum, the crack growth integration, fatigue crack growth laws.

UNIT – 4
Fracture Resistance of materials, fracture criteria, fatigue cracking criteria, effect of alloying and second phase particles, effect of processing and anisotropy, effect of temperature, closure.

UNIT – 5

Fracture toughness testing of metals, specimen size requirements, various test procedures, effects of temperature, loading rate and plate thickness on fracture toughness.

Text Books:

1. Mechanical Metallurgy, George E. Dieter, McGraw Hill Publication.
2. Testing of Metallic Materials, A. V. K. Suryanarayan, B. S. Publication.

Reference Books:

1. Elements of Fracture Mechanics, Prashant Kumar, Tata McGraw Hill, New Delhi, India, 2009.
2. Fracture Mechanics for Modern Engineering Design, K. R. Y. Simha, Universities Press (India) Limited, 2001.
3. Elementary Engineering Fracture Mechanics, D. Broek, Kluwer Academic Publishers, Dordrecht, 1986.
4. Fracture Mechanics - Fundamentals and Applications, T. L. Anderson, Taylor and Francis Group, 3rd Edition, 2005.

Course Outcome:

On completion of the course the student should be able to:

1. Predict material failure for any combination of applied stresses;
2. Estimate failure conditions of a structure;
3. Determine the stress intensity factor for simple components of simple geometry;
4. Predict the likelihood of failure of a structure containing a defect.

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Introduction to Nano-Science and Technology **Code: MME 4235(3)**

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Course Descriptions:

This course will provide an introduction to scientific principles and applications related to nano technology. This is a system based approach of nano scale with unique functions and characteristics. This course also endows with the nano technology tools and how to use this tools/equipment for nano scale fabrication and characterization.

Course Objectives:

1. To provide a basic knowledge of nanotechnology and overview of nano-materials in terms of the synthesis, characterization, properties;
2. Critically analyze nano technology systems and distinguish their features;
3. Describe operational principles of devices based on nano-scale patterning or nano-structural materials;
4. Knowhow the potential impact of nano-science in applications;
5. Adopt current challenges of nano-technology.

Syllabus:

UNIT – 1
Introduction to nano-science and nano-technology, basic idea about atoms, molecules and structure definition and background of development, length scale, band structure and density at nano-science.

UNIT – 2
Technique for synthesis and preparation of nano-materials, bottom up and top approach of nano-technology, electron beam lithography, mechanical milling, sol-gel method, chemical vapor deposition.

UNIT – 3
Measurement and characterization of nano-materials, caning probe microscopy, STM and AFM, Electron microscopy, resolution vs magnification, SEM, Field Ion, high resolution TEM.

UNIT – 4
Introduction to Carbon Molecules, Carbon Clusters, Carbon Nano-tube, type of carbon nano-tube, type of carbon nano-tube, formation of carbon nanotube and properties and application of carbon nano-tube.

UNIT – 5
Cutting age areas of application of Nanotechnology, state of art of the nano technology, cu rrent areas of research, scope and opportunity of the technology, some special topics on application of nano-materials.

Text Books:

1. Introduction to NanoscaleScience and Technology by Massimiliano Di Ventra.
2. Nano technology, Stephane Evoy and James R Helflin, Jr. Kluwer, Academic Publisher, New York.
3. Nano-structured Materials, Carl C Koch, Noyes Publication, 2002.

Reference Books:

1. Introduction to Nanotechnology. Charles P Pool. Frank J Owen, John Weily and Son Publication, New Jersey.
2. Nanotechnology: Basic Science and Emerging Technology, Mick Wilson, Overseas Press, Indian Edition, New Delhi.
3. Introduction to Nano-science and Nanotechnology, K K Chattopadhyay and A. N Banerjee, PHI, Privet Limited, New Delhi.

Course Outcome:

On completion of the course the student should be able to:

1. To understand the need to increase nanotechnology awareness;
2. To explain the fundamental principles for the different synthesis techniques, assembly of nano materials and physical and chemical properties at the nano-scale;
3. Explain general concepts and physical phenomena of relevance within the field of nano science;
4. To Know the processing and characterization tools/equipment to synthesized nano particles;
5. Knowhow the application areas of the nano particles.

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Nuclear Metallurgy **Code: MME 4235(4)**

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Course Description:

This course is to obtain knowledge over various nuclear materials, their resources, properties and applications. Importance of nuclear power and related issues will be covered thoroughly. Various nuclear fission and fusion process with related physics will be introduced. Existence and extraction of various materials their properties and applications related to nuclear will be discoursed.

Course Objectives:

1. To study and understand the fundamental concepts of nuclear physics and nuclear chemistry;
2. To obtain knowledge over the detection of radiation and necessary protection methods;
3. To study and obtain knowledge over various types of reactor components;
4. To study and obtain knowledge over the production of reactor materials;
5. To obtain knowledge over resources of various nuclear materials.

Syllabus:

UNIT - 1
Structure of nucleus, radioactivity, binding energy: nuclear interaction; fission and fusion: nuclear reaction; energy release and chain reactions; neutron cross-section; multiplication and criticality concepts and factors.

UNIT – 2
Mechanisms of moderation, radiation detection, radiation effects on fissile and non- fissile materials; radiation damage and radiation growth; thermal cycling; protection against radiations.

UNIT - 3
Occurrence and general characteristics of nuclear minerals and their production.

UNIT – 4
Types of reactors and classification. Materials for nuclear reactors: Considerations in selection and properties of common materials used as fuels, their physical and chemical properties; canning materials; coolants; control rods; reflectors and shielding materials.

UNIT - 5
Flow sheets of processing of nuclear minerals for the production of nuclear grade uranium, thorium, beryllium and zirconium with emphasis on basic scientific principles involved; production and enriched uranium and fabrication of fuel elements.

Text Books:

1. Wright JC -Metallurgy in Nuclear Power Technology: Iliffe Book Ltd., 1962

Reference Books:

1. Nuclear Reactor Metallurgy, Ilkinson WD and Murphy WF, Van Nostrand, Symposium on Rare materials: Indian Institute of Metals.
2. Principles of Nuclear Reactor Engineering: Glasstone S and Snesonske A; Macmillan, London.
3. Uranium and Thorium: Grainger L, George Newnes Ltd., London.
4. Nuclear Fuels, Gurinsky DH and Dienes JL, Macmillan.
5. US Atomic Energy Commission, Reactor Hand book Material McGraw Hill Book Co.
6. Proceedings of the symposium on Nuclear Science and Engineering – Bhabha Atomic Research Centre, Bombay.

Course Outcome:

1. Students will be able to have an exposure of all nuclear related materials and their applications;
2. Students will have better understanding of the nuclear energy and its importance;
3. Students will be able to differentiate the importance and need of fission and fusion energies.

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Foundry Metallurgy Lab **Code: MME 4236**

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Course Objective:

To learn the concept of different casting techniques and know the requirement of different foundry appropriate equipment and accessories.

Syllabus:

(At least six experiments to be performed)

1. Melting of medium carbon steel in an induction furnace and pouring in a mold
2. Melting in crucible furnace and pouring of Cu castings
3. Melting in a pot furnace and pouring Al/Al alloys castings
4. Calculation of Metal flow rate and velocity using Bernoulli's Theorem.
5. To design a runner and gates of a mold.
6. To design a feeder head (or Riser system) considering freezing time, freezing range and volume feed capacity
7. Calculation of heat loss from open riser
8. Study of coring (or segregation) during fast cooling of casting.
9. To design for a sand casting considering various important factors
10. Study of defects in castings, their causes and remedy.

List of Equipment:

1. Crucible furnace
2. Induction furnace
3. Pot furnace (fuel fired)
4. Metallurgical microscope
5. Mechanical testing equipment
6. Non-destructive testing equipment.

Expected Outcome:

By doing the experiment students should have the knowledge of different foundry equipment, their use and different type casting processes.

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Major Project **Code: MME 4237**

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Course Descriptions:

Major Project has its own importance in a career of a student who is pursuing a professional degree. It is considered as a part of UG curriculum and related to project/research practicality of their own field of specialization/interest.

Objectives:

1. To set out the chosen project/research methods, including their theoretical basis, and the literature supporting;
2. To perform experimental and what kind of reliance could place on the results and reaches a discussion section;
3. Aim to increase the analytical methods and establishment of the case studies/industrial problem solving/research topics.

Course Outcome:

1. Understand to summarize the research methods including literature survey process;
2. Able to know the Interpretation approach and problem solving skills;
3. Able to understand the key challenges that to be faced in the research/ immediate industrial problems/case studies;
4. Able to perform a detailed draft the project/research methods.

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Professional Development **Code: PFD 4208**

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Course Description:

Today in the present world, society and organization can be developed that follow a process among the people of organization as an instrument in order to get new styles in proceeding, production and services and effective decision making and the comparison of organization with dynamic environment and competitive market which this process is beds for the developed employment skill. Entrepreneur and Knowledge Management Course aims to provide students with scientific and practical knowledge about entrepreneurship and knowledge management as well as the skills to turn such knowledge into practice. The learning outcomes are therefore designed to help the student acquire perspectives, skills and experiences necessary to take on an entrepreneurial role in future positions and activities. Knowledge Management may provide the experiences knowledge and experts. This function will create new abilities; increase the performance and the new innovation.

Course Objectives

The objectives of this course are:

1. To provide an integrative and holistic understanding of the nature of entrepreneurship;
2. To make students understand the criticality of entrepreneurship survival, growth and sustainability;
3. To make students learn the factors that contribute to entrepreneurship success and failure;
4. To make students learn the role of creativity, knowledge and learning processes in entrepreneurship;
5. To make students learn the knowledge management.

Course Content:

UNIT - 1
Entrepreneurship – definition, role and expectations – entrepreneurial styles and types – characteristics of the entrepreneur – functions of an entrepreneur – promotion of entrepreneurship – role of socio-cultural, economic and political environment – growth of entrepreneurship in pre and post independence era – constraints for the growth of entrepreneurial culture.

UNIT - 2
Entrepreneurial motivation theories - entrepreneurial competencies – developing competencies – role of entrepreneur, development programs – assistance programme for small scale units – institutional framework – role of SSI Sector in the economy – SSI

units – failure, causes and preventive measures – turnaround strategies.

UNIT - 3
Identification of business opportunity – preparation of feasibility report – financial and technical evaluation – project formulation – common errors in project formulation – specimen project report – ownership structures – proprietorship, partnership, company, co-operative, franchise.

UNIT - 4
Corporate entrepreneurship (Entrepreneurship) – concepts – need – strategies - corporate practices – select cases – dynamics of competition – plans for survival and growth.

UNIT - 5
Women entrepreneurship – need – growth of women entrepreneurship – problems faced by women entrepreneurs – development of women entrepreneurship – entrepreneurship in informal sector – rural entrepreneurship – entrepreneurship in sectors like agriculture, tourism, health case, transport and allied services.

Text Books:

1. Innovation and Entrepreneurship, Peter F.Drucker, Heinemann.
2. The Art and Science of Entrepreneurship, Donald L. Sexton & Raymond W. Smilor, Ballinger Pub. Co.
3. Entrepreneurship and Venture Management, Clifford M. Baumback & Joseph R. Mancuso, Prentice Hall.
4. Entrepreneurship, Gifford Pinchot, Harper & Row.

Reference Books:

1. How to Succeed in Small Scale Industry, Ram K. Vepa, Vikas.
2. Effective Small Business Management, Richard M. Hodgets, Academic Press.
3. Small Business Management – Fundamentals, Dan Steinhoff & John F. Burgess, McGraw Hill.
4. Small Industries Service Institute (SISI), Madras Publication: Guidelines to Entrepreneurs for starting a Small Scale Industry.

Course Outcome:

Develop an integrative and holistic understanding of the nature of entrepreneurship, creativeness, knowledge and learning processes.

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Open Elective **Code: OPE 42 (1-38)**

S. No	Subject code	Board of Study	Name of the Courses
1	OPE4201	CIE	Disaster Management
2	OPE4202	CIE	Construction Management
3	OPE4203	CIE	Ecology and Sustainable Development
4	OPE4204	CSE	Bio Informatics
5	OPE4205	CSE	Software Technology
6	OPE4206	CSE	Internet & Web Technology
7	OPE4207	CSE	Business Analysis and Optimization
8	OPE4208	CSE	IT Industry Management
9	OPE4209	CSE	IT Industry Entrepreneurship
10	OPE4210	CSE	Evolutionary Computations
11	OPE4211	CSE	E-Commerce & Strategic IT
12	OPE4212	CSE	Decision Support & Executive Information
13	OPE4213	CSE	Information Theory & Control
14	OPE4214	EEE	Distributed Generation
15	OPE4215	EEE	Non-Conventional Energy Sources
16	OPE4216	EEE	Energy Auditing and Management
17	OPE4217	HSS	Innovation, Entrepreneurship and Leadership
18	OPE4218	HSS	Technology Management
19	OPE4219	HSS	Knowledge Entrepreneurship
20	OPE4220	HSS	Finance Management
21	OPE4221	HSS	Project Planning, Management & Evaluation
22	OPE4222	HSS	Intellectual Property Rights
23	OPE4223	HSS	Engineering Economics
24	OPE4224	HSS	Human Relations Management
25	OPE4225	HSS	Entrepreneurship Development
26	OPE4226	HSS	Personnel Management and Industrial Engineering
27	OPE4227	MEE	Safety Engineering
28	OPE4228	MEE	Value Engineering
29	OPE4229	MEE	Energy Conservation & Management
30	OPE4230	MEE	Thermal Treatment of Metal and alloys
31	OPE4231	MEE	Simulation of Physical Processes
32	OPE4232	MEE	TQM and Reliability Engineering
33	OPE4233	MEE	Non Traditional Machining Techniques
34	OPE4234	MME	Nanotechnology
35	OPE4235	MME	Introduction to Nano-Technology applications
36	OPE4236	MME	Material Characterization
37	OPE4237	MME	Materials Management
38	OPE4238	MME	Manufacturing Strategies

Metallurgical and Materials Engineering

Semester: VIII **Branch: Metallurgical and Materials Engineering**
Subject: Open Elective **Code: OPE 42 (1-38)**

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Course Description:

Students have to register for the Open Electives in the departments offering the electives. Every student shall earn 3credits by choosing the open elective courses from the list. The syllabus contents of which are similar to the departmental core/elective courses. Further students from a program, say Metallurgical and Materials Engineering, shall not opt for open electives offered by their own program. Rather can opt from other departments' program. Students may consult their faculty coordinators before opting for an open elective course. The open elective courses will be to availability of time table slot of the faculty members, class rooms and minimum class strength specified from time to time.
This course is also having PRE and ESE which contains 50+50 = 100 marks. PRE segment is as Teaching Assessment (TA) 20 marks and Mid Semester Examination of 30 Marks. Minimum pass marks for PRE is 15 and for ESE is 15. But overall marks of these two must be of 35 marks.

Course Objective:

Choice Based Credit System (CBCS) is widely being practiced by many Institutions since it has become signatory of the University Grants Commission (UGC). This has promoted in such a way that different open elective courses should be offered by every department in engineering to other departments. This interdisciplinary of learning open elective courses by other department students especially in engineering education will have learning awareness and job oriented benefits. Choice based credit system is one of them. Engineering students require the opportunity to choose any open elective course from different departments and apply their knowledge to acquire jobs in that field of course. Learning and employment benefits are not only through their own course subjects but also through open elective courses.

Syllabus:

As per the department recommends.

Course Outcome:

On completion of the course the student should be able to:

1. Accomplish a prior idea of building efficiency beside own core area;
2. Get a multidisciplinary expose;
3. Achieve a potential for employability significantly improved after studying;
4. Gain a good entrepreneurship idea with the knowledge;
5. Commitment towards environment and responsibility to the society will be considerably improved.