Name of Institute: Indus Institute of Technology & Engineering

Name of Faculty: Prof. Pradnya Tikhe

Course code: SH0301

Course name: HUMAN VALUES AND PROFESSIONAL ETHICS

Pre-requisites:

Credit points: 0

Offered Semester: 3

Course Coordinator

Full Name: Prof. Pradnya Tikhe
Department with siting location: Environmental Lab
Telephone: 3006
Email: pradnyatikhe.cvl@indsusuni.ac.in
Consultation times: 4:00-5:00 PM

Course Lecturer

Full name: Prof. Pradnya Tikhe
Department with siting location: Environmental Lab
Telephone: 3006
Email: pradnyatikhe.cvl@indsusuni.ac.in
Consultation times: 4:00-5:00 PM

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives

1. To Facilitates arriving at correct decisions because, correct decisions form basis for Succes anywhere and in any venture.

2. To Decode Success.

3. To achieve Emotional stability through righteous earning of wealth.

4. To understand and discriminate between ethical and unethical practices.

5. To study moral issues and critical decision making.

6. To understand the role of ethics in promoting sustainable

Course Outcomes (CO)

CO1: Identify the ways to decode success and redefining it for global sustainability [BT-1]

CO2: Understand the Difference between the ethical and unethical practices in surrounding and explore the reasons behind them. [BT-2]

CO3: Apply correct decisions to form basis for success in all ventures of life [BT-3]

CO4: Analyze various components of self (mind, body, soul) [BT-4]

CO5: Estimate the Emotional stability through righteous earning of wealth [BT5]

CO6: Develop the thought process for promoting sustainable practices in multiple domains of life and society. [BT6]

Course Outline

Method of delivery

70% of Lectures consist of Face to face lectures which are conducted on online mode (any platform), 20% of lectures comprise of PowerPoint Presentation through which various videos and images of related topics are shown to the students, and 10% of lectures consist of hands on session.

Study time

2 hours of lectures (theory) per week and 2 hours of laboratory sessions.

CO-PO Mapping (PO: Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	1	3	2	-	-	2	2	2	1	1	1	1
CO2	-	2	2	-	-	2	1	3	-	-	-	1
CO3	-	3	2	2	-	3	-	1	1	1	-	1
CO4	-	-	-	-	-	3	-	3	3	2	-	1
CO5	-	-	-	-	-	3	-	3	3	2	-	1
CO6	-	2	-	3	-	3	3	-	1	1	-	3

1-Lightly Mapped 2- Moderately Mapped 3- Highly Mapped

Blooms Taxonomy and Knowledge retention (For reference)

(Blooms taxonomy has been given for reference)

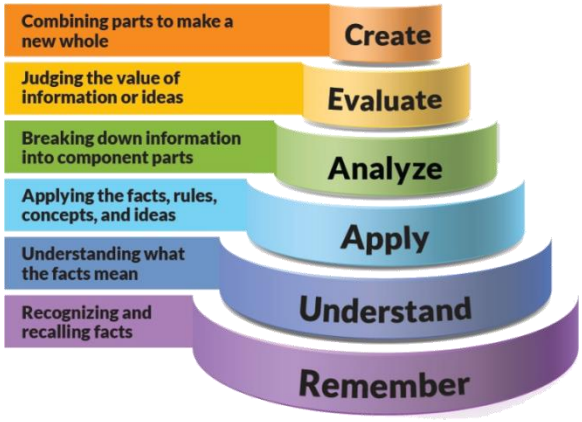

Figure 1: Blooms Taxonomy

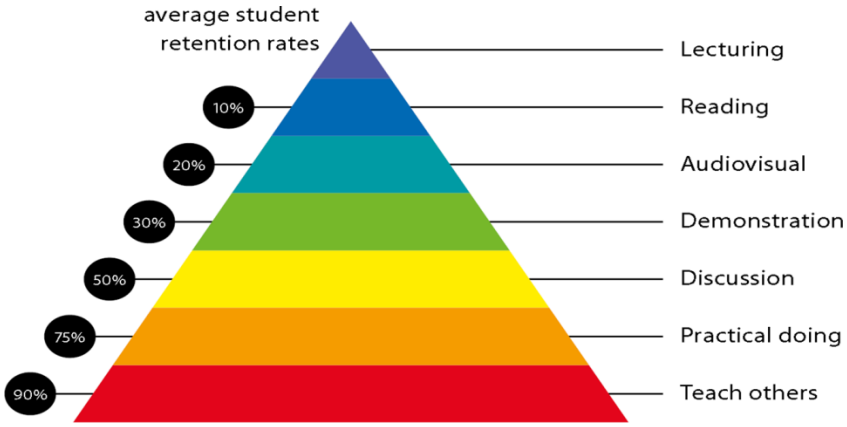

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of _____Graduate Capabilities

Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of other.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

List of Experiments:

Lecture/tutorial times

(Give lecture times in the format below)

Lecture	**Monday**	**2:00-3:00 pm**
Lecture	**Friday**	**11:10-12:10 am**

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in written work

Reference Books:

1) The Mahabharata box set - Bibek Debroy, ISBN-13: 978-0143424789

2) The Valmiki Ramayana, Set of 3 Vols - Bibek Debroy, ISBN-13: 978-0143441144

3) Honest truth of dishonesty Dan Ariely, Harper (2012), ISBN:

0062183591 / 9780062183590

4) “Seven Spiritual Laws of Success”, Deepak Chopra, Amber-Allen Publisher,

ISBN: 9782290339954

5) “The Vedas and Upanishads for Children”, Roopa pai,Hachette India,

ISBN: 9789351952961

6) The Gita: for Children - Roopa Pai, Hachette India Local; Latest edition, ISBN:

9789351950127

7) Go for Growth, Narsinhbhai K Patel, Ahmedabad Management Association

8) Be a Winner, Narsinhbhai K Patel, and Ahmedabad Management Association

9) Swadharma: Puranic stories for childrena

10) Pearls of Wisdom from Hinduism – Nicholas Sutton and Hanuman Dass

11) The Power of Dharma: The Universal Moral Principle - Nicholas Sutton and

Hanuman Dass

10) Two Vedic Tales: Stories from the Mahabharata and the Puranas

11) Inside Job (documentary) - Matt Damon (Actor), Gylfi Zoega (Actor), & 1

More Rated: U/A (Parental Guidance) Format: Blu-ray

12) Ethical and Spiritual Values in Indian Scriptures - Ved Prakash Bhatia

13) The Upanishads Demystified: Ethical values - Ved Prakash Bhatia

14) Lying - Sam Harris

15) Free Will - Sam Harris

16) Deep Work: Rules for Focused Success in a Distracted World Paperback – Cal Newport

17) The Elephant in the Brain: Hidden Motives in Everyday Life - Kevin Simler and Robin Hanson

18) Trust Me I'm lying: Confessions of a Media Manipulator - Ryan Holiday

19) Who is in Charge? Free Will and the Science of the Brain - Michael S.

Gazzaniga

20) The Ethical Brain: The Science of Our Moral Dilemmas - Michael S.

Gazzaniga

21) Misbehaving Paperback – by Richard H Thaler

Text books

Additional Materials

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Example:	
Introspection report	25Mark (week 8)
Video presentation	25
Assignments	25 Mark

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e mid semester or end semester) of semester concerned. Students must make themselves

available during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.

Do not share your work with other students (except where required for a group activity or assessment.

Course schedule (subject to change)

(Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Week 1	Music with invocation of thought process,	1	PPT
	Week 2	Decoding success: Skill or a trait or both?	1,2	PPT
	Week 3	Decoding self to decode success	1,2	PPT
	Week 4	Understanding Self-Confidence, Self-respect, Self-esteem,	3	PPT
	Week 5	False prestige towards removal of Identity crisis,	6	PPT
	Week 6	Components of self (mind, body, spirit), Idea of self (Which of the three am I?),	3	PPT
	Week 7	Mind and conscience,	2	PPT
	Week 8	Psychosomatic (mind over matter) effect and dis-ease	1,3	PPT
	Week 9	Effect of ethics and values on well-being,	1,2	PPT
	Week 10	Handling insecurity, anxiety and pressure, Handling failures, guilt,	4	PPT
	Week 11	Status and success, Success redefined.	3	PPT
	Week 12	Happiness being the key to success and not vice-versa	4	PPT
	Week 13	From self to society to global-sustainability.	3	PPT
	Week 14	Revision	1	PPT

Subject: HUMAN VALUES AND PROFESSIONAL ETHICS								
Program: B.Tech (All Branches)				Subject Code: SS0301			Semester: III	
Teaching Scheme (Hours per week)				Examination Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)-Theory	Continuous Internal Evaluation (CIE)-Practical	Total
2	0	0	2	00	00	100	00	100

Course Objectives:

1. To Facilitates arriving at correct decisions because, correct decisions form basis for Succes anywhere and in any venture.
2. To Decode Success.
3. To achieve Emotional stability through righteous earning of wealth.
4. To understand and discriminate between ethical and unethical practices.
5. To study moral issues and critical decision making.
6. To understand the role of ethics in promoting sustainable

Course Contents:

Music with invocation of thought process, Decoding success: Skill or a trait or both?, Decoding self to decode success, Understanding Self-Confidence, Self- respect, Self-esteem, False prestige towards removal of Identity crisis, Components of self (mind, body, spirit), Idea of self (Which of the three am I?), Mind and conscience, Psychosomatic (mind over matter) effect and dis-ease, Effect of ethics and values on well being, Handling insecurity, anxiety and pressure,Handling failures, guilt, Status and success, Success redefined., Happiness being the key to success and not vice-versa, From self to society to global-sustainability.

Course Outcomes:

CO1: Identify the ways to decode success and redefining it for global sustainability [BT-1]

CO2: Understand the Difference between the ethical and unethical practices in surrounding and explore the reasons behind them.[BT-2]

CO3: Apply correct decisions to form basis for success in all ventures of life [BT-3]

CO4: Analyse various components of self(mind, body, soul) [BT-4]

CO5: Estimate the Emotional stability through righteous earning of wealth [BT5]

CO6: Develop the thought process for promoting sustainable practices in multiple domains of life and society. [BT6]

Books:

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4) "Seven Spiritual Laws of Success", Deepak Chopra, Amber-Allen Publisher, ISBN: 9782290339954

5) "The Vedas and Upanishads for Children", Roopa pai,Hachette India, ISBN:9789351952961

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20) The Ethical Brain: The Science of Our Moral Dilemmas - Michael S. Gazzaniga

21) Misbehaving Paperback – by Richard H Thaler

Name of Institute: IITE, INDUS UNIVERSITY
Name of Faculty: Dr A D Dhass

Course code: BB0311
Course name: MANAGEMENT FOR ENGINEERS
Pre-requisites: INDUSTRIAL ENGINEERING
Credit points: **2**
Offered Semester: **3**

Course coordinator (weeks 01 - 15)
Full name: Dr A D Dhass
Department with sitting location: ME, 3 Floor Staff Room
Telephone:3333
Email: addhass.me@indusuni.ac.in
Consultation times: 4 pm to 5 pm

Course lecturer (weeks 01 - 15)
Full name: Dr A D Dhass
Department with siting location:. ME, 3 FLOOR Staff room
Telephone:3333
Email: addhass.me@indusuni.ac.in
Consultation times: 4 pm to 5 pm

Students will be contacted throughout the session via mail with important information relating to this course.

Course Objectives

1. Techniques relating to managing engineering activities, engineer's transition into management, engineering managerial functions, motivation of individual and group behavior.
2. Productivity assessment/improvement.
3. Managing the quality function and communications.

Course Outcomes (CO)

1. Able to know, comprehend, apply, analyze, synthesize and evaluate the basic principles of the fundamentals of managing technical organizations.
2. Prepare for further study in the area of engineering technology management.
3. Able to identify and apply appropriate management techniques for managing contemporary organizations.

4. Have an understanding of the skills, abilities, and tools needed to obtain a job on a management track in an organization of their choice.

Course Outline

1. Importance and Functions of Management
2. Leadership and Organization Management
3. Management of Technology
4. Marketing Management
5. Financial Management
6. Ethics

Method of delivery

Power Point presentations

Study time

2 Hours a week

CO-PO Mapping (PO: Program Outcomes)

PO1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

PO2. **Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

PO6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

COURSE OUTCOME (CO) and PROGRAM OUTCOME (PO) Matrix

(1– Low, 2-Medium, 3- High)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C0 1	2	1	-	1	-	1	-	2	1	2	-	1
C0 2	2	1`	-	1	-	1	1	2	1	1	-	1
C0 3	2	2	-	1	-	1	-	2	1	1	-	1
CO 4	2	2	-	1	-	1	1	2	1	2	-	1
BB0311	**3**	**1.5**	**-**	**1**	**-**	**1**	**0.5**	**2**	**1**	**1.5**	**-**	**1**

Blooms Taxonomy and Knowledge retention(For reference)

(Blooms taxonomy has been given for reference)

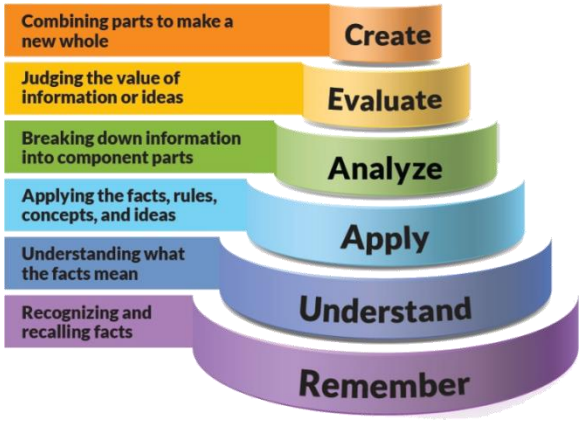

Figure 1: Blooms Taxonomy

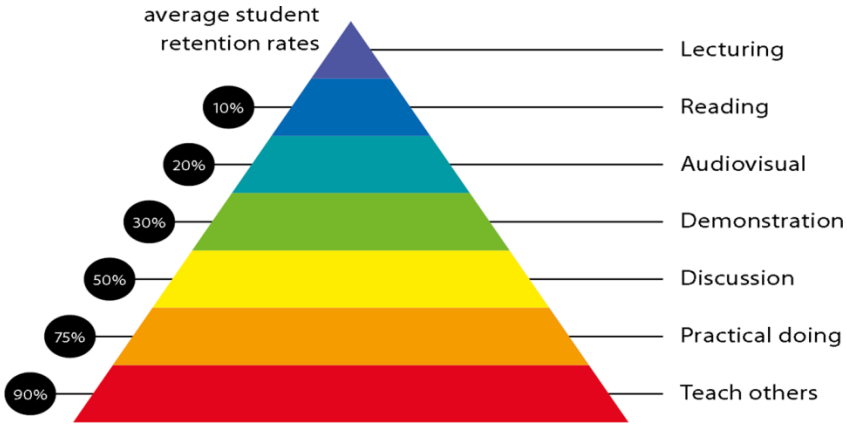

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of _____Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has	**1 Professional knowledge, grounding & awareness**

developed and how it relates to other areas.	
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

NIL

Lecture/tutorial times

(Give lecture times in the format below)

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for semester examinations.

Details of referencing system to be used in written work

1. https://www.managementstudyguide.com/management_functions.htm

2. https://www.managementstudyguide.com/organizational-leadership.htm

3. https://www.sopheon.com/wp-content/uploads/eBook-5-Keys-to-Effective-Innovation-and-New-Product-Development-NPD-Planning.pdf

4. http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_mm.pdf

5. http://www.pondiuni.edu.in/storage/dde/downloads/mbaii_fm.pdf

Text books

1. Principles of Management by PC Tripathi & Reddy.
2. Management –I by Stephen P. Robbins& Stoner.
3. Management-II BY Kotler,Stoner

Reference Books

1. L. M. Prasad; Principles of Management; Sultan Chand and Sons
2. Karminder Ghuman and K. Aswathapa; Management – Concept

Additional Materials

Power Point Presentations

Web Resources: http://nptel.ac.in/courses

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Internal Component : 60 Marks

Assignment : 10 Marks

Presentation : 10 Marks (2 Presentations, 10 marks each)

Mid Sem Exam : 40 Marks

Final Exam : 40 Marks

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in internal component or less than 40% in the end semester will be considered for supplementary assessment in the respective components (i.e internal component or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (internal component or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

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Do not copy the work of other students.

Do not share your work with other students (except where required for a group activity or assessment)

.

Course schedule(subject to change)

(Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
Weeks 1	Meaning, importance, skills and roles of manager, different levels of management.	1	ASSIGNMENT 1
Weeks 2	Functions of management, planning: nature, importance, steps,	1	ASSIGNMENT 2
Week 3	Organising: Meaning, process, principles of organizing, staffing:- manpower planning, recruitment, selection, placement.	2	ASSIGNMENT 3
Week 4	Leadership and Organizations Management, Strategic Planning	2	**QUIZ 1** ASSIGNMENT 4
Week 5	Budgeting, Project Planning	3	ASSIGNMENT 5
Week 6	Risk Identification, Assessment and Response Planning	3	ASSIGNMENT 6
Week 7	Management of Technology, Product Development and Innovation	3	ASSIGNMENT 7
Week 8	Technical Entrepreneurship,	3	**QUIZ 2** ASSIGNMENT 8
Week 9	Global Trade and International Operations, Operations Management	4	ASSIGNMENT 9

	Week 10	Marketing Management:-the 4 p's of marketing, demand forecasting (concepts only),	4	ASSIGNMENT 10
	Week 11	market segmentation.	4	ASSIGNMENT 11
	Week 12	Financial management:-meaning, scope, functions, objectives, role of financial manager.	4	ASSIGNMENT 12 **QUIZ 3**
	Week 13	Lean Systems,	4	ASSIGNMENT 13
	Week 14	Intellectual Property, Legal Issues in Engineering Management,	4,5	ASSIGNMENT 14
	Week 15	Principles of Ethics for Engineering Managers	4,5	**QUIZ 4** ASSIGNMENT 15

Subject: Management for Engineers								
Program: B. Tech in Metallurgy Engineering				Subject Code: BB0311			Semester: III	
Teaching Scheme (Hours per week)				Examination Evaluation Scheme (Marks)				
Lecture	Tutorial	Practical	Credits	University Theory Examination	University Practical Examination	Continuous Internal Evaluation (CIE)- Theory	Continuous Internal Evaluation (CIE)- Practical	Total
2	0	0	2	16/40	0	24/60	0	100

Course Objectives

1. Techniques relating to managing engineering activities, engineer's transition into management, engineering managerial functions, motivation of individual and group behavior.
2. Productivity assessment/improvement.
3. Managing the quality function and communications.

CONTENTS

UNIT-I

[7 hours]

Meaning, importance, skills and roles of manager, different levels of management. Functions of management, planning: nature, importance, steps, Organising: Meaning, process, principles of organizing, staffing:-manpower planning, recruitment, selection, placement.

UNIT-II

[7 hours]

Leadership and Organizations Management, Strategic Planning, Budgeting, Project Planning - Risk Identification, Assessment and Response Planning

UNIT-III [7 hours]

Management of Technology, Product Development and Innovation, Technical Entrepreneurship, Global Trade and International Operations, Operations Management

UNIT-IV [7 hours]

Marketing Management:-the 4 p's of marketing, demand forecasting (concepts only), market segmentation. Financial management:-meaning, scope, functions, objectives, role of financial manager. Lean Systems, Intellectual Property, Legal Issues in Engineering Management, Principles of Ethics for Engineering Managers

Course Outcomes

1. Able to know, comprehend, apply, analyze, synthesize and evaluate the basic principles of the fundamentals of managing technical organizations.

2. Prepare for further study in the area of engineering technology management.

3. Able to identify and apply appropriate management techniques for managing contemporary organizations.

4. Have an understanding of the skills, abilities, and tools needed to obtain a job on a management track in an organization of their choice.

Text Books

1. Principles of Management by PC Tripathi & Reddy.

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3. Management-II BY Kotler,Stoner

Reference Books

1. L. M. Prasad; Principles of Management; Sultan Chand and Sons

2. Karminder Ghuman and K. Aswathapa; Management – Concept

Name of Institute: Institute of Technology and Engineering
Name of Faculty: Dr.S.K. Chaudhury

Course code:MME0303
Course name: Metallurgical Thermodynamics
Pre-requisites: Materials Science
Credit points: 4
Offered Semester: 3rd

Course Coordinator (weeks 1 - 16)
Full Name: Dr. S.K. Chaudhury
Department with siting location: First Floor, Met. Lab. 3, Bhanwar Building
Telephone: 8469943117
Email: sujoychaudhury.mt@indusuni.ac.in
Consultation times: 4.15-5.00PM

Course Lecturer (weeks 1 - 16)
Full Name: Dr. S.K. Chaudhury
Department with siting location: First Floor, Met. Lab. 3, Bhanwar Building
Telephone: 8469943117
Email: sujoychaudhury.mt@indusuni.ac.in
Consultation times: 4.15-5.00PM

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives

By participating in and understanding all facets of this Course a student will:

1. To get the knowledge about the basic concept of system, properties of system and thermodynamics.
2. To analyze and understand all the laws of thermodynamics.
3. To understand thermodynamics of solutions ideal & non ideal solution.

Course Outcomes (CO)

CO 1: Able to define all terms and derive equations in metallurgical thermodynamics. (BT-1)
CO 2: Able to explain theories, represent mathematical derivations to reality and understand their limitations. (BT-2)
CO 3: Apply the knowledge of thermodynamics to different metallurgical processes. (BT-3)
CO 4: Analyze the results of numerical pertinent to different processing conditions. (BT-4)
CO 5: Evaluate Gibb's free energy, equilibrium constant and other thermodynamic properties of various reactions and enabling the feasibility of process at specific condition. (BT-5)
CO 6: Develop criteria for stability of phase(s) under given processing condition and construct Ellingham diagram. (BT-6)

Course Outline

(Key in topics to be dealt)
Basic definition of thermodynamics
Maxwell's relations
Ideal and Non-ideal solutions
Gibbs energy vs. composition diagram

Method of delivery

Interactive lectures using power point and demo using Thermo-Calc & PANDAT software, online classes

Study time

4 classes (including 1 tutorial) per week

CO-PO Mapping (PO: Program Outcomes)

CO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
C0 1	3	2								1		1
C0 2	3	3							1			1
C0 3	2	3							1	1		2
C0 4	2	3	1	1								
C0 5	1	2		1						1		3
C0 6	1			2					2	1		3
MME0303	2	2.6	1	1.3					1.3	1.3		2

Blooms Taxonomy and Knowledge retention (For reference)

(Blooms taxonomy has been given for reference)

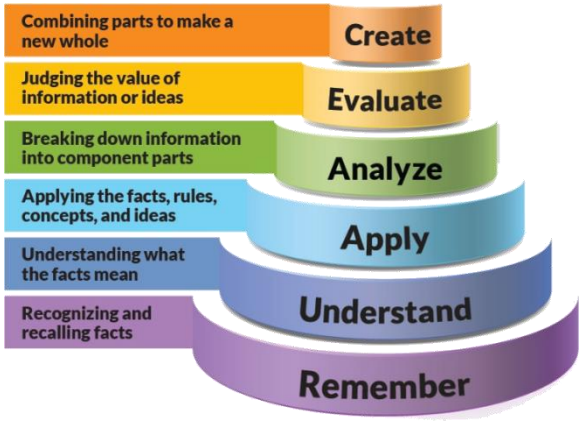

Figure 1: Blooms Taxonomy

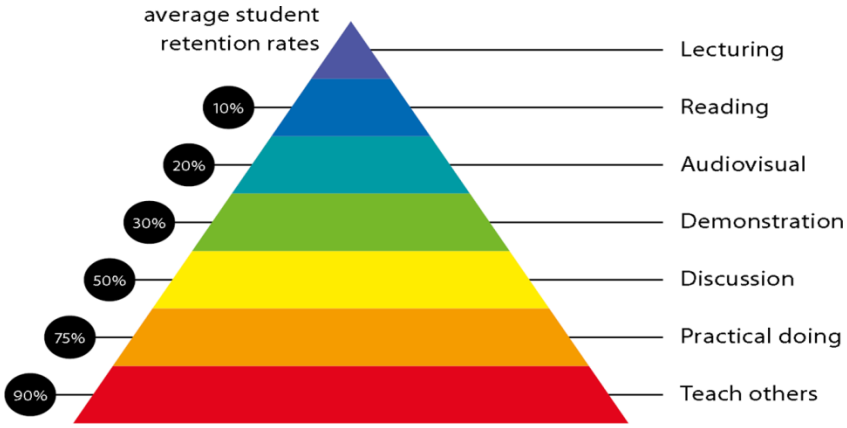

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of _____Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**

Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

(Mention what practical work this Course involves)

Lecture/tutorial times

(Give lecture times in the format below)

Example:			
Lecture	**Monday**	**2.00 – 3.00 pm**	**online platform**
Lecture	**Tuesday**	**3.10 – 4.10 pm**	**online platform**
Lecture	**Wednesday**	**2.00 – 3.00 pm**	**online platform**
Tutorial	**Thursday**	**3.10 – 4.10pm**	**online platform**

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in written work

Text books

1. A. Ghosh, "Introduction to Materials and Metallurgical Thermodynamics", Prentice Hall India Learning Private Limited, 1st Edition, 2002, ISBN: 9788120320918.
2. S. K. Dutta and A. B. Lele, "Metallurgical Thermodynamics Kinetics & Numericals", S. Chand Publications, 2nd Edition, 2014, ISBN: 9788121939645.
3. D. R. Gaskell, "Introduction to the Thermodynamics of Materials", T&F, 5th Edition.

Additional Materials

1. R. H. Tupkary, "Essentials of Metallurgical Thermodynamics", Khanna Publishers, 1st Edition, 2006, ISBN: 9789382609032.
2. G. S. Upadhyaya, R. K. Dube and D. W. Hopkins, "Problems in Metallurgical Thermodynamics and Kinetics", Pergamon Press, 1st Edition, 1977, ISBN: 9780080208640.
3. L. S. Darken and R. W. Gurry, "Physical Chemistry of Metals", CBS, 1st Edition, 2002, ISBN: 9788123914794.
4. NPTEL MOOC Course on "Laws of Thermodynamics" (https://onlinecourses.nptel.ac.in/noc17_mm16/preview)
5. SWAYAM MOOC Course on "Engineering Thermodynamics" (https://swayam.gov.in/course/3808-engineering-thermodynamics)

6. EdX Online Course on "Thermodynamics" (https://www.edx.org/course/thermodynamics-iitbombayx-me209-1x-1)
7. NPTEL Online Course on "Advanced Metallurgical Thermodynamics" (http://nptel.ac.in/courses/113106031/)

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

CIE 60 marks :(40 marks mid semester examination + 20 marks internal evaluation)
Breakup of 20 Marks: (05 marks as attendance bonus for all students having attendance > 80%) + (05 marks for presentation)+(10 marks for maximum 2 assignment or case studies)
ESE: 40 Marks of End Semester Examination

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e mid semester or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of 10% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

Course schedule (subject to change)

(Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	Importance of thermodynamics, Definition of thermodynamic terms, Concept of system, states and equilibrium.	1	Interactive teaching using PPT
	Weeks 2	Types of system, Extensive and intensive properties, Homogeneous and heterogeneous systems, Quasistatic process, Zeroth law of thermodynamics	1,2	Interactive teaching using PPT
	Week 3	First law of thermodynamics, Internal energy, Heat capacity, Specific heat and latent heat, Enthalpy, Isothermal and adiabatic processes.	1,2	Interactive teaching using PPT
	Week 4	State properties, Heat of reaction, Heat of formation, Standard heats, Heat of transition, Hess's law, Kirchoff's law equation.	1,2	Interactive teaching using PPT
	Week 5	Second law of thermodynamics, Entropy of irreversible processes, Auxiliary functions, combined statements of 1^{st} and 2^{nd} laws, Maxwell's relations.	2,3,4	Interactive teaching using PPT
	Week 6	Third law of thermodynamics, Temperature dependence of entropy, Statistical interpretation of entropy, Consequences of third law, Nernst heat theorem.	2,3,4	Interactive teaching using PPT
	Week 7	Concept of fugacity, activity and mole fraction, Activities in concentrated solution, Activity, Gas phase Reactions (H_2O- H_2 and CO_2 –CO mixtures),	4,5	Interactive teaching using PPT
	Week 8	Activity in industrial liquid metallic solution, Equilibrium constant, Gibb's-Helmholtz equation	3,4	Interactive teaching using PPT
	Week 9	Van't-Hoff equation, Clausius – Clapeyron equation, Reactions involving solid and gases.	2,3	Interactive teaching using PPT
	Week 10	Thermodynamics of solutions, Ideal solution, Raoult's law, Henry's law,	4,5	Interactive teaching using PPT.

	Week 11	Non-ideal solution Gibb's-Duhem equation, Partial molar properties of mixing.		
	Week 12	Excess functions, Concept of 1 wt% standard state and Interaction coefficient, Regular solutions, Sievert's law-residual gases in steel.	2	Interactive teaching using PPT
	Week 13	Phase relations and phase rule-its applications, Free energy-composition and temperature-composition diagrams for binary alloy systems and their correlation	6	Interactive teaching using PPT
	Week 14	Determination of liquidus, solidus and solvus lines. Effect of pressure on phase transformation and phase equilibrium	6	Interactive teaching using PPT
	Week 15	Ellingham diagram in detail for metal oxides.	6	Interactive teaching using PPT
	Week 16	Revision	1-6	Interactive teaching using PPT

Program Mapping (Metallurgy Engineering Department)

Sem	Subjects
1st	DELA; Engineering Chemistry; Workshop; Material Science; Environmental Science; Material Science (OE); Technical English 1
2nd	Calculus; Engineering Physics; Metallurgy for Non Metallurgists (OE); Structural Properties and Physics of Materials; Engineering Graphics; Advanced Material and Application (OE); Technical English 2
3rd	Probability, Statistics and Numerical Methods; Management for Engineers; Human Values and Professional Ethics; Mineral Processing; Metallurgical Thermodynamics; Internship-I; Physical Metallurgy
4th	Iron Making; Transport Phenomena; Metal Casting and Solidification (OE); Recycled Materials (OE); Heat Treatment Principles and Practices; Soft Skill and Interpersonal Comm.; Personality Credit-1
5th	Foundry Technology; Steel Making; Fuel Furnace and Refractories (EL); Environmental Pollution and its Control in Met. Ind. (EL); Non Ferrous Extractive Metallurgy; Plastic Deformation of Metals; Energy Economy and Waste Management- (OE); Internship-2
6th	Metal Forming; Phase Transformation; Powder Metallurgy (Elective-1); Modelling of Metallurgical Processes (Elective-1); Electrometallurgy and Corrosion; Ind. Ceramics and Polymers (El-2); Nano Technology (OE); Metal Joining Processes; Composite Materials (EL-2); Personality Credit-2
7th	Metal Testing and Characterisation; Alloy Design (EL); Advanced Ferrous Metallurgy (EL); Surface (EL); Internship-3; Non Destructive Testing (EL) and (OE); Material Testing and Standards; Selection of Material & Failure analysis (EL) & (OE); Advanced Foundry Technology (EL)
8th	Project

Subject: **Metallurgical Thermodynamics**								
Program: **B. Tech in Metallurgical Engineering**				Subject Code: **MME0303**				Semester: **III**
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	1	0	4	16/40	0	24/60	0	100

Course Objectives

1. To get the knowledge about the basic concept of system, properties of system and thermodynamics.
2. To analyze and understand all the laws of thermodynamics.
3. To understand thermodynamics of solutions ideal & non ideal solution.

CONTENTS

UNIT-I

[10 hours]

Importance of thermodynamics, Definition of thermodynamic terms, Concept of system, states and equilibrium, Types of system, Extensive and intensive properties, Homogeneous and heterogeneous systems, Quasistatic process, Zeroth law of thermodynamics. First law of thermodynamics, Internal energy, Heat capacity, Specific heat and latent heat, Enthalpy, Isothermal and adiabatic processes.

.

UNIT-II

[10 hours]

State properties, Heat of reaction, Heat of formation, Standard heats, Heat of transition, Hess's law, Kirchoff's law equation. Second law of thermodynamics, Entropy of irreversible processes, Auxiliary functions, combined statements of 1^{st} and 2^{nd} laws, Maxwell's relations,

Third law of thermodynamics, Temperature dependence of entropy, Statistical interpretation of entropy, Consequences of third law, Nernst heat theorem.

UNIT-III

[10 hours]

Concept of fugacity, activity and mole fraction, Activities in concentrated solution, Activity, Gas phase Reactions (H_2O- H_2 and CO_2 –CO mixtures), Activity in industrial liquid metallic solution, Equilibrium constant, Gibb's-Helmholtz equation. Van't-Hoff equation, Clausius – Clapeyron equation, Reactions involving solid and gases, Thermodynamics of solutions, Ideal solution, Raoult's law, Henry's law, Non-ideal solution Gibb's-Duhem equation, Partial molar properties of mixing.

UNIT-IV

[10 hours]

Excess functions, Concept of 1 wt% standard state and Interaction coefficient, Regular solutions, Sievert's law-residual gases in steel, Phase relations and phase rule-its applications, Free energy-composition and temperature-composition diagrams for binary alloy systems and their correlation, determination of liquidus, solidus and solvus lines, Effect of pressure on phase transformation and phase equilibrium, Ellingham diagram in detail for metal oxides.

Course Outcomes

1. To demonstrate the application of various factors & mathematical equations governing the thermodynamics in the system.
2. To solve different numerical pertaining to all three laws of thermodynamics for different systems.
3. To demonstrate the phenomena of Ellingham diagram & its importance pertaining to metal oxides.
4. To describe basis of phase rule & its application and various equilibrium using thermodynamics and correlation for binary alloy systems.

Text Books

1. A. Ghosh, "Introduction to Materials and Metallurgical Thermodynamics", Prentice Hall India Learning Private Limited, 1st Edition, 2002, ISBN: 9788120320918.
2. S. K. Dutta and A. B. Lele, "Metallurgical Thermodynamics Kinetics & Numericals", S. Chand Publications, 2nd Edition, 2014, ISBN: 9788121939645.
3. D. R. Gaskell, "Introduction to the Thermodynamics of Materials", T&F, 5th Edition.

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3. L. S. Darken and R. W. Gurry, "Physical Chemistry of Metals", CBS, 1st Edition, 2002, ISBN: 9788123914794.

Web Resources

1. NPTEL MOOC Course on "Laws of Thermodynamics" (https://onlinecourses.nptel.ac.in/noc17_mm16/preview)
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4. NPTEL Online Course on "Advanced Metallurgical Thermodynamics" (http://nptel.ac.in/courses/113106031/)

Name of Institute: IITE
Name of Faculty: Mr. Monil Salot

Course code: MME0302
Course name: Mineral Processing
Pre-requisites: Material Science
Credit points: 04
Offered Semester: 03

Course Coordinator

Full Name: Mr. Monil Salot
Department with siting location: Metallurgical Engineering, Bhanwar Building, Lab-004 (GF)
Telephone: 9428600336
Email: monilsalot.mt@indusuni.ac.in
Consultation times: 4:15-5:00 PM

Course Lecturer

Full Name: Mr. Monil Salot
Department with siting location: Metallurgical Engineering, Bhanwar Building, Lab-004 (GF)
Telephone: 9428600336
Email: monilsalot.mt@indusuni.ac.in
Consultation times: 4:15-5:00 PM

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives

By participating in and understanding all facets of this Course a student will:

1. To make the students aware about basics of mining technology.
2. To impart the knowledge about the basic steps followed in mineral dressing and its importance before extraction of pure metal from their respective ores.
3. To develop the knowledge regarding the auxiliary operation and the advancement in mining technology

Course Outcomes (CO)

CO1: To be able to list and define glossary and terminology associated with mineral processing and extractive metallurgy. (BT-1)
CO2: To understand liberation, communition and its significance. (BT-2)
CO3: To calculate and apply economics involved with ore extraction.(BT-3)
CO4: To analyse and categorise classifiers and separation techniques for classifying

ores. (BT-4)
CO5: To evaluate physical and chemical characteristics of industrial minerals. (BT-5)
CO6: To innovate beneficiation techniques for effective and efficient processing of minerals. (BT-6)

Course Outline

Proposed course mainly deal with nuances of Mineral Processing and deals with the majority of process pertaining to basis for process metallurgy and it helps understand the basis for lot many advanced production-based subjects, along with this, the subject deals with techniques for beneficiation and bettering the efficiency for production.

Method of delivery

Face to face lectures, Experiments in Laboratory, Model Making

Study time

3 hours of Lectures and 2 hours of Laboratory.

CO-PO Mapping (PO: Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	1	1	1	1							3
CO2	2	2	2	1							1	2
CO3	2	3	3	2		1					3	2
CO4	1	2	1	1								1
CO5	2	2	2	1	1							1
CO6	1	1	3	2	1						1	2

1-Lightly Mapped 2- Moderately Mapped 3- Highly Mapped

Blooms Taxonomy and Knowledge retention

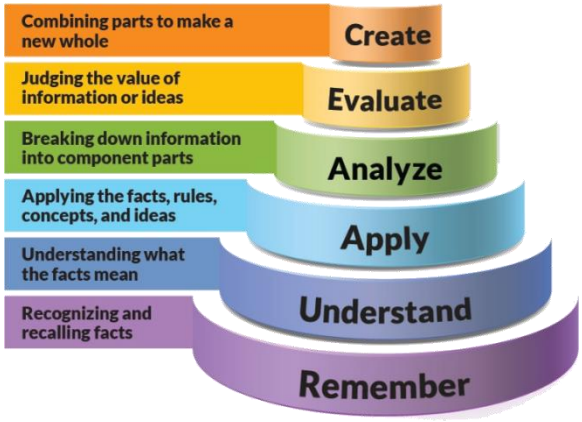

Figure 1: Blooms Taxonomy

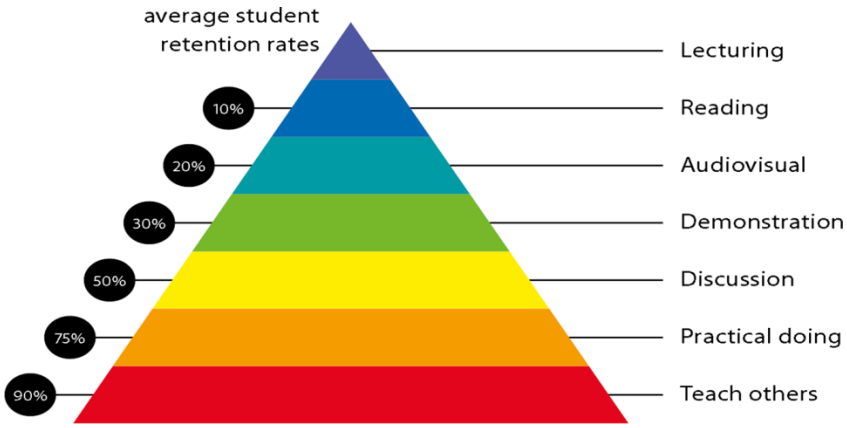

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

General Graduate Qualities	Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers	**4 Problem solving skills**

Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communications**
	6 Oral communication
	7 Teamwork
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

Experiment No	Title
1	To study the crushers (primary and secondary) like jaw crusher and roll crusher and to measure their reduction ratios and capacities
2	To determine the reduction ratio of Coal.
3	To determine the reduction ratio of Coke.
4	To determine the reduction ratio of Iron ore.
5	To determine the reduction ratio of Ceramic material.
6	To study the sieve analysis of weighed powder sample
7	To study the ball mill and measure the grind ability of Ball mill
8	To determine the grindability of Coal.
9	To determine the grindability of coke.
10	To determine the grindability of Iron ore.
11	To determine the grindability of ceramic material.
12	To study the principle, operation and efficiency of laboratory classifier
13	To determine the efficiency of magnetic separation by varying strength of magnetic field
14	To study the coal and gravel separation using jig
15	To study the froth flotation of given sample of coal

Lecture/tutorial times

Lecture	Monday	11:10- 12:10 PM	Room LH 4
Lecture	Tuesday	12:10- 01:15 PM	Room LH 4
Lecture	Thursday	11:10- 12:10 PM	Room LH 4
Lab	Tuesday	11:10- 1:10 PM	Lab -04 (Ground Floor)

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in written work

Reference Books

1. A. M. Gaudin, "Principles of Mineral Dressing", Tata McGraw Hill Publications, 1st Edition, 1939, ISBN: 9780070230309.
2. B. A. Wills and J. Finch, "Mineral Processing Technology", Butterworth-Heinemann, 8th Edition, 2015, ISBN: 9780080970530.
3. E. G. Kelly and D. J. Spottiswood, "Introduction to Mineral Processing", John Wiley & Sons Inc, 1982, ISBN: 9780471033790.
4. J. D. Gilchrist, "Extraction Metallurgy", Pergamon Press, 1st Edition, 1967, ISBN: 9780080120300.
5. E. J. Pryor, "Mineral Processing", Springer Netherlands, 3rd Edition, 1965, ISBN: 9789401029438.
6. J. Newton, "Extractive Metallurgy", John Wiley & Sons Inc, 1st Edition, 1959, ISBN: 9780471635918.
7. H. S. Ray, R. Sridhar and K. P. Abraham, "Extraction of Non-ferrous Metals", Affiliated East-west Press Pvt Ltd, 1st Edition, 2008, ISBN: 9788185095639.

Text books

1. S. K. Jain, "Mineral Processing", CBS Publishers & Distributors, 2nd Edition, 2012, ISBN: 9788123907536.

Additional Materials

1. nptel.ac.in

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

CIE 60 marks :(40 marks mid semester examination + 20 marks internal evaluation)

Breakup of 20 Marks: (05 marks as attendance bonus for all students having attendance > 80%) + (05 marks for presentation) +(10 marks for assignment or case studies)

ESE: 40 Marks of End Semester Examination

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e mid semester or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components. , For remedial and repeater remedial - CIE 60 marks (40 marks remedial mid semester examination + 20 marks for assignments or case studies, limited to minimum 04 assignments per course), and end semester repeater and remedial examination would be carried out centrally according to University Policy

Practical Work Report/Laboratory Report:

Upon completion of each experiment, the student has to complete the journal and get it evaluated within a weeks' time before the next experiment is started.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

Course schedule (subject to change)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	**General:** Introduction and scope of mineral processing in extractive metallurgy, mineral resources in India,	1,2,3	BB, PPT, OL
	Weeks 2	Physical characteristics exploited in mineral processing, terminology in mineral processing.	1,2,3	BB, PPT, OL
	Week 3	Physical and chemical characteristics of industrial minerals i.e. hematite, magnetite, galena, chalcopyrite, azurite, monazite, cassiterite, chromite, bauxite, and ilmenite, economics of ore processing.	1,2,3	BB, PPT, OL
	Week 4	Liberation and its significance, Comminution and sizing,	1,2,3	BB, PPT, OL
	Week 5	Crushing and Grinding- types, equipment, washing, sorting and hand-picking;	1,2,3	BB, PPT, OL
	Week 6	Laboratory and industrial screening- equipment, screen efficiency	1,2,3	BB, PPT, OL
	Week 7	Laws of comminution.	1,2,3	BB, PPT, OL
	Week 8	Classifier- mechanical and hydraulic, sizing and sorting,	1,2,3	BB, PPT, OL
	Week 9	Classifiers, Mill calculation and Selectivity index. Gravity concentration methods,	1,2,3	BB, PPT, OL
	Week 10	Tabling, Jigging, Heavy media separation, Separation in vertical and streaming currents.	1,2,3	BB, PPT, OL
	Week 11	Sedimentation, Dewatering, techniques, Thickener.	1,2,3	BB, PPT, OL
	Week 12	Filtration and Drying.	1,2,3	BB, PPT, OL
	Week 13	Froth flotation: principles, reagents, collectors, modifiers and frothers, process variables in floatation.	1,2,3	BB, PPT, OL

	Week 14	Tailings disposal, Process integration and, Study of flow sheet for important minerals.	1,2,3	BB, PPT, OL
	Week 15	Magnetic and Electrostatic separation: principles, wet and dry separators, High tension separation, Motion of solid in fluid, Strokes and Newton's law	1,2,3	BB, PPT, OL
	Week 16	Free and hindered settling, Thickening, Batch and continuous settling, chambers. Application of computer in mineral processing.	1,2,3	BB, PPT, OL

Program Mapping (Metallurgy Engineering Department)

Sem	Subjects
1st	DELA; Engineering Chemistry; Workshop; Material Science; Environmental Science; Material Science (OE); Technical English 1
2nd	Calculus; Engineering Physics; Metallurgy for Non Metallurgists (OE); Structural Properties and Physics of Materials; Engineering Graphics; Advanced Material and Application (OE); Technical English 2
3rd	Probability, Statistics and Numerical Methods; Management for Engineers; Human Values and Professional Ethics; Mineral Processing; Metallurgical Thermodynamics; Internship-I; Physical Metallurgy
4th	Iron Making; Transport Phenomena; Metal Casting and Solidification (OE); Recycled Materials (OE); Heat Treatment Principles and Practices; Soft Skill and Interpersonal Comm.; Personality Credit-1
5th	Foundry Technology; Steel Making; Fuel Furnace and Refractories (EL); Environmental Pollution and its Control in Met. Ind. (EL); Non Ferrous Extractive Metallurgy; Plastic Deformation of Metals; Energy Economy and Waste Management- (OE); Internship-2
6th	Metal Forming; Phase Transformation; Powder Metallurgy (Elective-1); Modelling of Metallurgical Processes (Elective-1); Electrometallurgy and Corrosion; Ind. Ceramics and Polymers (El-2); Nano Technology (OE); Metal Joining Processes; Composite Materials (EL-2); Personality Credit-2
7th	Metal Testing and Characterization; Alloy Design (EL); Advanced Ferrous Metallurgy (EL); Surface (EL); Internship-3; Non Destructive Testing (EL) and (OE); Material Testing and Standards; Selection of Material & Failure analysis (EL) & (OE); Advanced Foundry Technology (EL)
8th	Project

Subject: Mineral Processing								
Program: **B. Tech in Metallurgical Engineering**				Subject Code: **MME0301**			Semester: **III**	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	16/40	16/40	24/60	24/60	200

Course Objectives

1. To make the students aware about basics of mining technology.
2. To impart the knowledge about the basic steps followed in mineral dressing and its importance before extraction of pure metal from their respective ores.
3. To develop the knowledge regarding the auxiliary operation and the advancement in mining technology.

CONTENTS

UNIT-I

[10 hours]

Introduction and scope of mineral processing in extractive metallurgy, mineral resources in India, physical characteristics exploited in mineral processing, terminology in mineral processing. Physical and chemical characteristics of industrial minerals i.e. hematite, magnetite, galena, chalcopyrite, azurite, monazite, cassiterite, chromite, bauxite, and ilmenite, economics of ore processing.

UNIT-II

[10 hours]

Liberation and its significance, Comminution and sizing, Laws of comminution, Crushing and Grinding- types, equipment, washing, sorting and hand-picking; Laboratory and industrial screening-equipment, screen efficiency.

UNIT-III

[10 hours]

Classifier- mechanical and hydraulic, sizing and sorting, classifiers, Mill calculation and Selectivity index. Gravity concentration methods, Tabling, Jigging, Heavy media separation, Separation in vertical and streaming currents, Sedimentation, Dewatering, techniques, Thickener, Filtration and Drying.

UNIT-IV

[10 hours]

Froth flotation: principles, reagents, collectors, modifiers and frothers, process variables in floatation, Tailings disposal, Process integration and, Study of flow sheet for important minerals.
Magnetic and Electrostatic separation: principles, wet and dry separators, High tension separation, Motion of solid in fluid, Strokes and Newton's law, Free and hindered settling, Thickening, Batch and continuous settling, chambers. Application of computer in mineral processing.

Mineral Processing Lab (List of Experiments)

Experiment No.	Title
1	To study the crushers (primary and secondary) like jaw crusher and roll crusher and to measure their reduction ratios and capacities
2	To determine the reduction ratio of Coal.
3	To determine the reduction ratio of Coke.
4	To determine the reduction ratio of Iron ore.
5	To determine the reduction ratio of Ceramic material.
6	To study the sieve analysis of weighed powder sample
7	To study the ball mill and measure the grind ability of Ball mill
8	To determine the grindability of Coal.
9	To determine the grindability of coke.
10	To determine the grindability of Iron ore.
11	To determine the grindability of ceramic material.
12	To study the principle , operation and efficiency of laboratory classifier
13	To determine the efficiency of magnetic separation by varying strength of magnetic field
14	To study the coal and gravel separation using jig
15	To study the froth flotation of given sample of coal

Course Outcomes

1. To apply the knowledge of mineral processing to advance in the field of extraction.
2. To apply the basic principles behind ore dressing to different ores and minerals.

Text Books

1. S. K. Jain, "Mineral Processing", CBS Publishers & Distributors, 2nd Edition, 2012, ISBN: 9788123907536.

Reference Books

1. A. M. Gaudin, "Principles of Mineral Dressing", Tata McGraw Hill Publications, 1st Edition, 1939, ISBN: 9780070230309.
2. B. A. Wills and J. Finch, "Mineral Processing Technology", Butterworth-Heinemann, 8thEdition, 2015, ISBN: 9780080970530.
3. E. G. Kelly and D. J. Spottiswood, "Introduction to Mineral Processing", John Wiley & Sons Inc, 1982, ISBN: 9780471033790.
4. J. D. Gilchrist, "Extraction Metallurgy", Pergamon Press, 1st Edition, 1967, ISBN: 9780080120300.
5. E. J. Pryor, "Mineral Processing", Springer Netherlands, 3rdEdition, 1965, ISBN: 9789401029438.
6. J. Newton, "Extractive Metallurgy", John Wiley & Sons Inc, 1stEdition, 1959, ISBN: 9780471635918.
7. H. S. Ray, R. Sridhar and K. P. Abraham, "Extraction of Non-ferrous Metals", Affiliated East-west Press Pvt Ltd, 1stEdition, 2008, ISBN: 9788185095639.

Web Resources

1. NPTEL Course on “Non-ferrous Extractive Metallurgy” (http://nptel.ac.in/courses/113105021/)

Name of Institute: IITE

Name of Faculty: Gaurav Awasthi

Course code: MME0302

Course name: Physical Metallurgy

Pre-requisites: Physics, Chemistry

Credit points: 4

Offered Semester: 4

Course Coordinator (weeks 01-15)

Full Name: Gaurav Awasthi

Department with sitting location: Third Floor staff room

Telephone:9909709727

Email: gauravavasthi.mt@indusuni.ac.in

Consultation times: 4:15 – 5:00

Course Lecturer (weeks 01-15)

Full Name: Gaurav Awasthi

Department with sitting location: Third Floor staff room

Telephone:9909709727

Email: gauravavasthi.mt@indusuni.ac.in

Consultation times: 4:15 – 5:00

Students will be contacted throughout the Session via Mail with important information relating to this Course.

Course Objectives

By participating in and understanding all facets of this Course a student will:

1. To introduce the engineering science principles and applications associated with physical metallurgy.
2. To study the physical aspect behind metallurgical phenomena.

3. To study the structure of metals and its influence on material properties and performance

Course Outcomes (CO)

1. Students will be able to analyze and define the Structure of materials at different levels, basic concepts of crystalline materials like unit cell, FCC, BCC, HCP, APF (Atomic Packing Factor), Co-ordination Number etc.(I and IV)
2. Students can discover the types of defects in materials. (IV)
3. Students will learn to create and use different types of phase diagrams. (VI)
4. Students will gain knowledge to determine the effect of alloying elements on the properties of ferrous metals. (V)
5. Identify the microstructure and relate with mechanical properties (III)
6. Classify and Distinguish different types of cast irons and steels.(II)

To understand the physics and mechanics of solidification of metals and alloys. Course Outline

The proposed course deals with various microstructure and its identification.

Method of delivery

(Video (G0classroom) using power point presentations)

Study time

3 lectures, 2hrs lab per week

CO-PO Mapping (PO: Program Outcomes)

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	-	2	1	3	1	-	-	-	-	-	2	-
CO2	2	2	2	-	1	-	-	-	-	-	2	-
CO3	2	-	2	-	3	3	3	-	-	-	2	-
CO4	2	3	3	3	1	-	-	-	-	-	-	-

1-Lightly Mapped 2- Moderately Mapped 3- Highly Mapped

Blooms Taxonomy and Knowledge retention(For reference)

(Blooms taxonomy has been given for reference)

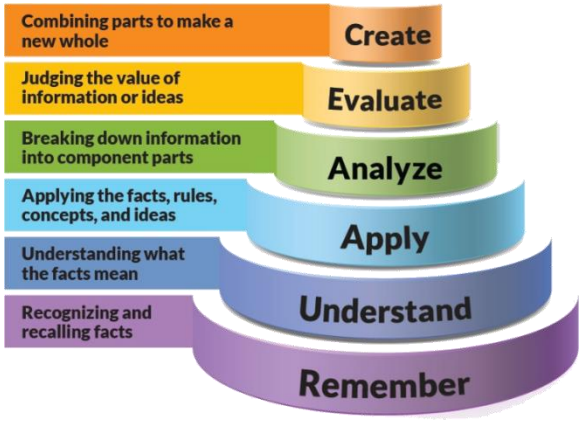

Figure 1: Blooms Taxonomy

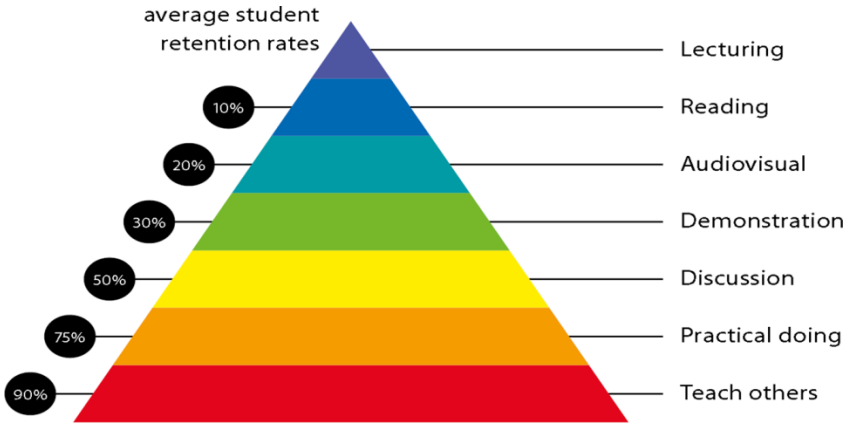

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of _____Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**

Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	**4 Problem solving skills**
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

Sample preparation, micro structure observations, inclusion rating and study of various phase diagrams etc.

Lecture/tutorial times

(Give lecture times in the format below)

Lecture	Monday	10:00am – 11:00 am	G-class
Lecture	Wednesday	10:00am – 11:00 am	G-class
Lecture	Friday	12:20pm – 01:20 pm	G-class

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the Course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for mid and end semester examinations.

Details of referencing system to be used in written work

Text Book(s)

1. Physical Metallurgy Principles - Robert E Reed-Hill and Reza Abbaschian(2008)
2. Y. Lakhtin, "Engineering Physical Metallurgy", CBS Publishers & Distributors, 1st Edition, 2005, ISBN: 9788123906027.

Reference Books

1. Phase Transformation in Metals & Alloys - D A Porter & K Easterling(1992)
2. Physical metallurgy by Avner-(1997)
3. Physical Metallurgy - Peter Haasen(1996)
4. Structure and Properties of Alloys - R M Brick, R B Gordon, A. Phillips(2002)
5. Physical Foundations of Materials Science - G. Gottstein (2004)
6. Physical Metallurgy and Advanced Materials Engineering - R.E. Smallman and A.H.W. Ngan (2007)

Digital Learning Resources

http://nptel.ac.in/courses/113105024/

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

SUPPLEMENTARY ASSESSMENT

Mid Semester(*closed book*)	40%
Internal evaluation	20%
(Attendance, Presentation, Assignments and Case studies)	

Students who receive an overall mark less than 40% in mid semester or end semester will be considered for supplementary assessment in the respective components (i.e mid

semester or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (mid semester or end semester) and need to obtain the required minimum 40% marks to clear the concerned components. For the Supplementary exams university policies will be followed.

Practical Work Report/Laboratory Report: (NA)

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -1% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.

Do not share your work with other students (except where required for a group activity or assessment)

Course schedule(subject to change)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
	Weeks 1	Introduction, solid Solution, Types of solid solution, Hume-Rothery Rules for Primary Substitutional Solid Solubility	1	Online(G-class)
	Weeks 2	Types of Interstitial Voids, Chemical compounds versus solidsolution, Intermediate Phases, Polycrystalline Materials, Multiple –Phase Alloys. Intermetallic compounds. Solidification of Metals & Alloys: Structure of Liquid Metals	2	Online(G-class)
	Week 3	Energetic of Solidification, Nucleation and growth phenomena, Homogenous & Heterogeneous Nucleation, Growth of Solid, Smoothor Stable interface growth, Temperature Inversion in pure Metals, Segregation, Porosity	*3*	Online(G-class)
	Week 4	Concepts of alloy system and explanation of terms like system, component, phase, micro constituent and degree of freedom, structural constituent of an alloy, phase rule and phase equilibrium	3	Online(G-class)
	Week 5	equilibrium diagrams and their classification based on solubility of components in liquid and solid states, cooling curves, morphology and distribution of phases, effect of non-equilibrium cooling on morphology. Constitutional super cooling Unary Diagram, Binary Phase Diagram, Use of Phase Diagram, Determination of Phase Diagrams	3	Online(G-class)
	Week 6	Limitation of Equilibrium Diagram, Zone Melting, Ternary Diagram, Numerical, Interpretation of Phase	*3*	Online(G-class)

		Diagram, Interpretation of Phase Diagram by using Lever Rule Introduction, Allotropy of Iron, Cooling & Heating curves of Pure Iron, e: Grain size effects, Grain size designation, Grain size measurement. Interpretation of Phase Diagram		
	Week 7	Effect of pressure on allotropy of Iron, Iron- carbon equilibrium diagram, phase Fe- Fe3C diagram. Effect of Alloying element on Fe- Fe3C diagram, effect of carbon on Fe- Fe3C.Critical temperature in Fe- Fe3C diagram. Physical significance of grain size	4	Online(G-class)
	Week 8	Steels Classification and application of carbon steels, Plain carbon steels, Advantages and limitations of Plain carbon steels	1	Online(G-class)
	Week 9	Effect of impurity elements on the properties of steels, Purpose of alloying of steel	*2*	Online(G-class)
	Week 10	Functions of alloying elements in steel, Effects of alloying elements on the properties of steels, Steel Specifications-according to UNS	2	Online(G-class)
	Week 11	Cast Iron Introduction, Cast Irons, Various Types, Properties & Applications	1	Online(G-class)
	Week 12	ADI – Austempered Ductile Cast Iron. Metallography Microscopic examination	1	Online(G-class)
	Week 13	polishing techniques for different metals and alloys, Etching and Mounting techniques	1	Online(G-class)
	Week 14	Difference between Macro & Micro Etching, electrolytic polishing Metallurgical microscope	1	Online(G-class)
	Week 15	Macroscopic & Microscopic examination methods, Nonmetallic inclusions	1	Online(G-class)

Program Mapping (Metallurgy Engineering Department)

	Subjects
1st	Calculus; Engineering Physics; Workshop; Material Science; Environmental Science; Material Science (OE); Technical Communication; Engineering Graphics
2nd	Differential Equations and Linear Algebra; Engineering Chemistry; Metallurgy for Non Metallurgists (OE); Structural Properties and Physics of Materials; Engineering Graphics; Advanced Material and Application (OE); Business Communication and Presentation Skills
3rd	Probability, Statistics and Numerical Methods; Management for Engineers; Human Values and Professional Ethics; Mineral Processing; Metallurgical Thermodynamics; Internship-I; Physical Metallurgy
4th	Iron Making; Transport Phenomena; Metal Casting and Solidification (OE); Recycled Materials (OE); Heat Treatment Principles and Practices; Soft Skill and Interpersonal Comm.; Personality Credit-1
5th	Foundry Technology; Steel Making; Fuel Furnace and Refractories (EL); Environmental Pollution and its Control in Met. Ind. (EL); Non Ferrous Extractive Metallurgy; Plastic Deformation of Metals; Energy Economy and Waste Management- (OE); Internship-2
6th	Metal Forming; Phase Transformation; Powder Metallurgy (Elective-1); Modelling of Metallurgical Processes (Elective-1); Electrometallurgy and Corrosion; Ind. Ceramics and Polymers (El-2); Composite Materials (EL-2); Nano Technology (OE); Metal Joining Processes; Personality Credit-2
7th	Metal Testing and Charachterization; Alloy Design (EL); Advanced Ferrous Metallurgy (EL); Surface (EL); Internship-3; Non Destructive Testing (EL) and (OE); Material Testing and Standards; Selection of Material & Failure analysis (EL) & (OE); Advanced Foundry Technology (EL)
8th	Project

Subject: Physical Metallurgy								
Program: **B. Tech in Metallurgical Engineering**				Subject Code: **MME0302**			Semester: **III**	
Teaching Scheme (Hours per week)				**Examination Evaluation Scheme (Marks)**				
Lecture	**Tutorial**	**Practical**	**Credits**	**University Theory Examination**	**University Practical Examination**	**Continuous Internal Evaluation (CIE)- Theory**	**Continuous Internal Evaluation (CIE)- Practical**	**Total**
3	0	2	4	16/40	16/40	24/60	24/60	200

Course Objectives

1. To introduce the engineering science principles and applications associated with physical metallurgy.
2. To study the physical aspect behind metallurgical phenomena.
3. To study the structure of metals and its influence on material properties and performance

CONTENTS

UNIT-I

Introduction, solid Solution, Types of solid solution, Hume-Rothery Rules for Primary Substitutional Solid Solubility, Types of Interstitial Voids, Chemical compounds versus solidsolution, Intermediate Phases, Polycrystalline Materials, Grain Size, Measurement of Grain Size, Multiple –Phase Alloys. Intermetallic compounds.

UNIT-II

Solidification of Metals & Alloys: Driving force for solidification, Nucleation and growth phenomena, Homogenous & Heterogeneous Nucleation, Growth of Solid, Smoothor Stable interface growth, Temperature Inversion in pure Metals, Segregation, Porosity.

Concepts of alloy system and explanation of terms like system, component, phase, micro constituent and degree of freedom, structural constituent of an alloy, phase rule and phase equilibria, equilibrium diagrams and their classification based on solubility of components in liquid and solid states, cooling curves, morphology and distribution of phases, effect of non-equilibrium cooling on morphology.

UNIT-III

Constitutional super cooling Unary Diagram, Binary Phase Diagram, Use of Phase Diagram, Determination of Phase Diagrams, Limitation of Equilibrium Diagram, Ternary Diagram, Interpretation of Phase Diagram, Interpretation of Phase Diagram by using Lever Rule.

Introduction, Allotropy of Iron, Cooling & Heating curves of Pure Iron, Effect of pressure on allotropy of Iron, Iron- carbon equilibrium diagram, phase Fe- Fe3C diagram. Effect of Alloying element on Fe- Fe_3C diagram, effect of carbon on Fe- Fe_3C.Critical temperature in Fe- Fe_3C diagram. Interpretation of Phase Diagram.

UNIT-IV

Steels Classification and application of carbon steels, Plain carbon steels, Advantages and limitations of Plain carbon steels, Effect of impurity elements on the properties of steels, Purpose of alloying of steel, Functions of alloying elements in steel, Effects of alloying elements on the properties of steels, Steel Specifications-according to UNS. Introduction to cast irons, Various Types, Properties & Applications.

Metallography Microscopic examination, polishing techniques for different metals and alloys, Etching and Mounting techniques, Difference between Macro & Micro Etching, electrolytic polishing Metallurgical microscope, Macroscopic & Microscopic examination methods, Nonmetallic inclusions.

Physical Metallurgy (List of Experiments)

Experiment No.	Title
1	Study of optical microscope.
2	Specimen preparation for metallography.
3	Mounting of specimen.
4	Plotting of Thermal Equilibrium Phase Diagram of Binary alloys and pure metal by Cooling Curve Method.
5	Microstructure observation of Pure metals
6	Application of Lever Rule for Phase, Phase Composition & Phase Fraction (Binary Alloys)
7	Microstructural observation of Cast Irons.
8	Study of phase diagrams for structure-properties correlation.
9	Eutectic, Hypo- And Hyper-Eutectic Alloys: Al-Si (Unmodified), Al-Si (Modified), Pb-6wt%Sb, Pb- 11.1 Wt%Sb And Pb- 20 Wt%Sb
10	Peritectic And Monotectic Alloys: 60:40 (+) Brass, 70:30 ( ) Brass, Cu-10wt%Sn, Cu- 36wt% Pb, Cu- 50 Wt% Pb*
11	Grain size measurement

Text books

1. Physical Metallurgy Principles - Robert E Reed-Hill and Reza Abbaschian(2008)
2. Y. Lakhtin, "Engineering Physical Metallurgy", CBS Publishers & Distributors, 1st Edition, 2005, ISBN: 9788123906027.

Reference books

1. Phase Transformation in Metals & Alloys - D A Porter & K Easterling(1992)
2. Physical metallurgy by Avner-(1997)
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4. Structure and Properties of Alloys - R M Brick, R B Gordon, A. Phillips(2002)
5. Physical Foundations of Materials Science - G. Gottstein (2004)
6. Physical Metallurgy and Advanced Materials Engineering - R.E. Smallman and A.H.W. Ngan (2007)

Web Resources

http://nptel.ac.in/courses/113105024/

Name of Institute: **IITE**
Name of Faculty: **Prof. Ronak Patel**

Course code: **MA0312**
Course name: **Basics of Probability, Statistics & Numerical Methods**
Pre-requisites: Calculus, Basic Statistics
Credit points: 04
Offered Semester: 03

Course coordinator (weeks 1 - 15)
Full name: Prof. Ronak Patel
Department with siting location: Mathematics Department, ISHLS,4th floor Bhanwar building, Indus University, Ahmadabad
Telephone: 3424
Email:ronakpatel.ec@indusuni.ac.in
Consultation times: Monday to Friday (4:00 PM to 5:00 PM)

Course lecturer (weeks 1 - 15)
Full name: Prof. Ronak Patel
Department with siting location: Mathematics Department, ISHLS,4th floor Bhanwar building, Indus University, Ahmadabad
Telephone: 3424
Email:ronakpatel.ec@indusuni.ac.in
Consultation times: Monday to Friday (4:00 PM to 5:00 PM)

Students will be contacted throughout the session via mail with important information relating to this course.

Course Objectives:

By participating in and understanding all facets of this course a student will:

1) To provide mathematical knowledge and skills needed to support their concurrent and subsequent engineering studies.
2) To provide an ability to apply knowledge of basic science and engineering fundamentals.
3) To provide an ability to undertake problem identification, formulation and solution.
4) To provide an ability to analyze different mathematical models within science and technology and work creatively, systematically and critically.
5) To provide an ability to find strategies for the solution of different types of mathematical models using knowledge about the possibilities and limitations of the different methods and tools.

6) To provide an ability to develop abstract, logical and critical thinking and the ability to reflect critically upon their work and work of others.
7) To provide an ability to insight their strengths and weakness as learners and to appreciate the value of errors or mistakes as powerful motivators to enhance learning and understanding.

Course Outcomes (CO):

By participating and understanding all facets of this course a student will be able to :

1) To understand the concept of probability, Characteristics of random variable, probability mass function and cumulative distribution function. [BT-2]
2) To learn the concept of discrete distribution : Binomial distribution and Poisson distribution. [BT-4]
3) To develop the awareness about testing of hypothesis, mean, standard deviation, coefficient of variance, F-test and T-test. [BT-5]
4) To learn Numerical Interpolation and its brief information. [BT-6]
5) To understand numerical differentiation and integration. [BT-2]
6) To solve problem of Algebraic, transcendental equations and various numerical method. [BT-3]

Course Outline

	COURSE OUTLINE	
Unit 1	**Basics of Probability:** Introduction to Probability, Characteristics of random variable, Probability mass function, cumulative distribution function, probability density function. **Probability distributions:** Discrete distributions: Binomial distribution, Poisson distribution, Continuous distributions: Normal distribution	**10 hours**
Unit 2	**Statistics:** Introduction and application of statistics, types of statistics, testing of hypothesis**,** Mean, standard deviation, coefficient of variation, F-test , t-test , Chi Square test, Correlation and regression.	**10 hours**
Unit 3	**Interpolation** Finite differences and Interpolation: Finite differences Forward, Backward & Central difference operators and difference tables. Interpolation Formula with equal intervals: Newton's forward, Newton's backward, Central difference interpolation by Stirling's formula Interpolation Formula with unequal intervals: Lagrange's & Newton's divided difference interpolation	**12 hours**

	Numerical differentiation: Using Newton's forward and backward interpolation formula Numerical Integration: Trapezoidal rule, Simpson's 1/3 rule, Simpson's 3/8 rule.	
Unit 4	**Numerical Methods** Basic Errors. Solution of Algebraic and Transcendental Equations: Bisection method, Regula-Falsi method, Newton-Raphson method., Convergence condition for these methods, Numerical methods in Linear Algebra: Gauss-Jacobi, Gauss-seidel method Largest Eigen values and corresponding Eigen vectors: By power method Numerical Solutions of ordinary differential equations: Taylor's Method, Euler's Method, Improved Euler Method (Heun's Method), Runge-Kutta method of order four	**13 hours**

Text Book:

B. V. Ramana, "Higher Engineering Mathematics", Tata McGraw Hill.

Reference Books:

1. Erwin Kreyszig, "Advanced Engineering Mathematics" (8th Edition), Wiley Eastern Ltd., New Delhi.
2. Dr. B.S. Grewal, "Higher Engineering Mathematics", Khanna Publishers, New Delhi
3. Murray Spiegel , "Advanced Mathematics for Engineering & Science: Schaum's Outline Series", Tata McGraw Hill Publication
4. Merel C Potter, J.L. Goldberg, "Advanced Engineering Mathematics" (3rd Edition), Oxford India Publication.
5. Python Programming And Numerical Methods: A Guide For Engineers And Scientists, https://pythonnumericalmethods.berkeley.edu/notebooks/Index.html

List of Practicals:

1. Programs to find roots of transcendental equations (N-R Method, Bisection Method)
2. Programs to find solutions to linear equations (Gauss seidel method)
3. Programs to find largest eigenvalue and corresponding eigenvector (Power Method)
4. Program to solve ODE (Euler's Method)
5. Program for Numerical Differentiation (Forward and backward interpolation)
6. Program for Numerical Integration (Simpson's Rule and Trapezoidal Rule)
7. Program to implement binomial distribution
8. Program to implement Poisson distribution
9. Program to find mean, standard deviation and variance.
10. Develop program for F-test/ T-test/ Chi-square test.

Method of delivery: **Lectures, Self-Study Material**

Study time: **3 hours Lecture + 2 hour Practical every week**

Blooms Taxonomy and Knowledge retention (For reference)

(Blooms taxonomy has been given for reference)

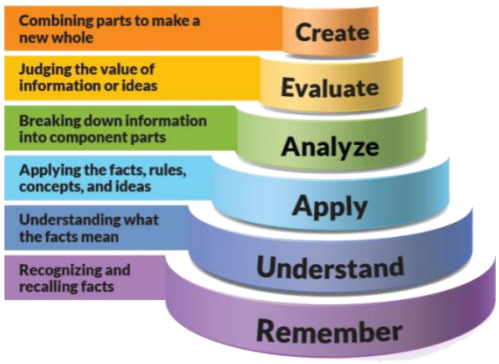

Figure 1: Blooms Taxonomy

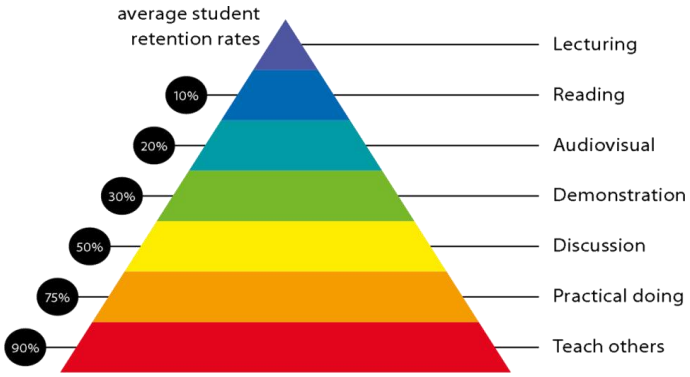

Figure 2: Knowledge retention

Graduate Qualities and Capabilities covered

(Qualities graduates harness crediting this Course)

General Graduate Qualities	Specific Department of _____Graduate Capabilities
Informed Have a sound knowledge of an area of study or profession and understand its current issues, locally and internationally. Know how to apply this knowledge. Understand how an area of study has developed and how it relates to other areas.	**1 Professional knowledge, grounding & awareness**
Independent learners Engage with new ideas and ways of thinking and critically analyze issues. Seek to extend knowledge through ongoing research, enquiry and reflection. Find and evaluate information, using a variety of sources and technologies. Acknowledge the work and ideas of others.	**2 Information literacy, gathering & processing**
Problem solvers Take on challenges and opportunities. Apply creative, logical and critical thinking skills to respond	**4 Problem solving skills**

effectively. Make and implement decisions. Be flexible, thorough, innovative and aim for high standards.	
Effective communicators Articulate ideas and convey them effectively using a range of media. Work collaboratively and engage with people in different settings. Recognize how culture can shape communication.	**5 Written communication** **6 Oral communication** **7 Teamwork**
Responsible Understand how decisions can affect others and make ethically informed choices. Appreciate and respect diversity. Act with integrity as part of local, national, global and professional communities.	**10 Sustainability, societal & environmental impact**

Practical work:

2 Hrs/week

Lecture/practical times

(Give lecture times in the format below)

Lecture/Tutorial	Day	Time	Class Code (Google Class room)
Lecture	Monday	03.10 PM to 4.10 PM	gmiahtj
Lecture	Wednesday	09.00 AM to 10.00 AM	
Lecture	Friday	11.10 AM to 12.10 PM	
Practical	Thursday	2.00 PM to 4.10 PM	
Link to Google Class Room: https://meet.google.com/wyv-izpv-fsx			

Attendance Requirements

The University norms states that it is the responsibility of students to attend all lectures, tutorials, seminars and practical work as stipulated in the course outline. Minimum attendance requirement as per university norms is compulsory for being eligible for semester examinations.

ASSESSMENT GUIDELINES

Your final course mark will be calculated from the following:

Type of Examination	Weightage	Bifurcation
Internal Examination (CIE-Theory)	60%	¤ 40 Marks - MSE (Mid Semester Examination - Closed book examination) ¤ 05 Marks - Attendance (if > 80%) ¤ 10 Marks - Assignments ¤ 05 Marks - Presentation
External Examination (ESE-Theory)	40%	¤ Closed Book Examination
Internal Examination (CIE-Practical)	60%	¤ 50 Marks - Lab performance / Lab manual work ¤ 10 Marks - Viva
External Examination (ESE- Practical)	40%	¤ 20 Marks - Viva ¤ 20 Marks - Practical exam or quiz

SUPPLEMENTARY ASSESSMENT

Students who receive an overall mark less than 40% in internal component or less than 40% in the end semester will be considered for supplementary assessment in the respective components (i.e internal component or end semester) of semester concerned. Students must make themselves available during the supplementary examination period to take up the respective components (internal component or end semester) and need to obtain the required minimum 40% marks to clear the concerned components.

Practical Work Report/Laboratory Report:

A report on the practical work is due the subsequent week after completion of the class by each group.

Late Work

Late assignments will not be accepted without supporting documentation. Late submission of the reports will result in a deduction of -% of the maximum mark per calendar day

Format

All assignments must be presented in a neat, legible format with all information sources correctly referenced. **Assignment material handed in throughout the session that is not neat and legible will not be marked and will be returned to the student.**

Retention of Written Work

Written assessment work will be retained by the Course coordinator/lecturer for two weeks after marking to be collected by the students.

University and Faculty Policies

Students should make themselves aware of the University and/or Faculty Policies regarding plagiarism, special consideration, supplementary examinations and other educational issues and student matters.

Plagiarism - Plagiarism is not acceptable and may result in the imposition of severe penalties. Plagiarism is the use of another person's work, or idea, as if it is his or her own - if you have any doubts at all on what constitutes plagiarism, please consult your Course coordinator or lecturer. Plagiarism will be penalized severely.

Do not copy the work of other students.
Do not share your work with other students (except where required for a group activity or assessment)

EC,CIVIL AND META

Course schedule (subject to change)

(Mention quiz, assignment submission, breaks etc as well in the table under the Teaching Learning Activity Column)

	Week #	Topic & contents	CO Addressed	Teaching Learning Activity (TLA)
Unit-IV	Weeks 1	Basic Errors, convergence conditions for solution of algebraic and transcendental equations, Bisection method and related examples,	CO-6	Online Lecture, Assignment , Tutorial
	Weeks 2	Regula-Falsi method and related examples, Newton Raphson method and related examples	CO-6	Online Lecture, Assignment , Tutorial
	Week 3	Solution of SLE using Gauss-Jacobi Method Solution of SLE using Gauss-Seidel method Largest Eigen value and corresponding eigen vector using power method	CO-6	Online Lecture, Assignment , Tutorial
Unit-III	Week 4	Numerical solution of ODE – Taylor's Method Numerical solution of ODE – Euler's Method Numerical solution of ODE – Improved Euler (Heun's) Method Numerical solution of ODE – RungeKutta Method of order four	CO-5	Online Lecture, Assignment , Tutorial
	Week 5	Understanding interpolation, finite differences (forward and backward), constructing forward, backward and central difference tables Interpolation with equal intervals – Newton forward interpolation Interpolation with equal intervals – Newton backward interpolation Interpolation with equal intervals – Stirling's formulae	CO-4	Online Lecture, Assignment , Tutorial
	Week-6	Interpolation with unequal intervals – Lagrange's interpolation Interpolation with unequal intervals – Newton's divided difference interpolation Numerical differentiation using Newton's forward and backward interpolation Related examples on numerical differentiation	CO-4	Online Lecture, Assignment , Tutorial
	Week-7	Numerical Integration –Trapezoidal rule Numerical Integration –Simpson's 1/3rd rule Numerical Integration –Simpson's 3/8th rule	CO-5	Online Lecture, Assignment , Tutorial

UNIT-I	Week-8	Introduction to Probability, types of Events, axioms, theorem.	CO-1	Online Lecture, Assignment , Tutorial
	Week-9	Conditional probability, characteristics of random variable.	CO-1	Online Lecture, Assignment , Tutorial
	Week-10	Discrete distributions: Binomial distribution, Poisson distribution	CO-2	Online Lecture, Assignment , Tutorial
	Week-11	Continuous distributions: Normal distribution	CO-2	Online Lecture, Assignment , Tutorial
UNIT - II	Week-12	Introduction and application of statistics, types of statistics	CO-3	Online Lecture, Assignment , Tutorial
	Week-13	testing of hypothesis**,** Mean, standard deviation	CO-3	Online Lecture, Assignment , Tutorial
	Week-14	coefficient of variation, F-test , t-test , Chi Square test	CO-3	Online Lecture, Assignment , Tutorial
	Week-15	Correlation and regression.	CO-3	Online Lecture, Assignment , Tutorial