INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)
Dundigal, Hyderabad - 500 043

MECHANICAL ENGINEERING

COURSE DESCRIPTION

Course Title	**:**	**ENVIRONMENTAL STUDIES**			
Course Code	**:**	**A30009**			
Course Structure	**:**	**Lectures**	**Tutorials**	**Practicals**	**Credits**
	:	4	1	-	4
Course Coordinator	**:**	Mr. Praveen, Assistant Professor.			
Team of Instructors	**:**	Mrs. M. Malathi, Assistant Professor.			

I. COURSE OVERVIEW

Environmental study is interconnected; interrelated and interdependent subject. Hence, it is multidisciplinary in nature. The present course is framed by expert committee of UGC under the direction of Honorable Supreme Court to be as a core module syllabus for all branches of higher education and to be implemented in all universities over India. The course is designed to create environmental awareness and consciousness among the present generation to become environmental responsible citizens. The course description is: multidisciplinary nature of environmental studies, Natural Resources: Renewable and non-renewable resources; Ecosystems; Biodiversity and its conservation; Environmental Pollution; Social Issues and the Environment; Human Population and the Environment; pollution control acts and Field Work. The course is divided into five chapters for convenience of academic teaching followed by field visits.

II. PREREQUISITE(S)

Level	Credits	Periods	Prerequisite
UG	4	4	Knowledge of basic sciences

III. MARKS DISTRIBUTION

Sessional Marks	University End Exam Marks	Total Marks
There shall be 2 midterm examinations. Each midterm examination consists of subjective test. The subjective test is for 20 marks, with duration of 2 hours. Subjective test of each semester shall contain 5 one mark compulsory questions in part-A and part-B contains 5 questions, the student has to answer 3 questions, each carrying 5 marks. First midterm examination shall be conducted for the first two and half units of syllabus and second midterm examination shall be conducted for the remaining portion. Five marks are earmarked for assignments. There shall be two assignments in	75	100

every theory course. Marks shall be awarded considering the average of two assignments in each course.		

IV. EVALUATION SCHEME

S.No	Component	Duration	Marks
1	I Mid examination	90 minutes	20
2	I Assignment	--	05
3	II Mid examination	90 minutes	20
4	II Assignment	--	05
5	External examination	3 hours	75

V. COURSE OBJECTIVES

I. Determine the Natural resources on which the structure of development is raised for sustainability of the society through equitable maintenance of natural resources.
II. Illustrate about biodiversity that raises an appreciation and deeper understanding of species, ecosystems and also the interconnectedness of the living world and thereby avoids the mismanagement, misuse and destruction of biodiversity.
III. Summarize a methodology for identification, assessment and quantification of global environmental issues in order to create awareness about the international conventions for mitigating global environmental problems
IV. Sustainable development that aims to meet raising human needs of the present and future generations through preserving the environment.
V. Outline green environmental issue provides an opportunity to overcome the current global environmental issues by implementing modern techniques like CDM, green building, green computing etc.

VI. COURSE OUTCOMES

After completing this course the student must demonstrate the knowledge and ability to:

1. **Discover** Knowledge regarding environment and its components.
2. **Understand** various ecosystems, their biodiversity and Scientific methods to protect them.
3. **Categorize** different types of pollutions and their control measures.
4. **Discover** effective methods of waste management.
5. **Analyze** global environmental problems and come out with best possible solutions.
6. **Illustrate** green environmental issues.
7. **Understand** environmental laws and Environmental Impact assessments.

VII. HOW PROGRAM OUTCOMES ARE ASSESSED

Program outcomes		Level	Proficiency assessed by
PO1	**Engineering knowledge**: An ability to apply knowledge of basic sciences, mathematical skills, engineering and technology to solve complex electronics and communication engineering problems (**Fundamental Engineering Analysis Skills**).	N	-
PO2	**Problem analysis**: An ability to identify, formulate and analyze engineering problems using knowledge of Basic Mathematics and Engineering Sciences (**Engineering Problem Solving Skills**).	N	-
PO3	**Design/development of solutions**: An ability to provide solution and to	N	-

	design Electronics and Communication Systems as per social needs **(Social Awareness).**		
PO4	**Conduct investigations of complex problems**: An ability to investigate the problems in Electronics and Communication field and develop suitable solutions (**Creative Skills**).	N	-
PO5	**Modern tool usage** An ability to use latest hardware and software tools to solve complex engineering problems (**Software and Hardware Interface**).	N	-
PO6	**The engineer and society**: An ability to apply knowledge of contemporary issues like health, Safety and legal which influences engineering design **(Social Awareness).**	N	-
PO7	**Environment and sustainability**: An ability to have awareness on society and environment for sustainable solutions to Electronics and Communication Engineering problems **(Social Awareness).**	N	-
PO8	**Ethics**: An ability to demonstrate understanding of professional and ethical responsibilities **(Professional**	N	-
PO9	**Individual and team work**: An ability to work efficiently as an individual and in multidisciplinary teams **(Team work).**	N	-
PO10	**Communication**: An ability to communicate effectively and efficiently both in verbal and written form **(Communication Skills).**	N	-
PO11	**Life-long learning**: An ability to develop confidence to pursue higher education and for life-long learning	N	-
PO12	**Project management and finance**: An ability to design, implement and manage the electronic projects for real world applications with optimum financial resources **(Practical Engineering Analysis Skills**).	N	-

VIII. HOW PROGRAM SPECIFIC OUTCOMES ARE ASSESSED

Program Specific Outcomes		Level	Proficiency Assessed by
PSO 1	**Professional Skills:** The ability to research, understand and implement computer programs in the areas related to algorithms, system software, multimedia, web design, big data analytics, and networking for efficient analysis and design of computer-based systems of varying complexity.	H	Lectures, Assignments
PSO 2	**Software Engineering practices:** The ability to apply standard practices and strategies in software service management using open-ended programming environments with agility to deliver a quality service for business success.		
PSO 3	**Successful Career and Entrepreneurship:** The ability to employ modern computer languages, environments, and		

N - None **S - Supportive** **H – Highly Related**

IX. SYLLABUS

UNIT-I

Structure of metals: Crystallography, Miller indices, packing efficiency, Density calculations, Grains and grain boundaries. Effect of grain size on the properties. Determination of grain size by different methods.

Constitution of alloys: Necessity of alloying, Types of solid solutions, Hume-Rothery rules, Intermediate alloy phases

UNIT-II

Phase Diagrams: Construction and interpretation of phase diagrams, Phase rule, Lever rule. Binary phase diagrams, Isomorphous, Eutectic and Eutectoid transformations with examples.

UNIT-III

Engineering Materials-I Steels: Iron –Carbon phase diagram and heat treatment: Study of iron-iron carbide phase diagram, Construction of TTT diagrams, Annealing, Normalizing,Hardening and Tempering of steels, Hardenabilty, Alloy steels.

UNIT-IV

Engineering Materials –II: Cast Irons: Structure and properties of White cast iron, Malleable cast iron Grey cast iron.

Engineering materials –III: Non-ferrous metals and alloys: Structure and properties of copper and its alloys, Al-Cu phase diagram, Titanium and its alloys.

UNIT-V

Engineering materials –IV: Ceramics, Polymers and composites: Crystalline ceramics, glasses, cermets: Structure, properties and applications. Classification, properties and applications of composites, Classification , properties and applications of polymers.

Textbooks:

1. Material science and Metallurgy /Kodgire
2. Essentials of Material science and engineering/Donald R Askeland/Thomson

Referencebooks:

1. Introduction to Physical Metallurgy/Sidney H Avner.
2. Material science and Engineering/William and Callister
3. Elements of Material science/V Raghavan
4. Engineering Materials and Metallurgy/Er.Amandeep Singh Wadhva
   Material science for engineering students-Traugott Fisher 2009 Edition.

X. COURSE PLAN:

The course plan is meant as a guideline. There may probably be changes.

Lecture No.	Course Learning Outcomes	Topics to be covered	Reference
1-2	**Identify** potential areas of applications in mechanical engineering	**Introduction to Metallurgy and Material Science** **Importance to Various Engineering disciplines**	T2
3	**Define** various branches and compare metals and non-metals	Branches of Metallurgy , chemical , physical , Mechanical Engineering , Metals , Non-metals, composites , nano-materials	T1,T2
4	**Compare** various crystal structures	Atomic structure , bonding in solids , different bonds and examples Crystal structure , unit cell , 7 crystal systems , 14 Bravais lattices , Miller indices , crystallographic planes of refrigeration	T1
	Examine various	Atomic radius , Coordination number ,	T1,T2

5-7	factors of crystal structures	Atomic packing factor , Density calculation	
8-12	**Compare** pure metals and alloys	Crystallization of pure metals ; solidification of pure metals , alloys Grains , Grain boundary , ASTM grain size no	T1
13	**Describe** defects in crystals	Crystal imperfections - Defects ; point , line , planar defects	T2
14	**Describe** Phase diagrams	**Phase diagrams : Phase rule**	T1,T2
15	**Explain** Cu-Ni Phase diagram	Binary alloys – phase diagrams: Isomorphous system. Cu-Ni	T1
16-17	**Analyze** types of cooling	Chemical composition of phases , Lever rule , Equilibrium cooling , Non - Equilibrium cooling	T1,T2
18-19	**Describe** Bi-Cd and Pb-Sn system	Eutectic system . I Bi-Cd , Hypo , Hyper II Pb-Sn system	T2
20-21	**Describe** the Pt-Ag system ,and explain various eutectoid and peritectoid reactions	Peritictic system Pt-Ag, Euctectoid reaction Peritectoid reaction	T1,T2
22-23	**Categorize & Describe** steels	**Engineering Materials – 1 steels :**	T1
24-26	**Explain** Fe-C diagram	Steels :Fe – C ; Allotropy of Fe	T1
27	**State** peritectic reaction	Peritictic transformation	T1,T2
28	**Explain** eutectoid reaction	Eutectoid transformation	T1
29	**Describe** Hyper eutectoid transformation	Hyper eutectoid transformation	T1
30	**Discuss** heat treatment	Heat treatment , Annealing Normalizing , Hardening , Tempering	T2
31-32	**Evaluate** hardenabilty	Hardenability	T1,T2
33	**Describe** the effect of alloying elements	Alloy steels – Effect of alloying elements	T1,T2
34	**Explain** types of alloy steels	Low alloy steels , stainless steels , Tool steels	T2,T1
35-38	**Explain** Types of cast irons	**Engineering Materials – II&III**	T1,T2
39-40	**Describe** various cast irons	White Cast Iron , Malleable CI , Grey CI , SG Iron	T2,T1
41-49	**Examine** classification of aluminium alloys	Engg. materials III :Non ferrous alloys – classification	T1,T2
50-51	**Discuss** the properties of copper alloys	Copper alloys	T2,T1
52-56	**Describe** Al alloys	Al-alloys	T1,T2

57-58	**Describe** the properties of titanium alloys	Titanium alloys	T2,T1
68	Explain **ceramics**	Engineering materials –IV:**Ceramics , Types , properties , applications**	T2
69-70	Describe **glasses**	Glasses , Types , Properties , applications	T2
71-72	Explain **cermets**	Cermets , Types , Properties , applications	T2
73-74	Describe **composites**	Composites , Types , Properties , applications	T2
75-76	Explain **polymers**	Polymers , Types , Properties , applications	T2

XI. MAPPING COURSE OBJECTIVES LEADING TO THE ACHIEVEMENT OF THE PROGRAM OUTCOMES:

Course Objectives	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
I	N							H				N	S	S	N
II		N								S			N	S	
III				N				S			S		N	S	
IV			S		S							N		S	
V	N			S											

N = None **S = Supportive** **H = Highly related**

XII. MAPPING COURSE OUTCOMES LEADING TO THE ACHIEVEMENT OF TSHE PROGRAM OUTCOMES:

Course Outcomes	Program Outcomes												Program Specific Outcomes		
	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
1	N		N					H			S	N	S	N	N
2	N				S						S		S	S	
3		S			S			S				H	N	S	
4	N			S				S		S	S			S	
5	N	S			S								N	S	
6	S		S	N						S			S	N	
7															

N = None **S = Supportive** **H = Highly related**

Prepared by:
Mrs. Malathi, Assistant Professor.

HOD, MECHANICAL ENGINEERING