Open Elective Courses

Introduction

Choice Based Credit System (CBCS) is promoted in such a way that different open elective courses should be offered by every department to other departments. This interdisciplinary of learning open elective courses by other department students will have learning awareness and job oriented benefits. Students require the opportunity to choose any open elective course from different departments and apply their knowledge to acquire jobs in that field of course. Learning and employment benefits are not only through their own course subjects but also through open elective courses.

Advantages

- The CBCS offers the students to choose open elective courses of their own choice.
- They can also opt for an interdisciplinary approach to learn a subject.
- The students have more scope to enhance their skills and more scope of taking up case studies, projects and assignments, vocational training including entrepreneurship.
- It improves the job opportunities of students.
- It will help in enabling potential employers assess the performance of students on a scientific scale.

Procedure

Every student shall earn 3 credits by choosing one of the open elective courses from the following list. Further students from a particular program, for example Mining Engineering., shall not opt for open electives offered by their own program. Students shall consult their class mentors before opting for an open elective course. The open elective courses on offer will be subject to availability of time table slot, faculty members, class rooms and minimum class strength specified from time to time.

Students may choose any one of the following courses.

Open Elective courses of 4th Semester

IV semester		
S. No	**Department**	**Open Elective Courses**
1	Department of EEE	Smart sensors
2	Department of Mechanical Engineering	Fundamentals of welding
3	AMET Business School	Introduction to Human Resource Management
4	Department of Naval Architecture and Offshore Engineering	Marine Pollution Regulations
5	Department of Marine Biotechnology	Microbiology for Petroleum Industry
6	Department of Petroleum Engineering	Principles of Petroleum Engineering
7	Department of Mining Engineering	Geology for Engineers
8	Department of Food Processing Technology	Fundamentals of Food and Nutrition
9	Department of Information Technology	Information Technology for Office Automation
10	Department of Mathematics	Mathematics for Competitive Exam
11	Department of Physics	Physics in Science Fiction Movies
12	Department of Chemistry	Green Chemistry
13	Department of English	Creative writing
		English for career Development

Open Elective courses of 6th Semester

VI semester		
S.no	**Department**	**Open Elective Courses**
1	Department of EEE	Solar power systems
2	Department of Mechanical Engineering	Non Destructive testing
3	AMET Business School	Organizational Development
4	Department of Naval Architecture and Offshore Engineering	Basic Principles of Marine Vehicle Design
5	Department of Marine Biotechnology	Marine Pollution and Biological Solutions
6	Department of Petroleum Engineering	Offshore Oil and Gas Operations
7	Department of Mining Engineering	Remote Sensing for Natural Resources
8	Department of Food Processing Technology	Ready to eat Food Processing Technology
9	Department of Information Technology	Python Programming
10	Department of Mathematics	Numerical Methods and Statistic
11	Department of Chemistry	Marine Chemistry
12	Department of Physics	Introduction to Nano Science

Students may choose any one of the following courses.

Open Elective courses of 4thSemester

IV semester		
S. No	**Department**	**Open Elective Courses**
1	Department of EEE	Smart sensors
2	Department of Mechanical Engineering	Fundamentals of welding
3	AMET Business School	Introduction to Human Resource Management
4	Department of Naval Architecture and Offshore Engineering	Marine Pollution Regulations
5	Department of Marine Biotechnology	Microbiology for Petroleum Industry
6	Department of Petroleum Engineering	Principles of Petroleum Engineering
7	Department of Mining Engineering	Geology for Engineers
8	Department of Food Processing Technology	Fundamentals of Food and Nutrition
9	Department of Information Technology	Information Technology for Office Automation
10	Department of Mathematics	Mathematics for Competitive Exam
11	Department of Physics	Physics in Science Fiction Movies
12	Department of Chemistry	Green Chemistry
13	Department of English	Creative writing
		English for career Development

PROGRAM	Common to all the BE Programmes offered in AMET (ME, Mech, EEEM, PE, HE, NA &OE, Mining) and B.Tech FPT; BBA Shipping, B.Com., LCA			
Course Code UDEE002	Course Name: Smart Sensors	L	T	P	C
		3	0	0	3
Year / Semester	II Year / IV Semester	Contact hours per week (3 Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			√	
Course Objective	1. To comprehend the principles behind sensors and its behaviors. 2. To impart knowledge on various Sensors and their applications			
Course Outcome	The students will be able to 1. Outline the Principles and characteristics of sensors 2. Explain the operation of acoustic, magnetic & Mechanical sensors 3. Illustrate the concepts of radiation, thermal and chemical sensors 4. Demonstrate various biosensors and its interface systems 5. Apply the suitable sensor for real time applications Apply the knowledge of sensors in the field of electronics engineering			

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	2	2	2	-	-
CO2	3	2	3	2	2	-	-	-	-	-	2	3	3	2	2
CO3	3	3	3	3	3	-	-	-	-	-	3	2	3	2	-
CO4	2	3	3	2	-	-	-	-	-	-	2	3	2	-	3
CO5	3	3	3	3	3	-	-	-	-	-	2	3	3	3	2
CO6	3	3	3	3	3	-	-	-	-	-	3	3	3	2	2
AVERAGE	2.7	3	2.8	2.7	2.8	-	-	-	-	-	2.3	2.7	2.7	2.2	2.2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT I : SENSOR CHARACTERISTICS AND PRINCIPLES OF SENSING 9 Hrs

Sensors classifications, Measurands, Characterization, Smart sensor systems, Physical principles of sensing: electric charges, fields, and potentials, Capacitance, magnetism, Induction, resistance, Piezoelectric effect, pyro electric effect, Hall effect, Seebeck and Peltier effects.

UNIT II : ACOUSTIC SENSORS , MAGNETIC SENSORS AND MECHANICAL SENSORS 9 Hrs

Acoustic waves, piezoelectric materials, Acoustic sensing, saw sensors. Sensor applications and future trends, Magnetic sensors: effects and materials. Integrated Hall sensors ,Magneto transistors, other magnetic transistor and future trends .Mechanical sensors: piezo resistivity , Piezo resistive sensors, Capacitive sensors

UNIT III : RADIATION SENSORS THERMAL SENSORS AND CHEMICAL SENSORS 9 Hrs

Radiation basics, HgCdTe infrared sensors, Visible-light color sensors, high-energy photodiodes, Heat transfer, thermal structures. Thermal-sensing elements Thermal and temperature sensors. Interaction of gaseous species at semiconductor Surfaces .Catalysis, the acceleration of chemical reactions, Thin-film sensor.FET devices for gas and ion sensing

UNIT IV : BIOSENSORS, ELECTRONIC INTERFACE AND INTEGRATED SENSORS 9 Hrs

Immobilization of biological elements, Transduction principles, Lab-on-chip sensors, Integrated sensors: system organization and functions, Interface electronics, Universal transducer interface, Micro technologies: introduction to microsystems engineering, Systems development: methods and tools, constructive and connective techniques

UNIT V : SENSOR APPLICATION 9 Hrs

Typical application of sensor, Weather monitoring systems, Battery monitoring Systems, Industrial automation, Building application, food industry application.

TOTAL: 45 PERIODS

TEXT BOOKS:

1. Jacob Fraden, "Handbook of Modern Sensors: Physics, Designs, and Applications", Fourth Edition, Springer, 2010.
2. Gerard Meijer, "Smart sensor systems", Wiley, 2008
3. Patranabis, "Sensors and Transducers", Prentice Hall India Pvt. Ltd, New Delhi 2014

REFERENCE:

1. Patranabis, "Sensors and Transducers", Prentice Hall India Pvt. Ltd, New Delhi 2014

Mech

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MECHANICAL ENGINEERING
CBCS CURRICULUM (2017-2018) (Regulation D)

Course Code	Course Name		L	T	P	C
UDMCO01	**FUNDAMENTLS OF WELDING**		**3**	**0**	**0**	**3**
(Common to All Engineering Courses)						
Year and Sem	**II / IV**	Course Type	Open Elective Course			
Prerequisite Course	Engineering Materials / Materials Science	Contact Hours per week	3 hrs			

Course Objective	1	To learn about the power sources for welding processes
	2	To learn about fusion welding processes
	3	To learn about solid state welding processes
	4	To understand about special welding processes
	5	To learn about welding metallurgy.

Course Outcome	1	After completing this course, the students will be able to understand the power sources in welding
	2	They will be able to understand the fusion welding processes
	3	They will be able to understand solid state welding processes
	4	The students will be able to understand the special welding processes
	5	They will be able to understand the concept of welding metallurgy

UNIT I POWER SOURCES **9 Hrs**

Classification of welding processes - heat sources, power sources, arc characteristics, V-I relationship, different types of electrodes, ingredients and function of electrode coverings, types of weld joints.

UNIT II FUSION WELDING PROCESSES **9 Hrs**

Shielded metal arc welding, gas welding, TIG welding, MIG welding, Submerged arc welding processes

UNIT III SOLID STATE WELDING PROCESSES **9 Hrs**

Resistance, friction, friction stir, ultrasonic, induction pressure, diffusion welding processes, explosive welding .

UNIT IV SPECIAL WELDING PROCESSES **9 Hrs**

Document Prepared in "Board of Studies" held on	Document Approved in "Academic Council" held on
Date : 15.05.2018	Date : 31.05.2018

Electron beam, laser beam welding, plasma arc processes; advantages, limitations, Introduction to Robotic welding, underwater welding.

UNIT V WELDING METALLURGY **9 Hrs**

Weld thermal cycles and their effects, effects of pre and post weld heat treatments, concept of HAZ, concept of weldability and its assessment. Welding of different materials, defects in welds, their causes and remedies.

TEXT BOOKS

1. Cornu. J.,(2004)"Advanced Welding Systems"-Volumes I, II and III, JAICO Publishers
2. Srinivasan N.K, (2004) "Welding Engineering", Khanna publishers.

REFERENCES

1. Lancaster L.F, (1996) 'The Physics of Welding', Pergamon Press.
2. Welding Handbook (Section I) American Welding Society1999
3. Parmer R.S, (2005) "Welding processes", Khanna publishers.
4. Rao P.N – (1998)"Manufacturing Technology (Foundry, Forming and Welding) II Edition", Tata McGraw Hill Pub. Co. Ltd,. New Delhi.

DEPARTMENT OF MECHANICAL ENGINEERING
CBCS CURRICULUM (2017-2018) (Regulation D)

Course Code	Course Name		L	T	P	C
UDMCO01	**FUNDAMENTLS OF WELDING**		**3**	**0**	**0**	**3**
(Common to All Engineering Courses)						
Year and Sem	**II / IV**	Course Type	Open Elective Course			
Prerequisite Course	Engineering Materials / Materials Science	Contact Hours per week	3 hrs			
Course Objective	1	To learn about the power sources for welding processes				
	2	To learn about fusion welding processes				
	3	To learn about solid state welding processes				
	4	To understand about special welding processes				
	5	To learn about welding metallurgy.				

Course Outcome	1	After completing this course, the students will be able to understand the power sources in welding
	2	They will be able to understand the fusion welding processes
	3	They will be able to understand solid state welding processes
	4	The students will be able to understand the special welding processes
	5	They will be able to understand the concept of welding metallurgy

UNIT I POWER SOURCES **9 Hrs**

Classification of welding processes - heat sources, power sources, arc characteristics, V-I relationship, different types of electrodes, ingredients and function of electrode coverings, types of weld joints.

UNIT II FUSION WELDING PROCESSES **9 Hrs**

Shielded metal arc welding, gas welding, TIG welding, MIG welding, Submerged arc welding processes

UNIT III SOLID STATE WELDING PROCESSES **9 Hrs**

Resistance, friction, friction stir, ultrasonic, induction pressure, diffusion welding processes, explosive welding .

UNIT IV SPECIAL WELDING PROCESSES **9 Hrs**

Document Prepared in "Board of Studies" held on	Document Approved in "Academic Council" held on
Date : 15.05.2018 .	Date : 31.05.2018 .

Electron beam, laser beam welding, plasma arc processes; advantages, limitations, Introduction to Robotic welding, underwater welding.

UNIT V WELDING METALLURGY **9 Hrs**

Weld thermal cycles and their effects, effects of pre and post weld heat treatments, concept of HAZ, concept of weldability and its assessment. Welding of different materials, defects in welds, their causes and remedies.

TEXT BOOKS

1. Cornu. J.,(2004)"Advanced Welding Systems"-Volumes I, II and III, JAICO Publishers
2. Srinivasan N.K, (2004) "Welding Engineering", Khanna publishers.

REFERENCES

1. Lancaster L.F, (1996) 'The Physics of Welding', Pergamon Press.
2. Welding Handbook (Section I) American Welding Society1999
3. Parmer R.S, (2005) "Welding processes", Khanna publishers.
4. Rao P.N – (1998)"Manufacturing Technology (Foundry, Forming and Welding) II Edition", Tata McGraw Hill Pub. Co. Ltd,. New Delhi.

PROGRAM	ABS UG – OPEN ELECTIVE				
Course Code UDBSO03	Course Name : Introduction to Hunan Resource Management	L	T	P	C
		3	0	0	3
Year and Semester	II(IV Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**
			✓		
Course Objective	1. To enable the students to gain complete insight into various domains of Human Resource Management 2. To study about procuring the Human Resources 3. To understand the standard procedures to maintain the HR in organisation. 4. To study the various compensation strategies for employees. 5. To understand HR practices in Maritime Industry				
Course Outcome	The Students will be able to 1. Make use of the nature and functions of management 2. Explain the need for human resource planning and procurement 3. Demonstrate the role of performance appraisal and pitfalls 4. Identify concepts of training and development 5. Evaluate the compensation plans and its implementation in shipping industry. 6. Apply the concepts of human resource management in organisations				

Pos/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	-	2	3	2	3	2	2	2	-	3	2
CO2	2	3	3	2	3	-	-	2	-	3	-
CO3	2	2	3	2	3	-	-	3	-	3	-
CO4	2	2	3	-	3	3	2	2	3	3	2
CO5	2	2	3	-	3	-	-	3	3	3	-
CO6	2	2	3	2	3	2	2	3	3	3	2
Average	2	2.17	3	2	3	2.33	2	2.5	3	3	2
Correlation Levels		1. Slight (Low)			2. Moderate (Medium)			3. Substantial (High)			

UNIT 1 : NATURE & SCOPE:

Evolution of Human Resource Management as a Discipline, Managerial & Operative Functions, Organization of HR Dept, Objectives of HRM, Competencies required for HR Managers, Importance of HR Department, Barriers to effective functioning, Future of HR.(9 Hours)

UNIT2 : PLANNING & PROCUREMENT:

HR planning - Recruitment, selection, placement, induction, Promotion and transfer policy. Job analysis, job-description, job specification, typical manpower planning scheme for large organizations - steps involved.(9 Hours)

UNIT 3 : PERFORMANCE APPRAISAL:

Concepts, Pre requisites of a good system, Pitfalls in PAR Remedies & Solutions, MBO approach, Performance appraisal in practice. (9 Hours)

UNIT 4 : TRAINING & DEVELOPMENT:

Framing effective policies and administering them, Training need assessment, Types/methods/techniques of training, Setting up and maintaining a good Training and Development department, Learning principles involved in training, Role of HR manager. (9 Hours)

UNIT5 : COMPENSATION:

Wage and salary administration, the rationale behind them, essential steps in formulating compensation package, Job evaluation, methods and importance, latest trends, Whether wages can be fixed on scientific basis alone. Career avenues & paths in Maritime Industry, HR practices of Maritime Industry- Merits & Demerits, Seafarers' employment agreements, Career progression in Maritime industry , skill development and opportunities in Maritime industry(9 Hours)

Total : 45 Hrs.

TEXT BOOKS :

1. Human Resource Development, P.C. Tripathi, Publisher: Sultan Chand & sons

REFERENCE

1. Human Resource Management: Text And Cases, K. Aswathappa, Publisher: Tata Mcgraw Hill
2. Human Resource Management, T.N. Chhabra, Publisher: DhanpatRaiPublishersShip broking and Chartering Practice, Ihre.R&Gordon.L, Publisher: Lloyd's of London Press

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNA002	MARINE POLLUTION REGULATIONS	L	T	P	C
		3	0	0	3
Year and Semester	II Year (semester IV)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
			✓		
Course Objective	1. This course provides basic knowledge about marine environment. 2. To provide the classification of marine pollution. 3. To understand the measure to prevent the pollution. 4. Provide the knowledge about impact of pollution.				
Course Outcome	1. Understand the nature of pollution and its possible sources. 2. Apply the law of the sea key provisions. 3. Apply measures and understand the requirement of pollution from oil and harmful substances. 4. Understand the prevention of pollution from sewage and garbage. 5. Evaluate the air pollution from ships during the initial phase of design. 6. Assemble the learning for a safe and sound design of ships.				

POS COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	1	1	-	-	1	-	3	3	1	2	1	-	-	2	-
CO2	3	2	-	-	2	-	-	-	-	-	2	-	-	3	-
CO3	3	2	-	-	2	-	-	-	-	-	2	-	-	3	-
CO4	2	2	-	-	1	-	-	-	1	2	2	-	-	3	-
CO5	2	2	-	-	1	-	-	-	1	2	2	-	-	3	-
CO6	3	2	-	2	3	-	1	-	1	3	3	-	-	3	-
AVERAGE	2.3	1.8	-	0.3	1.7	-	0.7	0.5	1.3	1.5	2	-	-	2.8	-
CORRELATION LEVELS		1.SLIGHT(LOW)			2.MODERATE(MEDIUM)					3.SUBSTANTIAL(HIGH)					

UNIT I – INTRODUCTION

The oceans – Maritime zones; Need for marine environment protection; Sources of marine pollution.

UNIT II –THE LAW OF THE SEA

The law of the sea and marine pollution – Navigation, exclusive economic zone, continental shelf, deep seabed mining, exploitation regime, marine scientific research.

UNIT III – POLLUTION FROM OIL & HARMFUL SUBSTANCES

Prevention of pollution by oil – operational measures and accidental discharges; Double hulls standards.

Control of pollution by noxious liquid substances in bulk – discharge criteria and measures; Types of substances; residues discharge concentrations and conditions.

Prevention of pollution by harmful substances Carried by Sea in Packaged Form – requirements of

standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications; Introduction to International Maritime Dangerous Goods Code (IMDG code).

UNIT IV – POLLUTION BY SEWAGE AND GARBAGE FROM SHIP

Need for pollution control by sewage/garbage; Measures for dumping the garbage; Disinfected sewage disposal and measures.

Types of garbage onboard ships; Measures for dumping the garbage; Disposal of all form of plastics into sea.

UNIT V –PREVENTION OF AIR POLLUTION FROM SHIPS

Limits on Sulphur oxide and Nitrogen oxide emissions from ship exhausts; Designated emission control areas; Stringent standards for SOx, NOx and particulate matter; Mandatory technical and operational energy efficiency measures.

TEXT BOOKS:

1. International Maritime Organization (IMO) conventions, International Convention for the Prevention of Pollution from Ships (MARPOL), United Kingdom, 2005.
2. United Nations, United Nations Convention on the Law of the Sea, New York.
3. J.W. Doerffer, Oil Spill Response in the Marine Environment,Pergamon Press, 1992, ISBN 0-08-041000-6.

REFERENCES:

1. John H. Bates, UK Marine Pollution Law, Lloyd's of London Press, 1985, ISBN 1-85044-028-X.
2. Ricardo Beiras, Marine Pollution–Sources, Fate and Effects of Pollutants in Coastal Ecosystems, Elsevier, 2018.
3. R.B. Clark, C. Frid and M Atttrill, Marine Pollution, 4th Edition, Oxford Science Publications, 1997, ISBN 0-19-850069-6.

Designed by	" Department of Naval Architecture & Offshore Engineering"

AMET

ACADEMY OF MARITIME EDUCATION AND TRAINING
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(Under Section 3 of UGC Act 1956)

Department of Marine Biotechnology

Open Elective Courses – Even Semester 2020

PROGRAM	B.E. /BTech/BCom/BBA					
Course Code **PDBTO01**	Course Name : **Microbiology for Petroleum Industry**		L	T	P	C
			3	0	0	3
Year and Semester	II year and IV sem		Contact hours per week (3 Hrs)			
Prerequisite course	Any Under Graduate degree with Engineering background					
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective ✓		Mandatory	
Course Objective	1. Microorganisms are inevitably associated with the petroleum industry 2. They are associated with microbially enhanced oil recovery, production of hydrocarbaon, degradation of hydrocarbons, bioindicators of hydrocarbon wealth etc. 3. This course would provide fundamental and advanced knowledge on Microbiology with special reference to petroleum industry.					
Course Outcome	At the end of the course the student will be able to :					
	1.	Outline the basic principles of microbiology.				
	2.	List out the types of compounds in petroleum and microorganisms involved in biodegradation.				
	3.	Interpret the mechanisms involved in microbially enhanced oil recovery.				
	4.	Explain the microbial degradation of hydrocarbon, quantitative estimation of hydrocarbon and biodegradation pathways.				
	5.	Extend the knowledge on inhabitant of oil reservoirs and microbial tolerants.				
	6.	Summarize the advancements for microbial degradation and microbial enhanced oil recovery.				

POS/ COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PSO 1	PSO 2	PSO 3	PS O 4
CO1	2	2	3	2	1	2	1	-	-	-	-	-	-	-
CO2	2	2	3	4	1	1	1	-	-	-	-	-	-	-
CO3	1	2	3	3	1	1	1	-	-	-	-	-	-	-
CO4	1	1	2	2	2	1	1	-	-	-	-	-	-	-
CO5	3	2	2	3	3	2	3	-	-	-	-	-	-	-
CO6	3	3	3	3	3	2	2	-	-	-	-	-	-	-
Average	2	2	2.6	3	1.7	1.5	1.5	-	-	-	-	-	-	-

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

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Department of Marine Biotechnology

Open Elective Courses – Even Semester 2020

Unit 1: Basic principles of Microbiology.

Definition and scope of microbiology- history and recent developments- General characteristics and functions of Microbes, Physical and Chemical Structures of different Microbes, Microscopy- simple and compound microscopy- Sterilization – principles - dry heat - moist heat – radiation - filtration.

Unit 2: Introduction to Petroleum Microbiology

Types of compounds in petroleum, products of compounds in petroleum, Determining/enumerating microbes in oilfields Biodegradation in oil reservoirs, Microorganisms and organic pollutants; Biodegradation, Bioremediation; Microorganisms and metal pollutants

Unit 3: Microbially Enhanced Oil Recovery:

Displacement mechanisms, microbial reservoir ecology, microbial growth models, bioclogging, wetability effect, biosurfactant production, sulfate reduction.

Unit 4: Microorganisms and Hydrocarbons:

Microbial degradation of aliphatic hydrocarbons and aromatic hydrocarbons (microorganisms involved, mon-terminal, biterminal oxidation of propane, decane, etc.) - Quantitative estimation of hydrocarbons/pesticides/organic Solvents /methane by Gas chromatography. Hydrocarbon biodegradation pathways, aerobic/anaerobic.

Unit 5: Advances in Petroleum Microbiology

Inhabitant of microbes in Oil reservoirs- Microbial tolerance to heavy metals (Pb, Hg), Biodegradation – reactions, enzymes and pathways. Biosurfactants

TEXT BOOKS

1. Pelczar TR M J Chan ECS and Kreig N R (2006). Microbiology. Fifth edition, Tata Mc Graw-Hill INC. New York.
2. Atlas RM (1999). Petroleum Microbiology. Macmillan Publishing Co

PE

PROGRAM	B.E. Petroleum Engineering				
Course Code UDPEO02	Course Name : Principles Of Petroleum Engineering	L	T	P	C
		3	0	0	3
Year and Semester	II Year & IV Semester	Contact hours per week (3Hrs)			
Prerequisite course	NIL				

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objective	To impart basic, comprehensive knowledge about the various facets of Petroleum Engineering.
Course Outcome	At the end of the course, the Students will be able to
	1 Describe about Petroleum and physical and chemical properties of crude oil and gas
	2 Explain about Drilling Operations and planning of GTO
	3 Summarize about Formation Evaluation
	4 Illustrate about Well Testing
	5 Estimating reserves and material balance equation
	6 Identify the Well site operation

POS/ COS	PO 1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO1 0	PO1 1	PO1 2	POS 1	POS 2	POS 3
CO1															
CO2															
CO3															
CO4															
CO5															
CO6															
Avera ge															

Correlation Levels	1.Slight(Low)	2.Moderate(Medium)	3.Substantial(High)

KL-Knowledge Level:K1-Remember,K2--Understand,K3-Apply,K4-Analyse,K5-Evaluate,K6-Create : PO-Programe Outcome:
CO-Course Outcome :PSO-Programe Specific Outcome

Unit I: INTRODUCTION **(9Hrs)**

Chemistry of petroleum. Structure of petroleum compounds. Types – alkanes, Napthenes, paraffins, aromatics. Physical and chemical properties of oil, gas and formation water.

Unit II: DRILLING **(9Hrs)**

Drilling – History, types of drilling –cable tool, rotary, drilling rigs and components. Types of wells – exploratory, delineation, development wells. Vertical, deviated, inclined, horizontal and ERD wells. Drilling fluids, casing and cementation. Planning – GTO.

Unit III:FORMATION EVALUATION **(9Hrs)**

Formation Evaluation – cutting, cores, mud logging unit. Well logging, types of well logs and their use. Sub surface correlation.

Unit IV:WELL TESTING **(9Hrs)**

Well Testing, perforation, testing methods, well completion production. Stimulation methods, recovery methods, Material balance, reserves estimation

Unit V: WELL SITE OPERATIONS **(9Hrs)**

Well site operations, roles of drilling, reservoir and production, hazards, environmental concerns, transportation of oil and gas, oil pollution and control, petroleum economics.

(Total: 45Hrs)

Text Books:

1. Leverson, Geology of Petroleum, 2nd Edition 2006, CBS Publishers & Distributors
2. Drilling operation Manual, 2007,ONGC.
3. T.E.W. Wind, Principles of oil Well Production ,1981,Mcgraw-Hill

Reference Books

1. Geltin, Introduction to Petroleum Engineering 2nd Edition 2017,Gulf Professional Publishing

Designed by	" Department of Petroleum Engineering"

Mining

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SYLLABUS FOR UNDER GRADUATE IN ENGINEERING AND TECHNOLOGY
B.E – MINING ENGINEERING
ACADEMIC YEAR 2020-2024 (BATCH - V)

PROGRAM	BE-Mining Engineering			
Course Code: UDMNO44	COURSE NAME: **Geology for Engineers**	**L**	**T**	**P**	**C**
		3	0	0	3

Year and Semester	III Year (IV Semester)		Contact hours per week (3 Hrs)	
Prerequisite course	NIL			
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**

Course Objective	1. Describe the physical geology 2. Explain the mineral deposits in India 3. Differentiate coal and petroleum geology 4. Describe the role of geophysical prospecting methods 5. Discuss geological investigation. 6. Analyze the presence of mineral deposits
Course Outcome	At the end of the course the student will be able to: 1. Understand the physical geology 2. Analyze the mineral deposits in india 3. Understand the coal and petroleum geology 4. Apply knowledge petrology 5. Determine the geological investigation Understand the presence of mineral deposits.

POS/	PO 1	PO 2	PO 3	PO 4	PO5	PO 6	PO 7	PO 8	PO 9	PO10	PO1 1	PO12	PSO 1	PSO2	PSO 3	

SYLLABUS FOR UNDER GRADUATE IN ENGINEERING AND TECHNOLOGY
B.E – MINING ENGINEERING
ACADEMIC YEAR 2020-2024 (BATCH - V)

COS															
CO1	2	-	1	-	2	2	3	-	-	2	3	2	2	1	1
CO2	3	2	2	1	2	-	2	-	-	-	2	1	1	2	1
CO3	-	-	2	-	-	-	2	-	-	2	2	1	2	2	2
CO4	-	-	-	-	-	2	2	-	-	-	3	1	2	1	1
CO5	-	-	2	1	2	3	2	-	-	2	2	2	2	1	1
CO6	2	1	2	1	2	3	3	-	-	2	3	2	2	2	1
Average	2	1.5	2.25	1	2	2	2.33	-	-	2	2.5	1.5	1.8	1.5	1.1

Correlation Levels	1.Slight(Low)	2.Moderate(Medium)	3.Substantial(High)

KL-Knowledge Level:K1-Remember,K2--Understand,K3-Apply,K4-Analyse,K5-Evaluate,K6-Create : PO-Programe Outcome:

CO-Course Outcome :PSO-Programe Specific Outcome

UNIT I PHYSICAL GEOLOGY 9Hrs

Interior of the earth and its composition – weathering of rocks – scale of weathering – soils - landforms and processes associated with river, wind, groundwater and sea – relevance to civil engineering. Plate tectonics – Earth quakes – Seismic zones in India.

UNIT II MINEROLOGY 9Hrs

Physical properties of minerals – Quartz group, Feldspar group, Pyroxene - hypersthene and augite, Amphibole – hornblende, Mica – muscovite and biotite, Calcite, Gypsum and Clay minerals.

UNIT III PETROLOGY 9Hrs

Classification of rocks, distinction between Igneous, Sedimentary and Metamorphic rocks. Engineering properties of rocks. Description, occurrence, engineering properties, distribution and uses of Granite, Dolerite, Basalt, Sandstone, Limestone, Laterite, Shale, Quartzite, Marble, Slate, Gneiss and Schist.

PROGRAM	Common to Engineering, Management and Commerce			
Course Code UDITO02	Course Name : INFORMATION TECHNOLOGY FOR OFFICE AUTOMATION	L 3	T 0	P 0	C 3

Year and Semester	II Year (semester IV)		Contact hours per week (3Hrs)	
Prerequisite course	Nil			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objective	1. To learn formatting and alignment using word (MS-Office). 2. To understand absolute and relative cell references in Excel. 3. To learn how to store and retrieve data using queries. 4. To know how to prepare power point presentation 5. To provide knowledge on creating Email and accessing web pages.
Course Outcome	After completion of the course, the students will be able to 1. Perform simple alignment in document 2. Utilize spreadsheet formulas to solve any engineering problems 3. Perform simple queries in database 4. Design form and report wizards in Access 5. Perform animation and transition in presentation 6. Create email and accessing web pages

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	2	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	3	2	2	2	-	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO6	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
AVERAGE	2.8	2.1	1.8	1.8	1.2	-	-	-	-	-	-	-	-	-	-

CORRELATION LEVELS	1.SLIGHT(LOW)	2.MODERATE(MEDIUM)	3.SUBSTANTIAL(HIGH)

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UNIT I WORD PROCESSING **9 Hours**

Introduction – Menu – Tool bar – Document – creation, editing, saving, opening- Text – editing , deleting, inserting, selection, moving, copying, converting case, find & replace, redo/undo - Formatting document – paragraph formatting – applying styles , header and footer, bullets and numbering, format painter ,line spacing – page layout – numbering pages - inserting section break – spell check - news paper column - Printing Document - page setup, inserting picture Tables - creation, editing, formatting, insertion, merging, splitting rows and columns, document with tables. Mail merge and template creation applying on business communication.

UNIT II SPREADSHEET **9 Hours**

Electronic spreadsheet features, work book, work sheet, menu, cells - entering data, text, functions – selecting cell – ranges- saving work sheet- editing work sheet data – copying , cut & paste - inserting , deleting rows, columns, cell ranges- find and replace data – Formatting work sheet – Changing column width, row height , aligning data – controlling text within a cell - changing font size, style - applying border, pattern styles. Charts - different types - titles and legend, saving , moving and copying between sheets. Formulas, functions - entering formulas- cell references –functions (sum, average, if, count, max, min, sin, sumif, hyperlink) - working with pivot table. Application – Employee payroll managment

UNIT III DATABASE **9 Hours**

MS Access: Introduction, Planning a Database, Starting Access, Access Screen, Creating a New Database, Creating Tables, Working with Forms, Creating queries, Finding Information in Databases, Creating Reports, Types of Reports, Printing & Print Preview – Importing data from other databases viz. MS Excel etc.

UNIT IV POWER POINT PRESENTATION **9 Hours**

Create presentation – inserting pictures and images - change position or layout of pictures – Apply 3D effect, shadows, back ground fill colors, textures and pattern. – multimedia – insert sounds and movies - slide transition - introduce animated objects. Slide show set up - insert navigation to slides- presentations and URL's – apply and edit timings – create a customized slide show.

UNIT V WEB ESSENTIALS **9 Hours**

Browsers and its types, internet browsing, searching - Search Engines - Portals - Social Networking sites- Blogs - viewing a webpage for public utilities, downloading and saving web documents, online payment system, Email - email id creation,compose,attach,send,inbox,spam,trash,CC,BCC,addressbook,reply& forward.

TOTAL HOURS: 45

TEXTBOOKS:

1. Joan Lambert and Curtis Frye, "Microsoft office 2016", Microsoft press, 2016.
2. Katherine Murray, "First Look Office 2010", Microsoft Corporation, 2010.
3. Professional Office Procedure by Susan H Cooperman, Printice Hall, 2010
4. Information Technology:Principles , Practices and Oppertunities by James A Senn, Printice Hall,2005.

REFERENCES:

1. Microsoft Office2007 Bible – John Walkenbach,HerbTyson,FaitheWempen,caryN.Prague,MichaelR.groh,PeterG.Aitken, and Lisa a.Bucki -Wiley India pvt.ltd.
2. A Conceptual Guide to OpenOffice.org 3 - R. Gabriel Gurley- CreateSpace Independent Publishing Platform, 2008
3. K. Arnold and J. Gosling, "The JAVA programming language", Third edition, Pearson Education, 2000.

PROGRAM	Non-DG(B.E/B.Tech/BBA/B.Com)					
Course Code UDCMO01	Course Name : Mathematics for Competitive Exam		L	T	P	C
			3	0	0	0
Year and Semester	II (IV Semester)		Contact hours per week (3Hrs)			
Prerequisite course	NIL					
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
			✓			
Course Objective	1. To develop the skill of reasoning applied to numerical problems. 2. To enable students to prepare for competitive examinations. 3. To develop the skill of reasoning applied to numerical problems. 4. To develop the logical reasoning in any kind of scenario. 5. To enable students to prepare for any kind interview and carrier developments.					
Course Outcome	The Students will be able to 1 understand the knowledge of finding area, surface and volume of common shapes. 2.understand and do problems in Simple interest -Compound interest 3.understand and do problems in Time ,work, Profit, loss, average and partnership 4. understandand do problems on Numbers, on Ages -Time Distance Problem ,Trains. 5.understand the Coding and Decoding tests, Analytical Reasoning tests- Calendar . 6 confidentlt participate in any competitive exam.					

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO10	PO11	PO 12
CO1	3	2	3	3	2	-	-	-	-	-	-	2
CO2	3	2	3	2	2	-	-	-	-	-	-	2
CO3	3	1	1	-	1	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	3	2	3	2	2	-	-	-	-	-	-	-
CO6	3	2	3	3	2	-	-	-	-	-	-	2
AVERAGE	**3**	**2**	**2**	**2**	**2**	-	-	-	-	-	-	1

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Unit I **(9 hours)**

H.C.F and L.C.M of Numbers -Percentage- Area of plane figures-circle, shaded portion.

Unit II **(9 hours)**

Volume and Surface Area of solid figures-Simple interest -Compound interest

Unit III **(9 hours)**

Time and workProblem–Profit and lossProblem - AverageProblem -Partnership Problem

Unit IV **(9 hours)**

Problems on Numbers,Problems on Ages -Time and DistanceProblem , Problems on Trains.

Unit IV **(9 hours)**

Coding and Decoding tests, Analytical Reasoning tests- Calendar.

Text Books:

1. R.S.Aggarwal, (1989) Quantitative Aptitude. S.Chand, New Delhi, Chapter 7, 8, 27.

2 .AbhijitGuha, (2005) Quantitative Aptitude 3rd ed. Tata Mcraw –Hill Publishing Company Limited, New Delhi, Chapters 2, 17, 22, 23, 27.

3. AbhijitGuha (2005) Quantitative Aptitude 3rd ed. Tata Mcraw –Hill Publishing Company Limited, New Delhi.

Web References:

1.www.2iim.com/india_mba_iim_cat.../quant_math.shtml

2. www.onestopmba.com/cattips/materials/maths/default.asp

PROGRAM	All UG Programmes				
Course Code: UDCCO04	Course Name : GREEN CHEMISTRY	L	T	P	C
		3	1	0	3

Year and Semester	II Year (IV semester)		Contact hours per week (3Hrs)	
Prerequisite course	NIL			
Course category	General	Foundation	Core / Professional	Open Elective
				Yes

Course Objective

1. 1. A functional understanding of the field of green chemistry.
2. A working understanding of the 12 principles of green chemistry.
3. An understanding of several real world examples where organizations used green chemistry to improve the sustainability performance of their products.
4. An appreciation of how the practice of green chemistry enhances competitiveness, innovation and faster time to market.
5. To expertise the global warming and its effects

Course Outcome

1. Describe the environmental status and evolution
2. Identify the sources of Pollution and its prevention measures
3. Summarize the green chemistry
4. Differentiate the bio-catalytic reactions
5. Describe the vitamins and antiobiotics
6. Evaluate the Green analytical technique to solve the engineering problems

Total Hours: 45 Hrs

Unit I

Introduction to Green Chemistry **9 Hrs**

Introduction-Current status of chemistry and the Environment-Evolution of the Environmental movement: Public awareness - Dilution is the solution to pollution-Pollution prevention

UNIT-II

Principles **9 Hrs**

Green Chemistry – Definition – Principles of Green Chemistry - Why is this new area of Chemistry getting to much attention - Why should chemist pursue the Goals of Green Chemistry - The roots of innovation – Limitations

Unit –III **9 Hrs**

Bio Catalytic Reactions

Green Chemistry Using Bio Catalytic Reactions – Introduction - Fermentation and Bio transformations - Production of Bulk and fine chemicals by microbial fermentation- Antibiotics – Vitamins - Bio catalyses synthesis of industrial chemicals by bacterial constructs - Future Tends.

Unit-IV **9 Hrs**

Green House Effect

Green house effect and Global Warming – Introduction - How the green house effect is produced - Major sources of green house gases - Emissions of CO_2 - Impact of green house effect on global climate - Control and remedial measures of green house effect - Global warming a serious threat - Important points.

Unit-V **9 Hrs**

Green Analytical Methods

Future trends in Green Chemistry - Green analytical methods, Redox reagents, Green catalysts; Green nano-synthesis, Green polymer chemistry, Exploring nature, Biomimetic, Proliferation of solvent-less reactions; Non-covalent derivatization, Biomass conversion, emission control

Text Books

1. V. Kumar, "An Introduction to Green Chemistry" Vishal publishing Co. Reprint Edition 2010
2. Rashmi Sanghi, M.M Srivastava "Green Chemistry" Fourth Reprint – 2009

References Book

1. Anastas & Warner, Green Chemistry: Theory & Practice ,Oxford Univ. Press,New York,1998

Eng

AMET
ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

CBCS CURRICULUM (2018 -19)
Elective

PROGRAM	BE (Common for ME/NA/PE//EEE/MECH/MINING/FPT)				
Course Code: UDLEO02	**Creative Writing**	**L**	**T**	**P**	**C**
		0	0	2	2
Year and Semester	II Year (IV Semester)	Contact hours per week (2Hrs)			
Prerequisite course	NIL				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Yes				
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
Course Objective	1. To make the students aware of the various aspects of Creative Writing. 2. To expose and familiarize the students with English writers and their works. 3. To equip the students to attempt at practical online writing. 4. To strengthen the creative talents and writing skills. 5. To enhance free writing skills of students				
Course Outcome	At the end of the course the student will be able to: 1. To identify different poetic forms. 2. To analyze and appreciate poems and short stories. 3. To write book and film reviews. 4. To appreciate literary works. 5. To become freelance writer.				

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UNIT I **PROCESS OF CREATIVE WRITING**

Kinds of Writing – fiction-non-fiction - Purpose and Use – freelance writing - content writing - Mechanics of Creative writing – figurative – diction – voice - style – Structure of creative writing - composition – creativity – appropriate language

UNIT II **PERSONAL ESSAYS**

Definition – Types – autobiographical - Characteristics – Maturity- Self and Subject- Anti-genre - Dr. A. B. J. Abdul Kalam – Wings of Fire - Stephen Hawking – My Brief History- Of Love - Francis - Writing Practice

UNIT III **POETRY**

Poetry – introduction - Chief elements – theme – structure - imagery and symbols - rhythm –Lyric - Sonnet – Ode - Dramatic Monologue - Free Verse - Sample Poems - The Road Not Taken - Robert Frost - I Wandered Lonely as a Cloud - William Wordsworth - Phenomenal Woman - Maya Angelou - Digging - Seamus Heaney

UNIT IV **SHORT STORY WRITING**

Short Story - introduction: Characteristic features of short stories in general – plot construction - Characterization - Narrative Techniques – Birbal Stories – Sleepless Nights – Karoly Kisfaludi – The Invisible Wound.

UNIT V **ONLINE BLOGGING**

Mechanics of Online Writing - Facebook profiles and timeline stories – Twitter - tweets and re-tweets – E-Commerce - Reviews and Comments – web blogging - Google class and Word press - You tube – Comments and reviews.

TOTAL: 30 Hrs

Text Books

1. Abrams, M.H. A Glossary of Literary Terms. Seventh Edition.

Reference Books

Document Prepared in "Board of studies" held on 20.02.2019	Document Approved in "Academic council" held on 05.03.2019

1. Prasad, B & Ramadoss H P (2016) A Background to the study of English Literature: Revised Edition, Chennai: Laxmi Publications.
2. Victor Jones 1974 Creative Writing, Kent Holder and Stoughton.
3. Birkett, Julian, 1983 Word Power: A Guide to Creative Writing, London: A & C Block.
4. Siegier, Isabelle 1968 Creative Writing, New York: Barnes and Novel.

CBCS CURRICULUM (2018-19) (REGULATION-D)

PROGRAM	B.E/B.Tech			
Course Code: UDLEO01	**ENGLISH FOR CAREER DEVELOPMENT**	L	T	P	C
		3			3

Year and Semester	III Year (VI Semester)		Contact hours per week (3Hrs)	
Prerequisite course	NIL			
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objective

1. To develop precision in oral and written communication
2. To equip students give public speaking
3. To help students write flawless English
4. To acquire the persuasive skills
5. To enable students to write competitive examinations with confidence

Course Outcome

At the end of the course the student will be able to:

1. To communicate effectively in oral and written form
2. To have confidence in making formal presentation and address in public meeting
3. To write official communication and report well
4. To have capacity in negotiating and convincing others
5. To appear for competitive examinations with self-confidence
6. To manage and lead a team effectively

PPOs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
Achieve better reading and writing skills	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-

Document Prepared in "Board of studies" held on 20.02.2019	Document Approved in "Academic council" held on 05.03.2019

Demonstrate efficiency to Interpret charts and technical vocabulary.	-	-	-	-	-	3	3	-	2	2	-	3	-	-	-
Demonstrate the use of Homonyms, Homograph and Homophones for error free communication	-	-	-	-	-	2	2	-	2	2	-	2	-	-	-
Discern the history of English and the usage of tenses	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
Proficiency in creative, critical, analytical and evaluative writing.	-	-	-	-	-	2	2	-	3	3	-	3	-	-	-
Acquire linguistic competence necessarily required in various life	-	-	-	-	-	3	3	-	3	3	-	3	-	-	-

situation															
AVERAGE						2.5	2.5		2.7	2.7		2.8			
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				3. SUBSTANTIAL (HIGH)			

UNIT –I SWOT Analysis

Problem solving – Assertive skills – Team work – Leadership –Strength and Weakness – Confidence building – Personal profile – Interactive strategies

UNIT –II Accuracy Development

Comprehension – Grammatical error identification – Sentence correction- Cloze test – Idiomatic expressions– Spelling/Punctuation pitfalls

UNIT- III Written and Oral communication

Presentation skills – Report Writing – Group Discussion – Debate – Job Interview – Narrating story/event– Precise writing

UNIT – IV Non-verbal Communication

Body language – Symbols – Images – Signs – Audio visual noises and gestures – Spatial language– Analogies

UNIT – V Stress and Time Management

Emotional intelligence – Handling multi task – Manage and control crisis- Prioritizing work

Reference Books:

1. Bhatnagar R P, *English for Competitive Examinations.*
2. Butterworth John, Thwaites Geoff, *Thinking Skills.*
3. Richards Jack C, *Interchange*

Fundamental of food and nutrition

UNIT ICONCEPTS AND CONTENT OF NUTRITION(9 HOURS)

Nutrition agencies, Nutrition of community, Nutritional policies and their implementation, Metabolic function of nutrients.

UNIT II WATER AND ENERGY BALANCE (9 HOURS)

Water intake and losses, Basal metabolism- BMR, Body surface area and factors affecting BMR.

UNIT III FORMULATION OF DIETS (9 HOURS)

Classification of balanced diet; Preparation of balanced diet for various groups, Diets and disorders. Recommended dietary allowances; For various age group, According to physiological status, Athletic and sports man, Geriatric persons.

UNIT IV MALNUTRITION(9 HOURS)

Type of Malnutrition, Multi-factorial causes, Epidemiology of under nutrition and over nutrition, Nutrition infection and immunity, Nutrition education.

UNIT V ASSESSMENT OF NUTRITIONAL STATUS (9 HOURS)

Diet surveys, Anthropometry, Clinical examination, Biochemical assessment, Additional medical information. In-born error of metabolism; Blood constituents, Nutrients, Hormones and enzymes, Miscellaneous disorders. Food fad and faddism. Potentially toxic substance in human food

physics

PROGRAM	B.E B.Tech, B.Com, B.B.A				
Course Code: UEPHO03	Course Name: **Physics in Science fiction movies**	**L**	**T**	**P**	**C**
		3	0	0	3
Year and Semester	II Year (IV Semester)	Contact hours per week 3 Hrs			
Prerequisite course	Nil				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
			✓		
Course Objective	01 To understand the basic laws physics through science fiction movies 02. To understand the basics concepts of quantum mechanics and relativity . 03. To demonstrate the concept of time dilation 04. To understand the origin of universe 05. To relate material science in science fiction movies and future technology				
Course Outcome	After successful completion of the course, the students should be able to 01. Summarize the laws of Physics 02. Explain concepts of quantum mechanics 03. Describe the concept of relativity 04. Demonstrate the origin of universe and life formation 05. Demonstrate the material science for futuristic applications				

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO 3
CO1	2	2	2	1	2	-	-	-	-	-	-	2	2	2	3
CO2	2	2	2	2	2	-	-	-	-	-	-	2	2	3	3
CO3	2	2	2	1	2	-	-	-	-	-	-	-	2	1	1
CO4	2	2	2	1	2	-	-	-	-	-	-	2	2	2	2
CO5	3	2	2	2	3	-	-	-	-	-	-	2	2	3	2
CO6	3	3	3	3	3	-	-	-	-	-	-	3	2	3	2
Avg	2.3	2.2	2.2	1.7	2.3							2.2	2.0	2.3	2.2

CORRELATION LEVELS	1. SLIGHT (LOW)	2. MODERATE (MEDIUM)	3. SUBSTANTIAL (HIGH)

UNIT I **(9 Hours)**

Introduction to science fiction and science fiction movies-Laws of physics-gravitation-concepts of quantum mechanics - relativity-black holes-worm holes-Dark matter

UNIT- II- **(9 Hours)**

Space travel- Space mission-space craft system-Rocket launch vehicle-Mission to moon-Mars missions-space technology

UNIT- III- **(9 Hours)**

Time Travel-Speed of light-Introduction to Special theory of relativity and General theory of relativity-Principle of causality-concept of time travel-possibilities

UNIT- IV- **(9 Hours)**

Life on other planets-solar system-stellar evolution-Nebular hypothesis-Bing bang theory-Elementary particles-Introduction to grand unification theory

UNIT –V- **(9 Hours)**

Physics of science fiction characters- novel materials-holography and holograms-nanotechnology based sensors-artificial intelligence.

TOTAL : 45 Hours

***Innovation**

Watch science fiction movies-Explain the basic and advanced physics concepts used in the movie plot-Debate/group discussion of possibilities of the concepts based on the existing laws of physics-videomaking/animation reviewing the particular plot for breaking laws of physics/using the laws of physics

Text Book

Arthur Beiser, 2017, Concepts of Modern Physics, 7th edition, McGraw Hill Education,1-648

REFERENCES:

01. R Feynmann, R Leighton, M Sands, 2012, The Feynmann Lectures on Physics, Volume 1,2,3, Pearson Education; 1st ed., New Delhi, 1-560.
02. D Halliday, R Resenic and J Walker, 2006, Fundamentals of Physics, Wiley India Pvt Ltd, 6th ed., New Delhi, 1-1216.
03. Hyper Space, 1994, MichioKaku,Oxford university press, UK
04. The theory of Everything, 2008, Stephen Hawking, I Edition, Jaico Publishers, Mumbai,1-125
05. Brief answers to big questions, Stephen Hawking, 2018, John Murray Publishers, UK, 1-221

Open Elective courses of 6th Semester

VI semester		
S.no	**Department**	**Open Elective Courses**
1	Department of EEE	Solar power systems
2	Department of Mechanical Engineering	Non Destructive testing
3	AMET Business School	Organizational Development
4	Department of Naval Architecture and Offshore Engineering	Basic Principles of Marine Vehicle Design
5	Department of Marine Biotechnology	Marine Pollution and Biological Solutions
6	Department of Petroleum Engineering	Offshore Oil and Gas Operations
7	Department of Mining Engineering	Remote Sensing for Natural Resources
8	Department of Food Processing Technology	Ready to eat Food Processing Technology
9	Department of Information Technology	Python Programming
10	Department of Mathematics	Numerical Methods and Statistic
11	Department of Chemistry	Marine Chemistry
12	Department of Physics	Introduction to Nano Science

EEE

PROGRAM	Common to all the BE Programmes offered in AMET (ME, Mech, EEEM, PE, HE, NA &OE, Mining) and B.Tech FPT; BBA Shipping, B.Com., LCA				
Course Code UDEE008	Course Name: Solar Energy Systems	L	T	P	C
		3	0	0	3
Year / Semester	III Year / VI Semester	Contact hours per week (3 Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
			√		
Introduction	Introduction to the course Class policies, grades, homework, prerequisites, and other details Power generation Overview of the power industry in the US today Fuels, heat rates Generation types Wind generation.				
Course Objective	1. To familiarize with the characteristics of solar radiation, its global distribution, and conversion methods of solar energy to heat and power. 2. To familiarize with the concepts of control and drives, importance of embedded system and implementation of control system for solar energy applications.				
Course Outcome	The Students will be able to 1. Illustrate the overview of solar resources 2. Explain the solar radiation and measurement techniques 3. Demonstrate how to calculate solar radiation at a given location 4. Summarize how to model a solar power system using MATLAB. 5. Outline the principle of operation of solar plants. 6. Apply the concept of solar collectors to renewable energy systems.				

POs / COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	3	2	-	2	-	-	-	-	-	-	-
CO2	2	2	3	-	2	-	-	-	-	-	2	2
CO3	2	3	2	3	2	-	-	-	-	-	2	2
CO4	3	2	3	3	3	-	-	-	-	-	2	2
CO5	2	3	3	2	3	-	-	-	-	-	2	2
CO6	3	3	3	3	3	-	-	-	-	-	2	3
AVERAGE	2.5	2.7	2.7	2.8	2.5	-	-	-	-	-	2	2
CORRELATION LEVELS				1. SLIGHT (LOW)				2. MODERATE (MEDIUM)				

UNIT I : ENERGY RESOURCES AND SOLAR SPECTRUM 9 Hrs

World energy resources - Indian energy scenario - Environmental aspects of energy utilization. Renewable energy resources and their importance - Global solar resources. Solar spectrum – Electromagnetic spectrum, basic laws of radiation. Physics of the Sun - Energy balance of the earth, energy flux, solar constant for earth, greenhouse effect.

UNIT II : SOLAR ELECTRICAL ENERGY CONVERSION 9 Hrs

Solar photovoltaic energy conversion - Principles - Physics and operation of solar cells. Classification of solar PV systems, Solar cell energy conversion efficiency, I-V characteristics, effect of variation of solar insolation and temperature, losses. Solar PV power plants.

UNIT III : MODEL REPRESENTATION 9 Hrs

Introduction to MATLAB, matrix operation, different graphical output, integration and solution to differential equation. Types of error - Convergence and stability. Models of electro - mechanical system – Thermo - fluid systems, solar photo voltaic cell and DC motor. Transient and steady state response of system. Simulation of model using MATLAB.

UNIT IV : CONTROL OF SOLAR PLANTS 9 Hrs

Basic and Advanced control of solar plants - basic control algorithms, adaptive and optimal controls. Model based predictive control strategies, frequency domain control and robust optimal control.

UNIT V : APPLICATIONS OF SOLAR COLLECTORS 9 Hrs

Application of non-concentrating collectors in low temperature solar thermal plants for space heating and cooling, drying, seawater desalination. Use of concentrating collectors for process heat production and power generation- Mini project of solar PV and its applications

TOTAL: 45 PERIODS

TEXT BOOKS :

1. Eduardo F. Camacho, Manuel Berenguel, Francisco R. Rubio, Diego Martinez,"Control of Solar Energy Systems", Springer, 2012.
2. Kai Velten., "Mathematical Modeling and Simulation", 1st ed., Wiley-VCH, 2009
3. Artur V.Kilian, "Solar Collectors: Energy Conservation, Design and Applications",Nova Science Publishers Incorporated, 2009

REFERENCES :

1. Garg .H.P, Prakash .J, "Solar Energy Fundamentals and Applications", TataMcGraw-Hill, 2005.
2. Kalogirou .S, "Solar Energy Engineering", Processes and Systems, Elsevier,2009.
3. Tiwari .G.N, "Solar energy: Fundamentals, Design, Modeling & Applications",CRC Press Inc., 2002.

Mechanical

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(Under Section 3 of UGC Act 1956)

DEPARTMENT OF MECHANICAL ENGINEERING
CBCS CURRICULUM (2017-2018) (Regulation D)

Course Code	Course Name	L	T	P	C
UDMCO05	**NON DESTRUCTIVE TESTING**	**3**	**0**	**0**	**3**
(Common to All Engineering Courses)					
Year and Sem	**III/VI**	Course Type	Open Elective Course		
Prerequisite Course		Contact Hours per Week	3		

Course Objective	1	To learn about NDET and surface NDT techniques
	2	To understand about radio graphic testing
	3	To learn about eddy current testing and ultrasonic testing
	4	To understand the concept of special/emerging testing
	5	To learn about the defects in materials

Course Outcome	1	After completing this course, the students will be able to understand the NDT techniques for various products.
	2	They will be able to know skills needed for selection of appropriate NDT technique(s) for new inspection jobs
	3	The students will be able to acquire sound knowledge of established NDE techniques and basic familiarity of emerging NDE techniques.
	4	They will be able to know the use of standards and codes in the area of NDET
	5	They will be able to identify the defects in materials

UNIT I INTRODUCTION TO NDET AND SURFACE NDT TECHNIQUES

Introduction to non-destructive testing and evaluation, visual examination, liquid penetrant testing and magnetic particle testing. Advantages and limitations of each of these techniques.

UNIT II RADIOGRAPHIC TESTING

Radiography principle, electromagnetic radiation sources, X-ray films, exposure, penetrameter, radiographic imaging, inspection standards and techniques, neutron radiography. Radiography applications, limitations and safety.

Document Prepared in "Board of Studies" held on	Document Approved in "Academic Council" held on
Date : 15.05.2018 .	Date : 31.05.2018 .

DEPARTMENT OF MECHANICAL ENGINEERING
CBCS CURRICULUM (2017-2018) (Regulation D)

UNIT III EDDY CURRENT TESTING AND ULTRASONIC TESTING

Eddy current principle, depth of penetration, eddy current response, eddy current instrumentation, probe configuration, applications and limitations. Properties of sound beam, ultrasonic transducers, inspection methods, flaw characterization technique, immersion testing.

UNIT IV SPECIAL/EMERGING TECHNIQUES

Leak testing, Acoustic Emission testing, Holography, Thermography, Magnetic Resonance Imaging, Magnetic Barkhausen Effect. In-situ metallography.

UNIT V DEFECTS IN MATERIALS / PRODUCTS AND SELECTION OF NDET METHODS

Study of defects in castings, weldments, forgings, rolled products etc. and defects arising during service. Selection of NDET methods to evaluate them. Standards and codes.

Text Books

1. Baldevraj, Jayakumar T., Thavasimuthu M., (2008) "Practical Non-Destructive Testing", 3rd edition, Narosa Publishers.

Reference Books

1. American Society for Metals, "Non-Destructive Evaluation and Quality Control": Metals Hand Book: 1992, Vol. 17, 9th Ed, Metals Park, OH.
2. Paul E Mix, "Introduction to nondestructive testing: a training guide", Wiley, 2nd edition New Jersey, 2005.
3. Ravi Prakash, "Nondestructive Testing Techniques", New Age International Publishers, 1st rev. edition, 2010.

Document Prepared in "Board of Studies" held on	Document Approved in "Academic Council" held on
Date : 15.05.2018 .	Date : 31.05.2018 .

PROGRAM	ABS UG – OPEN ELECTIVE				
Course Code UDBSO07	Course Name : Organizational Development	L	T	P	C
		3	0	0	3
Year and Semester	III (VI Semester)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
			✓		
Course Objective	1. To learn the basics of organizational development 2. To study the issues and challenges for organizational development 3. To understand the innovative changes for organizations 4. To study about change management 5. To study about change management for effective organizational management,				
Course Outcome	The Students will be able to 1. Make use of characteristics of Organizational development as managers. 2. Examine the theories and models of Organizational change . 3. Adapt ethical values in resolving ethical dilemma. 4. Explain the process and challenges of human resource intervention. 5. Evaluate the future scope of organizational development in the globalized environment. 6. Appraise the theories and models in the business context				

Pos/ COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PSO1	PSO2	PSO3	PSO4
CO1	2	1	2	2	2	3	3	3	2	2	3
CO2	-	-	3	3	3	-	2	3	-	3	2
CO3	2	3	3	3	3	2	3	3	2	3	3
CO4	3	3	3	3	3	-	3	3	2	3	3
CO5	2	2	2	3	3	3	3	3	2	3	3
CO6	3	2	3	3	3	2	3	3	3	3	3
Average	2.4	2.2	2.67	3	2.83	2.5	2.83	3	2.2	2.83	2.83
Correlation Levels		1. Slight (Low)			2. Moderate (Medium)			3. Substantial (High)			

Unit 1:Organisational development

9 hours

An introduction: Organisational Development – Meaning and Definition, History of OD, Relevance of Organisational Development for Managers, Characteristics of OD, Assumptions of OD

Unit 2:Change Process and Models

9 hours

Organisational Change, Strategies for Change, Theories of Planned Change (Lewin's change model, Action research model, the positive model), Action Research as a Process, Resistance to Change

Unit 3 : Values and Ethics in OD

9 hours

Professional Values, Value Conflict and Dilemma, OD Values and Changing Themes over Time, Ethics in OD, Ethical Dilemmas in Practicing OD, Factors that Influence Ethical Judgment

Unit 4 : Human Resource Interventions

9 hours

HRM Interventions, Goal Setting, Performance Appraisal, Reward Systems, Career Planning and Development, Managing Workforce Diversity, Employee Wellness

Unit 5 : Future of OD

9 hours

Organisational Development and Globalization, Emerging Trends in OD - Expanding the use of OD, Combining traditional "hard" business competencies and OD, Creating whole system change, Using OD to facilitate partnerships and alliances, Enhancing constant learning, Trends within the Organization

Total 45 hours

TEXT BOOK :

Organisational development and change, 10th edition, by Thomas G. Cummings (Author), Christopher G. Worley (Author)

Reference book:

Organisational Development and Intervention Strategies (English, Paperback, S. B. Sharan) 2015

DEPARTMENT OF NAVAL ARCHITECTURE AND OFFSHORE ENGINEERING

OEC Syllabus for IV and VI semester

VI semester

PROGRAM	BE-Naval Architecture & Offshore Engineering				
Course Code: UDNAO01	BASIC PRINCIPLES OF MARINE VESSEL DESIGN	**L**	**T**	**P**	**C**
		3	0	0	3
Year and Semester	III Year (semester VI)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
			✓		
Course Objective	1. To understand the various steps involved in ship design. 2. This course provides basic knowledge about marine environment. 3. To provide the idea about the ship hull 4. To understand the stability of marine vehicles.				
Course Outcome	1.Understand Marine Environment 2.Understand the design process of a Marine Vessel Design 3.Understand the stability of floating structure 4.Predict the ship resistance and powering 5.Understand ship motions and hull form design 6.Understand the marine vehicle structural design philosophy				

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO2	2	2	2	-	1	-	-	1	1	2	2	1	1	2	2
CO3	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO4	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO5	2	2	2	-	1	-	-	1	2	2	2	1	1	2	2
CO6	2	2	1	-	1	-	-	1	2	2	2	1	1	2	2
AVERAGE	2	2	1.8	-	1	-	-	1	1.7	2	2	1	1	2	2

CORRELATION LEVELS	1.SLIGHT(LOW)	2.MODERATE(MEDIUM)	3.SUBSTANTIAL(HIGH)

UNIT I - MARINE ENVIRONMENT

Ocean Waves, Regular waves, Irregular waves, Beaufort scale, Sea state conditions – Ocean data collection

UNIT II – DESIGN PROCESS

Market Study, Mission requirement, , Identifying the customer needs, System design, System Integration, Design process, Design spiral, Design Stages, Vehicle parameter estimation

UNIT III – STABILITY OF MARINE VESSELS

Hydrostatics, Intact stability, Initial stability, Stability at large angles, Trim, Damage Stability

UNIT IV – HYDRODYNAMIC DESIGN

Ship Resistance components, Estimation of ship resistance, Propulsion characteristics, Ship powering, model tests, Ship Motions, Ship maneuvering, Hullform design

UNIT V - STRUCTURAL DESIGN

Ship building materials, Ship structural components and scantlings, Midship section design, Longitudinal strength, Typical midship sections of bulk carrier, oiltanker and container ships

TEXT BOOKS

1. Ship Design Methodologies of Preliminary Design by ApostolosPapanikolaou
2. Practical Ship Design by D.G.M Watson
3. Ship Design for Efficiency and EconomybyH. Schneekluth and V. Bertram
4. Ship Design and Construction by R.Taggart

REFERENCES

1. Basic Ship Theory, Vol.1 & 2 by K.J.Rawson and E.C.Tupper
2. Principles of Naval Architecture, Vol. 1,2&3 by Ed.V. Lewis

Designed by	" Department of Naval Architecture & Offshore Engineering"

Marine

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Department of Marine Biotechnology
Open Elective Courses – Even Semester 2020

PROGRAM	B.E. /BTech/BBA/BCom				
Course Code PDBTO05	Course Name : **Marine pollution and biological solutions**	**L**	**T**	**P**	**C**
		3	0	0	3
Year and Semester	III year and VII Semester	Contact hours per week (3 Hrs)			
Prerequisite course	Any under graduate degree with Engineering background				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective ✓	Mandatory	
Course Objective	• To understand the most complex problems of Marine pollution. There can be several causes of ocean pollution, but the leading causes include sewage, toxic chemicals from industries, nuclear waste, thermal pollution, plastics, acid rain, and oil spillage. • This course would provide insight into various types of marine pollution and how they can be managed by biological solutions.				
Course Outcome	At the end of the course the student will be able to :				
	1.	List out the types and sources of marine pollution.			
	2.	Explain about the causes and impacts of marine pollution.			
	3.	Classify the bioindicators used for environmental monitoring.			
	4.	To extend the knowledge for disposal of marine pollutants.			
	5.	Outline the importance of living organisms in the management of marine pollution.			
	6.	Outline the impact of marine pollution in management aspects.			

POS/ COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PSO 1	PSO 2	PSO 3	PSO 4
CO1	1	2	2	2	1	2	1	-	-	-	-
CO2	2	2	1	2	1	2	1	-	-	-	-
CO3	1	1	1	1	1	1	1	-	-	-	-
CO4	1	1	2	2	1	2	1	-	-	-	-
CO5	2	2	1	2	2	2	2	-	-	-	-
CO6	1	1	2	2	2	1	1	-	-	-	-
Average	1.3	1.5	1.5	1.8	1.3	1.7	1.2	-	-	-	-
CORRELATION LEVELS			1. SLIGHT (LOW)			2. MODERATE (MEDIUM),			3. SUBSTANTIAL (HIGH)		

Unit - I- Types of Marine Pollution

Marine Pollution-definition- role of GESAMP- major pollutant- sources, transport path, dynamics. Toxicology- lethal

and sub lethal effects of pollutants to marine organisms- bioconcentration, bioaccumulation and biomagnifications- methods of toxicity testing factors influencing toxicity- synergistic and antagonistic effects- role of microcosms and mesocosms.

Unit-II- Causes and impacts of Marine Pollution

Analysis and presentation of physical, chemical and biological impacts of aquaculture activities in the coastal environment. Economic impacts of pollution, Global warming and ocean acidification, Marine animal diseases, Marine plant and coral disease's impact on the marine environment. Plastics and Litter source and impact in the marine environment.

Unit - III- Bioindicators of marine pollution

Environmental monitoring- Diversity of bioindicators used for environmental monitoring- biomarkers of marine contamination- Microbial Bioindicators.

Unit - IV- Coastal Zone Management

Knowledge of the precautions - prevent pollution of the marine environment- Knowledge of the use and operation of anti pollution equipment Knowledge of the approved methods for disposal of marine pollutants.

Unit - V -Management of Marine Pollution with living organisms and their products/processes

Enrichment and isolation of crude oil degrading marine bacteria- Isolation of biosurfactant producing microorganisms- Isolation of selenite/tellurite resistant marine-derived bacteria/fungi for application in bioremediation.

TEXT BOOKS

1. Clark, R.B., 2001. Marine Pollution, Oxford University Press
2. Johnston, R. (ed), 1976. Marine Pollution, Academic Press, London
3. Belkin, S and Cowell, R. R., Ocean & Health: Pathogens of the Marine Environment, Springer Publishers.
4. Satyanarayana, T., Johri, B. and Anil, T., Microorganisms in Environmental Management, Springer Publishers.
5. Reddy, S. M., Charya, M. A. S. and Girisham, S., Microbial Diversity: Exploration and Bioprospecting, Scientific blishers.

PROGRAM	B.E. Petroleum Engineering				
Course Code UDPEO05	Course Name : Offshore Oil & Gas Operations	**L**	**T**	**P**	**C**
		3	0	0	3
Year and Semester	III Year & VI Semester	Contact hours per week (3 Hrs)			
Prerequisite course	NIL				

Course category				
	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objective	1. To understand the basics of offshore structures 2. Types and classification of offshore structures 3. Installing offshore structures 4. Understanding drilling and production 5. Estimating the oil resources	
Course Outcome	At the end of the course, the Students will be able to	
	1	Explain the Offshore oil and gas operations
	2	Classification, properties of marine sediments
	3	Describe about the Drilling. Sampling techniques

	4	Analyze offshore structures
	5	Explain drilling components especially for offshore
	6	Illustrate about the Offshore soil mechanics

POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	3	3									3	2	
CO2	3	2	3	3									2	2	
CO3	2	2	2	2									2	3	3
CO4	1	2	2	1									3	2	1
CO5	1	1	1	1									1	1	
CO6	1	1	1	1									1	1	
Average	1.833333	1.833333	2	1.833333									2	1.833333	2

Correlation Levels	1.Slight(Low)	2.Moderate(Medium)	3.Substantial(High)

KL-Knowledge Level:K1-Remember,K2--Understand,K3-Apply,K4-Analyse,K5-Evaluate,K6-Create : PO-Programe Outcome: CO-Course

Outcome :PSO-Programe Specific Outcome

UNIT-I **Introduction** **(9 Hrs)**

Introduction to offshore oil and gas operations.. Sea States and Weather, Offshore Fixed and mobile Units, Offshore Drilling, Difference in drilling from land, from fixed platform, jack up, ships and semi submersibles. Offshore Well Completion, Offshore Production systems, Deep-water technology, Divers and Safety, Offshore Environment.

UNIT-II **Properties of marine sediments** **(9 Hrs)**

Introduction; classification, properties of marine sediments. Consolidation and shear strength characteristics of marine sediments. Planning and site exploration.

UNIT-III **Sampling techniques** **(9 Hrs)**

Drilling. Sampling techniques. Laboratory testing, In situ testing methods and geophysical methods. Current design practices of pile supported and gravity offshore structures.

UNIT-IV **Dynamic analysis of offshore structures** **(9 Hrs)**

Dynamic analysis of offshore structures. Centrifugal modeling. Anchor design. Break out resistance analysis and geotechnical aspects of offshore pipeline and cable design. Field instrumentation and performance observation.

UNIT-V Offshore soil mechanics **(9Hrs)**

Offshore soil mechanics; Offshore pile foundations and caissons; Design of breakwaters; Buoy design and mooring systems; Offshore drilling systems and types of platforms; Ocean mining and energy systems.ROV. Onshore drilling-on shore oil rigs, onshore drilling equipments-onshore rig structures-hydraulics applied in onshore rigs.

Total Hours: 45

Text Book

1. Mohamed El-Reedy, Offshore Structures Design, Construction and Maintenance,2012,Gulf Publishers.
1. Sahay.B, Wellsite Geological Techniques for petroleum Exploration 1998,Oxford & IBH Publishing Company

Reference Books

1. BencGerwick Jr.: Construction of Marine and offshore structures, IDT ONGC Dehradun, drilling operations manual,2007

Designed by	" Department of Petroleum Engineering"

Mining

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SYLLABUS FOR UNDER GRADUATE IN ENGINEERING AND TECHNOLOGY
B.E – MINING ENGINEERING
ACADEMIC YEAR 2019-2023 (BATCH - IV)

PROGRAM	BE- Mining Engineering				
Course Code: UDMNO08	COURSE NAME: **REMOTE SENSING FOR NATURAL RESOURCES**	**L**	**T**	**P**	**C**
		3	0	0	3
Year and Semester	III Year (VI SEMESTER)	Contact hours per week (3Hrs)			
Prerequisite course	NIL				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**	**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**	**Mandatory**	
			✓		
Course Objective	1. To provide exposure to students in gaining knowledge on concepts and applications leading to modeling of earth resources management using Remote Sensing 2. To acquire skills in storing, managing digital data for planning and development. 3. To acquire skills in advance techniques such as hyper spectral, thermal and LiDAR scanning for mapping, modeling and monitoring. 4. To acquire knowledge about mineral corridor and mining information system. 5. To elaborately study about planning in transportation.				
Course Outcome	At the end of the course the student will be able to: 1. Discuss the concepts, methodologies and applications of Remote Sensing Technology. 2. Prepare the candidates for National and Global Employability 3. Explain handling instruments, tools, techniques and modeling while using Remote Sensing Technology 4. Discuss theEmpowers the candidate with confidence and leadership qualities. 5. Explain Mining Information system and its utility 6. Explain Transport planning using GPS				

POS/ COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	1	2		3		1				1	1	3		2
CO2	2	2		2		1		2		1			3		
CO3	2		1		3				1			2	3		2
CO4	2			2							1		3		

SYLLABUS FOR UNDER GRADUATE IN ENGINEERING AND TECHNOLOGY
B.E – MINING ENGINEERING
ACADEMIC YEAR 2019-2023 (BATCH - IV)

CO5	3				3				1			1	3		2
CO6															
Average	2.00	0.50	0.50	0.67	1.50	0.17	0.17	0.33	0.33	0.17	0.33	0.67	2.50	0.00	1.00
Correlation Levels				1.Slight(Low)				2.Moderate(Medium)				3.Substantial(High)			

KL-Knowledge Level:K1-Remember, K2—Understand ,K3-Apply, K4-Analyse, K5-Evaluate, K6-Create ;
PO-Programme Outcome; CO-Course Outcome ;PSO-Programme Specific Outcome

UNIT I: Introduction **(9 Hrs)**

Introduction to Remote Sensing, Mineral , structural, geomorphic Anomaly Mapping, Resource Estimation

UNIT II: Survey of mines **(9 Hrs)**

Remote Sensing survey for Mine planning, Mine Monitoring, Identification of Illegal mining and Mining environmental Mapping and monitoring.

UNIT III : GIS **(9 Hrs)**

Creation of Mining maps thru GIS, creation of resource analysis thru GIS software. Systematic retrieval, updation and Modification of mine plans and sections.

UNIT IV : Mineral Corridor **(9 Hrs)**

Mining Information system and its utility, introduction to Mineral Corridor.

UNIT V : Transportation Planning (9 Hrs)

Transport planning, effective mine productivity MIS system creation through information and communication systems; ICT Linking of various intra and inter mining companies, central repository system

Total :(45 Hrs)

TEXT BOOKS

1. SatheeshGopi, Rasathishkumar, N.Madhu, – Advanced Surveying, Total Station GPS and Remote Sensing – Pearson education , 2007 ISBN: 978-81317 00679 52.
2. Alfred Leick, GPS satellite surveying, John Wiley & Sons Inc., 3rd Edition, 2004.
3. Jie Shan and Charles K. Toth, Topographic Laser Ranging and Scanning – Principles and Processing, CRC Press, Taylor & Francis Group, 2009.

REFERENCES:

1. Rueger, J.M. Electronic Distance Measurement, Springer-Verlag, Berlin, 1996.
2. Michael Renslow, Manual of Airborne Topographic LiDAR, The American Society for Photogrammetry and Remote Sensing , 2013.
3. R.Subramanian, Surveying and Levelling, Oxford University Press, Second Edition, 2012.

Ready to eat food Processing tecchnology

UNITI Introduction **(9 Hours)**

Introduction – definition – need for RTE foods – pros and cons of RTE – recent RTE foods available in market. source of contamination- Microbial concern – – microbial aspects – bacteria, virus, fungi – chemical contamination – physical contamination

UNIT II **Fruis And Vegetables** **(9 Hours)**

Ready to eat fruits and vegetable products – dehydrated fruits and vegetables, pickle, salads, chutney, sauce, ketcup, concentrated curry, dried fruits and vegetables – steaks and chips, cured fruits and vegetables.

UNIT III **Cereals** **(9 Hours)**

Ready to eat cereal products – breakfast cereals from corn, wheat, rice, oats and millets - flaked cereal, puffed cereal, shredded cereal, extruded expanded cereal – noodles, pasta, etc

UNIT IV **Milk Products** **(9 Hours)**

Ready to eat milk products – gulabjammun, peda, ice cream, yogurt, whey drinks, paneer and dairy based sweets.

UNIT V **Meat Products** **(9 Hours)**

Ready to eat meat products – pepperoni – sausages - meat balls – frankfurters- meat pickles.

IT

PROGRAM	Common to Engineering, Management and Commerce			
Course Code UDITO08	Course Name : PYTHON PROGRAMMING	L	T	P	C
		3	0	0	3

Year and Semester	III Year (semester VI)	Contact hours per week (3Hrs)	
Prerequisite course	Programming for Problem Solving		
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective
	Basic Science	Engineering Science	Open Elective	Mandatory
			✓	

Course Objective

1. Understand the Preliminary Concepts of Programming Language & syntax and Semantics methods
2. Understand the Strings, Lists, Functions and Methods
3. Write the Sub Python Scripts and the Simple File Programs
4. Handle the Errors &Exceptions
5. Comprehend the OOPs concepts

Course Outcome

After completion of the course, the students will be able to

1. Write a simple Python program following the basic syntactical structure of Python Language.
2. Develop an application to perform string manipulation
3. Use the built-in function and function objects in the Program
4. Apply Error catching and Exception handling mechanisms
5. Implement file handling in programming environment
6. Apply the OOPS concepts for engineering problems

POS/COS	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	3	1	1	-	-	-	-	-	-	-	-	-	-	-
CO2	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO3	2	1	3	3	2	-	-	-	-	-	-	-	-	-	-
CO4	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO5	3	2	2	2	1	-	-	-	-	-	-	-	-	-	-
CO6	2	1	3	3	2	-	-	-	-	-	-	-	-	-	-
AVERAGE	2.5	1.8	2.1	2.1	1.4	-	-	-	-	-	-	-	-	-	-

CORRELATION LEVELS	1.SLIGHT(LOW)	2.MODERATE(MEDIUM)	3.SUBSTANTIAL(HIGH)

Document Prepared in "Board of studies" held on Date:___	Document Approved in "Academic council" held on Date___

UNIT I INTRODUCTION TO PYTHON **9 Hours**

Introduction to Python Interpreter and Interactive Mode - Values and Types:Int, Float, Boolean, String and List - Variables - Operators - Expressions - Statements – Comments

UNIT II CONTROL FLOW, FUNCTIONS AND STRINGS **9 Hours**

Conditionals: Conditional (If), Alternative (If-Else), Chained Conditional (If-Elif-Else) - Iteration: While, For, Break, Continue, Pass - Functions: Fruitful Functions, Return Values, Parameters, Local and Global Scope, Function Composition and Recursion - Strings: String Slices, Immutability, String Functions and Methods

UNIT III LISTS, TUPLES AND DICTIONARIES **9 Hours**

Lists: List Operations, List Slices, List Methods, List Loop, Mutability, Aliasing, Cloning Lists, List Parameters, List Comprehension - Tuples: Tuple Assignment, Tuple as Return Value - Dictionaries: Operations and Methods; Applications: Permutations using list - Telephone directory using dictionary

UNIT IV FILES, EXCEPTION, MODULES AND PACKAGES **9 Hours**

Files and Exception: Text Files, Reading and Writing Files, Format Operator and Command Line Arguments - Exception: Errors and Exceptions, Handling Exceptions - Modules –Packages; Applications:Raise an exception if number not quadratic in quadratic equation

UNIT V OOPS CONCEPTS **9 Hours**

Class - Objects - methods - Instance - Constructor and Destructor - Friend function - Function Overloading, - Inheritance; Applications:Bank account creation with deposit and withdraw using class

TOTAL HOURS: 45

TEXT BOOKS:

1. John C. Lusth, "The Art and Craft of Programming in Python", The University of Alabama, 2016
2. PovelSolin, Martin Novak, "Introduction to Python Programming", NCLab Public Computing, 2013

REFERENCES:

1. Mark Lutz, Learning Python, O'Reilly, Fifth Edition, 2013
2. Jacob Fredslund, Introduction to Python Programming, , 2007
3. Introduction to Python, DaveKuhlman, 2014

AMET
ACADEMY OF MARITIME EDUCATION AND TRAINING
DEEMED TO BE UNIVERSITY
(Under Section 3 of UGC Act 1956)

PROGRAM	OEC for Semester-IV					
Course Code **UDCMO06**	Course Name : Numerical Methods and Statistics		L	T	P	C
			3	0	0	3
Year and Semester	III (VI Semester)		Contact hours per week(3 Hours)			
Prerequisite course	NIL					
Course category	Humanities and Social Sciences	Management courses	Professional Core		Professional Elective	
	Basic Science	Engineering Science	Open Elective		Mandatory	
		✓				

Course Objective

1. To understand the perception of the power of numerical methods
2. To understand numerically different kinds of problems occurring in engineering and technology
3. To understand the basics of approximation, integration and differentiation.
4. To understand how to design experiments and surveys for efficiency.
5. To know the concepts of SQC.

Course Outcome

The Students will be able to

1. Understand the basic knowledge on solution of polynomials.
2. Use interpolation and approximation to solve engineering problem.
3. Discuss the numerical differenation and integration.
4. Apply to design experiments related Problems
5. Apply the control charts uses in industry
6. Solve problem in engineering field using numerical methods.

POS\COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	1	1	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	1	1	-	-	-	-	-	-	-	-	-	-
AVERAGE	**1.67**	**1.5**	-	-	-	-	-	-	-	-	-	-
Correlation level			1.Slight (Low)			2.Moderate(Medium)			3. Substantial (High)			

UNIT I Solution of Equations **9 Hours**

Solution of algebraic equations: Fixed point iteration method – Newton Raphson method - Solution of linear system of equations: Iterative methods of Gauss Jacobi and Gauss Seidel.

UNITII Interpolation And Approximation **9 hours**

Interpolation with equal intervals: Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference.

PROGRAM	OEC for Semester-IV				
Course Code **UDCMO06**	Course Name : Numerical Methods and Statistics	**L**	**T**	**P**	**C**
		3	0	0	3
Year and Semester	III (VI Semester)	Contact hours per week(3 Hours)			
Prerequisite course	NIL				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic Science	Engineering Science	Open Elective	Mandatory	
		✓			
Course Objective	1. To understand the perception of the power of numerical methods 2. To understand numerically different kinds of problems occurring in engineering and technology 3. To understand the basics of approximation, integration and differentiation. 4. To understand how to design experiments and surveys for efficiency. 5. To know the concepts of SQC.				
Course Outcome	The Students will be able to 1. Understand the basic knowledge on solution of polynomials. 2. Use interpolation and approximation to solve engineering problem. 3. Discuss the numerical differenation and integration. 4. Apply to design experiments related Problems 5. Apply the control charts uses in industry 6. Solve problem in engineering field using numerical methods.				

POS\COS	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO11	PO 12
CO1	2	1	-	-	-	-	-	-	-	-	-	-
CO2	2	2	-	-	-	-	-	-	-	-	-	-
CO3	1	1	-	-	-	-	-	-	-	-	-	-
CO4	2	2	-	-	-	-	-	-	-	-	-	-
CO5	2	2	-	-	-	-	-	-	-	-	-	-
CO6	1	1	-	-	-	-	-	-	-	-	-	-
AVERAGE	**1.67**	**1.5**	-	-	-	-	-	-	-	-	-	-
Correlation level			1.Slight (Low)			2.Moderate(Medium)			3. Substantial (High)			

UNIT I Solution of Equations

9 Hours

Solution of algebraic equations: Fixed point iteration method – Newton Raphson method - Solution of linear system of equations: Iterative methods of Gauss Jacobi and Gauss Seidel.

UNITII Interpolation And Approximation

9 hours

Interpolation with equal intervals: Newton's forward and backward difference formulae. Interpolation with unequal intervals: Lagrange's interpolation – Newton's divided difference.

UNIT III Numerical Differentiation and Integration **9 hours**

Approximation of derivatives using interpolation polynomials - Numerical integration using Trapezoidal, Simpson's 1/3 rule Simpson's 3/8 rule – Romberg's method.

UNIT IV: Design of Experiments **9 hours**

Analysis of variance – One way classification – Completely randomized design – Two way classifications- Randomized Block design – Latin square

UNIT V: Statistical Quality Control **9 hours**

Control charts for measurements (X and R charts) – Control charts for attributes (p, c and np Charts) – Tolerance limits - Acceptance sampling.

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TEXT BOOKS:

1. Grewal. B.S., and Grewal. J.S." Numerical methods in Engineering and Science", Khanna Publishers, 9th Edition, New Delhi, 2007.
2. Gerald. C. F., and Wheatley. P. O., "Applied Numerical Analysis", Pearson Education, Asia, 6 th Edition, New Delhi, 2006.

REFERENCES:

1. Chapra. S.C., and Canale.R.P., "Numerical Methods for Engineers, Tata McGraw Hill, 5 th Edition, New Delhi, 2007.
2. Brian Bradie. "A friendly introduction to Numerical analysis", Pearson Education, Asia, New Delhi, 2007.
3. Sankara Rao. K., "Numerical methods for Scientists and Engineers", Prentice Hall India Private, 3rd Edition, New Delhi, 2007.
4. M.R.Spiegel, J.Schiller and R. Alu Srinivasan R, "Schaum"s Outlines Probability and Statistics", Tata McGraw-Hill Publishing Company Ltd. New Delhi, 2007.

PROGRAM	All UG Programmes				
Course Code: UDCCO07	Course Name : MARINE CHEMISTRY	L	T	P	C
		3			3
Year and Semester	VI	Contact hours per week 3 Hrs			
Prerequisite course	NIL				
Course category	General	Foundation	Core / Professional	Elective	
				Yes	
Course Objective	1. By the end of this lesson, the student will be able to classify the different dissolved gases in sea water. 2. By the end of this lesson, the student will be able to predict the role of biological processes in affecting oceanic carbonate system. 3. By the end of this lesson, the student will be able to describe chemical and pharmacological properties of bioactive substances in marine organisms. 4. By the end of this lesson, the student will be able to determine micro-nutrient elements (N, P, Si) in seawater. 5. By the end of this lesson, the student will be able to identify dissolved elements in the estuary.				
Course Outcome	1. List the various dissolved gases in sea water and factors affecting their concentration. 2. Demonstrate knowledge of concepts and principles of ocean acidification. 3. Analyse and evaluate biomedical aspects of marine natural products. 4. Integrate and apply the knowledge of stoichiometry of uptake and regeneration of nutrients elements. 5. Reflect on the influence heavy metals in estuaries. 6. Evaluate total findings in marine chemistry to solve engineering problems				

Total Hours: 45 Hrs

Unit 1 **9 hrs**

Dissolved gases in seawater

Dissolution of gases in seawater and their solubility; classification of dissolved gases and factors affecting their concentration in seawater; distribution of dissolved oxygen in seawater and affecting factors, AOU and oxygen minimum zone formation in the ocean, origin and consequences of ocean hypoxia.

Unit 2 **9 hrs**

Carbonate systems in the ocean

Acid base equilibria in seawater carbon dioxide system; parameters of carbonate systems and their distribution in the ocean; role of biological processes in affecting oceanic carbonate system; precipitation and dissolution of calcium carbonate in seawater, lysocline and carbonate compensation depth; Ocean acidification.

Unit 3 **9 hrs**

Chemistry of marine natural products

Biomedical Aspects; chemical and pharmacological properties of bioactive substances in marine organisms, carbohydrates and their derivatives in red and brown algae, aliphatic acids and their derivatives in marine organisms, steroids and their use as biomarkers, nitrogenous compounds in invertebrates, nucleosides from sponges, biopolymer.

Unit 4 **9 hrs**

Micronutrients in seawater

Micro-nutrient elements (N, P, Si) in seawater, their forms, distribution and seasonal variation in the ocean. Stoichiometry of uptake and regeneration of nutrients elements and AOU. Micronutrients and primary productivity.

Unit 5 **9 hrs**

Estuarine chemistry

Behavior of dissolved and particulate material during estuarine mixing, interaction among them and speciation of dissolved elements in the estuary; physico-chemical characteristic of estuarine sediment, anoxic sediments and pore water; heavy metals in estuaries and the processes affecting its distribution.

Reference books

1. Introduction to Marine Chemistry, 1971 – Riley, J.P. and Chester, R., Academic Press.
2. Chemical Oceanography (Vol.1, 2, 3 & 8), 1975 – Riley, J.P. & Skirrow, G., Academic Press.
3. Marine Chemistry, 1969 – Horne, R.A., Wiley-Interscience
4. Seawater: Its composition, properties & behaviour, 1989, 1995, 2004 – The Open University.
5. Marine Chemistry (Vol.2), 1970 – Martin, D.F., Marcel Dekker, NY.
6. Tracers in the Sea, 1982 – Broecker and Peng., Lamont-Doherty Geological Observatory, NY.
7. Marine Geochemistry, 1990, 2000 – Chester, R., Blackwell Science.
8. Chemical Oceanography, 1992 – Millero, F. J. and Sohn, M.L., CRC Press.
9. Dynamic processes in the chemistry of the upper ocean, 1986 - Burton et al., Plenum Press.
10. The chemistry of the Atmosphere and Oceans, 1978 – Holland, H.D., Wiley.

physics

PROGRAM	B. E., B.TECH.				
Course Code: UEPHO02	INTRODUCTION TO NANOSCIENCE	L	T	P	
		3	0	0	
Year and Semester	3, VI				
Prerequisite course	Fundamentals of Physics				
Course category	Humanities and Social Sciences	Management courses	Professional Core	Professional Elective	
	Basic	Engineering	Open Elective	Mandatory	

	s i c S c i e n c e	Science		
Course Objective	1. To Introduce Nanoscience to engineering students 2. To explain different nanomaterials synthesis methods 3. To illustratenanomaterialsand their interesting properties 4. To demonstrate about various nanomaterial characterization tools 5. To describe about various applications of nanoscience			
Course Outcome	After completion of the course, the students will be able to , 1. To understand the basic concepts of nanomaterials. 2.To discuss the nanomaterial synthesis techniques 3.Toanalyze the properties of nanomaterials and their utility. 4. To apply the tools for nanomaterials study. 5. To apply Nanoscience for various applications 6. To apply the basic understanding of Nanoscience in fabrication of engineering devices			

Pre- requisite :Higher Secondary School Education; Fundamental concepts of Physics

Knowledge Levels as per Bloom Taxonomy:

K1- Remember; K2- Understand; K3- Apply; K4- Analyse; K5- Evaluate; K6- Create

Mapping of CO vs POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO_1	1	1			3							3
CO_2	3	2		1		2						2
CO_3	2	2			1							3
CO_4	2	1		2		3	2					2
CO_5	1	3		3	2	1						1
CO_6	1	1		1	1	1	3					3
CO_7	3	2		2	2	3	1					2

Unit I Introduction to Nanoscience:(9 Hours)

Scientific Revolution-Atomic Structure and atomic size, emergence and challenges of nanoscience and nanotechnology, influence of nano over micro/macro, size effects, large surface to volume ratio, surface effects on the properties, functional Materials, Composite materials.

Unit II Synthesis of nanomaterials: (9 Hours)

Chemical Routes for Synthesis of Nanomaterials: Chemical precipitation and coprecipitation; Metal nanocrystals by reduction, Sol-gel synthesis; Sonochemical synthesis; Electrochemical synthesis, Process of self-assembly,

Fabrication of Nanomaterials by Physical Methods, Arc discharge, Ion sputtering, Laser ablation, Ball Milling, Molecular beam epitaxy, Chemical vapour deposition method nanolithography, E beam lithography

Unit III Properties of nanomaterials:(9 Hours)

Nanostructures: Zero-, One-, Two- and Three- dimensional structure, Size control of semiconductor, metal, polymer Nanoparticles and their properties: Optical, Electronic, Magnetic properties; Surface plasmon Resonance, Change of bandgap.

Unit IV Characterization techniques:(9 Hours)

X-ray diffraction, Optical Microscope and their description, Scanning Electron Microscopy (SEM), TEM, DLS and EDAX analysis, UV-VIS-IR Spectrophotometers-band gap measurement, FTIR- ATR, TGA, DTA (Principle and Applications).

Unit V Nanomaterial Applications:(9 Hours)

Applications of nanomaterialsinEnvironment, energy, medical &health care, electronics & communication and other Industrial applications.

Total : 45 Hours

Text Books

1. Textbook of Nanoscience and Nanotechnology, Murty, B.S., Shankar, P., Raj, B., Rath, B.B., Murday, J. Springer Berlin Heidelberg, 2013, Pgs1-223.

2. Textbook of Nanoscience and Nanotechnology, T. Pradeep, 2012McGraw Hill Education (India) Private Limited, 1-445.

3. Basic Principles of Nanotechnology1st Edition, Wesley C. Sanders, CRC Press, 2018, Pgs178.

References

1. Introduction to Nanoscience and Nanomaterials, , Dinesh C Agrawal , World Scientific Publishing Co Pte Ltd, 2013, Pgs572

2. Essentials in Nanoscience and Nanotechnology, Narendra Kumar, SunitaKumbhat, John Wiley & Sons, Inc., 2016, Pgs472