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 5ᵗʰ Semester

S. No	V semester	
	Department	**Open Elective Courses**
1	**Department of EEE**	Principles of Robotics and Applications
2	**AMET Business School**	Basics of Entrepreneurship Development
3	**Department of Naval Architecture and Offshore Engineering**	Ocean Energy
4	**Department of Petroleum Engineering**	Petroleum Refining Technology
5	**Department of Information Technology**	Web Design Fundamentals
6	**Department of Mathematics**	Mathematics for Competitive Exam-II
7	**Department of Chemistry**	Pollution and its Management
8	**Department of Physics**	Space Science
9	**Department of Mining Engineering**	Disaster Management
10	**Food Processing Technology**	Milk and Milk Products
11	**Department of Mechanical Engineering**	Engineering Instruments and Measurements
12	**Marine Biotechnology**	Biomaterials for Engineering Application

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:	Course Name:	L	T	P	C
UEEEO02	Principles of Robotics and Applications	3	0	0	3

Year and Semester	III Year / V semester	Contact hours per week
Prerequisite course	NIL	(3Hrs)

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

Course Objective	• To Outline the basics of robotics and its applications • To discuss the types of electrical drives in robots • To Summarize different types of sensors and actuators used to design robots

Course Outcome	After the successful completion of the course, the students will be able to: 1. Outline the basic concept of robotics. 2. Explain the functions of basic components of a robot 3. Interpret various types of Sensors 4. Illustrate various types of End Effectors 5. Implement the robots in industries 6. Apply the concepts of robots in real time applications

UNIT I: BASIC CONCEPTS

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and control issues, Programming languages.

Unit 2: ROBOT DRIVE SYSTEMS   **9 hours**

Pneumatic Drives-Hydraulic Drives-Mechanical Drives-Electrical Drives-D.C. Servo Motors- Stepper Motors,-A.C. Servo Motors-Salient Features- Applications and Comparison of all Drives.

Unit 3: SENSORS FOR ROBOTS   **9 hours**

Introduction to robotic sensors, vision systems, Range detectors, assembly aid devices, force and torque sensors, machine vision, ranging, laser, acoustic, magnetic, fiber optic and tactile sensors.

Unit 4: ROBOT AND END EFFECTORS   **9 hours**

Introduction-classification of end effectors-Types of Grippers- Hooks-scoops and other devices-Gripper force analysis and design of Drive system for gripper.

Unit 5: APPLICATION OF ROBOTS   **9 hours**

Introduction to robot programming languages-robots in manufacturing and non- manufacturing applications- selection of robot.

Total hours:45 hours

TEXT BOOKS

1. Niku, Saeed B, " Introduction to Robotics Analysis, Control and application", Whiley, 2020
2. Klafter R.D., Chmielewski T.A and Negin M., "Robotic Engineering – An Integrated Approach", Prentice Hall, 2003.
3. Groover M.P., "Industrial Robotics -Technology Programming and Applications", McGraw Hill, 2001.
4. Robotics a complete guide, **ISBN:** 1867448149, 2021

REFERENCES

1. Siciliano, Bruno, 'Handbook of Robotics", Springer, 2018
2. Staple, Danny, "Learn Robotics Programming", PACKT, 2018
3. Peter McKinnon, "Robotics:Everything You know about Beginner to Expert", Peter Mckinnon, 2016
4. Craig J.J., "Introduction to Robotics Mechanics and Control", Pearson Education, 2008.
5. Rajput R.K., "Robotics and Industrial Automation", S.Chand and Company, 2008.

PROGRAM	ABS UG – OPEN ELECTIVE					
Course Code	**Course Name :**		**L**	**T**	**P**	**C**
	Basics of Entrepreneurship Development		3	0	0	3
Year and Semester	III (V Semester)		Contact hours per week			
Prerequisite course	NIL		(3Hrs)			
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 entrepreneurship					
	2. To study the different ways to become an entrepreneur					
	3. To learn about project management					
	4. To understand the financial analysis for business					
	5. To understand the various marketing channels					
Course Outcome	The Students will be able to					
	1. To know the basics of entrepreneurship					
	2. Learn the process of setting up a new business together with problems to be faced					
	3. Learn about project management					
	4. Learn about financial analysis and sources of finance					
	5. Get an idea about marketing channels					
	6. Able to start the new business establishment					

UNIT – I Introduction to Entrepreneurship:

Definition of Entrepreneur, Entrepreneurial Traits, and Entrepreneur vs. Manager, Entrepreneur vs. Entrepreneur. The Entrepreneurial decision process. Role of Entrepreneurship in Economic Development, Ethics and Social responsibility of Entrepreneurs. Opportunities for Entrepreneurs in India and abroad. Woman as Entrepreneur. (10 hours)

UNIT – II Creating and Starting the Venture

Sources of new Ideas, Methods of generating ideas, creating problem solving, product planning and development process.(8 hours)

UNIT – III The Business Plan

Nature and scope of Business plan, Writing Business Plan, Evaluating Business plans, Using and implementing business plans. Marketing plan, financial plan and the organizational plan, Launching formalities.   (10 hours)

UNIT – IV New Venture Expansion Strategies and Issues

Features and evaluation of joint ventures, acquisitions, merges, franchising. Public issues, rights issues, bonus issues and stock splits. (7 hours)

UNIT-V Institutional support to Entrepreneurship

Role of Directorate of Industries, District Industries Centers (DICs), Industrial Development Corporation (IDC), State Financial corporation (SFCs), Commercial banks Small Scale Industries Development Corporations (SSIDCs), Khadi and village Industries Commission (KVIC), National Small Industries Corporation (NSIC), Small Industries Development Bank of India (SIDBI).

(10 hours)

Total 45 Hours

TEXT BOOKS :

1. Dynamics of Entrepreneurial Development and Management, Vasant Desai, Publisher: Himalayan Book Company
2. Entrepreneur Development, Gupta &Srinivasan, Publisher: Pearson

REFERENCES:

1. Entrepreneurship Development and Management, Dr. A.K. Singh, Publisher: Laxmi Publications
2. Entrepreneurial Development, S. S. Khanka, Publisher: S. Chand

PROGRAM	COMMON TO ENGINEERING, MANAGEMENT AND COMMERCE					
Course Code	Course Name : WEB DESIGN FUNDAMENTALS		**L**	**T**	**P**	**C**
			0	2	2	3
Year and Semester	III YEAR (SEMESTER V)		Contact hours per week (4 Hrs)			
Prerequisite course	Basic knowledge of HTML Tags					
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**	
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**	
			✓			
Course Objective	1. Learn the basics of web concepts and HTML 2. Be familiar to use the scripting languages – JavaScript 3. Learn to develop XML and DTD documents 4. Know the fuzzy control applications 5. Learn genetic programming					
Course Outcome	After completion of the course, the students will be able to 1. Apply solutions for static web page problem using HTML 2. Design an interactive web page using CSS. 3. Design a dynamic web page using Java script 4. Implement a service side program in server 5. Develop a well formed / valid XML document 6. Apply a server side JSP and ASP scripting languages in real world applications					

UNIT I   INTRODUCTION TO HTML

Introduction to World Wide Web - Basics of HTML - Tags and Attributes - Elements - Images and

Hyperlink - Frames - Tables - Lists – Forms

UNIT II   INTRODUCTION TO CASCADING STYLE SHEETS (CSS)

Introduction to CSS - Creating Style Sheet - Properties - ID and Class - Styling: Background - Text

Format - Controlling Fonts - Working with block elements and objects - Lists and Tables - Box Model

UNIT III   BASICS OF JAVASCRIPT

Introduction to JavaScript - Data types - Variables - Operators - Conditionals and Loops - Arrays -

Functions - Built-in objects - Methods and Properties - Form validation – online registration page.

UNIT IV   SERVER SIDE PROGRAMMING

Introduction to XML - Attributes - Tags - Prolog - Namespace - Comments - Structure in Data - Elements

- Naming Rules - DTD - DOM methods

UNIT V   INTRODUCTION TO ASP AND JSP

Basics of ASP - Working with ASP - Creating a simple ASP - Declaring variables and methods in pages -

Script lets - Session and cookies – JSP – Overview - Lifecycle – Syntax - Directives - Implicit Objects,

Application - Simple interactive web page – quiz application

TUTORIAL: 30 HOURS

EXPERIMENT LIST

1. Design a page having suitable background color and text color with title "My First Web Page" using all the attributes of the Font tag.
2. Create a HTML document giving details of your [Name, Age], [Address, Phone] and [Register Number, Class] aligned in proper order using alignment attributes of Paragraph tag.
3. Write HTML code to design a page containing some text in a paragraph by giving suitable heading style.
4. Create a web page using Inline CSS
5. Create a web page using Embedded CSS
6. Create a web page using CSS BOX model
7. Write a java script program to perform arithmetic calculation
8. Create a web page using java script to validate user name and password
9. Create a java script interactive web page
10. Create a valid xml document for student information
11. Create an XML document with internal DTD
12. Create an xml document with external DTD
13. Create a simple web application using ASP
14. Write a JSP program to perform session tracking
15. Write a JSP program to implement quiz application

PRACTICAL: 30 HOURS

TOTAL : 60 HOURS

TEXT BOOKS

1. Deitel H.M. and Deitel P.J., "Internet and World Wide Web - How to program", Pearson Education, Fourth Edition, 2012.

REFERENCES

1. Jennifer Niederst Robbins, "Learning Web Design", O'Reilly fifth edition, 2018.
2. Jeffrey C Jackson, "Web Technology – A Computer Science perspective", Pearson Education, 2007.

Elective Course: **Mathematics for Competitive Exam -II**

Year : III/ V Sem

Course objectives:

1. To develop the skill of reasoning applied to numerical problems.
2. To enable students to prepare for competitive examinations.

Unit I   **(9 hours)**

Problems: Decimal fractions-Square root and cube root-Ratio and propositions-Pipes and Cisterns

Unit II   **(9 hours)**

Problems: Boats and Streams- Chain rule-Alligation or Mixture-Race and games of skill

Unit III   **(9 hours)**

Problems: Clock- Stock& shares-True discount-Banker's discount problems.

Unit IV   **(9 hours)**

Problems: Tabulation- Data analysis-Odd man odd&series_Blood relation problems.

Unit V   **(9 hours)**

Problems: Analogy-Logicalvenn diagrams-Direction sense test- logical sequence of words.

Text Books:

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

2 .A Mordern approach to verbal and Nonverbal Reasoning-R.S.Aggarwal - S.Chand, New Delhi-reprint 2007.

Web References:

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

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

<div align="center">**CHEMISTRY – POLLUTION AND ITS MANAGEMENT**</div>

Total contact Hours: 45   **Prerequisite: Nil**

Course Objectives

1. To learn the basic fundamental concepts in the field of water pollution
2. To know the standards and importance of water pollution
3. To study the various industrial effects and mitigation management
4. To learn the importance of methods of control of water pollution
5. To study the various water control act and functions of regulatory boards

UNIT I – SOURCES & CHARACTERISTICS OF WATER POLLUTION   (9 Hrs)

Water and wastewater pollution – Sources & Types of water and wastewater pollution – Physical, chemical and biological characteristics – Effects of water pollution. Drinking water - quality standards – WHO, ICMR, ICAR, Central and State quality control norms.

UNIT II – WATER QUALITY & TESTING PROCEDURES   (9 Hrs)

Quality of surface water – Water quality in flowing water, Water quality in impounded water, Ground water quality – Testing procedures of important water quality parameters (pH, Electrical Conductivity, Total Dissolved Solids, Calcium, Magnesium, Chloride, Sulfate, Sodium, Potassium, Dissolved Oxygen, Iron, Total Kjeldahl nitrogen, FRC, FAC).

UNIT III – INDUSTRIAL ACTIVITY & MITIGATION MEASURES   (9 Hrs)

Role of water in different industries – Effluent discharge characteristics – Discharge Standards for River and Streams – Role of stakeholders, public, NGOs, Government in Protection of Water bodies – Control measures – Industrial water contamination due to industries.

UNIT IV – WATER POLLUTION REGULATION   (9 Hrs)

Administrative regulations under recent legislations in water pollution control. Water (Prevention & Control of Pollution) Act 1974 and its Amendment Act 1988, Rules 1975, Cess Act 1977 and its Amendment Act 1991.

UNIT V – FUNCTIONS AND MANAGEMENT OF REGULATORY BOARDS(9 Hrs)

Sustainable Development, Rain Water Harvesting – Methods – Water Pollution – Causes and Effects – Role of Regulatory bodies and Local bodies – CPCB – TWAD Board – CMWSSB etc. – Case studies related to Effective Water Management

REFERENCES

1. Fair, G.M., Water and Wastewater engineering, Vol I & II, John Wiley and Sons, Newyork, 2010.
2. Metcalf & Eddy, Wastewater engineering, Treatment and Reuse, Tata MacGrawhill publications, 2008.
3. ArunaVenkat, Environmental law and policy, PHI learning private limited, New Delhi, 2011.

PROGRAM	B.E, B.TECH, B.Com, BBA				
Course Code: **UDPHO 07**	SPACE SCIENCE	**L**	**T**	**P**	**C**
		3	0	0	3

Year and Semester	III, V		
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 Introduce Space science 2. To explain the formation of solar systems 3. To demonstrate formation of stars 4. To describe origin of galaxies 5. To apprise the creation of universe
Course Outcome	After completion of the course, the students will be able to 1. To understand the basic concepts to Space. 2. To discuss the laws of solar system. 3. To demonstrate formation of stellar objects 4. To analyze evolution and origin of galaxies. 5. To demonstrate creation of Universe 6. To summarize the basic laws of space science and formation of universe

Unit 1: Introduction   **(9 Hours)**

Introduction to space science -applications, historical development-Space programs -National and International-Space organizations-Space craft subsystems-Rocket launch vehicles and launching mechanism.

Unit 2: Solar System   **(9 Hours)**

Nebular theory of formation of our Solar System. Nuclear reaction as the source of energy. **Sun and Planets:** Brief description about shape size, period of rotation about axis and period of revolution, distance of planets from sun, Bode's law, Kepler's Laws of planetary motion, Newton's deductions from Kepler's Laws, Newton's Law of gravitation, determination of mass of earth, determination of mass of planets with respect to earth. Brief description of Asteroids, Satellites and Comets

Unit 3: Stars and Stellar evolution   **(9 Hours)**

Stellar spectra and structure, stellar evolution, nucleo-synthesis and formation of elements. Classification of stars, Luminosity of star, variable stars; composite stars (white dwarfs, Neutron stars,

black hole, star clusters, supernova and binarystars); Chandrasekhar limit.

Unit 4: Galaxies   **(9 Hours)**

The distance of galaxies, The hubbles law, Clusters and super clusters, Colliding galaxies, Origin and evolution of galaxies, quasars, Ultraluminous galactic nuclei, Active galaxies, Gamma ray busters

Unit 5:   Cosmology: Origin and Evolution of Universe   **(9 Hours)**

The expanding Universe, Big-Bang, cosmic microwave background radiation, Universe before recombination, Shape of Universe, Dark energy and accelerating universe, search for extra terrestrial life.

Total : 45 Hours

Text Books

1. K. S. Krishnaswami, 1996, Astrophysics: A modern Perspective, New Age International PVT LTd, 1-342

References

1. Roger A Freedman, William J Kaufmann, 2005, Universe, 7th Edition, W.H Freeman and company, New York, 1-356

PROGRAM		BE-Mining Engineering				
Course Code: UDMN510	Disaster management		**L**	**T**	**P**	**C**
			3	0	0	3

Year and Semester	III Year (v 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. Understand the types of hazards 2. Discuss the methods to prevent risk 3. Describe the impacts of disaster on development 4. Explain the contingency plan of disaster management 5. Discuss the lessons leamt from various disasters			
Course Outcome	At the end of the course the student will be able to: 1. To understand the disaster management 2. Analyze the method of prevention 3. Understand the impacts of disaster on development 4. Understand contingency plan of disaster management 5. Create the prevention chart for various disasters 6. Understand the over all prevention and mitigation measures.			

UNIT I INTRODUCTION **(9 Hrs)**

Definition – Disaster, Hazard,Vulnerability, Resilience, Risks – Types of disasters –

Earthquake, Landslide, Flood, Drought, Fire – Classification, Causes, Impacts including social, economic, political, environmental, health, psychosocial.

UNIT II APPROACHES TO DISASTER RISK REDUCTION (DRR) **(9Hrs)**

Disaster cycle – Phases, Culture of safety, prevention, mitigation and preparedness of community based DRR, structural – non-structural measures, Roles and responsibilities of community, Panchayat Raj Institutions/Urban Local Bodies (PRI/ULB), Institutional Processes and Framework at State and Central level – State Disaster Management Authority (SDMA).

UNIT III INTER-RELATIONSHIP BETWEEN DISASTERS AND DEVELOPMENT (9 Hrs)

Factors affecting Vulnerabilities, differential impacts, impact of development projects such as dams, embankments, changes in Land-use – Impact of Climate change

UNIT IV DISASTER RISK MANAGEMENT IN INDIA **(9 Hrs)**

Hazard and Vulnerability profile of India, Components of Disaster relief – Water, Food, Sanitation, Shelter, Health, Waste management – Role of GIS and Information technology Components in Preparedness, Risk Assessment, Response and Recovery Phases of Disaster – Disaster Damage Assessment.

UNIT V DISASTER MANAGEMENT: APPLICATIONS AND CASE STUDIES AND FIELD

WORKS   **(9 Hrs)**

Landslide Hazard Zone - Case Studies, Earthquake Vulnerability Assessment of Buildings and Infrastructure – Drought Assessment - Case studies – Coastal Flooding – Storm Surge Assessment – Floods - Fluvial and Pluvial Flooding - Case studies – Health Disaster - Case studies – Man Made Disasters - Case studies.

(TOTAL: 45Hrs)

Text Books

1. Singhal J.P. "Disaster Management", Laxmi Publications, 2010. ISBN-10: 9380386427 ISBN-13:978-9380386423
2. Tushar Bhattacharya, "Disaster Science and Management", McGraw Hill India Education Pvt.Ltd., 2012. ISBN-10: 1259007367, ISBN-13: 978-1259007361
3. Gupta Anil K, Sreeja S. Nair. Environmental Knowledge for Disaster Risk Management, NIDM, New Delhi, 2011
4. KapurAnu Vulnerable India: A Geographical Study of Disasters, IIAS and Sage Publishers, New Delhi, 2010.

References:

1.   Govt. of India: Disaster Management Act , Government of India, New Delhi, 2005
2.   Government of India, National Disaster Management Policy,2009.

PROGRAM CODE:UGA007	B.Tech Food Processing Technology				
Course Code: **UDFPO04**	**Milk and Milk products Technology**	**L** 3	**T** 0	**P** 0	**C** 3

Year and Semester	III Year (5th 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 discover the fundamental properties of milk and milk products 2. To explain the Processing of Milk and Manufacture of dairy products Sanitation and effluent treatment in dairy industry 3. To learn the basic nutritive value and importance of milk. 4. To list various categorize of dairy products based on coagulation.
Course Outcome	After completion of the course, the students will be able to 1. Describe the importance of milk and their sources 2. Summarize the basic processing aspects of milk processing 3. Illustration of various processing SOP of dairy equipments 4. Examine various dairy products based on coagulation, concentration and drying 5. Define the various quality standards of dairy industry 6. Define the sanitation, cleaning and effluent of dairy industry.

Unit I   Properties Of Milk   (9 hours)
Milk-Types-Introduction – Definition - Composition-Physical-Chemical and Thermal Properties-Heat
   Capacity, Density-Freezing-Boiling point.

Unit II   Processing And Quality Parameters Of Milk   (9 hours)
Processing of Milk- Pasteurization, Milk-cream separation-Methods and Equipment's- packaging of
   milk and milk products, judging and grading of milk

Unit III   Milk Products   .   (9 hours)
Traditional dairy products, Introduction of Yogurt, Cheese, Butter, Ghee, Ice-cream, malted products,
   evaporated milk products – Methods of processing and Equipment used.

Unit IV Milk Powder Processing   (9 hours)
Processing of Milk Powder- Composition - Properties- methods of drying, substitutes for milk and milk
   products.

Unit V Storage Sanitation And Effluent Treatment   (9 hours)
Storage of Milk in Tanks- cold storage - Milk and milk products storage Cleaning and Sanitation-

Effluent – Effluent treatment plant

Text Book
   1. Ananthakrishnan, C.P., and Sinha, N.N., "Technology and Engineering of Dairy Plant Operations, Laxmi Publications, New Delhi. 1984.
   2.Sukumar De., "Outlines of Dairy Technology", Published by Oxford University press, New Delhi,1991.

References

1. Warner, J.N., "Principles of Dairy Processing", Wiley Eastern Pub. Co., New York, 1975.
2. Walstra, P. etal., "Diary Technology : Principles of Milk Properties and Processes". Marcel Dekker, 1999
3. Spreer, Edgar "Milk and Dairy Product Technology". Marcel Dekker, 2005.
4. Tufail Ahmed., "Dairy Plant Engineering and Management", Kitab Mahal Publishers, Allahabad, 1997.

PROGRAM	BE-Naval Architecture & Offshore Engineering					
Course Code: UDNAO03	Ocean Energy		**L**	**T**	**P**	**C**
			3	0	0	3
Year and Semester	III Year (semester V)		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 demonstrate the resources available for various types of ocean energies and its associated principles and economics for prototype development.					
Course Outcome	After completion of the course, the students will be able to 1. Evaluate the available resources of ocean energy worldwide. 2. Understand wave theories and its application to wave energy system development and design. 3. Analyze the various design aspects of tidal and current energy systems. 4. Understand the necessity of thermal & osmotic energy system design. 5. Perform economic analysis of ocean energy systems, financing and its socio-economic impact. 6. Demonstrate the various aspects of ocean energy system development and its socio-economic analysis.					

UNIT I – OCEAN ENERGY RESOURCES
Introduction to ocean environment – ocean circulation and stratification, ocean habitat, ocean economy; Various ocean energy resources worldwide; Site selection and characterization; Present development and future need; Energy routes.
UNIT II – WAVE ENERGY
Ocean surface waves – wave measurements, wave theories, existing resources in India; System working principle; Various design concept, design challenges; Case study – reliability of the design and lifespan.
UNIT III – TIDAL & CURRENT ENERGY
Current measurements, current turbulence and energy resources; Existing resources in India, working principle; Various design concept, design challenges; Material selection; Case study – future requirement and any existing design.
UNIT IV – THERMAL & OSMOTIC ENERGY
Introduction – Existing resources in India, working principle; Various design concept, design challenges; Case study – efficiency calculation of various system components.
UNIT V – ECONOMICS, POLICY AND ENVIRONMENT
Basic economic analysis of ocean energy systems – cost and financing; Policy issues regarding ocean energy system in India – Socio-economic impact, licensing and permitting procedures; Environmental impact; Case study – any existing ocean energy system.

TEXT BOOKS:
1. Sørensen, Bent. Renewable Energy, Second Edition. San Diego: Academic Press, 2000, 911 pp. ISBN 0-12-656152-4.
2. Vining, J., Muetze, G. A., Economic Factors and Incentives for Ocean Wave Energy Conversion.
3. Karimirad, Madjid, Offshore Energy Structures - For Wind Power, Wave Energy and Hybrid Marine Platforms, Springer International Publishing, Switzerland, 2014.
4. Michael E.McCormick, Ocean Wave Energy Conversion, Dover Publications

REFERENCES:
1. Vining, J., Muetze, G. A., Economic and Legal aspects of Ocean Wave Energy Conversion, EC 999: Advanced Independent Study Report, May 2006.
2. Bent Sorensen, Renewable Energy, Elsevier, Academic Press, 2011.
3. NPTEL lectures: Elements of Ocean Engineering (video): Web Address: http://nptel.ac.in/syllabus/114105002/
4. Iea-Retd (Stichting Foundation Renewable), Offshore Renewable Energy: Accelerating the Deployment of Offshore Wind, Tidal, and Wave Technologies, Routledge, 2012.

PROGRAM	B.E. Petroleum Engineering					
Course Code UDPEO04	Course Name : Petroleum Refining Technology		**L**	**T**	**P**	**C**
			3	0	0	3
Year and Semester	III Year & V 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 gain comprehensive knowledge on oil refining and associated downstream processing activities and modern technologies involved in it.					
Course Outcome	At the end of the course, the Students will be able to					
	1	Classify the Distillation process in refinery by separation of crude into different petroleum products and testing the products with ASTM standards				
	2	Explain about the Secondary processing and its classification in the refineries.				
	3	Describe about Cracking of crude oil into other products and its importance in the refineries with its applications in petrochemical industries				
	4	Explain about the Unit process in petrochemical industries and its production techniques that will enhance the study of different petrochemicals.				
	5	Classify the Polymerization and its production methods in petroleum industries and its applications.				
	6	Describe the applications of petrochemical products				

UNIT I – INTRODUCTION   (9Hrs)

Origin, exploration and production of Petroleum, Types of crudes, composition, characteristics, Products Pattern, Indigenous and imported crudes.Crude heating, primary distillation principles, separation of cuts, gaps / overlaps, stripping. Desalting heat balance in distillation, energy input and recovery, vacuum distillation, types of trays, draw offs, intermediate product, quality control.

UNIT II- SECONDARY PROCESSING   (9 Hrs)

Lube oil and wax processing, solvent extraction, dewaxing desilting, deasphalting, clay contacting, principles operating parameters, feed and product equalities and yields.Types and functions of secondary processing, cracking, thermal cracking and visbreaking, different feed stocks, products, yields and qualities.

UNIT III – CRACKING AND ITS TYPES   (9 Hrs)

Fluid catalytic feed stocks and product yields and qualities. Catalyst and operating parameters. Steam Reforming, Hydrogen, Synthesis gas, cracking of gaseous and liquid feed stocks, olefins, Diolofins, Acetylene and Aromatics and their separation.

UNIT IV- UNIT PROCESSES   (9 Hrs)

Alkylation, oxidation, dehydrogenation, nitration,chlorination, sulphonation and Isomerization.

UNIT V – POLYMERISATION   **(9 Hrs)**

        Models and Techniques, production of polyethylene, PVC, Polypropylene, SAN, ABS, SBR, Polyacrylonitrile, Polycarbonates, Polyurethanes, Nylon, PET

(Total 45 Hrs).

Text Books
1. B.K. Bhaskara Rao, "Modern Petroleum Refining Processes" Edition 3, Oxford and IBH Publishing Company Pvt. Ltd., New Delhi,2010.
2. William L. Leffler, "Petroleum Refining" fourth edition, 2008,Pennwell publishers.

References
1. Nelson W.L., "Petroleum Refinery Engineering", McGraw Hill Publishing Company Limited, 1985
2. Watkins, R.N., "Petroleum Refinery Distillation, second edition, Gulf Publishing Company, Texas 1981
3. Groggins, "Unit Processing in Organic Synthesis" Edition 5, Tata McGraw Hill 1987

PROGRAM		BE-Mechanical Engineering				
Course Code: UDMCO03	ENGINEERING INSTRUMENTS AND MEASUREMENTS		**L**	**T**	**P**	**C**
			3	0	0	3

Year and Semester	III Year (V Semester)		Contact hours per week (3Hrs)		
Prerequisite course	PHYSICS				
Course category	**Humanities and Social Sciences**	**Management courses**	**Professional Core**		**Professional Elective**
	Basic Science	**Engineering Science**	**Open Elective**		**Mandatory**
			✓		
Course Objective	1 To learn about the measurement systems				
	2 To learn about the parameter measurements				
	3 To understand about linear and angular measurements				
	4 To understand about the metrology of surfaces				
	5 To learn about the advanced metrology				
Course Outcome	1. After completing this course, the students will be able to analyze the general concept of measurement systems				
	2. They will be able to utilize the parameter measurements				
	3. The students will be able to apply the linear and angular measurements				
	4. They will be able to apply angular measurements				
	5. The students will be able to analyze the metrology of surfaces				
	6. They will be able to make use of advanced metrology				

UNIT I : MEASUREMENT SYSTEMS   **9 Hrs**
General concept - units and standards - characteristics of measuring instruments - sensitivity, stability, range, accuracy and precision - static and dynamic response - repeatability, hysteresis - systematic and random errors - correction, calibration – interchangeability

UNIT II : PARAMETER MEASUREMENTS   **9 Hrs**

Measurement of force, torque, power using mechanical, pneumatic, hydraulic, electrical instruments - flow measurement - rotameter, pitot tube - Temperature measurement - bimetallic strip, thermocouple, electrical resistance thermometer

UNIT III : LINEAR AND ANGULAR MEASUREMENTS   **9 Hrs**

Linear measuring instruments - vernier, micrometer, slip gauges, tool maker"s microscope - interferometry, optical flats, comparators - mechanical, pneumatic, electrical applications - angular measurements - sine bar, sine center, bevel protractor, autocollimator

UNIT IV : METROLOGY OF SURFACES   **9 Hrs**

Fundamentals of GD & T - measurement of straightness, flatness and roundness - measurement of surface finish -

Functionality of surfaces, parameters, comparative, stylus based and optical measurement techniques, filters-Introduction to 3D surface metrology.

UNIT V : ADVANCED METROLOGY   **9 Hrs**

Precision instruments based on laser - principles - laser interferometer - application in linear, angular measurements - machine tool metrology - Coordinate Measuring Machine (CMM) - constructional features - types, applications - digital devices - computer aided inspection - 3D scanning - machine vision systems

TEXT BOOKS:
1. Thomas G. Beckwith, Roy D, Marangoni, John H.Lienhard V., "Mechanical Measurements", 6th ed., Pearson Education India, 2014
2. Jain R.K., "Engineering Metrology", 20th ed, Khanna Publishers, 2009

REFERENCES:
1. Raghavendra N.V, Krishnamurthy L, "Engineering Metrology and Measurements", 1st ed., Oxford University Press, 2013
2. Gupta.I.C., "Engineering Metrology", 10th ed., Dhanpat Rai Publications, 2013
3. Anand K Bewoor, Vinay A Kulkarni, "Metrology & Measurement", McGraw Hill Education, 2009
4. Mahajan.M, "Engineering Metrology", Dhanapat Rai publications, 2014
5. Tayal A.K, "Instrumentation and Mechanical Measurements", 4th ed., Galgotia Publications, 2000

PROGRAM	B.E.				
Course Code **PDBTO04**	Course Name : **Biomaterials for Engineering Applications**	**L**	**T**	**P**	**C**
		3	0	0	3
Year and Semester	III Year (V Semester)	Contact hours per week (2 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	• Many of the biologically derived materials such as biosurfactants, biopolymers and biomaterials are widely used. • Biomaterials used in Packaging, Constructions, paints, Oil and gas, agriculture/Forestry/Fishery, Electronics, Medical, Dental, and Pharmaceutical Applications. • This course would provide overviews of Modern Biopolymers are used in Engineering.				
Course Outcome	At the end of the course the student will be able to :				
	1.	Outline the process, properties and surface characterization of Biomaterials.			
	2.	List out the different types of biomaterials.			
	3.	Classification of biomaterials based on the industrial applications.			
	4.	Extend the knowledge of biomaterials in medical applications			
	5.	List out the new classes for biomaterials for novel applications.			
	6.	Summarize the applications of biomaterials in engineering.			

UNIT 1- Introduction to Biomaterials

Introduction to biomaterials engineering and processing - an overview- Properties of materials- Surface properties and surface characterization of materials.

UNIT 2- Types of Biomaterials

Biomaterials Classifications- Bioinert materials- Bioactive materials- Bioresorsable materials and biomineralisation - Mechanisms and its uses.

UNIT 3- Biomaterials in Industrial Applications

Classes of materials used in medicine: metals, polymers, FRPs, fabrics- Bioceramics- Hydrogel- Silicone biomaterials: history and chemistry- Medical fibers and biotextiles.

UNIT 4- Biomaterials in medical applications

Design of materials for biomedical application: Cardiovascular medical devices- Tissue engineering scaffolds- Ophthalmologic applications- Bioelectrodes and biosensors- Burn dressing and skin substitutes- Sutures- Drug delivery systems (DDS).- Dental materials- Conventional acid-base cements.

UNIT 5- New Classes of Biomaterials for novel applications

Applications in Nephrology- Applications in Ophthalmology- Applications in Orthopedics- Applications in Drug Delivery.

TEXT BOOKS

1. Biology for Engineers, Arthur T. Johnson, CRC Press, Taylor and Francis, 2011

REFERENCE BOOKS

1. Biomaterials Science, An Intoduction to Materials in medicine, Eds. B. D. Ratner and A. S. Hoffman, Academic Press, New York, 1996.
2. H.Boenig, Fundamentals of Plasma Chemistry and Tehnology, Technomic Publishing Co.Inc. Lancaster Basel, 1990.
3. K.C. Dee, D.A. Puleo and R. Bizios. An Introduction to Tissue-Biomaterial Interactions. Wiley 2002. ISBN: 0-471-25394-4.
4. T.S. Hin (Ed.) Engineering Materials for Biomedical Applications. World Scientific. 2004. ISBN 981-256-061-0.
5. Atala, A; Mooney, D. J. Eds Synthetic Biodegradable Polymer Scaffolds, Springer Verlag, New York,1997

Black, J.; Hastings, G. Handbook of Biomaterials Properties, Chapman/Hall, London.