

MINOR DEGREES

CONSTRUCTION TECHNOLOGY

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1.	20A01M01	Building Materials	3	1	0	4
2.	20A01M02	Building Construction	3	1	0	4
3.	20A01M03	Building planning and Drawing	3	1	0	4
4.	20A01M04	Surveying	3	1	0	4
5.	20A01M05	Concrete Technology NPTEL	-	-	-	2
6.	20A01M06	Green Buildings https://nptel.ac.in/courses/105102195	-	-	-	2

ENVIRONMENTAL GEOTECHNOLOGY

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1.	20A01M07	Environmental Legislation & Management systems.	3	1	0	4
2.	20A01M08	Engineering Geology	3	1	0	4
3.	20A01M09	RS & GIS Applications in Environmental Engineering	3	1	0	4
4.	20A01M10	Disaster Management	3	1	0	4
5.	20A01M11	Rock Engineering https://nptel.ac.in/courses/105107208	-	-	-	2
6.	20A01M12	Air quality modeling & Management https://www.nptelvideos.com/video.php?id=1923	-	-	-	2

ENERGY SYSTEMS

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A02M01	Energy Audit and Management	3	1	0	4
2	20A02M02	Energy Management in Building	3	1	0	4
3	20A02M03	Energy Conversion Systems	3	1	0	4
4	20A02M04	Energy Scenario and Energy Policy	3	1	0	4
5	20A02M05	Energy Resources & Technology (MOOC-NPTEL)	--	--	--	2
6	20A02M06	Waste to Energy Conversion (MOOC-NPTEL)	--	--	--	2

3D PRINTING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A03M01	3D Printing materials	3	1	0	4
2	20A03M02	Interactive Computer Graphics	3	1	0	4
3	20A03M03	Geometric Modeling	3	1	0	4
4	20A03M04	Finite Element Methods	3	1	0	4
5	20A03M05	Additive Manufacturing	3	1	0	4
6	20A03M06	Applications of 3D Printing	3	1	0	4
7	20A03M07	Design for Manufacturing	3	1	0	4
8	20A03M08	Product Design and Development	3	1	0	4
9	20A03M09	Computer Aided Machine Drawing	3	1	0	4

INDUSTRIAL ENGINEERING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A03M10	Six Sigma & lean manufacturing	3	1	0	4
2	20A03M11	Total Quality Management	3	1	0	4
3	20A03M12	Supply Chain Management	3	1	0	4
4	20A03M13	Statistical quality control	3	1	0	4
5	20A03M14	Management Information Systems	3	1	0	4
6	20A03M15	Ergonomics	3	1	0	4
7	20A03M16	Production Planning and Control	3	1	0	4
8	20A03M17	Customer Relationship Management	3	1	0	4
9	20A03M18	Marketing Management	3	1	0	4

INTERNET OF THINGS

S.No	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1.	20A04M01	Introduction to Internet of Things	3	0	2	4
2.	20A04M02	IoT with Arduino, ESP, and Raspberry Pi	3	0	2	4
3.	20A04M03	Introduction to Security of Cyber Physical Systems	3	1	0	4
4.	20A04M04	Communication Technologies for IoT	3	1	0	4
5.	20A04M05	Embedded Systems for IoT	3	0	2	4
6.	20A04M06	Sensors and IoT	3	1	0	
7.	20A04M07	Introduction to Data Analytics	3	1	0	4
	20A04M08	MOOC Course Design for internet of things https://onlinecourses.nptel.ac.in/noc21_ee85/preview (8 Weeks)				2
	20A04M09	MOOC Course Introduction to Machine Learning https://nptel.ac.in/courses/106105152 (8 Weeks)				2

ARTIFICIAL INTELLIGENCE & DATA SCIENCE

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A05M01	Introduction to Data Science	3	0	2	4
2	20A05M03	Fundamentals of Deep Learning	3	0	2	4
3	20A05M05	Principles of Software Development & Operations	3	1	0	4
4	20A05M06	Applications of AI & DS	3	1	0	4
5		MOOC – I				2
6		MOOC - 2				2

VIRTUAL & AUGMENTED REALITY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1		Virtual Reality	3	1	0	4
2		Free & Open-source software for VR-AR	3	0	2	4
3		Advanced Game development	3	0	2	4
4		VR-AR for Health Care	3	1	0	4
5		MOOC – I				2
6		MOOC - II				2

FOOD SCIENCE

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1	20A27M01	Principles of Food Engineering	3	1	4
2	20A27M02	Food Plant Utilities & Services	3	1	4
3	20A27M03	Business Management and Economics	3	1	4
4	20A27M04	Plant Design and Economics	3	1	4
5	20A27M05	MOOC.I: Fundamentals of Food Process Engineering – Prof. Jayeeta Mitra IIT Kharagpur			2
6	20A27M06	MOOC.II: Thermal Processing of Foods – Prof. R. Ananda Lakshmi IIT Guwahati			2

(20A01M01) BUILDING MATERIALS

Course Objectives:

- The course intends to provide basic information on the structure and properties of construction materials to students.
- Acquire basic knowledge on building materials such as stones, bricks, cement, aggregates, concrete
- Study the types of timber, their preservation techniques and usage in construction.
- Course provides basic knowledge of the properties of essential materials like steel and plastics
- Understanding of typical and potential applications of common building materials

Course Outcomes :

After completion of the course the student will be able to

- Explain the characteristics of stones and bricks.
- Describe the properties of cement, aggregate, concrete, mortar.
- Identify the suitability of timber, paints and varnishes for building works.
- Link the material choice with the application in construction.
- Understand the types and applications of reinforcing steel and plastics in construction

UNIT I

Stones: Classifications of stones, uses of stones as building materials, characteristics of good building stones - General characteristics of stones – Marble, Kota stone, Granite, Sand, Trap, Basalt stone, Lime stone and Slate

UNIT II

Bricks: Composition of brick clay. Raw materials for brick manufacturing and properties of good brick making earth - Process of manufacturing bricks. Characteristics of good building bricks, classification of bricks. Testing of common building bricks as per BIS: 3495 - Introduction to light weight bricks.

UNIT III

Timber: Timber as a building material and its uses. Various types of timber -Identification and uses of different types of timber: Teak, Deodar, Shisham, Sal, Mango, Kail, Chir, Fir, Hollock, Champ - Seasoning and its importance - Defects in timber, decay in timber - Preservation of wood. Other wood based products- manufacture and uses: laminated board, gypsum board, block board, fibre board, hard board, sunmica, plywood, veneers

UNIT IV

Cement: Chemical composition of cement, manufacturing process. Specifications for Ordinary Portland Cement, Types of cements. Fine Aggregate: Characteristics of good sand and its classifications, bulking of sand. Quarry sand. Coarse Aggregate: Characteristics of good coarse aggregates for manufacture of concrete.

UNIT V

Reinforcing steel: Types of reinforcement, specifications - M.S., HYSD, TMT. Paints : Constituents, characteristics of good paints, varnishes- Plastics – Introduction and uses of various plastic products in buildings such as doors, water tanks and PVC pipes

Textbooks:

1. Building Materials: Products, Properties and Systems, Gambhir M.L., Neha Jamwal, McGraw Hill Education (India) Private Limited, 2014.
2. Building Materials, by Varghese P.C., PHI Learning Pvt. Ltd., Delhi, 2015.
3. Advances in Building Materials and Construction, Central Building Research Institute, Roorkee, 2004.

Reference Books:

1. Building Materials, by Duggal S.K., New Age Publishers, 2012
2. Engineering Materials, by Rangwala Charotar Publishers, 2015

Online Learning Resources:

https://onlinecourses.nptel.ac.in/noc21_ce10/preview

(20A01M02) BUILDING CONSTRUCTION

Course Objectives:

- Propose suitable type of foundation for building structures.
- Construction technique to be followed in brick and stone masonry
- Understanding the concepts involved in flooring and roofing of building structures.
- To make students familiar with Pre fabricated building technology
- To introduce students about the various components and methods of utilizing solar energy in buildings

Course Outcomes :

- Identify components of building structures
- Explain the salient characteristics for the given building structure
- Select suitable type of masonry for building structures
- Identify various types of flooring and roofing materials.
- Understand the methodology of constructing advances structures

UNIT I **Buildings and foundations**

Component parts of a building -Their functions - Classification of buildings according to National building code - Site investigation for foundation as per N.B.C – Classification of buildings according to National building code. - Spread footing foundation for columns and walls - Raft foundation - Pile foundation - RCC Piles - Bearing piles, friction piles and under reamed pile - Causes, effects and prevention of dampness at basement level.

UNIT II **Masonry**

Classification of stone masonry - Ashlar, Random rubble and Coursed Rubble Masonry - general principles to be observed while constructing stone masonry - Brick Masonry - Bonds in brick masonry - (English bond only) for various wall thicknesses - General principles to be observed in construction of brick masonry - principles of locating doors, windows and ventilators in buildings - functions of lintels, sunshades, canopy, sun-breakers and porticos.

UNIT III **Roofs and Floorings**

Roof - functions of roofs - Classification of roofs - flat roofs - pitched roofs - Different types of trusses - classification based on material and shape king post truss, queen post truss, fan roof truss, north light roof truss, steel trusses of angular and tubular sections as per IS code - Weather proof course on R.C.C. roof - Decorative ceilings for auditoriums - method of fixing Plaster of Paris -Fibre glass - Parts of flooring - Requirements of a good floor - Methods of constructing flooring - cement concrete flooring, stone slab (Kadapa slab, Shahabad stone) floorings, cement plaster flooring, Tiled flooring, mosaic flooring.

UNIT IV **Pre fabricated building technology**

Alternatives for cast in-situ structures - Understand pre fabrication technology - Importance for standardisation and modularisation – pre fabricated structures their utility & advantages - Materials used in pre fabricated elements – suitability for various climatic conditions - Types of pre fabricated systems – large panel systems - frame systems – slab / column systems with walls – mixed systems.

UNIT V **Solar Energy Utilization in Building**

Conversion of Solar energy into Electricity - Photovoltaic Effect, Solar photovoltaic cell and its working principle - Active - Passive concepts of solar Heating and cooling - Different types of Solar cells, Series and parallel connections, Photovoltaic applications: Solar energy utilities – water heaters, air heaters, cookers, lighting and water pump sets. - Roof top Solar power generation systems

Textbooks:

1. Building Construction by [Pc Varghese](#), [Prentice Hall Of India](#)
2. Prefab Architecture, a guide to modular design & construction Ryan E Smith, John Wiley Publishers

Reference Books:

1. A To Z Practical Building Construction & Its Management by [Sandeep Mantri](#), [Satya Prakashan](#).
2. Building Construction By S.C.Rangawala, Charitor Publications.
3. Solar Energy Utilization, G. D. Rai, Khanna Publishers
4. N.B.C, National Building code
5. Explanatory handbook on Masonry code, SP20

Online Learning Resources:

<https://nptel.ac.in/courses/124105013>

(20A01M03) BUILDING PLANNING AND DRAWING

Course Objectives:

- Understand basic principles of building design and planning.
- Comprehend local building bye-laws and provisions of National Building Code in respect of building and town planning
- They will explore building drawing as a way of discovering and developing ideas for designing residential , commercial and public buildings.
- The student develops basic drawing skills; create multilayer architectural and prepare working drawings, foundation plans and other executable drawings with proper details for residential buildings
- Explain the principles of planning and design considerations to construct earthquake resistant building

Course Outcomes :

- The scope of this course is to introduce the concepts of building planning and drawing with emphasis on architectural planning.
- This subject is designed as an introduction for subjects who wish to develop their competence and skills in the preparation of architectural and building drawings.
- Able to know the requirements of different rooms and characteristics of various types of residential buildings.
- Able to know about building byelaws and regulations.
- Ability to draw line sketch and planning and bi section of a building.

UNIT I

PART - A

PLANING OF BUILDINGS: Types of buildings, Types of residential buildings, site selection for residential building, orientation of buildings; aspect; prospect; privacy; furniture requirement e;grouping;circulation;sanitation;lighting;ventilation;cleanliness;flexibility;elegancy;Economy; practical considerations.

BUILDING BYELAWS AND REGULATIONS: Introduction- Terminology ;Objectives of building byelaws; Minimum plot sizes; Open space requirements ;Plinth area, floor area, carpet area; Floor area ratio (FAR), Floor space Index (FSI) ;areas for different units; Principles underlying building byelaws ; built up area limitations – Height of Buildings ,Wall thickness, lighting and ventilation requirement, safety from fire, drainage and sanitation; applicability of the bye-laws.

UNIT II

PLANNING OF RESIDENTIAL BUILDINGS: Minimum standards for various parts of buildings– Requirements of different rooms and their grouping – Characteristics of various types of residential buildings

PLANNING OF PUBLIC BUILDING: Planning of Educational institutions, Hospitals, Office buildings, Banks, Industrial buildings, Hotels and Motels, Hostels, Bus Station.

UNIT III

BUILDINGS: SAFETY AND COMFORT: Aspects of safety-Structural, health, fire and constructional safety. Components of building automation system - HVAC, electrical lighting, Security, fire-fighting, communication etc. design for thermal comfort, ventilation comfort, air conditioning comfort, lighting comfort, noise and acoustic comfort.

UNIT IV

PART - B

SIGN CONVENTIONS AND BONDS: Brick, Stone, Plaster, Sand filling, Concrete, Glass, Steel, Cast iron, Copper alloys, Aluminum alloys etc., Lead, Zinc, tin, and white lead etc., Earth, Rock, Timber and Marble. English bond & Flemish bond; odd & even courses for one, one and half, two and two and half brick walls in thickness at the junction of a corner.

DOORS WINDOWS, VENTILATORS AND ROOFS: Paneled Door – Paneled and glazed door; glazed windows – Paneled windows; Swing ventilator – Fixed ventilator; Couple roof – Collar roof; Kind Post truss – Queen post truss.

UNIT V

Given line diagram with specification to draw plan, section and elevation of the following :

1. Residential Building
2. Hospital
3. Schools
4. Post office
5. Corporate Office Building
6. Hotels
7. Bank buildings
8. Bus stations
9. Industrial buildings

FINAL EXAMINATION PATTERN: The end examination paper should consist of Part- A and Part-B. Part- A consists of three questions with either or choice from three units in planning portion .Each question carries 10 marks. Total marks for Part-A is 30 marks. Part- B consists of two questions with either or choice from drawing portion. Question from unit-IV carries 10 marks and question from unit-V carries 30 marks. Total marks for Part-B is 40 marks.

Textbooks:

1. Planning and Designing and Scheduling – Gurucharan Singh and Jagadish Singh- Standard publishers.
2. Building Planning and Design – N.Kumara Swamy and A.Kameswara Rao. Charotar publications.

Reference Books:

1. Building by laws by state and Central Governments and Municipal corporations. National Building Code.
2. Building drawing with an integrated approach to building environment-M.G.Saha, G.M.Kale, S.Y.patki-Tata Mc Graw Hill

(20A01M04) SURVEYING

Course Objectives:

- To make the student to get well conversant with the fundamentals of various basic methods and instruments of surveying.
- To introduce to the students in identifying reduced level of the ground and its profile for finding areas and volumes of embankments and cuttings
- To make the student to use angular measuring instruments for horizontal and vertical control.
- To enable the student to set simple horizontal curves
- To introduce the knowledge construction surveys and usage of modern instrument such as total station

Course Outcomes :

- The student will be able to calculate angles, distances and levels
- The student will be able to identify data collection methods and prepare field notes
- The student will be able to understand the working principles of survey instruments
- The student will be able to understand the basics and elements of different types of curves on roads and surveying applications in setting out of curves
- The student will be able to use modern survey instruments.

UNIT I

Introduction and Basic Concepts: Introduction, Objectives, classification and principles of surveying, Scales, Shrinkage of Map, Conventional symbols and Code of Signals, Surveying accessories, phases of surveying. Measurement of Distances and Directions Linear distances- Approximate methods, Direct Methods- Chains- Tapes, ranging, Tape corrections, indirect methods- optical methods- E.D.M. method. Prismatic Compass- Bearings, included angles, Local Attraction, Magnetic Declination, and dip.

Plane table surveying: Introduction, accessories, setting up of plane table, techniques, testing, adjustments, errors, advantages and disadvantages.

UNIT II

Levelling - Basics definitions, types of levels and levelling staves, temporary adjustments, methods of levelling, booking and Determination of levels- HI Method-Rise and Fall method, Effect of Curvature of Earth and Refraction.

Contouring- Characteristics and uses of Contours, Direct & Indirect methods of contour surveying, interpolation and sketching of Contours.

Computation of Areas and Volumes: Areas - Determination of areas consisting of irregular boundary and regular boundary, Planimeter. Volumes - Computation of areas for level section and two level sections with and without transverse slopes, determination of volume of earth work in cutting and embankments, volume of borrow pits, capacity of reservoirs.

UNIT III

Theodolite Surveying: Types of Theodolites, Fundamental Lines, temporary adjustments, measurement of horizontal angle by repetition method and reiteration method, measurement of vertical Angle, Trigonometrical levelling when base is accessible and inaccessible.

Traversing: Methods of traversing, traverse computations and adjustments, Gale's traverse table, Omitted measurements.

UNIT IV

Tacheometric Surveying: Principles of Tacheometry, stadia and tangential methods of Tacheometry.

Curves: Types of curves and their necessity, elements of simple circular curve, setting out of simple horizontal circular curves.

UNIT V

Construction surveys: Introduction-staking out buildings-Pipelines and sewers-Highways-Culverts. Bridge surveys-Determining the length of a bridge-Locating Centres of piers- Surface surveys and tunnel alignment-Underground surveys-connection of surface and underground surveys-Leveling in tunnels.

Total station Surveying: Basic principles, applications, comparison with conventional surveying. Electromagnetic wave theory - Electromagnetic distance measuring system - Principle of working and EDM instruments.

Textbooks:

1. Text book of surveying by C.Venkatramaiah , Universities press,2nd edition2018
2. Surveying” (Vol – 1 & 2), by S K Duggal, Tata McGraw Hill Publishing Co. Ltd. New Delhi, 2004.

Reference Books:

1. Surveying Vol 1, 2 & 3, by Arora K R Standard Book House, Delhi, 2004.
2. Surveying (Vol – 1, 2 & 3) by B. C. Punmia, Ashok Kumar Jain and Arun Kumar Jain - Laxmi Publications (P) ltd., New Delhi.
3. Higher Surveying by Chandra A M, New age International Pvt. Ltd., Publishers, New Delhi, 2002.

Online Learning Resources:

<https://nptel.ac.in/courses/105104101>

(20A01M07) ENVIRONMENTAL LEGISLATION & MANAGEMENT SYSTEMS

Course Objectives:

- Explain the various global conventions and their objectives in the field of environment.
- Describe the constitutional provision for environmental protection and conservation in India
- List and describe the various Indian environmental laws along with their objectives
- Describe the various pollution related acts such as water, air and environment act;
- Students are introduced to the wide range of tools used in environmental management and for environmental decision-making.

Course Outcomes :

- Implement environmental policies and address governmental regulations.
- Ensuring a holistic approach to environmental impacts
- Understand the standards of IS 14000 & 14001 and its framework to address environmental management issues.
- Exposition about the human right to environment and constitutional framework governing environment in India.
- Understanding the role of international/ national environmental institutions, NGOs, civil society and community involvement in promoting the cause of environment.

UNIT I

Global Environmental Policies: UNO and Environmental Protection – EPA Guidelines for environmental protection - International multilateral environmental agreements and Protocols – Montreal Protocol, Kyoto agreement, Rio declaration etc –Government of India environmental policies – Ministry of Environment, Forest and Climate Change -Institutional framework (SPCB/CPCB/NGT) –Setting up of environmental standards.

UNIT II

Water (P & CP) Act, 1974: Powers & functions of regulatory agencies - Responsibilities of Occupier, Provision relating to prevention and control – Legal sampling procedures, State Water Laboratory – Appellate Authority – Penalties for violation of consent conditions etc - Provisions for closure/directions in apprehended pollution situation.

UNIT III

Air (P & CP) Act, 1981: Powers & functions of regulatory agencies - Responsibilities of Occupier, Provision relating to prevention and control – Legal sampling procedures - State Air Laboratory – Appellate Authority – Penalties for violation of consent conditions etc - Provisions for closure/directions in apprehended pollution situation.

UNIT IV

Environment (Protection) Act 1986: Provisions of Act – delegation of powers – Role of Central Government - EIA Notification – Siting of Industries – Coastal Zone Regulations - Responsibilities of local bodies –Legislations on Solid Waste Management (MSW, Biomedical, Plastic, e-waste , Hazardous waste) - Indian Forest Act.

UNIT V

Legislative Management Systems: Public Liability Insurance Act, CrPC, IPC -Public Interest Litigation - ISO 14000 - ISO 14001- Environmental management systems - CPCB/ICMR/ICAR standards. - Scheme of Consent for establishment, Consent for operation - SEAC Environmental Clearance.

Textbooks:

1. Pollution Control acts, Rules and Notifications issued there under “Pollution Control Serie – PCL/2/1992, Central Pollution Control Board, Delhi, 1997.
2. Environmental law and policy in India“ - Shyam Divan and Armin Roseneranz - Oxford University Press, New Delhi, 2001.

Reference Books:

1. The ISO 14000 Handbook: Joseph Cascio.
2. ISO 14004: Environmental management systems: General guidelines on principles, systems and supporting techniques (ISO 14004:1996 (E)).
3. ISO 14001: Environmental management systems: Specification with guidance for use (ISO 14001:1996b (E)) (International organization for standardization-Switzerland)
4. Constitution of India [Referred articles from part-III, part-IV and part-IV A]
5. Environmental Laws in India (Deep, Latededn.) Pares Distn.
6. Handbook of environmental management and technology: Gwendolyn Holmes, Ben Ramnarine Singh, Louis Theodore.

Online Learning Resources:

<https://nptel.ac.in/courses/129106002>

(20A01M08) ENGINEERING GEOLOGY

Course Objectives:

- Type of rocks ,civil engineering importance of rock forming minerals.
- Geological structures, reasons of formation for each type and their side effects on the engineering projects
- Study ground water, factors affecting on the variation of water table depth methods of searching for ground water.
- Study the geophysical investigation methods
- Study the dams and geology of dam site.

Course Outcomes :

- To apply the geological knowledge to civil engineering. Constructions at different stages .The kind of study exposes the Geological drawbacks if any
- To help the site engineers to take suitable precautionary measures to overcome the drawbacks but also to take advantage of the site geology findings wherever possible. To take precautionary measures in civil engineering constructions based on geological parameters
- To develop a native construction plan incorporating all relevant aspects of geology.
- To know seismic and electrical methods to investigate the subsurface geology
- To characterize of engineering properties of rocks and soils

UNIT I

INTRODUCTION:

Importance of geology from Civil Engineering point of view. Brief study of case histories of failure of some Civil Engineering constructions due to geological draw backs. Importance of Physical geology, Petrology and Structural geology.

WEATHERING OF ROCKS:

Its effect over the properties of rocks importance of weathering with REFERENCE to dams, reservoirs and tunnels weathering of common rock like “Granite”

MINERALOGY:

Definition of mineral, Importance of study of minerals, Different methods of study of minerals. Advantages of study of minerals by physical properties. Role of study of physical properties of minerals in the identification of minerals. Study of physical properties of following common rock forming minerals: Feldspar , Quartz , Flint , Jasper, Olivine , Augite , Hornblende , Muscovite , Biotite , Asbestos, Chlorite , Kyanite , Garnet, Talc , Calcite. Study of other common economics minerals such as Pyrite, Hematite , Magnetite, Chlorite , Galena , Pyrolusite , Graphite, Magnesite, and Bauxite.

UNIT II

PETROLOGY:

Definition of rock: Geological classification of rocks into igneous, Sedimentary and metamorphic rocks. Dykes and sills, common structures and textures of Igneous. Sedimentary and Metamorphic rocks. Their distinguishing features, Megascopic study of Granite, Dolerite, Basalt, Pegmatite, Laterite, Conglomerate, Sand Stone, Shale, Limestone, Gneiss, Schist, Quartzite, Marble and Slate.

STRUCTURAL GEOLOGY:

Out crop, strike and dip study of common geological structures associating with the rocks such as folds, faults un conformities, and joints – their important types. Their importance Insitu and drift soils, common types of soils, their origin and occurrence in India

UNIT III

GROUND WATER, EARTH QUAKE & LAND SLIDES:-

Groundwater, Water table, common types of ground water, springs, cone of depression, geological controls of ground water movement, ground water exploration. Earth quakes, their causes and effects, shield areas and seismic belts. Seismic waves, Richter scale, precautions to be taken for building construction in seismic areas. Landslides, their causes and effect; measures to be taken to prevent their occurrence. Importance of study of ground water, earth quakes and land slides.

UNIT IV**GEOPHYSICAL STUDIES:**

Importance of Geophysical studies Principles of geophysical study by Gravity methods. Magnetic methods, Electrical methods. Seismic methods, Radio metric methods and geothermal method. Special importance of Electrical resistivity methods, and seismic refraction methods. Improvement of competence of sites by grouting etc.

UNIT V**GEOLOGY OF DAMS, RESERVOIRS AND TUNNELS:**

Types of dams and importance of Geology of site in their selection, Geological Considerations in the selection of a dam site. Analysis of dam failures of the past. Factors Contributing to the success of a reservoir. Geological factors influencing water Lightness and life of reservoirs. Purposes of tunneling, Effects of Tunneling on the ground Role of Geological Considerations (ie. Tithological, structural and ground water) in tunneling over break and lining in tunnels.

Textbooks:

1. Engineering Geology by N.Chennkesavulu, Mc-Millan, India Ltd. 2005
2. Engineering Geology by Vasudev Kanthi, Universities press, Hyderabad.

Reference Books:

1. Engineering geology by Prabin singh, Katson Pubilcations
2. Engineering geology by Duggal, TMH Publishers.
3. Engineering Geology by Subinoy Gangopadhyay, Oxford University press.
4. Principals of Engineering Geology by K.V.G.K. Gokhale – B.S publications
5. “ Environmental Geology”, by K. S. Valdiya, Tata Mc Grew Hill.

Online Learning Resources:

<https://nptel.ac.in/courses/105105106>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CE) **L T P C**
3 1 0 4
(20A01M09) RS & GIS APPLICATION IN ENVIRONMENTAL ENGINEERING

Course Objectives:

- To study the basic Environmental aspects and satellites
- To study the RS & GIS application in soil degradation
- To study the RS & GIS application in water pollution
- To study the RS & GIS application in Air quality
- To understand the RS & GIS application in Environmental management

Course Outcomes :

- Understand the importance and applications of various environmental satellites for land, water, atmosphere and oceans monitoring
- Realize the role of RS & GIS in assessing the soil degradation and suggest necessary control measures.
- Understand the concepts of spectral characteristics for assessing quality of ground water and data base creation
- To apply the remote sensing techniques for monitoring atmosphere constituents and modelling using GIS
- The knowledge gained is applied to solve complex spatial problems related to environmental engineering.

UNIT I

BASICS

Water- Air-Land-Marine Environment Global Climatologic, urban Environment
Environmental satellites GEOS, NOAA, AVHRR, CZCR Monitoring land, water, atmosphere
and ocean using Remote Sensing Data. Water- Air-Land-Marine Environment Global
Climatologic, urban Environment

UNIT II

SOIL DEGRADATION

Spectral characteristics of soil- Soil formation- classification of soils- soil survey
interpretation and mapping- impact of agricultural and industrial activity on soil properties.
RS & GIS in assessing Soil salinity- alkalinity- water logging studies- soil erosion- types and
estimation -control measures.

UNIT III

WATER QUALITY AND GROUND WATER POLLUTION

Spectral characteristics of water- classification of water quality -Data base creation and
quality modeling using GIS. Aquifer Vulnerability -Intrinsic and specific vulnerability-
contaminant transport model.

UNIT IV

AIR QUALITY AND COASTAL STUDIES

Atmosphere: Chemicals, Particulate matters present in the atmosphere, allowable limits,
Remote Sensing techniques - Monitoring atmosphere constituents- air pollution - industrial
activity, modeling using GIS - Ecology studies- Coastal color monitoring- marine studies.

UNIT V

ENVIRONMENTAL MANAGEMENT

Revenue management-environment and ecological concerns- Resource development in

remote areas-Impacts of anthropogenic activity- Solid Waste management- Forest classification Mapping – Biomass estimation - Carbon footprints and sinks, carbon trading, carbon credits and marketing, Indian and international status.

Textbooks:

1. Fundamentals of Remote Sensing, Third Edition, George Joseph, C Jeganathan, Universities Press, 2018
2. Remote Sensing and Image Interpretation by Lilliesand .T.M and Kiefer .R.W, John Wily and sons, 1994.

Reference Books:

1. Principles of Geograj1JhicaJ Information Systems by Burrough .P.A and McDonnell .R.A, Oxford University Press, 1988.
2. Remote Sensing of Environment by Lintz .J and Simonet Addison Wesley Publishing Company, 1994.

Online Learning Resources:

<https://nptel.ac.in/courses/105103193>

(20A01M10) DISASTER MANAGEMENT

Course Objectives:

- To give knowledge types of disasters and stages in disaster rehabilitation process.
- To make awareness on change in climates and their impacts on occurrence of environmental disasters.
- To impart knowledge on Consideration of wind and water effects as per codal provisions to withstand disasters.
- To familiarize the student with the Causes of earthquake and their effects and remedial methods to be adopted for buildings.
- To illustrate the methodology in Planning and design considerations of various structures constructing in disaster prone areas.

Course Outcomes :

- About various types of disasters and stages in disaster rehabilitation process.
- Impact of change in climates and their impacts on occurrence of environmental disasters.
- Adopting suitable codal provisions to study the effect of wind and water effects on various structures constructed at disaster prone areas.
- Causes of earthquake and their effects and remedial methods to be adopted for buildings.
- Adopt suitable Planning and design considerations of various structures constructing in disaster prone areas.

UNIT I

Brief introduction to different types of natural disaster, Occurrence of disaster in different climatic and geographical regions, hazard (earthquake and cyclone) map of the world and India, Regulations for disaster risk reduction, Post disaster recovery and rehabilitation (socioeconomic consequences)

UNIT II

Climate change and its impact on tropical cyclone, Nature of cyclonic wind, velocities and pressure, Cyclone effects, Storm surge, Floods, Landslides. Behavior of structures in past cyclones and wind storms, case studies. Cyclonic retrofitting, strengthening of structures and adaptive sustainable reconstruction. Life-line structures such as temporary cyclone shelter.

UNIT III

Basic wind engineering, aerodynamics of bluff bodies, vortex shedding and associated unsteadiness along and across wind forces. Lab: Wind tunnel testing, its salient features. Introduction to Computational fluid dynamics. General planning/design considerations under wind storms & cyclones; Wind effects on buildings, towers, glass panels etc, & wind resistant features in design. Codal Provisions, design wind speed, pressure coefficients; Coastal zoning regulation for construction & reconstruction phase in the coastal areas, innovative construction material & techniques, traditional construction techniques in coastal areas.

UNIT IV

Causes of earthquake, plate tectonics, faults, seismic waves; magnitude, intensity, epicenter, energy release and ground motions. Earthquake effects – On ground, soil rupture, liquefaction, landslides. Performance of ground and building in past earthquakes: Behavior of various types of buildings, structures, and collapse patterns; Behavior of Non-structural elements like services, fixtures, mountings- case studies. Seismic retrofitting- Weakness in existing buildings, aging, concepts in repair, restoration and seismic strengthening.

UNIT V

General Planning and design consideration; Building forms, horizontal and vertical eccentricities, mass and stiffness distribution, soft storey etc.; Seismic effects related to building configuration. Plan and vertical irregularities, redundancy and setbacks. Various Types and Construction details of: Foundations, soil stabilization, retaining walls, plinth fill, flooring, walls, openings, roofs, terraces, parapets, boundary walls, under-ground – overhead tanks, staircases and isolation of structures; innovative construction material and techniques; Local practices: traditional regional responses; Computational investigation techniques.

Textbooks:

1. Disaster Management by Rajib Shah, Universities Press, India, 2003
2. Disaster Management by R.B. Singh (Ed) Rawat Publication, New Delhi, 2000

Reference Books:

1. Natural disasters. By Abbott, L. P. (2013) 9th Ed. McGraw-Hill.
2. Earthquake Resistant Design of Structures. By Agarwal, P. and Shrikhande, M. (2009). New Delhi : PHI Learning.
3. Mapping Vulnerability: Disasters, Development and People. by Bankoff, G., Frerks, G. and Hilhorst, D. (2004). London : Earthscan.
4. Improving Earthquakes and Cyclone Resistance of Structures: Guidelines for the Indian Subcontinent. TERI
5. Disaster Mitigation, preparedness, recovery and Response. By Sinha, P. C. (2006). New Delhi : SBS Publishers.
6. World Bank. (2009). Handbook for Reconstructing after Natural Disasters.

Online Learning Resources:

https://onlinecourses.swayam2.ac.in/cec19_hs20/preview

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (EEE) **L T P C**
3 1 0 4
(20A02M01) ENERGY AUDIT AND MANAGEMENT

Course Objectives:

- Able to understand the basic concepts of Energy Audit and Management, Principles and objectives of Energy management and Basics of Thermal, Electrical energy management
- Able to apply the fundamental concepts for development of energy management systems
- Able to Design Energy Audit reports
- Able to analyze designed energy management systems

Course Outcomes:

- Understand the basic concepts of Energy Audit, Management, Principles and objectives of Energy management and Basics of Thermal, Electrical energy management
- Apply the fundamental concepts for development of energy management systems
- Design Energy Audit reports by considering various methods
- Analyze designed Energy management systems by using various tests

UNIT I INTRODUCTION Lecture Hrs:10
Basic elements and measurements - Mass and energy balances – Scope of energy auditing industries - Evaluation of energy conserving opportunities.

UNIT II ENERGY AUDIT CONCEPTS Lecture Hrs:14
Need of Energy audit - Types of energy audit – Energy management (audit) approach - understanding energy costs - Bench marking – Energy performance - Matching energy use to requirement - Maximizing system efficiencies - Optimizing the input energy requirements - Duties and responsibilities of energy auditors- Energy audit instruments - Procedures and Techniques.

UNIT III PRINCIPLES AND OBJECTIVES OF ENERGY MANAGEMENT Lecture Hrs:14
Design of Energy Management Programmes - Development of energy management systems – Importance - Indian need of Energy Management - Duties of Energy Manager - Preparation and presentation of energy audit reports - Some case study and potential energy savings.

UNIT IV THERMAL ENERGY MANAGEMENT Lecture Hrs:14
Energy conservation in boilers - steam turbines and industrial heating systems - Application of FBC - Cogeneration and waste heat recovery - Thermal insulation - Heat exchangers and heat pumps - Building Energy Management.

UNIT V ELECTRICAL ENERGY MANAGEMENT Lecture Hrs:12
Supply side Methods to minimize supply-demand gap- Renovation and modernization of power plants - Reactive power management – HVDC - FACTS - Demand side - Conservation in motors - Pumps and fan systems – Energy efficient motors.

Textbooks:

1. Hamies, Energy Auditing and Conservation; Methods Measurements, Management and Case study, Hemisphere, Washington, 1980.
2. Energy Management: W.R.Murphy, G.Mckay

Reference Books:

1. Energy Management Principles: C.B.Smith
 2. Efficient Use of Energy : I.G.C.Dryden
 3. Energy Economics A.V.Desai
 4. Guide book for National Certification Examination for Energy Managers and Energy Auditors (Could be downloaded from www.energymanagertraining.com).
- Online Learning Resources: . <https://nptel.ac.in/courses/108106022>

Course Objectives:

- Able to understand the significance of energy management in buildings, Ventilation and Air conditioning aspects, Climate influence, energy usage estimation and technological options for energy management
- Able to apply the Energy management concepts for building designs
- Able to analyze different conditions for preparation of efficient energy management system for a building
- Able to design efficient energy management systems for buildings

Course Outcomes:

- Understand the significance of energy management in buildings, Ventilation and Air conditioning aspects, Climate influence, energy usage estimation and technological options for energy management
- Apply the Energy management concepts for building designs
- Analyze different conditions for preparation of efficient energy management system for a building
- Design efficient energy management systems for buildings

UNIT I OVERVIEW OF THE SIGNIFICANCE OF ENERGY USE AND ENERGY PROCESSES IN BUILDING Lecture Hrs:12

Indoor activities and environmental control - Internal and external factors on energy use and the attributes of the factors - Characteristics of energy use and its management - Macro aspect of energy use in dwellings and its implications – Concepts of energy efficient building.

UNIT II INDOOR ENVIRONMENTAL REQUIREMENT AND MANAGEMENT Lecture Hrs:14

Thermal comfort – Ventilation and air quality - Air-conditioning requirement - Visual perception – Illumination requirement - Auditory requirement – Concept of sick building syndrome – Significance in energy management in buildings.

UNIT III CLIMATE Lecture Hrs:12

Solar radiation and their influences - The sun-earth relationship and the energy balance on the earth's surface – Climate – Wind - Solar radiation - Temperature – Sun shading and solar radiation on surfaces - Energy impact on the shape and orientation of buildings.

UNIT IV END-USE Lecture Hrs:14

Energy utilization and requirements – Lighting and day lighting – End-use energy requirements – Status of energy use in buildings – Estimation of energy use in a building - Heat gain and thermal performance of building envelope – Steady and non steady heat transfer through the glazed window and the wall – Standards for thermal performance of building envelope – Evaluation of the overall thermal transfer – Concepts of window management.

UNIT V ENERGY MANAGEMENT OPTIONS Lecture Hrs:12

Energy audit and energy targeting – Technological options for energy management – Modifications for energy efficient buildings for Indian conditions.

Textbooks:

1. Heating and Cooling of Buildings – Design for Efficiency, J. Krieder and A. rabl, McGraw Hill, 1994.

2. Mechanical and Electrical Equipment for Buildings, S. M. Guinness and Reynolds, Wiley, 1989.

Reference Books:

1. Energy Design for Architects, Shaw, Aee Energy Books, 1991.
2. Energy Conservation in Buildings – Royal Institute of Architecture, Canada.
3. Publication of CBRI, Roorkee – Energy Management in Buildings.

Online Learning Resources:

(20A02M03) ENERGY CONVERSION SYSTEMS

Course Objectives:

The student able to:

- Understand basic concepts involved in energy conversion process
- Apply the knowledge to choose different conversion topologies
- Analyze conversion system behaviour
- Create an Energy conversion system

Course Outcomes:

- Understand the basic concepts of Energy conversion systems, types of converters, Energy storage devices, Fuel cells and different energy storage technologies
- Apply the acquired knowledge to choose proper techniques, different converters, energy storage devices
- Analyze energy conversion systems and technologies
- Design efficient energy conversion system at most

UNIT I CONVERSION CYCLES

Lecture Hrs:12

Reversible and irreversible cycles - Thermodynamics analysis of Carnot - Stirling – Ericsson – Otto – Diesel – Dual – Atkinson - Brayton, Rankine.

UNIT II DIFFERENT TYPES OF CONVERTERS

Lecture Hrs:14

Fundamentals of converters – Thermoelectric Converters - Thermionic converters – MHD - Ferro electric converter - Nernst effect generator.

UNIT III ENERGY STORAGE DEVICES

Lecture Hrs:12

Different types of Batteries – Working – Performance governing parameters - Hydrogen energy - Solar photovoltaic cells.

UNIT IV FUEL CELLS

Lecture Hrs:12

Basics – Types – Working - Comparative analysis - Thermodynamics and kinetics of fuel cell process - Performance of fuel cell – Applications - Advantages and drawbacks.

UNIT V ENERGY STORAGE TECHNOLOGIES

Lecture Hrs:14

Mechanical energy - Electrical energy – Chemical energy - Thermal Energy.

Textbooks:

1. Principles of Energy Conversion, Archie.W.Culp, McGraw-Hill Inc., 1991, Singapore.
2. Direct Energy Conversion, Kettari, M.A. Addison-Wesley Pub. Co 1997.

Reference Books:

1. Fuel Cell and Their Applications, Kordesch. K, and Simader.G, Wiley-Vch, Germany 1996.
2. Fuel Cells: Theory and Application, Hart A.B and Womack, Prentice Hall Newyork Ltd., London 1989.

Online Learning Resources:

(20A02M04) ENERGY SCENARIO AND ENERGY POLICY

Course Objectives:

The student able to:

- Understand the basic concepts of Energy scenario and Energy policy
- Apply the concepts to strengthen energy system
- Analyze the different scenarios around the globe
- Implementation of suitable Energy policy for existing systems

Course Outcomes:

- Understand the Energy scenario in global market, different countries energy policies, Energy scenario in India, Energy policies and Future energy aspects
- Apply the concepts to enhance present day energy scenario and communicate the same to society
- Analyze different energy scenarios and energy policies
- Implement different policies and different new energy technologies as per the global guidelines

UNIT I GLOBAL ENERGY SCENARIO

Lecture Hrs:14

Role of energy in economic development and social transformation - Energy and GDP - GNP and its dynamics - Energy sources and overall Energy demand and availability - Energy consumption in various sectors and its changing pattern - Depletion of energy sources and impact exponential rise in energy consumption on economies of countries

UNIT II ENERGY POLICIES

Lecture Hrs:12

International Energy Policies of G-8 Countries - G-20 Countries - OPEC Countries - EU Countries - International Energy Treaties (Rio, Montreal, Kyoto) - INDO-US Nuclear Deal.

UNIT III INDIAN ENERGY SCENARIO

Lecture Hrs:12

Energy resources and Sector wise energy Consumption pattern Impact of energy on economy and development - National and State Level Energy policies and Issues - Status of Nuclear and Renewable Energy and Power Sector reforms.

UNIT IV ENERGY POLICY

Lecture Hrs:12

Global Energy Issues - Energy Security - Energy Vision Energy Pricing and Impact of Global Variations Energy Productivity (National and Sector wise productivity).

UNIT V ENERGY CONSERVATION

Lecture Hrs:14

Act – 2001 and its features - Electricity Act – 2003 and its features - Energy Crisis - Future energy options - Need for use of new and renewable energy sources - Energy for Sustainable development.

Textbooks:

1. Energy for a sustainable World: Jose Golden berg, Thomas Johan son, AKN. Reddy, Robert Williams (Wiley Eastern).
2. Energy Policy, B.V. Desai (Wiley Eastern)

Reference Books:

1. Modeling approach to long term demand and energy implication, J.K.Parikh
2. Energy Policy and Planning, B.Bukhootsow
3. TEDDY Year Book Published by Tata Energy Research Institute(TERI) World Energy Resources, Charles E. Brown, 'International Energy Outlook' - EIA annual Publication
4. BEE Reference book: no. 1/2/3/4

Online Learning Resources: 1. <https://nptel.ac.in/courses/109106161>

(20A03M01) 3D PRINTING MATERIALS

Pre-requisite Material Science

Course Objectives:

- ≠ Explain the need of 3D Printing Technology.
- ≠ Familiarize manufacturing of polymer components.
- ≠ Describe the manufacture of products through powder metallurgy.
- ≠ Impart knowledge on various material characterization techniques.

Course Outcomes (CO):

After successful completion of the course, the student will be able to

- ≠ Development mechanical components with powder metallurgy technique.(L6)
- ≠ Select materials for Additive Manufacturing (L4)
- ≠ Explain the concept of material characterization (L3)
- ≠ Understand the concepts of powder shaping and sintering.(L1)

UNIT I Introduction: 8 Hrs
Need for AM, Historical Development, Fundamentals of AM, AM Process Chain, Advantages and Limitations of AM, Classification of AM Systems, Materials used in AM

UNIT II Polymers basic concepts: 10 Hrs
Polymers Basic Concepts: Introduction to Polymers used for additive manufacturing: polyamide, PF resin, polyesters etc. Classification of polymers, Concept of functionality, Polydispersity and Molecular weight [MW], Molecular Weight Distribution [MWD]
Polymer Processing: Methods of spinning for additive manufacturing: Wet spinning, Dry spinning. Biopolymers, Compatibility issues with polymers. Moulding and casting of polymers, Polymer processing techniques.

UNIT III Powder Metallurgy: 10 Hrs
Powder Metallurgy Basic Concepts: Introduction and History of Powder Metallurgy (PM), Present and Future Trends of PM, Different Mechanical and Chemical methods, Atomization of Powder, other emerging processes

UNIT IV Powder Shaping and Sintering 10 Hrs
Powder Shaping: Particle Packing Modifications, Lubricants & Binders, Powder Compaction & Process Variables, Pressure & Density Distribution during Compaction, Isotactic Pressing, Injection Moulding, Powder Extrusion, Slip Casting, Tape Casting.
Sintering: Theory of Sintering, Sintering of Single & Mixed Phase Powder, Liquid Phase Sintering Modern Sintering Techniques, Physical & Mechanical Properties Evaluation, Structure-Property Correlation Study, Modern Sintering techniques, Defects Analysis of Sintered Components

UNIT V Introduction Characterization: 10 Hrs
Characterization Techniques: Particle Size & Shape Distribution, Electron Microscopy of Powder, Interparticle Friction, Compression ability, Powder Structure, Chemical Characterization. Microstructures of Powder by Different techniques characterization methods -BET surface area analyzer, Atomic force Microscopy (AFM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), X-ray Diffraction (XRD), Small Angle X-ray Scattering (SAXS) and High Power X-ray.

Textbooks:

1. Chee Kai Chua, Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" 5/e, World Scientific.
2. G Odian Principles of Polymerization, Wiley Inerscience John Wiley and Sons, 4/e, 2005.

Reference Books:

1. Mark James Jackson, Microfabrication and Nanomanufacturing, CRC Press, 2005.
2. Powder Metallurgy Technology, Cambridge International Science Publishing, 2002.
3. P. C. Angelo and R. Subramanian: Powder Metallurgy- Science, Technology and Applications, PHI, New Delhi, 2008.
4. Ray F. Egerton , Physical Principles of Electron Microscopy: An Introduction to TEM, SEM, and AEM , Springer, 2005.

Online Learning Resources:

- <https://nptel.ac.in/courses/112104265>
- <https://nptel.ac.in/courses/112103306>
- <https://nptel.ac.in/courses/108108115>
- https://onlinecourses.nptel.ac.in/noc20_mg70/preview
- <https://nptel.ac.in/courses/116102052>

1. Donald Hearn & M.P. Bakers, Computer Graphics, Prentice-Hall; 2/e, 1994.
2. D. F. Rogers, Procedural elements for computer graphics- Tata McGraw-Hill, 2/e, 2017.

Reference Books:

1. New mann & Sprowl, Interactive computer graphics, McGraw Hill Education, 2001.
2. Steven Harrington, Computer graphics, McGraw-Hill Inc.,US; 2/e, 1983.
3. Ibrahim Zeid, CAD/CAM theory and practice, 2/e, Tata McGraw-Hill, 2009.

Online Learning Resources:

- <https://nptel.ac.in/courses/106106090>
- <https://nptel.ac.in/courses/106102065>
- <https://nptel.ac.in/courses/106103224>
- https://onlinecourses.nptel.ac.in/noc21_cs97/preview

(20A03M03) GEOMETRIC MODELING

Course Objectives:

- To Learn advanced concepts of feature based modeling and parametric modeling.
- To understand the mathematical basis for geometric modeling of curves and surfaces and their relationship with computer graphics.
- To understand the methods of representation of wireframe, surface, and solid modeling systems.
- To Consider data associativity concepts of CAD/CAE integration; Be familiar with interoperability and data transfer techniques between design and analysis software systems.

Course Outcomes:

- Represent curves and surfaces using parametric equations
- Define and relate the basic concepts, tools, and algorithms in geometric modeling and digital surface processing
- Critically analyze and assess current research on surface representations and geometric modeling with the intent to apply the proposed methods in your own work
- Define the methods of representation of wireframe, surface, and solid modeling systems.

UNIT I Introduction:

8 Hrs

Definition, Explicit and implicit equations, parametric equations.

UNIT II Cubic Splines:

10 Hrs

Algebraic and geometric form of cubic spline, tangent vectors, parametric space of a curve, blending functions, four point form, reparametrization, truncating and subdividing of curves, Graphic construction and interpretation, composite pc curves.

UNIT III Bezier Curves & B-Spline Curves:

10 Hrs

Bezier Curves: Bernstein basis, equations of Bezier curves, properties, derivatives and related problems.

B-Spline Curves: B-Spline basis, equations, knot vectors, properties, derivatives and related problems.

UNIT IV Surfaces:

8Hrs

Bicubic surfaces, Coon's surfaces, Bezier surfaces, B-Spline surfaces, surfaces of revolutions, Sweep surfaces, ruled surfaces, tabulated cylinder, bilinear surfaces, triangular patches, sculptured surface and rational parametric surface.

UNIT V Solid and Solid Modelling Concepts

8 Hrs

Solids: Tricubic solid, Algebraic and geometric form.

Solid modeling concepts: Wire frames, Boundary representation, Half space modeling, spatial cell, Constructive Solid Geometry (CSG), Analytical Solid Modelling (ASM).

Textbooks:

1. Michael E. Mortenson, Geometric Modeling, Industrial Press Inc. Edition: 3/e, 2006.
2. Ibrahim Zeid, CAD/CAM, Tata McGraw Hill, 2/e, 2009..
3. P. N. Rao, CAD/CAM principles and applications by, McGraw Hill Publishers, 3/e, 2017.

Reference Books:

1. Rogoer's Adams, Mathematical Elements for Computer Graphics, Tata McGraw Hill, 1990.
2. K.Lalit Narayan, K.Mallikarjuna Rao, MMM Sarcar, Computer Aided Design and Manufacturing, PHI Publishers, 2008.

Online Learning Resources:

- <https://www.youtube.com/watch?v=0IgOapAtauM>
- <https://www.youtube.com/watch?v=tgbXCwjlaE>
- https://www.youtube.com/watch?v=CeOV_tVo970
- <https://www.youtube.com/watch?v=vjX4PDJcFOI>
- <https://nptel.ac.in/courses/112102102>
- <https://nptel.ac.in/courses/112102101>
- <https://archive.nptel.ac.in/courses/112/104/112104252/>

(20A03M04) FINITE ELEMENT METHODS

Pre-requisite **Basic Mathematics & Mechanics of Materials**

Course Objectives:

- ≠ Familiarize basic principles of finite element analysis procedure.
- ≠ Explain theory and characteristics of finite elements that represent engineering structures.
- ≠ Apply finite element solutions to structural, thermal, dynamic problem.
- ≠ Learn to model complex geometry problems and solution techniques.

Course Outcomes:

Upon successful completion of this course you should be able to

- ≠ Understand the concepts behind variational methods and weighted residual methods in FEM.
- ≠ Identify the application and characteristics of FEA elements such as bars, beams, and isoparametric elements, and 3-D element.
- ≠ Develop element characteristic equation procedure and generation of global stiffness equation will be applied.
- ≠ Able to apply Suitable boundary conditions to a global structural equation, and reduce it to a solvable form.
- ≠ Able to identify how the finite element method expands beyond the structural domain, for problems involving dynamics, heat transfer and fluid flow.

UNIT I Introduction to finite element methods 12 Hrs

Introduction to finite element methods for solving field problems, applications, Stress and equilibrium, Boundary conditions, Strain-Displacement relations, Stress- strain relations for 2D and 3D Elastic problems. Potential energy and equilibrium, Rayleigh-Ritz method, Formulation of Finite Element Equations.

One dimensional Problems: Finite element modelling of 1D bar elements, coordinates and shape functions. Requirements for Convergence and Interpolation functions, Pascal's Triangle, Assembly of global stiffness matrix and load vector. Finite element equations, Treatment of boundary conditions, Quadratic shape functions.

UNIT II Analysis of Trusses and Beams 8 Hrs

Analysis of trusses: Stiffness Matrix for 1D truss element, Stress Calculations and Problems with maximum of three elements.

Analysis of beams: Element Stiffness Matrix and Load vector for 1 D beam element, Hermite shape functions and simple problems.

UNIT III Finite element modelling 8 Hrs

Finite element modeling of two dimensional stress analysis with constant strain triangles and treatment of boundary conditions. Estimation of load Vector, Stresses.

Finite element modeling of Axi-symmetric solids subjected to axi-symmetric loading with triangular elements.

UNIT IV Quadrilateral Elements 10 Hrs

Quadrilateral Elements: Isoparametric, Sub parametric and Super parametric elements, Modelling of 4 noded and 8 noded quadrilateral elements and simple problems. Numerical Integration.

Steady state heat transfer analysis: One dimensional analysis of composite slab and fin.

UNIT V Dynamic analysis 8 Hrs

Analysis of a 1D uniform shaft subjected to torsion – Simple problems

Dynamic analysis: Formulation of finite element model, element – mass matrices, evaluation of Eigen values and Eigen vectors for a bar and shaft.

Textbooks:

1. Chandraputla, Ashok & Belegundu, Introduction to Finite Element in Engineering, Prentice Hall, 4/e, 2011.
2. S.S.Rao, The Finite Element Methods in Engineering, Elsevier Butterworth -Heinemann 2/e, 2000.

Reference Books:

1. J N Reddy, An introduction to the Finite Element Method, McGraw – Hill, New York, 1993.
2. S.Md.Jalaludeen, Finite Element Analysis in Engineering, 2/e, Anuradha Publications, 2016.
3. R D Cook, D S Malkus and M E Plesha, Concepts and Applications of Finite Element Analysis, 3/e, John Wiley, New York, 1989.
4. K J Bathe, Finite Element Procedures in Engineering Analysis, Prentice-Hall, Englewood Cliffs, 1982.
5. G.Lakshmi Narasaiah, Finite Element Analysis, 1/e, B.S. Publications, 2008.
6. C Zienkiewicz and R L Taylor, the Finite Element Method, 3/e. McGraw-Hill, 1989.

Online Learning Resources:

- <https://nptel.ac.in/courses/112/104/112104193/>
- <https://nptel.ac.in/courses/112/104/112104205/>
- <https://nptel.ac.in/courses/105/105/105105041/>
- <https://nptel.ac.in/courses/112/106/112106130/>
- <https://nptel.ac.in/courses/112/103/112103295/>

(20A03M05) ADDITIVE MANUFACTURING

Pre-requisite **CAD & Manufacturing Process**

Course Objectives:

- ≠ Familiarize of additive manufacturing / rapid prototyping and its applications in various fields.
- ≠ Impart reverse engineering techniques.
- ≠ Explain different processes available in additive manufacturing.
- ≠ Bring awareness on mechanical properties of materials and geometric issues related to additive manufacturing applications.

Course Outcomes:

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

- ≠ Demonstrate various additive manufacturing and rapid prototyping techniques applications.
- ≠ Describe different additive manufacturing processes.
- ≠ Apply methods in rapid prototyping.
- ≠ Use powder based AM system.
- ≠ Model 3D printing using SDM and BPM methods.

UNIT I Introduction to Additive Manufacturing (AM) 10 Hours

Systems:

History and Development of AM, Need of AM, Difference between AM and CNC, Classification of AM Processes: Based on Layering Techniques, Raw Materials and Energy Sources, AM Process Chain, Benefits and Applications of AM, Representation of 3D model in STL format, RP data formats: SLC, CLI, RPI, LEAF, IGES, CT, STEP, HP/GL.

UNIT II CAD & Reverse Engineering: 8 Hours

Basic Concept, Digitization techniques, Model Reconstruction, Data Processing for Additive Manufacturing Technology: CAD model preparation, Part Orientation and support generation, Model Slicing, Tool path Generation, Software's for Additive Manufacturing Technology: MIMICS, MAGICS. Reverse Engineering (RE) –Meaning, Use, RE – The Generic Process, Phase of RE Scanning, Contact Scanners, Noncontact Scanners, Point Processing, Application Geometric Model, Development.

UNIT III Solid and Liquid Based AM Systems: 8 Hours

Stereolithography (SLA): Principle, Process, Materials, Advantages, Limitations and Applications. Solid Ground Curing (SGC): Principle, Process, Materials, Advantages, Limitations, Applications. Fusion Deposition Modeling (FDM): Principle, Process, Materials, Advantages, Limitations, Applications. Laminated Object Manufacturing (LOM): Principle, Process, Materials, Advantages, Limitations, Applications.

UNIT IV Powder Based AM Systems: 8 Hours

Principle and Process of Selective Laser Sintering (SLS), Advantages, Limitations and Applications of SLS, Principle and Process of Laser Engineered Net Shaping (LENS), Advantages, Limitations and Applications of LENS, Principle and Process of Electron Beam Melting (EBM), Advantages, Limitations and Applications of EBM.

UNIT V Other Additive Manufacturing Systems: 8 Hours

Three Dimensional Printing (3DP): Principle, Process, Advantages, Limitations and Applications. Ballistic Particle Manufacturing (BPM): Principle, Process, Advantages, Limitations, Applications. Shape Deposition Manufacturing (SDM): Principle, Process, Advantages, Limitations, Applications.

Textbooks:

1. Ian Gibson, David W. Rosen, Brent Stucker, Additive Manufacturing Technologies: Rapid Prototyping to Direct Digital Manufacturing, 1/e Springer, 2010.
2. Chua C.K., Leong K.F. and Lim C.S., Rapid Prototyping: Principles and Applications, 2/e World Scientific Publishers, 2003.

3. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.

Reference Books:

1. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001.
2. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.
4. RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Online Learning Resources:

- <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
- <https://slideplayer.com/slide/6927137/>
- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- <https://www.youtube.com/watch?v=NkC8TNts4B4>

(20A03M06) APPLICATIONS OF 3D PRINTING

Pre-requisite Additive manufacturing

Course Objectives:

- € Explain the typical application areas of additive manufacturing.
- € Familiarize with the applications of 3D printing in Design and Engineering area.
- € Describe the concepts of manufacturing of bio-medical implants.
- € Impart knowledge on Applications in Automotive, Civil and other fields.

Course Outcomes:

After successful completion of the course, the student will be able to

- € Design CAD model and verification of CAD model.(L6)
- € Select type of 3D printing technology for different applications.(L2)
- € Identify the various applications of 3D printing in manufacturing and aerospace.(L3)
- € Explain the various Applications of 3D printing in Automotive, Civil and other fields. (L2)
- € List the various applications of 3D printing technology. (L1)

UNIT I Typical application areas of Additive Manufacturing: 8 Hrs
Finishing Processes- Cutting Processes, Sand-Blasting and Polishing, Coating, Painting.

UNIT II Applications in Design and Engineering: 10 Hrs
Applications in Design: CAD Model Verification, Visualizing Objects, Proof of Concept, Marketing and Commercial Applications,
Applications in Engineering Analysis and Planning: Scaling, Form and Fit, Flow Analysis, Stress Analysis, Mock-Up Parts, Pre-Production Parts, Diagnostic and Surgical Operation Planning, Design and Fabrication of Custom Prosthesis and Implant,

UNIT III Applications in Manufacturing and Tooling: 8 Hrs
Classification of rapid tooling, Direct Soft Tooling, Indirect Soft Tooling, Direct Hard Tooling.

UNIT IV Applications in Bio-medical and Aerospace: 8 Hrs
Operation Planning for Cancerous Brain Tumor Surgery, Planning Reconstructive Surgery with RP Technology, Craniofacial Reconstructive Surgery Planning, Biopsy Needle Housing, Knee Implants, Scaffolds for Tissue Engineering, Customized Tracheobronchial Stents, Inter-Vertebral Spacers, Cranium Implant, Design Verification of an Airline Electrical Generator, Engine Components for Fanjet Engine, Fabrication of Flight-Certified Production Castings.

UNIT V Applications in Automotive, Civil and other fields 10 Hrs
Prototyping Complex Gearbox Housing for Design Verification, Prototyping Advanced Driver Control System with Stereolithography, Creating Cast Metal Engine Block with RP Process, Using Stereolithography to Produce Production Tooling, Civil engineering- 3D printing in house construction, Development of Contour Crafting Process, Building Disaster Relief Shelters, Metal Frames For Solid Structures, other fields- Coin industry, Jewelry Industry, tableware industry.

Textbooks:

1. Chee Kai Chua, Kah Fai Leong, "3D Printing and Additive Manufacturing Principles and Applications" 5/e, World Scientific.
2. Liou W. Liou, Frank W., Liou, Rapid Prototyping and Engineering Applications: A Tool Box for Prototype Development, CRC Press, 2007.

Reference Books:

1. Pham D.T. and Dimov S.S., Rapid Manufacturing; The Technologies and Application of RPT and Rapid Tooling, Springer, London 2001.
2. Gebhardt A., Rapid prototyping, Hanser Gardener Publications, 2003.
3. Hilton P.D. and Jacobs P.F., Rapid Tooling: Technologies and Industrial Applications, CRC Press, 2005.
4. RafiqNoorani, Rapid Prototyping: Principles and Applications in Manufacturing, John Wiley & Sons, 2006.

Online Learning Resources:

- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- <https://www.youtube.com/watch?v=NkC8TNts4B4>

(20A03M07) DESIGN FOR MANUFACTURING

Pre-requisite Manufacturing Processes

Course Objectives:

- ≠ Explain the product development cycle and manufacturing issues to be considered in design.
- ≠ Familiarize manufacturing consideration in cast, forged, and weld components.
- ≠ Describe the manufacture of sheet metal components.
- ≠ Impart knowledge plastics as substitution to metallic parts.

Course Outcomes:

After successful completion of the course, the student will be able to

- ≠ design mechanical components with economical consideration.(L6)
- ≠ select materials and machining processes.(L6)
- ≠ identify the necessity for redesigning components out of manufacturing considerations.(L3)
- ≠ consider the manufacturing considerations while designing cast, forged weld and sheet metal components.(L3)
- ≠ design plastic parts with manufacturing considerations.(L6)

UNIT I Introduction 8 Hrs

Introduction: Design philosophy-steps in design process-general design rules for manufacturability-basic principles of designing for economical production-creativity in design.

Materials: Selection of materials for design-developments in material technology-criteria for material selection-material selection interrelationship with process selection-process selection charts.

UNIT II Machining processes: 8 Hrs

Machining processes: Overview of various machining processes-general design rules for machining-dimensional tolerance and surface roughness-Design for machining – ease –redesigning of components for machining ease with suitable examples. General design recommendations for machined parts.

UNIT III Metal Casting and Joining 8 Hrs

Metal casting: Appraisal of various casting processes, selection of casting process,-general design considerations for casting-casting tolerance-use of solidification, simulation in casting design-product design rules for sand casting.

Metal joining: Appraisal of various welding processes, factors in design of weldments – general design guidelines-pre and post treatment of welds-effects of thermal stresses in weld joints-design of brazed joints.

UNIT IV Forging, Extrusion & Sheet metal work 10 Hrs

Forging: Design factors for forging – closed die forging design – parting lines of dies – drop forging die design – general design recommendations.

Extrusion & Sheet metal work: Design guide lines extruded sections-design principles for punching, blanking, bending, deep drawing-Keeler Goodman forging line diagram – component design for blanking.

UNIT V Plastics 8 Hrs

Visco elastic and creep behavior in plastics-design guidelines for plastic components-design considerations for injection moulding – design guidelines for machining and joining of plastics.

Textbooks:

1. George E Dieter and Linda Schmidt, Engineering Design, 4/e, McGraw Hill, 2015.
2. A.K.Chitale and R.C.Gupta, Product Design and Manufacturing, 5/e, PHI Learning, 2011.
3. David M Anderson, Design for Manufacturability, CRC Press, 2003.

Reference Books:

1. James G Bralla, Design For Manufacturability Handbook, 2/e, McGraw Hill, 2004.
2. Dr.P.C.Sharma, Production Technology, S.Chand & Company, 2009.

Online Learning Resources:

- <https://nptel.ac.in/courses/112/101/112101005/>
- https://www.iare.ac.in/sites/default/files/lecture_notes/DFMA_Lecture_NOTES.pdf
- <https://ocw.mit.edu/courses/mechanical-engineering/2-008-design-and-manufacturing-ii-spring-2004/lecture-notes/>
- <https://dokumen.tips/documents/design-for-manufacturing-and-assembly-1-lecture-notes-on-design-for-manufacturing.html>
- <https://www.youtube.com/watch?v=ofmbhbVCUqI>
- https://onlinecourses.nptel.ac.in/noc21_me66/preview

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (ME) **L T P C**
3 1 0 4
(20A03M08) PRODUCT DESIGN AND DEVELOPMENT

Course Objectives:

- To Design products creatively while applying engineering design principles.
- To Apply principles of human factors, ethics and environmental factors in product design.
- To Work in groups or individually in their pursuit of innovative product design.
- To implement value design for optimum product cost.

Course Outcomes :

After successful completion of the course, the student will be able to

- Apply knowledge of basic science and engineering fundamentals. (L5)
- Undertake problem identification, formulation and solution. (L2)
- Understanding of the principles of sustainable design and development. (L2)
- Understanding of professional and ethical responsibilities and commitment to them. (L2)

UNIT I Product Development Process: 8 Hrs

General problem solving process - Flow of Work during the process of designing - Activity Planning
Timing and scheduling, Planning Project and Product Costs - Effective Organization Structures -
Interdisciplinary Cooperation, Leadership and Team behaviour.

UNIT II Task Clarification: 8 Hrs

Importance of Task Clarification - Setting up a requirements list - Contents, Format, Identifying the
requirements, refining and Extending the requirements, Compiling the requirements list, Examples.
Using requirements lists - Updating, Partial requirements lists, Further uses - Practical applications of
requirements lists.

UNIT III Conceptual Design: 10 Hrs

Steps in Conceptual Design. Abstracting to identify the essential problems - Aim of Abstraction,
Broadening the problem. Formulation, Identifying the essential problems from the requirements list,
Establishing functions structures, Overall function, Breaking a function down into sub-functions.
Developing working structures - Searching for working principles, Combining Working Principles,
Selecting Working Structures, Practical Application of working structures. Developing Concepts -
Firming up into principle solution variants, Evaluating principle solution variants, Practical
Applications of working structures. Examples of Conceptual Design - One Handed Household Water
Mixing Tap, Impulse - Loading Test Rig.

UNIT IV Embodiment Design 10 Hrs

Steps of Embodiment Design, Checklist for Embodiment Design Basic rules of Embodiment Design
Principles of Embodiment Design - Principles of Force Transformations, Principles of Division of
Tasks, Principles of Self-Help, Principles of Stability and Bi-Stability, Principles of Fault-Free Design
Guide for Embodiment Design - General Considerations, Design to allow for expansion, Design to
allow for creep and relaxation, Design against Corrosion, Design to minimize wear, Design to
Ergonomics, Design for Aesthetics, Design for Production, Design for Assembly, Design for
Maintenance, Design for Recycling, Design for Minimum risk, Design to standards. Evaluation of
Embodiment Designs.

UNIT V Mechanical Connections, Mechatronics And 10 Hrs
Adaptronics:

Mechanical Connections - General functions and General Behaviour, Material connections, From
Connections, Force connections, Applications. Mechatronics - General Architecture and Terminology,
Goals and Limitations, Development of Mechatronic Solution, Examples. Adaptronics - Fundamentals

and Terminology, Goals and Limitations, Development of Adaptronics Solutions, Examples.

Textbooks:

1. G.Paul; W. Beitzetal, Engineering Design, Springer International Education, 2010.
2. Kevin Otto: K. Wood, Product Design And Development, Pearson Education, 2013.

Reference Books:

1. Kenith B. Kahu, Product Planning Essentials, Yes dee Publishing, 2011.
2. K.T. Ulrich, Product Design and Development, TMH Publishers, 2011.

Online Learning Resources:

- <https://nptel.ac.in/courses/112107217>
- <https://nptel.ac.in/courses/112104230>
- <https://www.youtube.com/watch?v=mvaqZAFdL6U>
- <https://nptel.ac.in/courses/107103082>
- <https://quizxp.com/nptel-product-design-and-manufacturing-assignment-5/>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (ME) **L T P C**
3 1 0 4
(20A03M09) COMPUTER AIDED MACHINE DRAWING

Course Objectives:

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D assembly drawings from 3D assemblies.

Course Outcomes:

After successful completion of the course, the student will be able to

- Demonstrate the conventional representations of materials and machine components.(L6)
- Model riveted, welded and key joints using CAD system. (L5)
- Create solid models and sectional views of machine components. (L6)
- Generate solid models of machine parts and assemble them. (L5)
- Translate 3D assemblies into 2D drawings. (L6)

UNIT I Isometric and Orthographic Projections 8 Hrs

Principles of isometric projection- Isometric Scale-Isometric Views- Conventions- Isometric Views of lines, Planes Figures, Simple and Compound Solids-Conversion of isometric Projections/Views of Orthographic Views-Conventions.

UNIT II Perspective projections: 8 Hrs

Perspective projections –Planes and simple solids. Vanishing point Method only.

UNIT III Detachable joints & Permanent Joint 10 Hrs

Drawing of thread profiles, hexagonal and square-headed bolts and nuts, bolted joint, bolted joint with washer and locknut, stud joint, screw joint.

Riveted joints: Drawing of rivet, lap joint, butt joint with single strap, single riveted, double riveted double strap joints.

Welded joints: Lap joint and T joint with fillet, butt joint with conventions.

UNIT IV Keys and Couplings 10 Hrs

Keys: Taper key, sunk taper key, round key, saddle key, feather key, woodruff key.

Shaft coupling: bushed pin-type flange coupling, universal joint, Oldhams' coupling.

Sectional views: Creating solid models of complex machine parts and create sectional views.

UNIT V Assembly drawings: 10 Hrs

Piston, connecting rod, Eccentric, Screw jack, Plumber block, Pipe vice, Clamping device, Tail stock, Air Cock, Machine vice, Carburetor.

Textbooks:

1. K.L.Narayana, P.Kannaiah, A text book on Machine Drawing, SciTech Publications, 2014.
2. Cecil Jensen, Jay Helsel and Donald D.Voisinet, Computer Aided Engineering Drawing, Tata Mcgraw-Hill, NY, 2000.

Reference Books:

1. James Barclay, Brain Griffiths, Engineering Drawing for Manufacture, Kogan Page Science, 2003.
2. N.D.Bhatt, Machine Drawing, Charotar, 50/e, 2014.
3. K.L.Narayana, Production Drawing, NewAge International Publishers, 3/e, 2014.

Online Learning Resources:

- <https://www.youtube.com/watch?v=4U0kmyXT47o>
- <https://www.youtube.com/watch?v=EA3YOMfh99M>
- <https://www.bietdvg.edu/media/department/ME/data/learning->

materials/CAMD_MANUAL18ME36A_FINAL.pdf

- <https://www.youtube.com/watch?v=4vw1GpigfMk>

Course Objectives:

- To explain concept of Six Sigma and Lean manufacturing.
- To outline division resource for lean six sigma.
- To analyse the Process with various analysis techniques like ANOVA, Regression and KAIZEN.

Course Outcomes:

At the end of the course the student will

- ≠ Explain the basic concepts of solar radiation and solar collectors (L2)
- ≠ Explain DMAIC process (L2)
- ≠ Apply the principles of QFD,TRIZ methods. (L3)
- ≠ Utilize different Analysis methods for lean manufacturing (L3)

UNIT I Introduction To Lean And Six-Sigma 8 Hrs

Introduction to Lean- Definition, Purpose, features of Lean, top seven wastes, Need for Lean, Elements of Lean Manufacturing, Lean principles, the lean metric, Hidden time traps. Introduction to quality, Definition of six-sigma, origin of six-sigma, six-sigma concept, and Critical success factors for six-sigma. Evolution of lean six-sigma, the synergy of Lean and six sigma, Definition of lean six-sigma, the principles of lean six-sigma, Scope for lean six sigma, Features of lean sixsigma, the laws of lean six-sigma, Benefits of lean six-sigma.

UNIT II Initiation, Resource and Project Selection For Lean Six Sigma 12 Hrs

Top management commitment – Infrastructure and deployment planning, Process focus, organizational structures, Measures – Rewards and recognition, Infrastructure tools, structure of transforming event, Launch preparation. Resource and project selection, Selection of Black belts, 24 Selecting projects – Benefit/Effort graph, Process mapping, value stream mapping, Balanced score card for project identification, project suitable for lean six sigma.

UNIT III Team Building And The DMAIC Process 8 Hrs

Predicting and improving team performance, nine team roles, Team leadership, Team building & Team exercise. DMAIC process and toll gate reviews.

UNIT IV The Tools For Lean Six- Sigma 12 Hrs

Define tools- Project Definition Form(PDF) and SIPOC; Measure tools- Process mapping, Parato chart, cause and effect matrix, FMEA, Brain-storming, NGT, Multi-voting, Cause & Effect diagram, Check sheets, Gauge R&R, Run charts, Control charts and process capability analysis; Analyze tools- scatter plots, ANOVA, Regression analysis and time trap analysis; Improve tools- Mistake proofing, KAIZEN, Reducing cong

UNIT V Institutionalizing And Design For Lean Six-Sigma 10 Hrs

Need for institutionalizing Lean Six- Sigma, Comply, commit, embed and encode; Steps in institutionalizing the Lean Six- Sigma; Objectives of Design for Lean Six-Sigma, improving design velocity,Reducing product line complexity, Design for Lean Six-Sigma-QFD,TRIZ, Robust design.

Textbooks:

1. Forrest W. Breyfogle III, Implementing Six Sigma: Smarter solutions Using Statistical Methods, 1999.
2. James P. Womack, Daniel T. Jones, Lean Thinking, Free press business, 2003
3. Michael L. George, Lean Six Sigma, McGraw-Hill, 2002.

Reference Books:

1. Ronald G. Askin and Jeffrey B. Goldberg, Design and Analysis of Lean Production Systems, John Wiley & Sons, 2003.
2. Rother M. and Hook J., Learning to See: Value Stream Mapping to add value and Eliminate Muda, Lean Enterprise Institute, Brookline, MA

Online Learning Resources:

- https://www.youtube.com/watch?v=G_0bl6FHo_c
- <https://www.youtube.com/watch?v=SMOQV2CyVQo&list=PL8F39D0611CB7BD3B>
- https://www.youtube.com/watch?v=iEM0df_0-0o
- <https://www.youtube.com/watch?v=2ePeXePNLrs>
- https://www.youtube.com/watch?v=50yrQ5Ub1lc&list=PLLy_2iUCG87B2T7MqpfCr8Vl4A5nwLVm2
- <https://www.youtube.com/watch?v=-2Cd38P6Y00>
- <https://www.youtube.com/watch?v=Xi12Lwmz5dE>
- <https://www.youtube.com/watch?v=9P9Gs8o9oHk>
- <https://nptel.ac.in/courses/110105123>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (ME) **L T P C**
3 1 0 4
(20A03M11) TOTAL QUALITY MANAGEMENT

Course Objectives:

The objectives of this course are to

- Introduce the students, the basic concepts of Total Quality Management.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of customer satisfaction by the application of various quality concepts.
- Understand the importance of Quality standards in Production

Course Outcomes:

At the end of this course, the student will be able to

- ≠ Develop an understanding on quality Management philosophies and frameworks
 - ≠ Adopt TQM methodologies for continuous improvement of quality
 - ≠ Measure the cost of poor quality, process effectiveness and efficiency to identify areas for improvement
 - ≠ Apply benchmarking and business process reengineering to improve management processes.
- Determine the set of indications to evaluate performance excellence of an organization.

UNIT I Introduction 10 Hrs

Introduction: Definition of Quality, Dimensions of Quality, Definition of Total quality management, Quality Planning, Quality costs – Analysis, Techniques for Quality costs, Basic concepts of Total Quality Management.

UNIT II Historical Review: 9 Hrs

Quality council, Quality statements, Strategic Planning, Deming Philosophy, Barriers of TQM Implementation, Benefits of TQM, Characteristics of successful quality leader, Contributions of Gurus of TQM, Case studies.

UNIT III TQM Principles: 8 Hrs

Customer Satisfaction – Customer Perception of Quality, Customer Complaints, Service Quality, Customer Retention, Employee Involvement – Motivation, Empowerment teams, Continuous Process Improvement – Juran Trilogy, PDCA Cycle, Kaizen, Supplier Partnership – Partnering, sourcing, Supplier Selection, Supplier Rating, Relationship Development, Performance Measures – Basic Concepts, Strategy, Performance Measure Case studies.

UNIT IV TQM Tools: 9 Hrs

Benchmarking – Reasons to Benchmark, Benchmarking Process, Quality Function Deployment (QFD) – House of Quality, QFD Process, Benefits, Taguchi Quality Loss Function, Total Productive Maintenance (TPM) – Concept, Improvement Needs, FMEA – Stages of FMEA, The seven tools of quality, Process capability, Concept of Six Sigma, New Seven management tools, Case studies.

UNIT V Quality Systems: 12 Hrs

Need for ISO 9000 and Other Quality Systems, ISO 9000: 2000 Quality System – Elements, Implementation of Quality System, Documentation, Quality Auditing, QS 9000, ISO 14000 – Concept, Requirements and Benefits, Case Studies.

Textbooks:

1. Dale H Besterfield, Total Quality Management, Fourth Edition, Pearson Education, 2015.
2. Subburaj Ramaswamy, Total Quality Management, Tata Mcgraw Hill Publishing Company Ltd., 2005.
3. Joel E. Ross, Total Quality Management, Third Edition, CRC Press, 2017.

Reference Books:

1. Narayana V and Sreenivasan N.S, Quality Management – Concepts and Tasks, New Age International, 1996.
2. Robert L. Flood, Beyond TQM, First Edition, John Wiley & Sons Ltd, 1993.
3. Richard S. Leavenworth & Eugene Lodewick Grant, Statistical Quality Control, Seventh

Edition, Tata McGraw Hill, 2015

4. Samuel Ho , TQM – An Integrated Approach, Kogan Page Ltd, USA, 1995.

Online Learning Resources:

- <https://www.youtube.com/watch?v=VD6tXadibk0>
- <https://www.investopedia.com/terms/t/total-quality-management-tqm.asp>
- <https://blog.capterra.com/what-is-total-quality-management/>
- <https://nptel.ac.in/courses/110/104/110104080/>
- https://onlinecourses.nptel.ac.in/noc21_mg03/preview
- <https://nptel.ac.in/courses/110/104/110104085/>
- <https://nptel.ac.in/noc/courses/noc18/SEM2/noc18-mg39/>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (ME) **L T P C**
3 1 0 4
(20A03M12) SUPPLY CHAIN MANAGEMENT

Course Objectives:

The objectives of this course are to

- ≠ Explain the basics of supply chain management.
- ≠ Familiarize inventory management techniques and models to ensure EOQ batch size under risk management.
- ≠ Demonstrate various distribution strategies for shipment of products.
- ≠ Focus on evaluating of strategic alliance partners and understanding of RDBMS..

Course Outcomes:

At the end of the course student will be able to

- apply the concepts of supply chain management for demand forecasting. (L3)
- make use of SCM and inventory management for procurement(L3)
- analyse the shipment activities and related issues (L4)
- build third party alliances. (L5)
- adapt the RDBMS data for communications and analyzing future challenges and understand e-commerce strategies(L6)

UNIT I Understanding the supply chain: 8 Hrs

What is SCM? Why SCM? The Complexity, Key issues in SCM Logistics network -Introduction, Data Collection, Transportation, Ware house Management, Strategic location of ware houses, Demand forecasting, Role of aggregate planning, MRP, ERP, Managing variability, Key features of Network configuration.

UNIT II Inventory management: 8 Hrs

Concepts of Materials Management, Economic lot size model, Effect of Demand uncertainly, Fixed order costs, Variable lead frames, Inventory under certainly & uncertainty, Risk Management

UNIT III Distribution strategies: 8 Hrs

Introduction, Centralized vs Decentralized control, Direct shipment, Cross Docking, Push based vs Pull based supply chain.

UNIT IV Strategic alliances: 7 Hrs

Third party Logistics (3PL), Retailer – supplier relationship issues, requirements, success & failures, Distributor integration Types & issues.

UNIT V MIS & SCM 8 Hrs

Relational Data Base Management (RDBMS), System Architecture, Communications, and Implementation of ERP, Decision support systems for SCM: Analytical tools, Presentation tools, Smooth production flow Current issues & directing challenges for future, e-Commerce strategies and world class supply chain management

Textbooks:

1. Sunil Chopra, Peter Meindl, Supply Chain Management: Strategy, Planning, and Operation, 4/e, Pearson, 2010.
2. David N. Burt, Donald W. Dobler , World Class Supply Management: The Key to Supply Chain Management, 2/e, McGraw-Hill/Irwin, 2003

Reference Books:

1. John Joseph Coyle, Edward J. Bardi, C. John Langley, The Management of Business Logistics: A Supply Chain Perspective, South-Western/Thomson Learning, 2003.
2. Upendra Kachru ,Logistics and Supply Chain Management, Excel Books, 2009

Online Learning Resources:

- <https://www.coursera.org/specializations/supply-chain-management>
- <https://www.investopedia.com/terms/s/scm.asp>
- <https://www.youtube.com/watch?v=IZPO5RclZEo>
- <https://www.youtube.com/watch?v=raqi4gjMLm8>
- <https://nptel.ac.in/courses/110108056>
- <https://www.youtube.com/watch?v=Nrl0CtS1m8Y>
- <https://www.digimat.in/nptel/courses/video/110105141/L01.html>
- <https://ocw.mit.edu/courses/engineering-systems-division/esd-273j-logistics-and-supply-chain-management-fall-2009/lecture-notes/>

(20A03M13) STATISTICAL QUALITY CONTROL

Course Objectives:

The objectives of this course are to

- To facilitate the students in knowing the application of statistical techniques in Quality control and assurance.

Course Outcomes:

At the end of the course student will be able to

- Control the quality of processes using control charts for variables in manufacturing industries.
- Control the occurrence of defective product and the defects in manufacturing companies.
- Control the occurrence of defects in service.

UNIT I Introduction 8 Hrs

Statistical concepts for quality- Fundamentals of quality- history, Quality definitions, Quality dimensions, Quality terminology- Inspection, Quality control, SQC, Quality Assurance, Quality planning- policies & objectives, Quality costs – Economics of quality, Quality loss function, Quality Vs productivity, Quality Vs reliability.

UNIT II Statistical Process Control 12 Hrs

Process variation, Control charts for variables- $\bar{X}$, R and S charts- preliminary decisions, computation of control limits, Construction and interpretation, Relation between process in control and specification limits, modified and warning control limits, O.C. curve for $\bar{X}$ chart, Control procedure, adjustment for trend in process mean.

UNIT III Special Control Procedures 8 Hrs

Control charts for attributes- p, np, c and u charts, demerits control chart, O.C curve for p-chart, Control charts for individual measurements- $\bar{X}$ -chart, moving average and moving range charts, cumulative-sum and exponentially weighted moving average control charts, multi-vari chart.

UNIT IV Process And Measurement System Capability 12 Hrs

Process stability, process capability analysis using a Histogram or normal probability plot and control chart, process capability indexes, Gauge capability studies, setting specification limits.

UNIT V Acceptance Sampling 12 Hrs

Acceptance sampling, Economics of sampling, Single sampling plan for attributes- O.C. curve, design, double sampling- O.C. curve, multiple and sequential sampling plans, sampling plans for variables, MIL-STD-105E and MIL-STD-414 & IS2500 standards.

Textbooks:

1. Douglas C Montgomery, Introduction to Statistical Quality Control, Sixth Edition, John Wiley & sons, Inc., 2009. IS 2500 Standard sampling plans
2. E.L. Grant and R.S. Leavenworth, Statistical Quality Control, Seventh Edition, TMH, 2000.
3. Levin R.I. and Rubin D.S., Statistics for Management, 7/e, Prentice Hall of India Pvt. Ltd., New Delhi, 2001

Reference Books:

1. K.Krishnaiah, Applied Statistical Quality Control and Improvement, PHI, 2014.
2. Srivatsava TN, Shailaja Rego, Statistics for Management, Tata McGraw Hill, 2008.
3. Anand Sharma, Statistics for Management, Himalaya Publishing House, Second Revised edition, 2008.

Online Learning Resources:

- https://www.youtube.com/watch?v=5pMWmU_8lfi&list=PLPjSqITyvDeUUUwunywq41yJZofQEzMI
- <https://nptel.ac.in/courses/110105088>
- <https://www.youtube.com/watch?v=TbPUiJKyxqw>
- <https://www.youtube.com/watch?v=xJ3czkvNxpK>

(20A03M14) MANAGEMENT INFORMATION SYSTEMS

Pre-requisite **MEFA**

Course Objectives:

The objectives of this course are to

- ∄ To describe the role of information technology and decision support systems in business and record the current issues with those of the firm to solve business problems.
- ∄ To introduce the fundamental principles of computer-based information systems analysis and design and develop an understanding of the principles and techniques used.
- ∄ To enable students, understand the various knowledge representation methods and different expert system structures as strategic weapons to counter the threats to business and make business more competitive.
- ∄ To enable the students to use information to assess the impact of the Internet and Internet technology on electronic commerce and electronic business and understand the specific threats and vulnerabilities of computer systems.
- ∄ To provide the theoretical models used in database management systems to answer business questions.

Course Outcomes:

At the end of the course student will be able to

- Relate the basic concepts and technologies used in the field of management information systems;
- Compare the processes of developing and implementing information systems.
- Outline the role of the ethical, social, and security issues of information systems.
- Translate the role of information systems in organizations, the strategic management processes, with the implications for the management.
- Apply the understanding of how various information systems like DBMS work together to accomplish the information objectives of an organization.

UNIT I Fundamentals Of Information Systems 8 Hrs
Information systems in business, fundamentals of information systems solving business, problems with information systems. Business Information systems, Transaction processing systems, management information systems and decision support systems. Artificial intelligence technologies in business, information system for strategic applications and issues in information technology.

UNIT II Issues In Managing Information Technology 10 Hrs
Managing information resources and technologies global information technology, management, planning and implementing change, integrating business change with IT, security and ethical challenges in managing IT, social challenges of information technology.

UNIT III Introduction To E-Business 8 Hrs
E-commerce frame work, Media convergence, Consumer applications, Organization applications. E-BUSINESS MODEL: Architectural frame work for E-commerce, Application services and transaction Models – B2C Transactions, B2B Transactions, Intra-Organisational Transactions.

UNIT IV Consumer-Oriented E-Commerce 8 Hrs
Consumer oriented Application: Finance and Home Banking, Home shopping, Home Entertainment, Mercantile Process Models, Consumers perspective, Merchants perspective.

UNIT V Electronics Data Interchange (EDI) 8 Hrs

EDI Concepts, Applications in business – components of international trade, Customs Financial EDI, Electronic fund transfer, Manufacturing using EDI, Digital Signatures and EDI

Textbooks:

1. A OBrien, Management Information systems- managing information technology in the internet worked enterprise- jams. – Tata McGraw Hill publishing company limited, 2002.
2. Laaudon and Laudon, Management Information Systems”, PHI ISBN 81-203-1282-1.1998.

Reference Books:

1. Sadogopan. S., Management Information Systems” 1998 Edition, PHI ISBN 81-20311809
2. Murdick. G.R., Information systems for modern management”, 2ndEdition. PHI.

Online Learning Resources:

- <https://www.youtube.com/watch?v=5JMkdGQCm4k&list=PL4719F414C9FBD659>
- <https://www.youtube.com/watch?v=-18Py3sX5sM>
- <https://www.youtube.com/watch?v=mLR0Xgxa7qc&list=PLRwVotYfwvUGoRz9xYIfmEA5FTVBtYN7q>

(20A03M15) ERGONOMICS

Course Objectives:

The objectives of this course are to

- ∄ Familiarize the fundamentals of human factors in engineering.
- ∄ Explain principles Hours Anthropometry, Ergonomics and product design.
- ∄ Describe the Improvement of human work place through controls.
- ∄ Evaluate the sources of vibration and performance effect of vibration in machine tools.
- ∄ Know the Special purpose lighting for illumination and quality control.

Course Outcomes:

At the end of the course student will be able to

- Describe the sources of vibration and performance effect of vibrations in machine tools(L6)
- Indentify recommended illumination levels. (L3)
- Illustrate the design of major controls in automobiles and machine tools. (L2)
- State the limitations of anthropometric data in ergonomic design. (L4)
- Measure the energy expenditure, respiration, pulse rate and blood pressure during physical exertion. (L4)

UNIT I Fundamentals of Human Factors Engineering 10 Hrs

Human Biological, Ergonomic and psychological capabilities and limitations, Concepts of human factors engineering and ergonomics, Man-Machine system and Design philosophy.

Physical work and energy expenditure: Manual lifting, Work posture, Repetitive motion, Provision of energy for muscular work, Heat stress, Role of oxygen physical exertion, Measurement of energy expenditure, Respiration, Pulse rate and blood pressure during physical work, Physical work capacity and its evaluation.

UNIT II Hours Anthropometry and Ergonomics 10 Hrs

Physical dimensions of the human body as a working machine, Motion size relationships, Static and dynamic anthropometry, Anthropometric design principles, Using anthropometric measures for industrial design.

Ergonomics and product design: Ergonomics in automated systems, Expert systems for ergonomic design, Anthropometric data and its application in ergonomic design, Limitations of anthropometric data, Use of computerized database.

UNIT III Physiological Aspects Of Human At Work 8 Hrs

Stress and fatigue -Physical work capacity - Physiological factors affecting work capacity –Fitness for work –Working hours and shift work- Quantitative work load analysis – Psychological work Demands.

UNIT IV Design Of Environment 10 Hrs

Design and Assessment in Hot, cold workplaces and the design of the physical environment– Noise and vibration- Vision –Human errors and Accidents – OSHA: Ergonomics Safety and Health Management rules – Personal Protective Equipment's.

UNIT V Human Performance 10 Hrs

Human Information receiving and processing – Information theory and its application – Cognitive systems - Mental Work Load -Signal detection theory –Design of Displays and controls

Textbooks:

1. M. S. Sanders and E. J. McCormick, Human Factors in Engineering Design, 7/e, McGraw- Hill International, 1993.
2. Bridger, R. S."Introduction to Ergonomics", 3rd ed. CRC Press, New York and London,2008
3. Martin Helander, "A guide to Ergonomics of Manufacturing", TMH, 2006.

Reference Books:

1. P. V. Karpovich and W. E. Sinning, Physiology of Muscular Activity, 7/e, Saunders (W.B.) Co Ltd., 1971.
2. Applied Ergonomics Handbook, I.P.C. Science and Technology Press Limited, 1974.
3. K. H. E. Kroemer, H. B. Kroemer and K. E. Kroemer Elbert, Ergonomics: How to design for ease and efficiency, 2/e, Pearson Publications, 2001.
4. Philips, Chandler A, "Human Factors Engineering", John Wiley and Sons, Inc. 2000
5. Sanders, M.M. & McCormick, E.J. "Human Factors in Engineering & Design "7th ed., McGraw-Hill, NY,1993

Online Learning Resources:

- <https://www.youtube.com/watch?v=a2x-rCNJn3w>
- https://onlinecourses.swayam2.ac.in/aic20_ed03/preview
- <https://industri.fatek.unpatti.ac.id/wp-content/uploads/2019/03/104-Introduction-to-Human-Factors-and-Ergonomics-for-Engineers-Mark-Lehto-Steven-J.-Landry-Edisi-2-2012.pdf>
- <https://kuliahdianmardi.files.wordpress.com/2016/03/handbook-of-human-factors-and-ergonomics-fourth-edition-2012.pdf>
- <https://oer.galileo.usg.edu/cgi/viewcontent.cgi?article=1000&context=engineering-collections>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (ME) **L T P C**
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(20A03M16) PRODUCTION PLANNING AND CONTROL

Course Objectives:

The objectives of this course are to

- To understand the various components and functions of production planning and control such as work study, product planning, process planning, production scheduling, Inventory Control.
- To know the recent trends like manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

Course Outcomes:

At the end of the course student will be able to

- Upon completion of this course, the students can able to prepare production planning and control activities such as work study, product planning, production scheduling, Inventory Control.
- They can plan manufacturing requirements manufacturing requirement Planning (MRP II) and Enterprise Resource Planning (ERP).

UNIT I Introduction 8 Hrs

Objectives and benefits of planning and control-Functions of production control-Types of production- job-batch and continuous-Product development and design-Marketing aspect - Functional aspects- Operational Aspect-Durability and dependability aspect aesthetic aspect. Profit consideration- Standardization, Simplification & specialization- Break even analysis-Economics of a new design.

UNIT II Work Study 12 Hrs

Method study, basic procedure-Selection-Recording of process - Critical analysis, Development - Implementation - Micro motion and memo motion study – work measurement - Techniques of work measurement - Time study - Production study - Work sampling - Synthesis from standard data - Predetermined motion time standards.

UNIT III Product Planning And Process Planning 8 Hrs

Product planning-Extending the original product information-Value Analysis-Problems in lack of product planning-Process planning and routing-Pre requisite information needed for process planning- Steps in process planning-Quantity determination in batch production-Machine capacity, balancing- Analysis of process capabilities in a multi-product system.

UNIT IV Production Scheduling 12 Hrs

Production Control Systems-Loading and scheduling-Master Scheduling-Scheduling rules-Gantt charts-Perpetual loading-Basic scheduling problems - Line of balance – Flow production scheduling- Batch production scheduling-Product sequencing – Production Control systems- Periodic batch control-Material requirement planning kanban – Dispatching-Progress reporting and expediting- Manufacturing lead time- Techniques for aligning completion times and due dates.

UNIT V Inventory Control And Recent Trends In Ppc 10 Hrs

Inventory control-Purpose of holding stock-Effect of demand on inventories-Ordering procedures. Two bin system - Ordering cycle system-Determination of Economic order quantity and economic lot size- ABC analysis - Recorder Procedure-Introduction to computer integrated production planning systems- elements of Just In Time Systems-Fundamentals of MRP II and ERP.

Textbooks:

1. James. B. Dilworth,” Operations management – Design, Planning and Control for manufacturing and services” McGraw Hill International edition 1992.
2. Martand Telsang, “Industrial Engineering and Production Management”, First edition, S. Chand and Company, 2000.

Reference Books:

1. Chary. S.N., “Theory and Problems in Production & Operations Management”, Tata McGraw Hill, 1995.
2. Elwood S.Buffa, and Rakesh K.Sarin, “Modern Production / Operations Management”, 8th Edition John Wiley and Sons, 2000.
3. Jain. K.C. & Aggarwal. L.N., “Production Planning Control and Industrial Management”, Khanna Publishers, 1990.
4. Kanishka Bedi, “Production and Operations management”, 2nd Edition, Oxford university press, 2007.
5. Melynk, Denzler, “Operations management – A value driven approach” Irwin McGraw hill.
6. Norman Gaither, G. Frazier, “Operations Management” 9th Edition, Thomson learning IE, 2007
7. Samson Eilon, “Elements of Production Planning and Control”, Universal Book Corpn.1984
8. Upendra Kachru, “Production and Operations Management – Text and cases” 1st Edition, Excel books 2007

Online Learning Resources:

- <https://www.youtube.com/watch?v=yYIVumq6sVM>
- <https://nptel.ac.in/courses/110107141>
- <https://nptel.ac.in/courses/112107143>
- <https://www.youtube.com/watch?v=Q7KpUY8spmM>

(20A03M17) CUSTOMER RELATIONSHIP MANAGEMENT

Pre-requisite	MEFA
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Course Objectives:

The objectives of this course are to

- ∄ Introduce basic concepts and principles of customer relationship management (CRM).
- ∄ Familiarize with appreciate the role and changing face of CRM as an IT enabled function.
- ∄ Describe concept of managing and sharing customer data.
- ∄ Explain the principles of CRM links in e-Business.
- ∄ Expose the students on Enterprise resource planning (ERP),supply chain management (SCM) and Supplier relationship management (SRM).

Course Outcomes:

At the end of the course student will be able to

- Summarizes the how CRM works in industries. (L2)
- Discuss about market basket analysis (MBA). (L6)
- Develop the skills related to predict the behaviour and retention of the customer. (L6)
- Explain the concepts of customer relationship management. (L2)

UNIT I	CRM concepts	8 Hrs
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CRM concepts - Acquiring customers, - Customer loyalty and optimizing customer relationships - CRM defined - success factors, the three levels of Service/ Sales Profiling - Service Level Agreements (SLAs), creating and managing effective SLAs.

UNIT II	CRM in Marketing	8 Hrs
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CRM in Marketing - One-to-one Relationship Marketing - Cross Selling & Up Selling - Customer Retention, Behaviour Prediction - Customer Profitability & Value Modeling, - Channel Optimization - Event-based marketing, - CRM and Customer Service - The Call Centre, Call Scripting - Customer Satisfaction Measurement.

UNIT III	Sales Force Automation	8 Hrs
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Sales Force Automation - Sales Process, Activity, Contact- Lead and Knowledge Management - Field Force Automation. - CRM links in e-Business - E-Commerce and Customer Relationships on the Internet - Enterprise Resource Planning (ERP), - Supply Chain Management (SCM), - Supplier Relationship Management (SRM), - Partner relationship Management (PRM).

UNIT IV	Analytical CRM	8
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Analytical CRM - Managing and sharing customer data - Customer information databases - Ethics and legalities of data use - Data Warehousing and Data Mining concepts - Data analysis - Market Basket Analysis (MBA), Click stream Analysis, Personalization and Collaborative Filtering.

UNIT V	CRM Implementation	8 Hrs
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CRM Implementation - Defining success factors - Preparing a business plan requirements, justification and processes. - Choosing CRM tools - Defining functionalities - Homegrown versus out-sourced approaches - Managing customer relationships - conflict, complacency, Resetting the CRM strategy. Selling CRM internally - CRM development Team - Scoping and prioritizing - Development and delivery - Measurement.

Textbooks:

1. Alok Kumar Rai, Customer Relationship Management Concept & Cases, Prentice Hall Of

- India Private Limited, New Delhi. 2011.
2. S. Shanmugasundaram, Customer Relationship Management, Prentice Hall Of India Private Limited, New Delhi, 2008.

Reference Books:

1. Kaushik Mukherjee, Customer Relationship Management, Prentice Hall Of India Private Limited, New Delhi, 2008.
2. Jagdish Seth, Et Al, Customer Relationship Management.
3. V. Kumar & Werner J., Customer Relationship Management, Willey India, 2008.

Online Learning Resources:

- <https://nptel.ac.in/courses/110105145>
- https://onlinecourses.swayam2.ac.in/imb19_mg10/preview
- <https://www.classcentral.com/course/swayam-customer-relationship-management-13977>
- <https://www.edx.org/course/customer-relationship-management>

(20A03M18) MARKETING MANAGEMENT

Course Objectives:

The objectives of this course are to

- Developing an understanding of ideas and nuances of modern marketing.
- Describe the process to formulate and manage the B2B marketing strategy including all key components.
- Explain the techniques to conduct market analysis practices including market segmentation and targeting.
- Compare and contrast different perspectives that characterize the study of consumer behavior.
- Explain the role of IMC in the overall marketing program.

Course Outcomes:

At the end of the course student will be able to

- Knowledge of analytical skills in solving marketing related problem.
- Awareness of marketing management process
- Students will be able to identify the scope and significance of Marketing in Domain Industry
- Students will be able to examine marketing concepts and phenomenon to current business events In the Industry.
- Students will be able to coordinate the various marketing environment variables and interpret them for designing marketing strategy for business firms
- Students will be able to illustrate market research skills for designing innovative marketing strategies for business firms

UNIT I Introduction 8 Hrs

Marketing – Definitions - Conceptual frame work – Marketing environment: Internal and External - Marketing interface with other functional areas – Production, Finance, Human Relations Management, Information System. Marketing in global environment – Prospects and Challenges.

UNIT II Marketing Strategy 12 Hrs

Marketing strategy formulations – Key Drivers of Marketing Strategies - Strategies for Industrial Marketing – Consumer Marketing — Services marketing – Competitor analysis - Analysis of consumer and industrial markets – Strategic Marketing Mix components.

UNIT III Marketing Mix Decisions 8 Hrs

Product planning and development – Product life cycle – New product Development and Management – Market Segmentation – Targeting and Positioning – Channel Management – Advertising and sales promotions – Pricing Objectives, Policies and methods.

UNIT IV Buyer Behaviour 12 Hrs

Understanding industrial and individual buyer behaviour - Influencing factors – Buyer Behaviour Models – Online buyer behaviour - Building and measuring customer satisfaction – Customer relationships management – Customer acquisition, Retaining, Defection.

UNIT V Marketing Research & Trends In Marketing 10 Hrs

Marketing Information System – Research Process – Concepts and applications: Product – Advertising – Promotion – Consumer Behaviour – Retail research – Customer driven organizations - Cause related marketing - Ethics in marketing –Online marketing trends.

Textbooks:

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14/e, 2012
2. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2/e, 2011.
3. Kotler, Philip (2002) Marketing Management, Millennium Edition. Intl ed. US: Prentice Hall, 2002

Reference Books:

1. Philip Kotler and Kevin Lane Keller, Marketing Management, PHI 14th Edition, 2012
2. KS Chandrasekar, “Marketing management-Text and Cases”, Tata McGraw Hill, First edition, 2010

3. Lamb, hair, Sharma, Mc Daniel– Marketing – An Innovative approach to learning and teaching-A south Asian perspective, Cengage Learning — 2012
4. Paul Baines, Chris Fill and Kelly Page, Marketing, Oxford University Press, 2/e,2011.
5. Micheal R.Czinkota & Masaaki Kotabe, Marketing Management, Cengage, 2000.

Online Learning Resources:

- <https://nptel.ac.in/courses/110104068>
- <https://www.youtube.com/watch?v=uTIfDBH80HU&list=PLPjSqITyvDeUgSjU9XcEdZmd5Epz1L-Yn>
- <https://www.youtube.com/watch?v=XD7Ie16qMT4&list=PLNsppmbLKJ8JSbzCxO8TYG8HDxxO5sSmV>

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B.Tech (ECE) **L T P C**
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(20A04M01) INTRODUCTION TO INTERNET OF THINGS

Course Objectives:

Students will understand the concepts of Internet of Things and can able to build IoT applications.

Course Outcomes:

- Understand the concepts of Internet of Things
- Identify hardware and software components of Internet of Things
- Analyze basic communication protocols
- Design IoT applications in different domain and be able to analyze their performance

UNIT 1

Introduction to IoT: Architectural overview, Design principles and needed capabilities, IoT Applications, Sensing, Actuation, Basics of Networking, M2M and IoT Technology Fundamentals- Devices and gateways, Data management, Business processes in IoT, Role of cloud in IoT

UNIT II

Elements of IoT: Hardware components – computing (Arduino, Raspberry Pi), communication, Sensing, Actuation, I/O interfaces Software Components- Programming APIs (Using python/Arduino) for communication protocols-MQTT, Zigbee, Bluetooth, CoAP, UDP, TCP

UNIT III

Sensing and Actuation: Definition of Sensor, Sensor features, Resolution, Classes, Different types of sensors, Actuator, Different types of Actuators, purpose of Sensors and Actuators in IoT

UNIT IV

IoT Application Development: Solution frame work for IoT Applications-Implementation of Device integration, Data acquisition and Integration, Device data storage on cloud/local server, Authentication, authorization of Devices

UNIT V

IoT Case Studies: IoT Case studies and mini projects based on industrial Automation, Transportation, Agriculture, Healthcare, Home Automation.

Textbooks:

1. Vijay Madiseti, ArshdeepBahga, “Internet of Things a Hands-On- Approach”,2014.

References:

1. Dr SRN Reddy, Rachit Thukral and Manasi Mishra ,” Introduction to Internet of Things”: A practical Approach” ETI Labs
2. Raj Kamal , “ Internet of Things: Architecture and Design”, McGraw Hill
3. Adrian McEwen, “Designing the Internet of Things”, Wiley Publishers, 2013

(20A04M02) IOT WITH ARDUINO, ESP, AND RASPBERRY PI

Course Objective:

- To give students hands-on experience using different IoT architectures.
- To provide skills for interfacing sensors and actuators with different IoT architectures.
- To develop skills on data collection and logging in the cloud.

UNIT I

IoT- introduction and its components, IoT building blocks, Sensors and Actuators, IoT Devices, IoT boards (Arduino Uno, ESP 8266-12E Node MCU, and Raspberry Pi 3).

UNIT II

Arduino Uno – getting started with the Uno boards, blink program, connection of sensors to the Uno board, reading values of sensors from the Uno board, interrupts.

Case study: Temperature/Humidity Control; Case Study: Sending values Temperature/Humidity values to the Internet via GSM module.

UNIT III

ESP 8266-12E Node MCU – getting started with the ESP board, Micropython and Esplora IDE, Flushing the ESP8266 board with micropython, connecting sensors to the ESP board, Connecting ESP board to WiFi, Interfacing ESP with the Cloud (REST API-GET, POST, MQTT), interrupts, comparison of ESP 32 board with the ESP 8266 board.

Case Study: Switching light on /off remotely.

Case Study: Voice-based Home Automation for switching lights on/off (Android phone – Google Assistant (Assistant <-> IFTTT), MQTT (ESP <-> IFTTT), ESP 8266 <-> Lights).

UNIT IV

Raspberry Pi 3 - Rpi3 introduction and installing the Raspbian Stretch OS, Headless Computer and Rpi3 configuration to connect through SSH via Ethernet, Headless - connecting Rpi3 remotely without Ethernet cable via SSH, IP address, Rpi 3 - Testing the GPIO pins through Scripts.

UNIT V

Raspberry Pi3 interfacing with Sensor DHT11, Raspberry pi3 python library install and reading sensor feed, 'Plug and play ' type cloud platform overview for integration to IOT devices, 'Plug and play' cloud platform for integration to IOT device - actuator (LED), Plug and play platform - Custom widget (DHT11-Sensor) integration through Python.

New -Raspeberry Pi 4 Vs Raspberry Pi3 Model B Comparison, LoRawan /LPWAN – Overview.

Textbooks:

1. Rao, M. (2018). Internet of Things with Raspberry Pi 3: Leverage the power of Raspberry Pi 3 and JavaScript to build exciting IoT projects. Packt Publishing Ltd.
2. Arduino for Beginners: Essential Skills Every Maker Needs, Baichtal, J. (2013).. Pearson Education.
3. Internet of Things with ESP8266, Schwartz, M. (2016).. Packt Publishing Ltd.

References:

1. “Getting started with Raspberry Pi”, Richardson, M., & Wallace, S. (2012).. O’Reilly Publisher Media, Inc.

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B.Tech (ECE) **L T P C**
3 1 0 4
(20A04M04) COMMUNICATION TECHNOLOGIES FOR IOT

Course Objective:

- To make student to acquire knowledge about transferring data using various Wired/Wireless communication technologies.

Course Outcomes: After completion of this course the students will be able to

- Design communication architecture
- Work with various communication technologies (Wired/Wireless)
- Work with various protocols
- Configure and test communication technologies

UNIT I

Communications and Information Theory: Communication theory, RF energy and theoretical range, RF interference, Information theory, Bitrate limits and the Shannon-Hartley theorem, Bit error rate, Narrowband versus wideband communication, The radio spectrum, Governing structure

UNIT II

Wireless personal area network standards: 802.15 standards

Bluetooth: Bluetooth history, Bluetooth 5 communication process and topologies, stack, PHY and interference, packet structure, BR/EDR operation, BLE operation, Bluetooth profiles, BR/EDR security, BLE security, Beaconing, Range and speed enhancement, mesh introduction, mesh topology, mesh addressing modes, mesh provisioning

IEEE 802.15.4: Architecture, topology

Zigbee: Overview, PHY and MAC, protocol stack, addressing and packet structure, mesh routing association, security

UNIT III

Internet protocol and transmission control protocol: IP role in IoT

WPAN with IP – 6LoWPAN: Topology, Protocol stack, Mesh addressing and routing, Header compression and fragmentation, Neighbor discovery, 6LoWPAN security.

IEEE 802.11 protocols and WLAN: IEEE 802.11 suite of protocols and comparison, architecture, modulation and encoding techniques, MIMO, packet structure, operation, security

UNIT IV

Cellular connectivity: Governance models and standards, Cellular access technologies, 4G-LTE spectrum allocation and bands, topology and architecture

LoRa and LoRaWAN: LoRa physical layer, LoRaWAN MAC layer, topology

UNIT V:

IoT Edge to Cloud Protocols:

MQTT: MQTT publish-subscribe, architecture details, packet structure, communication formats working example

MQTT-SN: Architecture and topology, differences between MQTT and MQTT-SN

Constrained Application Protocol: CoAP architecture details, messaging formats, usage example

Other protocols: STOMP, AMQP

Textbooks:

1. Internet of Things for Architects, Perry Lea, Packt Publications, 2018
2. Internet of Things Principles and Paradigms, Rajkumar Buyya, Amir Vahid Dastjerdi, Elsevier, 2016.

(20A04M06) INTRODUCTION TO DATA ANALYTICS

Course Objective:

- Provide you with the knowledge and expertise to become a proficient data scientist
- Demonstrate an understanding of statistics and machine learning concepts that are vital for data science.
- Produce Python code to statistically analyze a dataset.
- Critically evaluate data visualizations based on their design and use for communicating stories from data.

UNIT I

Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.

UNIT II

Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA-Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions.

UNIT III

Feature Generation and Feature Selection (Extracting Meaning from Data)- Motivating application: user (customer) retention- Feature Generation (brainstorming, role of domain expertise, and place for imagination)- Feature Selection algorithms.

UNIT IV

Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.

UNIT V

Applications of Data Science, Data and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.

Textbooks:

1. Data Science from Scratch, Joel Grus, Shroff Publisher Publisher /O'Reilly Publisher Media
2. Numsense! Data Science for the Layman, Annalyn Ng, Kenneth SooShroff Publisher Publisher
3. Doing Data Science, Straight Talk from The Frontline, Cathy O'Neil and Rachel Schutt, O'Reilly Publisher Media.

References:

1. Mining of Massive Datasets. v2.1, Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Cambridge University Press.
2. Python Data Science Handbook, Jake VanderPlas, Shroff Publisher Publisher /O'Reilly Publisher Media
3. Data Analysis with Open Source Tools, Philipp Janert, Shroff Publisher Publisher /O'Reilly Publisher Media.

(20A05M01) INTRODUCTION TO DATA SCIENCE

Pre-requisite DBMS

- The objective of the data scientist is to explore, sort and analyze data from various sources in order to take advantage of them and reach conclusions to optimize business processes or for decision support.

Course Outcomes:

After completion of the course, students will be able to

- Develop relevant programming abilities.
- Demonstrate proficiency with statistical analysis of data.
- Develop the ability to build and assess data-based models.
- Execute statistical analyses with professional statistical software.
- Demonstrate skill in data management.
- Apply data science concepts and methods to solve problems in real-world contexts and will communicate these solutions effectively

UNIT I

Lecture 8Hrs

Getting started with Data Science: Introduction, exploring data engineering pipelines and infrastructure, applying data driven insights to business and industry

UNIT II

Lecture 9Hrs

Using Data science to extract meaning from data: Machine learning: Learning from data with your machine, Math, probability, and statistical Modeling, using clustering to subdivide data, Modeling with instances, building models that operate internet of things devices.

UNIT III

Lecture 9Hrs

Creating data visualization that clearly communicate meaning: Following the principles of data visualization design, using d3.js for data visualization, Web based applications for visualization design, exploring best practices in dashboard design, Making maps from spatial data.

UNIT IV

Lecture 8Hrs

Computing for Data science: Using python for data science, using open-source R for Data science, Using SQL in Data science, doing data science with excel and knime

UNIT V

Lecture 8Hrs

Applying domain expertise to solve real-world problems using data science: Data science for driving growth in E-Commerce, using data science to describe and predict Criminal activity, Data science tools and Applications.

Textbooks:

1. Lillian Pierson, Data Science for Dummies, 2nd edition, John Wiley& Sons, 2017

Reference Books:

1. Fundamentals of data science by Arvim Blum, john hope croft, Ravindran Kannan
2. Understanding Machine Learning: From Theory to Algorithms by shaiselvshawrtaz, shaiben David

Online Learning Resources:

Coursera: Rav Ahuja, IBM Data Science Professional Certificate course(s)
 NPTEL course: Python for Data Science

(20A05M02) DATA SCIENCE LAB

Pre-requisite **DBMS, Python programming**

Course Objectives:

- Understand the process of Importing and Exporting the data.
- Learn how to collect, store and manage data from multiple data sources.
- Know the insights of data using statistical methods
- Identify different techniques for data analysis and data visualization.
- Discuss the applications of Data Science for real world problems.

Course Outcomes (CO):

After completion of the course, students will be able to

- Examine the process for importing and exporting the data.
- Apply appropriate data collection and pre-processing methods.
- Identify different data analysis Techniques suitable for a given applications
- Demonstrate data visualization techniques for Data Analysis.

List of Experiments:

1. a. Write program to create a list, manipulate and slices it.
 b. Create a new list and add elements to it from another list, and creates a matrix from two lists
 c. Create same a, b steps for Tuple and Dictionary
2. Write a program for Accessing/Importing and Exporting Data
3. The following table gives the size of the floor area (ha) and the price (\$A000), for 15 houses sold in the Canberra (Australia) suburb of Aranda in 1999. are

s.no	sale	prices
1	694	192.0
2	905	215.0
3	802	215.0
4	1366	274.0
5	716	112.7
6	963	185.0
7	821	212.0
8	714	220.0
9	1018	276.0
10	887	260.0
11	790	221.5
12	696	255.0
13	771	260.0
14	1006	293.0
15	1191	375.0

Explore with different formats of data and describe the procedure of storing of data Type these data into a data frame with column names area, sale and Price. (a) Plot sale. Price versus area. (b) Use the hist () command to plot a histogram of the sale prices. (c) Repeat (a) and (b) after taking logarithms of sale prices. (d) The two histograms emphasize different parts of the range of sale prices. Describe the differences

4. Develop an application to analyze Stock Market Data using Python tools
5. Given the iris dataset:
<https://archive.ics.uci.edu/ml/datasets/iris>
 1. Compute the average petal length
 2. Compute the average of all numerical columns
 3. Extract the petal length outliers (i.e., those rows whose petal length is 50% longer

aggregate () group by (), than the average petal length)

4. Compute the standard deviation of all columns, for each iris species

6. Extract the group-wise petal length outliers, i.e., find the outliers (as above) for each iris species using, and merge (). Write a python program to compute all the functionalities of the above-mentioned data
7. Consider the Iris data set, write a python script to arrange the attributes in hierarchical structure and perform clustering with similar attributes.
8. Develop an application to Analyze twitter data with Python tools.
9. Develop an application for Text Data Analysis using Python Tools.
10. Demonstrate Object detection in an image.

References:

1. Joel Grus, Data Science from Scratch, O'Reilly Publications.
2. Davy Ceilen, Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, DreamTech Publications.

Online Learning Resources/Virtual Labs:

1. <https://www.coursera.org/browse/data-science>

(20A05M03) FUNDAMENTALS OF DEEP LEARNING

Pre-requisite Knowledge about working of Computers

Course Objectives:

- This course will introduce the theoretical foundations, algorithms, methodologies, and applications of neural networks and deep learning.
- Design and develop an application-specific deep learning models and also provide the practical knowledge handling and analyzing real world applications.

Course Outcomes:

After completion of the course, students will be able to

- Differentiate machine learning and deep learning techniques
- Understand the concept of CNN and transfer learning techniques, to apply it in the classification problems
- Learned to use RNN for language modelling and time series prediction.
- Use autoencoder and deep generative models to solve problems with high dimensional data including text, image and speech.
- Design and implement various machine learning algorithms in a range of real-world applications.

UNIT I

Lecture 8 Hrs

Introduction to Deep Learning & Architectures:

Machine Learning Vs. Deep Learning, Representation Learning, Width Vs. Depth of Neural Networks, Activation Functions: RELU, LRELU, ERELU, Unsupervised Training of Neural Networks, Restricted Boltzmann Machines, Auto Encoders.

UNIT II

Lecture 9 Hrs

Convolutional Neural Networks:

Architectural Overview – Motivation - Layers – Filters – Parameter sharing – Regularization, Popular CNN Architectures: ResNet, AlexNet.

Transfer Learning:

Transfer learning Techniques, Variants of CNN: DenseNet, PixelNet.

Lecture 8 Hrs

UNIT III

Sequence Modelling – Recurrent and Recursive Nets:

Recurrent Neural Networks, Bidirectional RNNs – Encoder-decoder sequence to sequence architectures - BPTT for training RNN, Long Short-Term Memory Networks.

UNIT IV

Lecture 9 Hrs

Machine Learning Basics:

Learning algorithms, Maximum likelihood estimation, Building machine learning algorithm, Neural Networks Multilayer Perceptron, Back-propagation algorithm and its variants Stochastic gradient decent, Curse of Dimensionality.

Lecture 9 Hrs

UNIT V

Auto Encoders:

Under complete Autoencoders – Regularized Autoencoders – stochastic Encoders and Decoders – Contractive Encoders.

Deep Generative Models:

Deep Belief networks – Boltzmann Machines – Deep Boltzmann Machine - Generative Adversarial Networks.

Textbooks:

1. Ian Goodfellow, YoshuaBengio, Aaron Courville, “Deep Learning”, MIT Press,2016.
2. Josh Patterson and Adam Gibson, “Deep learning: A practitioner's approach”, O'Reilly Media, First Edition,2017.

Reference Books:

1. Fundamentals of Deep Learning, Designing next-generation machine intelligence algorithms, Nikhil Buduma, O'Reilly, Shroff Publishers,2019.
2. Deep learning Cook Book, Practical recipes to get started Quickly, DouweOsinga, O'Reilly, Shroff Publishers,2019.

Online Learning Resources:

1. Coursera: Andrew Ng, Machine Learning
2. Edx: IBM Professional Certificate on Deep Learning
3. <https://keras.io/datasets/>
4. <http://deeplearning.net/tutorial/deeplearning.pdf>.

Pre-requisite **Machine learning Theory, Deep Learning Theory, Fundamentals of programming, Python programming**

Course Objectives:

- Understand the context of Neural networks and deep learning.
- Introduce major Deep learning algorithms, the problem settings, and their applications to solve real world problems

Course Outcomes (CO):

After completion of the course, students will be able to

- Identify the Deep learning algorithms which are more appropriate for various types of learning tasks in various domains
- Implementing Deep learning algorithms and solve real- world problems.

List of Experiments:

1. Basic image processing operations: Histogram equalization, thresholding, edge detection, data augmentation, morphological operations
2. Implement SVM/SoftMax classifier for CIFAR-10 dataset:
 - (i) using KNN,
 - (ii) using 3-layer neural network
3. Study the effect of batch normalization and dropout in neural network classifier
4. Familiarization of image labelling tools for object detection, segmentation
5. Image segmentation using Mask RCNN, UNet, SegNet
6. Object detection with single-stage and two-stage detectors (Yolo, SSD, FRCNN, etc.)
7. Image Captioning with Vanilla RNNs
8. Image Captioning with LSTMs
9. Network Visualization: Saliency maps, Class Visualization
10. Generative Adversarial Networks
11. Chatbot using bi-directional LSTMs
12. Familiarization of cloud-based computing like Google colab

References:

1. “Deep Learning (Adaptive Computation and Machine Learning series)”, Yoshua Bengio,2016.

Online Learning Resources/Virtual Labs:

1. Introduction to Deep Learning Course | Introduction to Deep Learning Course (rses-dl-course.github.io)
2. Deep Learning | Introduction to Long Short-Term Memory - GeeksforGeeks

(20A05M05) PRINCIPLES OF SOFTWARE DEVELOPMENT & OPERATIONS

Pre-requisite **Fundamentals of Software Engineering, Fundamentals of Programming**

Course Objectives:

- Understand collaboration and productivity by automating infrastructure and workflows
- Familiarize with continuous measuring applications performance

Course Outcomes:

After completion of the course, students will be able to

- Enumerate the principles of continuous development and deployment, automation of
- configuration management, inter-team collaboration, and IT serviceability
- Describe DevOps & DevSecOps methodologies and their key concepts
- Illustrate the types of version control systems, continuous integration tools,
- continuous monitoring tools, and cloud models
- Set up complete private infrastructure using version control systems and CI/CD tools

UNIT I

Lecture 8Hrs

Phases of Software Development life cycle. Values and principles of agile software development

UNIT II

Lecture 9Hrs

Fundamentals of DevOps: Architecture, Deployments, Orchestration, Need, Instance of applications, DevOps delivery pipeline, DevOps eco system.

UNIT III

Lecture 9Hrs

DevOps adoption in projects: Technology aspects, Agiling capabilities, Tool stack implementation, People aspect, processes

UNIT IV

Lecture 8Hrs

CI/CD: Introduction to Continuous Integration, Continuous Delivery and Deployment, Benefits of CI/CD, Metrics to track CICD practices

UNIT V

Lecture 8Hrs

Devops Maturity Model: Key factors of DevOps maturity model, stages of Devops maturity model, DevOps maturity Assessment

Textbooks:

1. The DevOps Handbook: How to Create World-Class Agility, Reliability, and Security in Technology Organizations, Gene Kim, John Willis, Patrick Debois, Jez Humb,1st Edition, O'Reilly publications,2016.
2. What is Devops? Infrastructure as code, 1st Edition, Mike Loukides, O'Reilly publications,2012.

Reference Books:

1. Building a DevOps Culture, 1st Edition, Mandi Walls, O'Reilly publications,2013.
2. The DevOps 2.0 Toolkit: Automating the Continuous Deployment Pipeline with Containerized Microservices, 1st Edition, Viktor Farcic, CreateSpace Independent Publishing Platform publications,2016
3. Continuous Delivery: Reliable Software Releases Through Build, Test, and Deployment Automation, 1st Edition, Jez Humble and David Farley,2010.
4. Achieving DevOps: A Novel About Delivering the Best of Agile, DevOps,andmicroservices, 1st Edition, Dave Harrison, Knox Lively, Apress

publications, 2019

Online Learning Resources:

1. <https://www.javatpoint.com/devops>
2. <https://github.com/nkatre/Free-DevOps-Books-1/blob>
3. Coursera: IBM DevOps on AWS and DevOps and Software Engineering

(20A05M06) APPLICATIONS OF AI & DS

Pre-requisite **Artificial Intelligence, Machine Learning, Data Science**

Course Objectives:

- Demonstrate data analytics
- Understand the relation between big data and AI
- Discuss various applications of AI

Course Outcomes:

After completion of the course, students will be able to

- Apply AI in various fields
- Know the prospects in the Data Science field
- Summarize past, present and future of Artificial Intelligence
- Develop AI Applications involving huge data

Lecture 9Hrs

UNIT I

The story of big data, Artificial intelligence, Machine learning and Big data, why is Big Data useful?
Use cases for data analytics,

UNIT II

Lecture 8Hrs

Understanding the big data ecosystem, How Big data can help guide your strategy, forming your strategy for Big Data and Data Science.

UNIT III

Lecture 9Hrs

Implementing Data Science Analytics, Algorithms and Machine Learning, choosing your technologies, Building your team.

Lecture 10Hrs

UNIT - IV

AI Business Models, AI and Speech Recognition: Conversation Interfaces, The Challenges towards Master bots, how is the market distributed? Final food for thoughts.

AI and Insurance: A bit of background, so how can AI help the Insurance Industry? Who are the sector innovators? Concluding thoughts.

AI and Financial Services: Financial Innovations, Innovation transfer, Financial Disruptor, Segmentation of AI in Fintech.

AI and Blockchain: Non-technical introduction to Block chain, A Digression on initial coin offerings, How AI can change Block chain, How Block chain can change AI, Decentralized Intelligent Companies.

UNIT V

Lecture 10Hrs

New Roles in AI: Hiring new figures to lead the data revolution, The chief data officer, The chief artificial intelligent officer, The chief robotics officer.

AI and Ethics: How to design machines with ethically significant behaviors, data and biases, accountability and trust, AI usage and the control problem, AI safety and catastrophic risks.

AI and Intellectual property: Why startup patent inventions, the advantages of patenting your product, reasons behind not looking for patent production, the patent landscape.

AI and Venture Capital: The Rationale, Personal and team characteristics, financial considerations, business features, industry knowledge, an outsider study: Hobos and Highfliers.

Textbooks:

1. David Stephenson, Big data demystified, Pearson
2. Francesco Corea, An Introduction to data, everything you need to know about AI, Big Data, Data Science, Springer, 2019

Reference Books:

1. Johnson, Benny G., Fred Phillips, and Linda G. Chase. "An intelligent tutoring system for the accounting cycle: Enhancing textbook homework with artificial intelligence." Journal of Accounting Education 27.1 (2009): 30-39.

Online Learning Resources:

1. AI Foundations for Everyone | Coursera
2. IBM Data Science Professional Certificate | Coursera

(20A05M07) VIRTUAL REALITY

Pre-requisite **Coordinate Geometry, Fundamentals of Programming**

Course Objectives:

- This course is designed to give historical and modern overviews and perspectives on virtual reality. It describes the fundamentals of sensation, perception, technical and engineering aspects of virtual reality systems.

Course Outcomes:

After completion of the course, students will be able to

- Describe how VR systems work and list the applications of VR.
- Understand the design and implementation of the hardware that enables VR systems to be built.
- Understand the system of human vision and its implication on perception and rendering.
- Explain the concepts of motion and tracking in VR systems.
- Describe the importance of interaction and audio in VR systems.

UNIT I Introduction to Virtual Reality Lecture 8 Hrs

Defining Virtual Reality, History of VR, Human Physiology and Perception, Key Elements of Virtual Reality Experience, Virtual Reality System, Interface to the Virtual World-Input & output- Visual, Aural & Haptic Displays, Applications of Virtual Reality Case Study: Study the use of Virtual Reality at NASA

UNIT II Representing the Virtual World, The Geometry of Virtual Lecture 8 Hrs
Worlds & The Physiology of Human Vision

Representation of the Virtual World, Visual Representation in VR, Aural Representation in VR and Haptic Representation in VR

Geometric Models, Changing Position and Orientation, Axis-Angle Representations of Rotation, Viewing Transformations, Chaining the Transformations, Human Eye, eye movements & implications for VR

UNIT III Visual Perception & Rendering Lecture 10 Hrs

Visual Perception - Perception of Depth, Perception of Motion, Perception of Color, Combining Sources of Information Visual Rendering -Ray Tracing and Shading Models, Rasterization, Correcting Optical Distortions, Improving Latency and Frame Rates

UNIT IV Motion & Tracking Lecture 10 Hrs

Motion in Real and Virtual Worlds- Velocities and Accelerations, The Vestibular System, Physics in the Virtual World, Mismatched Motion and Vection Tracking- Tracking 2D & 3D Orientation, Tracking Position and Orientation, Tracking Attached Bodies

UNIT V Interaction & Audio Lecture 9 Hrs

Interaction - Motor Programs and Remapping, Locomotion, Manipulation, Social Interaction. Audio -The Physics of Sound, The Physiology of Human Hearing, Auditory Perception, Auditory Rendering

Textbooks:

1. Virtual Reality, Steven M. LaValle, Cambridge University Press, 2016
2. Understanding Virtual Reality: Interface, Application and Design, William R Sherman and Alan B Craig, (The Morgan Kaufmann Series in Computer Graphics)". Morgan Kaufmann Publishers, San Francisco, CA, 2002
3. Developing Virtual Reality Applications: Foundations of Effective Design, Alan B Craig, William R Sherman and Jeffrey D Will, Morgan Kaufmann, 2009.

Reference Books:

1. Gerard Jounghyun Kim, "Designing Virtual Systems: The Structured Approach", 2005.
2. Doug A Bowman, Ernest Kujff, Joseph J LaViola, Jr and Ivan Poupyrev, "3D User Interfaces, Theory and Practice", Addison Wesley, USA, 2005.

3. Oliver Bimber and Ramesh Raskar, “Spatial Augmented Reality: Merging Real and Virtual Worlds”, 2005.
4. Burdea, Grigore C and Philippe Coiffet, “Virtual Reality Technology”, Wiley Interscience, India, 2003.

Online Learning Resources:

1. Coursera: Virtual Reality Specialization
2. NPTEL course: Prof. Steven LaValle, Virtual Reality, IIT Madras,

(20A05M08) FREE & OPEN SOURCE SOFTWARE FOR VR-AR

Pre-requisite Fundamentals of Programming and Internet

Course Objectives:

- The objective of this course is to explain how Unity and other open source software supports the many components of a VR app, including tracking, teleporting, interacting with virtual objects and at the same time to see how Unity's AR Foundation supports building AR apps

Course Outcomes:

- Compare and Contrast VR and AR experiences
- Demonstrate and develop VR apps in Unity
- Demonstrate and develop AR apps in Unity
- Acquire knowledge in VR and AR technologies in terms of used devices, building of the virtual environment and modalities of interaction and modelling.
- Acquire knowledge about the application of VR and AR technologies in medicine, education, cultural heritage and games
- Understand Web based VR

UNIT I Introduction to AR & VR Lecture Hrs 8

Introduction to VR and WebVR: Introducing Virtual Reality, Types of VR Hardware Setup, Web Based Virtual Reality, Opportunities for WebVR Applications, Current State of WebVR, Virtual Reality Devices Available in the Market.

Bringing VR to the Web and WebVR Frameworks: The WebVR API, What Is MozVR? Is Your Browser WebVR Enabled? WebVR Developer Tools.

Setting Up Your VR Lab and Popular WebVR Projects: Google: Google Cardboard, Oculus Rift, HTC Vive, Other Requirements, A-Painter, Blair Witch WebVR Experience.

Introduction to A-Frame: Introducing the A-Frame Library, The Entity-Component System, Primitives, A-Frame Inspector.

UNIT II VR App Development with Unity Lecture Hrs 8

From "Hello, World" to a VR Content Display: Building a Simple "Hello, World" VR Application, Building a VR Content Display Web Site.

Building a VR-Based Movie Theatre: Planning the Movie Theatre, building 3D Models with Magic Voxel, Getting Prebuilt Models from Clara.

A-Frame Components and the Registry: Components in A-Frame, Lifecycle Methods of Components Built-in Components, Using A-Frame Registry Components.

Version Control and Deploying Your Code on GitHub: Introduction to Version Control Systems, Advantages of Version Control, Git: All You Need to Know, working with GitHub, Hosting Your VR Web Site for Free Using GitHub Pages.

UNIT III AR App Development with Unity Lecture Hrs 10

Getting to know Unity: Why is Unity so great? Unity, How to use Unity, Getting up and running with Unity programming

Building a demo that puts you in 3D space: Before you start, Begin the project, making things move, Script component for looking around, Keyboard input component.

Adding enemies and projectiles to the 3D game: Shooting via raycasts, Scripting reactive targets, Basic wandering AI, spawning enemy prefabs, Shooting the projectile and colliding with a target 3.5.3. Damaging the player

Developing graphics for your game: Understanding art assets, understanding art assets, building basic 3D scenery: white boxing, Texture the scene with 2D images, generating sky visuals using texture images, working with custom 3D models, creating effects using particle.

UNIT IV Programming for AR & VR applications Lecture Hrs 10

Building a Memory game using Unity's new 2D functionality:Setting everything up for 2D graphics, Building the object out of sprites, Displaying the various card images, Making and scoring matches, Restart Button.

Putting a 2D GUI in a 3D game: Before you start writing code, Setting up the GUI display , Programming an invisible UIController , Updating the game by responding to events

Creating a third-person 3D game: player movement and animation: Adjusting the camera view for third-person , Programming camera-relative movement controls , Implementing the jump action , Setting up animations on the player character

Defining animation clips in the imported model: Creating the animator controller for these animations,adding interactive devices and items within the game,creating doors and other devices, interacting with objects by bumping into them, Managing inventory data and game state,Inventory UI for using and equipping items, 8.4.1. Displaying inventory items in the UI 8.4.2. Equipping a key to use on locked doors ,Strong finish

UNIT V Game Interaction and Deployment Lecture Hrs 8

Connecting your game to the internet: Creating an outdoor scene , Downloading weather data from an internet service , Adding a networked , Posting data to a web server

Playing audio: sound effects and music:Importing sound effects , Playing sound effects , Audio control interface , Background music

Putting the parts together into a complete game: Building an action RPG by repurposing projects , Developing the overarching game structure , Handling the player's progression through the game

Deploying your game to players' devices:Start by building for the desktop: Windows, Mac, and Linux, Building the application, Building for mobile apps: iOS and Android

Textbooks:

- 1.SrushtikaNeelakantam, Tanay Pant - Learning Web-based Virtual RealityBuild and Deploy Web-based Virtual Reality Technology, APress, 2017.
2. Joseph Hocking -Unity in Action, Manning Publisher, 2015.

Reference Books:

- 1.Jesse Glover, Jonathan Linowes – Complete Virtual Reality and Augmented Reality Development with Unity: Leverage the power of Unity and become a pro at creating mixed reality applications. Packt publishing, April 2019.
2. Jonathan Linowes, Krystian Babilinski – Augmented Reality for Developers: Build practical augmented reality applications with Unity, ARCore, ARKit, and Vuforia. Packt publishing, October 2017.

Online Learning Resources:

1. <https://www.udemy.com/course/learn-a-frame-and-get-ready-for-webvr/>
2. <https://www.udemy.com/course/intro-webxr/>

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (CSE) **L T P C**
0 0 4 2
(20A05M09) FREE & OPEN SOURCE SOFTWARE FOR VR-AR LAB

Pre-requisite Coordinate Geometry, Fundamentals of
 Programming, Virtual Reality

Course Objectives:

The objective of this course is to use Unity and other open source software to develop VR games, Virtual Environments and develop Applications for medical purpose.

Course Outcomes:

After completion of the course, students will be able to

- Design VR games
- Develop VR games
- Create Virtual Experiments

List of Experiments

A-Frame Experiments

1. Use A-Frame primitives to create different objects.
2. Attach physics components to A-Frame primitives.
3. Register your own primitives using A-Frame.
4. Create your own A-Frame Component.
5. Create your own scene and control the components in the scene using Java Script code.
6. Add the functionality grab, throw, rub, flip, pole, stretch, press, etc in VR using A-frame.
7. Use Don McCurdy's animation-mixer component to add animations.
8. Host and Publish A-Frame site.

Unity Experiments

1. Create different possible 3D objects. View them in game view. Move them, rotate them and view them again. Try to perform all the possible operations.
2. Create a Rolling ball and control it using arrow keys of the keyboard.
3. Create a missile. Move it in the air. Let it go and hit specific target. When it hits a blast should result and everything should vanish expect same ash.
4. Create an animated cat. You can download assets if necessary. Let the cat walk, move, jump, etc.
5. Create a tiger. You can download assets if necessary. When you move near to it is should attack. If it is successful you are going to die. Otherwise you can play with it.
6. Create a Terrain of your choice. Create a car and move it on the terrain. You can download assets if necessary.
7. Integrate Google cardboard with unity. With any simple program (you may use above experiments) build the application, load it into mobile and view it in Google cardboard.
8. Virtual reality can be used to treat different phobias. Do mini project to treat the phobias
 - a. Fear of Public speaking
 - b. Fear of Heights
 - c. Fear of Lift
 - d. Claustrophobia

Equipment: Computer systems with minimum of 16 GB RAM and a separate (not inbuilt) Graphics card.

For all the above you may make use of different HMDs available including Google Cardboard.

References:

1. Official Website aframe.io
2. <https://riptutorial.com/Download/aframe.pdf> a free e-book created by stack overflow contributors.

Online Learning Resources/Virtual Labs:

1. <https://www.udemy.com/course/learn-a-frame-and-get-ready-for-webvr/>
2. <https://www.udemy.com/course/intro-webxr/>

(20A05M10) ADVANCED GAME DEVELOPMENT

Pre-requisite **Unity**

Course Objectives:

- To learn the fundamentals of Game Development
- To choose the team

Course Outcomes:

After completion of the course, students will be able to

- Understand the need for Game development.
- Integrate various concepts and techniques of 3D Game design.
- Commercialize games
- Building career in game industry

UNIT I Art of Game Design Lecture 12 Hrs

In the Beginning There is the game designer, the Designer creates an experience, The experience rises out of a game,

UNIT II Art of Game Design continued Lecture 6 Hrs

The game is made for a player, The experience is in the Players mind,

UNIT III Characteristics of games Lecture 9 Hrs

Length of Play time, Number of Players, Heuristics, Player Elimination, Interactivity, Politics, King making, Teamwork

UNIT IV Working Context Lecture 8 Hrs

Introduction, Contemporary Serious games, Games with an Agenda, Realistic Games, Core Contemporary Games, Repurposed Commercial of the shelf games, Modified games, The Value proposition

UNIT V Serious Business and Game design Lecture Hrs

Introduction, Entertainment Games Industry, Serious game market, Stakeholders, Customer base, Human resources

Serious game design document, Requirements specification, Technical Architecture, Game Design

Textbooks:

- 1) Jesse Schell, "The Art of Game Design", Morgan Kaufmann
- 2) George Skaff Elias, Richard Garfield, and K. Robert Gutschera, "Characteristics of Games", The MIT Press.
- 3) Bryan Bergeron, "Developing Serious Games", Charles River Media

Reference Books:

- 1) Jeremy Gibson, "Introduction to Game Design, Prototyping, and Development: From Concept to Playable Game with Unity and C#", Addison-Wesley Professional, 2nd edition, 2016.
- 2) 2 John Horton, "Learning Java by Building Android Games", Packt Publishing Limited, 1st edition, 2015. 3 Jorge Palacios, "Unity 5.x Game AI Programming Cookbook", Packt Publishing Limited, 1st edition, 2016

Online Learning Resources:

1. <https://www.coursera.org/specializations/game-design-and-development>
2. <https://www.edx.org/course/cs50s-introduction-to-game-development>

(20A05M11) ADVANCED GAME DEVELOPMENT LAB

Pre-requisite **Fundamental Programming**

Course Objectives:

- Learn the process of game design
- Learn the process of game development
- Understand art role in game development

Course Outcomes:

After completion of the course, students will be able to

- Design new games
- Create animations
- Collaborate in a team
- Improve curiosity

List of Experiments (can be implemented using any tools: Play Canvas, jMonkey Engine, Direct 3D 11, Scratch, Python or Unity.)

Unity Experiments

1. Draw a continuously expanding spiral.
2. Draw expanding concentric circles.
3. Construct a house of your choice in Unity
4. Create different pet animals. Add your own animations to them. Use can use asset store. Create a simple story using the pet animals and their animations.
5. Create a rain animation. Add sound.
6. Create a big park using terrains, trees, and other assets. Permit the user to go round it.
7. Create a target. Create a gun. Permit the user to fire the gun. Count number of hits and misses.
8. Create a car game. The game consists of your car and also other cars. Your car is controlled with arrow keys. There is deadline based on time. If your car gets involved in more than three collisions or deadline is reached game will restart. There will be a destination which the car has to reach to become victorious. Display time elapsed at the end of the game.
9. Create a flight. Make the flight fly in plain area, over the buildings, over the hills, over the sea, etc. Add different types of controls to your game to control the flight.
10. Create a cartoon character of a person. Add different animations of your choice.
11. Create a big hall. Create different objects in the hall. Use teleporting to move to those objects using Gaze based interaction.
12. Design any multi user game of your choice.
Equipment: Computer systems with minimum of 16 GB RAM and a separate (not inbuilt) Graphics card.

For all the above you may make use of different HMDs available including Google Cardboard.

References:

1. Jesse Schell, "The Art of Game Design: A book of Lenses", CRC Press, 2019
2. Nicolas Alejandro Borromeo, "Hands-on Unity 2020 Game Development: Build, Customize and Optimize professional games using Unity 2020 and C#", Packt Publisher, 2020

Online Learning Resources/Virtual Labs:

1. <https://www.coursera.org/specializations/game-design-and-development>
2. <https://www.edx.org/course/cs50s-introduction-to-game-development>

(20A05M12) VR-AR FOR HEALTH CARE

Pre-requisite Virtual Reality

Course Objectives:

- Understand the significance of VR-AR in Health care
- Demonstrate application of VR-Ar in Healthcare

Course Outcomes:

- Apply VR-AR to treat Phobias
- Apply VR-AR to treat Depression
- Use VR-AR to treat various medical issues

Lecture 8 Hrs

UNIT I

VR in Psychological Applications:

Being There: Understanding the Feeling of Presence in a Synthetic Environment and Its Potential for Clinical Change,

Virtual Realities in the Treatment of Mental Disorders: A Review of the Current State of Research

Games for Health: Have Fun with Virtual Reality!

UNIT II

Lecture 8 Hrs

Description of a Treatment Manual for in virtuo Exposure with Specific Phobia Virtual Reality and Body Dissatisfaction Across the Eating Disorder's Spectrum A Discussion of the Use of Virtual Reality in Dementia

UNIT III

Lecture 10Hrs

VR in Medical Applications:

Virtual Reality – A New Era in Surgical Training

Virtual Reality Simulation: A Valuable Adjunct to Surgical Training

Virtual Rehabilitation and Training for Postural Balance and Neuromuscular Control

UNIT IV

Lecture 10 Hrs

Applications of Virtual Reality Technology in Brain Imaging Studies

Cybertherapy in Medicine – Experience at the Universidad Panamericana, IMSS and ISSSTE

Mexico

UNIT V

Lecture 9 Hrs

VR in Pedagogical Applications:

Using Augmented Reality Artifacts in Education and Cognitive Rehabilitation

Virtual Environments for Children and Teens

Textbooks:

- 1) Christiane Eichenberg, "VIRTUAL REALITY IN PSYCHOLOGICAL, MEDICAL AND PEDAGOGICAL APPLICATIONS", Addison- JanezaTrdine, 2012,

Reference Books:

1. Kerry Dinmont, Virtual Reality in Health care, Brightpoint publisher, 2021
2. Samiya Khan, Mansaf Alam, "Extended Reality for Healthcare Systems:Recent Advances in Contemporary Research, Academic Press, 2022

Online Learning Resources:

1. <https://www.udemy.com/course/virtual-reality-and-mental-healthcare/>

Course Objectives:

- To familiarize the importance and usage of units.
- To interpret the fundamental laws and principles and its application

Course Outcomes (CO):

- Students will learn the importance of units.
- Students will understand the basic laws and principles and its application in food engineering

UNIT I

Introduction to Food Engineering: Definition of terms, System of measurements, The S.I System, Conversion of Units. Steam Generation & Utilization: Concept of normal boiling point, Properties of Steam, Forms of Steam. Pressure-Enthalpy diagram, Problems; Boilers: Classification, Types, Criteria for selection, Maintenance & Applications

UNIT II

Basic principles of Physics & Chemistry: Ideal Gas law, Vander Waal's equation, Avagadro's law, Dalton's law, Problems; Kinetic Theory of gases. Thermodynamics: Basic concepts, First law of thermodynamics, Second law of thermodynamics, Zero law of thermodynamics Refrigeration: Basic concepts, Joule-Thomson effect, Refrigerants, Problems, Refrigeration types (VCC, VAC), Applications

UNIT III

Humidity: Humidity & Relative Humidity, Saturation Humidity, Percentage Humidity, Psychometric chart – Utilization, problems; Humidifiers & Dehumidifiers; Applications.

Material balance and Energy balance in various unit operations – Problems, significance in food processing.

UNIT IV

Dimensional Analysis, Fundamental -derived units. Conversion of Dimensional equations – Uses, Methods (Rayleigh's & Buckingham's) Examples: Nusselts Number, Reynolds number, Prandtl's number, Froude's number. Engineering properties of Food Materials: Mass- volume- area related properties of foods, rheological properties of solid foods, thermal properties of frozen & unfrozen foods, electrical conductivity of foods, dielectric properties of foods.

UNIT V

Measurement & Control of Process Parameters: Various Process Parameters, On-line & Off-line parameters, Critical & non-critical parameters, Measurement of various parameters, controlling methods (Manual, Automatic & Computer control)

Textbooks:

1. R. Paul Singh and Dennis R. Heldman, "Introduction to Food Engineering". Academic Press, 4th Edition, 2009.
2. P.G. Smith, "Introduction to Food Process Engineering". Springer, 2nd Edition, 2011.

References:

1. J.M. Smith, H.C. Van Ness and M.M. Abbott "Introduction to Chemical Engineering Thermodynamics", 7th Edition, McGraw-Hill, Inc., NY, USA. 2005.
2. Z. Berk, "Food Process Engineering and Technology, Food Science and Technology", 1st Edition, International Series, Elsevier, 2009.
3. D. G. Rao, "Fundamentals of food engineering", Prentice-Hall of India, New Delhi, 2010.
4. R.K. Rajput. "Engineering Thermodynamics", 3rd Edition, Laxmi Publications (P) Ltd., Bangalore, 2007

(20A27M02) FOOD PLANT UTILITIES & SERVICES

Course Objectives:

- To give brief idea about the utilities that are required/used in food industry and their sources and importance.

Course Outcomes:

By end of the course, students will understand the following

- Various utilities and services used in food industry and its applications in food industry namely water, steam, electricity and etc.

UNIT I

Introduction Classification of various utilities and services in food industry. Water use in Food Processing Industry Water supply system: Pumps of different types, operational aspects, piping system for fresh water, chilled water etc., fittings and control, water requirement for cleaning and processing, water quality, water purification and softening Unit

UNIT II

Water use in food processing: Different types of water requirements in food processing plants, types of water use, waste water sources, water wastage minimization, water loadings per unit mass of raw material.

Water conservation: Water and waste water management, economic use of water, water filtration and recirculation.

UNIT III

Steam uses in Food Industry Steam uses in food industry: Food processing operations in which steam is used, temperature, pressure and quantity of steam required in various food processing operations Steam generation system: Components of a boiler system, fuels used in boilers, energy analysis for a steam generation system, heat loss from boiler system, boiler design consideration.

UNIT IV

Heat Recovery in Food Processing Facilities: Quantity and quality of waste heat in food processing facilities, waste heat utilization, heat exchangers for waste heat recovery, and heat pumps for waste heat recovery. Waste Disposal and its Utilization Industrial waste, sewage, influent, effluent, sludge, dissolved oxygen, biological oxygen demand, chemical oxygen demand.

UNIT V

Planning and Design of Service Facilities in Food Industry Estimation of utilities requirements: Lighting, ventilation, drainage, CIP system, dust removal, fire protection etc. Maintenance of facilities: Design and installation of piping system, codes for building, electricity, boiler room, plumbing and pipe coloring, maintenance of the service facilities. Services required in offices, laboratories, locker and toilet facilities, canteen, parking lots and roads, loading docks, garage, repair and maintenance shop, ware houses etc.

Textbooks:

1. Lijun Wang. "Energy Efficiency and Management in Food Processing Facilities". CRC Press. 2008,
2. M. E. Casper. "Energy-saving Techniques for the Food Industry". Noyes Data Corporation. 1977,

References:

1. P.L. Ballaney, "Thermal Engineering in SI Units", 23rd Edition, Khanna Publishers, Delhi, 2003.

2. C.P. Arora. "Refrigeration and Air Conditioning". 3rd Edition, Tata McGraw Hill Publishing Co. Ltd. New Delhi. 2008,
3. W. E. Whitman, "A Survey of Water Use in the Food Industry", S. D. Holdsworth. Published by British Food Manufacturing Industries Research Association.
4. Chilton's Food Engineering. 1979, Chilton Co Publishers

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (FT)

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(20A27M03) BUSINESS MANAGEMENT AND ECONOMICS

Course Objectives:

- To familiarize the students about management principles, various economic aspects of chemical processes
- Learn basics of Cost estimation, Working Capital and Capital Investment and understand the time value of money
- Learn the importance of Cash flow diagrams and Break-even analysis.
- Study depreciation methods and methods of estimation of profitability of an industry
- Study the procedures adopted for sources of recruitment, process of selection; Corporate social responsibility: Importance, business ethics.

Course Outcomes:

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

- Explain the design considerations, cash flow and various costs involved in process Industries
- Calculate different types of interest & Predict the Present worth and annuities
- Explain types of taxes and Solve problems on depreciation using various methods
- Analyze different systems of accounting.
- Familiarize sources of recruitment, process of selection; Corporate social responsibility: Importance, and business ethics

UNIT I

Definitions, management principles, scientific principles, administrative principles; Maslow's Hierarchy of needs theory; Functions of management: Planning, organizing, staffing, directing, controlling Organizational structures, principles of organization; Types of organization: Formal and informal, line, line and staff, matrix, hybrid

UNIT II

Introduction to economics: Definitions, nature, scope, difference between microeconomics and macroeconomics; Theory of demand and supply, elasticity of demand, price and income elasticity; Markets: Types of markets and their characteristics; National income: GDP, GNP, NNP, disposable personal income, per capita income, inflation;

UNIT III

Theory of production: Production function, factors of production. Law of variable proportions and law of returns to scale; Cost: Short run and long run cost, fixed cost, variable cost, total cost, average cost, marginal cost, opportunity cost; Break even analysis;

UNIT IV

Finance management: Definition, scope, objective; Different systems of accounting: Financial accounting, cost accounting, management accounting;

UNIT V

Human resource management: Definitions, objectives of manpower planning, process, sources of recruitment, process of selection; Corporate social responsibility: Importance, business ethics.

Textbooks:

1. Reddy and Raghuram, Agriculture, Finance and Management, Oxford & IBH Pub Co, 1996
2. Kotler and Keller, Burton, Marketing Management , Pearson Education Australia, 2008
3. Duening and Ivacevinch , Management: Principles and Guidelines, Dreamtech Press, 2003

Referencebooks:

1. L.M. Prasad, Principles and Practices of Management, 9th Ed. S. Chand & Sons, New Delhi 2001
2. Koontz Harold, Principles of Management, Tata McGraw-Hill Education Private Limited, New Delhi
3. K.K. Dewett and M.H. Navalur , Modern Economic Theory, S. Chand & Sons, New Delhi
4. S.P. Jain , Financial Accounting , Kalyani Publications, Ludhiana

(20A27M04) PLANT DESIGN AND ECONOMICS

Course Objectives:

- To familiarize the students about various economic aspects of chemical processes
- Learn basics of Cost estimation, Working Capital and Capital Investment and understand the time value of money
- Learn the importance of Cash flow diagrams and Break-even analysis.
- Study depreciation methods and methods of estimation of profitability of an industry
- Study the procedures adopted for Replacement and Selection from Alternatives.

Course Outcomes:

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

- Explain the design considerations, cash flow and various costs involved in process Industries
- Calculate different types of interest & Predict the Present worth and annuities
- Explain types of taxes and Solve problems on depreciation using various methods
- Analyze alternative investments, pay out period for an investment and rate of return
- Solve linear programming problems (LPP) by graphical and algebraic methods

UNIT I

Introduction, Process Design development. General design considerations, Cost and asset accounting. Cash flow for industrial operations, factors effecting investment and production cost, capital investments, estimation of capital investments, cost indices, cost factors in capital investment

UNIT II

Organizations for presenting capital investments, estimates by compartmentalization, estimation of total product of cost direction, production costs, fixed charges, plant overhead costs, financing. Interest and investment cost, type interest, nominal and effective interest rates, continuous interest, present worth and discount annuities, cost due interest on investment, source of capital.

UNIT III

Taxes and insurances, type of taxes: federal income taxes, insurance-types of insurance, self-insurance.

Depreciation: types of depreciation, services life, salvage value, present value, methods for determining depreciation, single unit and group depreciation.

UNIT IV

Profitability: alternative investments and replacements, profitability standards, discounted cash flow, capitalized cost, pay out period, alternative investments, analysis with small investments, increments and replacements.

UNIT V

Optimum design and design strategy, incremental cost, general procedure for determining optimum condition, comparison of graphical and analytical methods, optimum production rates, semi continuous cyclic operation, fluid dynamics, mass transfer strategy of linearization

Textbook:

1. Plant Design and Economics for Chemical Engineering, 4th ed., M.S. Peters and K.D. Timmermans, McGraw-Hill, 1991

Reference Books:

1. Process Engineering Economics, Schweyer, McGraw-Hill, 2002

