JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERISTY ANANTAPUR
MINORS

CONSTRUCTION TECHNOLOGY

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1.	20A01M11	Building Materials	3	1	0	4
2.	20A01M12	Building Construction	3	1	0	4
3.	20A01M13	Building planning and Drawing	3	1	0	4
4.	20A01M14	Surveying	3	1	0	4
5.	20A01M15	MOOC I: Concrete Technology				2
6.	20A01M16	MOOC II: Green Buildings				2

ENVIRONMENTAL GEOTECHNOLOGY

S.No.	Course Code	Course Title	Contact Hours per week			Credits
			L	T	P	
1.	20A01M21	Environmental Legislation & Management systems.	3	1	0	4
2.	20A01M22	Engineering Geology	3	1	0	4
3.	20A01M23	RS & GIS Applications in Environmental Engineering	3	1	0	4
4.	20A01M24	Disaster Management	3	1	0	4
5.	20A01M25	MOOC I: Rock Engineering				2
6.	20A01M26	MOOC II: Air quality modeling & Management				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	MOOC I: Energy Resources & Technology				2
6	20A02M06	MOOC II: Waste to Energy Conversion				2

3D PRINTING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A03M11	Material Science for engineering	3	1	0	4
2	20A03M12	Computer Aided Machine Drawing	3	1	0	4
3	20A03M13	3D Printing Materials	3	1	0	4
4	20A03M14	Applications of 3D Printing	3	1	0	4
5	20A03M15	MOOC I: Metal Additive Manufacturing https://onlinecourses.nptel.ac.in/noc22_me130/preview				2
6	20A03M16	MOOC II: Introduction to Composites https://nptel.ac.in/courses/112104168				2

INDUSTRIAL ENGINEERING

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A03M21	Production Planning and Control	3	1	0	4
2	20A03M22	Marketing Management	3	1	0	4
3	20A03M23	Customer Relationship Management	3	1	0	4
4	20A03M24	Six Sigma & Lean Manufacturing	3	1	0	4
5	20A03M25	MOOC I: Work System Design https://onlinecourses.nptel.ac.in/noc22_me133/preview				2
6	20A03M26	MOOC II: Strategic Management for Competitive Advantage https://onlinecourses.nptel.ac.in/noc22_mg88/preview				2

INTERNET OF THINGS

S.No	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
4.	20A04M03	Communication Protocols for IoT	3	1	0	4
6	20A04M04	Industrial IoT	3	1	0	4
8.	20A04M05	MOOC I: Introduction to Data Analytics				2
9.	20A04M06	MOOC II: Introduction to Machine Learning				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	20A05M02	Fundamentals of Deep Learning	3	0	2	4
3	20A05M03	Principles of Software Development & Operations	3	1	0	4
4	20A05M04	Applications of AI & DS	3	1	0	4
5	20A05M05	MOOC I: Tools for Data Science Python for Data Science, AI & Development Python Project for Data Science				2
6	20A05M06	MOOC II: Data Science for Engineers Applied Accelerated Artificial Intelligence				2

VIRTUAL & AUGMENTED REALITY

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	T	P	
1	20A30M01	Virtual Reality	3	1	0	4
2	20A30M02	Free & Open-source software for VR-AR	3	0	2	4
3	20A30M03	Advanced Game development	3	0	2	4
4	20A30M04	VR-AR for Health Care	3	1	0	4
5	20A30M05	MOOC I: Introduction to XR: VR, AR, and MR Foundations Mobile VR App Development with Unity Handheld AR App Development with Unity				2
6	20A30M06	MOOC II: 3D Interaction Design in Virtual Reality Building Interactive 3D characters and Social VR Making your First Virtual Reality Game				2

CYBER SECURITY AND BLOCK CHAIN TECHNOLOGIES

S.No.	Code	Course Name	Contact Hours per week			Credits
			L	**T**	**P**	
1	20A12M01	Applied Cryptography	4	0	0	4
2	20A12M02	Introduction to Crypto Currency	4	0	0	4
3	20A12M03	Foundations of Block Chain Technology	4	0	0	4
4	20A12M04	Block Chain Use Cases	4	0	0	4
5	20A12M05	MOOC I: Foundations of Cryptography Computer Networks & Internet Protocol				2
6	20A12M06	MOOC II: Information Security Ethical Hacking Privacy & Security in online social media				2

FOOD SCIENCE

S.No.	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			2
6	20A27M06	MOOC.II: Thermal Processing of Foods			2

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (CE)	L	T	P	C
	3	1	0	4

(20A01M11) 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:
- 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 RangwalaCharotar Publishers, 2015

Online Learning Resources:https://onlinecourses.nptel.ac.in/noc21_ce10/preview

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B.Tech (CE)　　　　　　　　　　　　　　　　　　　L　T　P　C

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(20A01M12) 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 IBuildings 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 IIMasonry
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 IIIRoofs 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 IVPre 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 VSolar 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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (CE)	L	T	P	C
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(20A01M13) 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

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B.Tech (CE)   L T P C
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(20A01M14) 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 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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (CE)   **L   T   P   C**
                                                                                     3   1   0   4

(20A01M21) 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

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B.Tech (CE)	L	T	P	C
	3	1	0	4

(20A01M22) 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, Chrorite , 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 resistivitymethods, 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 Prabinsingh, KatsonPubilcations
2. Engineering geology by Duggal, TMH Publishers.
3. Engineering Geology by SubinoyGangopadhyay, 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

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(20A01M23) 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 managehent-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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (CE)   L T P C
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(20A01M24) 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 Reconstructingafter 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
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(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   Lecture Hrs:14
                   MANGEMENT

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (EEE)   **L   T   P   C**
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(20A02M02) ENERGY MANAGEMENT IN BUILDING

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   Lecture Hrs:12
**   USE AND ENERGY PROCESSES IN BUILDING**

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   Lecture Hrs:14
**   AND MANAGEMENT**

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. Guinnes 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:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (EEE)	L	T	P	C
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(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:

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (EEE)	L	T	P	C
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(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 Polices 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 polices 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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (ME)   **L   T   P   C**
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(20A03M11) MATERIAL SCIENCE FOR ENGINEERING

Course Objectives:
- To teach the principles of physical metallurgy, i.e. crystallography of metals, constitution of alloys, phase diagrams and heat treatment of steels.
- To Explain the methods to change the properties of materials through heat treatment processes.
- To Expose commercially important metals and alloys (both ferrous and nonferrous) with engineering constraints.
- To Familiarize properties and applications of ceramics, polymers and composite materials.

Course Outcomes (CO):
- Explain the principles of binary phases
- Apply heat treatment to different applications
- Select steels and cast irons for a given application
- Utilize nonferrous metals and alloys in engineering
- Choose composites for various applications
- Assess the properties of Nano-scale materials and their applications

UNIT - I   **Structure of Metals & Constitution of Alloys**   8 Hrs
Structure of Metals: Crystal Structures: Unit cells, Metallic crystal structures, Imperfection in solids: Point, Line, interstitial and volume defects; dislocation strengthening mechanisms and slip systems, critically resolved shear stress.
Constitution of Alloys: Necessity of Alloying, substitutional and interstitial solid solutions – Phasediagrams: Interpretation of binary phase diagrams and microstructure development; eutectic, peritectic, peritectoid and monotectic reactions. Iron – Iron – carbide diagram and microstructural aspects of ferrite, cementite, austenite, ledeburite, and cast iron.

UNIT - II   **Heat Treatment of Steels**:   8 Hrs
Heat Treatment of Steels: Annealing, tempering, normalizing and spheroidizing, isothermal transformation diagrams for Fe-Fe$_3$Calloys and microstructure development. Continious cooling curves and interpretation of final microstructures and properties- austempering, martempering, case hardening, carburizing, nitriding, cyaniding, carbo-nitriding, flame and induction hardening, and vacuum and plasma hardening

UNIT - III   **Steels and Cast Irons**   10 Hrs
Steels: Plain carbon steels, use and limitations of plain carbon steels. AISI& BIS classification of steels. Classification of alloys steels. Microstructure, properties and applications of alloy steels-stainless steels and tool steels.
Cast irons: Microstructure, properties and applications of white cast iron, malleable cast iron, grey cast iron, nodular cast iron and alloy cast irons.

UNIT - IV   **Non-ferrous Metals and Alloys**   10 Hrs
Non-ferrous Metals and Alloys: Microstructure, properties and applications of copper and its alloys, aluminium and its alloys. Study of Al – Cuphase diagram, precipitation hardening. Microstructure, properties and applications of titanium and its alloys.

UNIT - V   **Ceramics, Polymers and Composites:**   10 Hrs
Ceramics, Polymers and Composites: Structure, properties and applications of ceramics, polymers and composites. Introduction to super alloys and nanomaterials.
Textbooks:

1. V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.
2. William D. Callister Jr, Materials Science and Engineering: An Introduction, 8/e, John Wiley Sons, 2009.

Reference Books:
1. Y. Lakhtin, Engineering Physical Metallurgy, University Press of the Pacific, 2000.
2. S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
3. L.H.VanVlack, Elements of Material Science and Engineering, 6/e, Pearson Education, 2008.
4. George E.Dieter, Mechanical Metallurgy, 3/e, McGraw-Hill, 2013.

Online Learning Resources:
- https://nptel.ac.in/courses/113102080
- https://www.digimat.in/nptel/courses/video/113102080/L01.html

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (ME)   **L T P C**
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(20A03M12) COMPUTER AIDED MACHINEDRAWING

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

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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (ME)	L	T	P	C
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(20A03M13) 3D PRINTING MATERIALS

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
- Select materials for Additive Manufacturing
- Explain the concept of material characterization
- Understand the concepts of powder shaping and sintering

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 to 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

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (ME)	L	T	P	C
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(20A03M14) APPLICATIONS OF 3D PRINTING

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 onApplications in Automotive, Civil and other fields.

Course Outcomes (CO):

After successful completion of the course, the student will be able to
- Design CAD model and verification of CAD model
- Select type of 3D printing technology for different applications
- Identify the various applications of 3D printing in manufacturing and aerospace
- Explain the various Applications of 3D printing in Automotive, Civil and other fields
- List the various applications of 3D printing technology

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

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(20A03M11) 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 (CO):
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. MichealR.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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(20A03M22) 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 (CO):

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. MartandTelsang, "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

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(20A03M23) CUSTOMER RELATIONSHIP MANAGEMENT

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 (CO):

At the end of the course student will be able to

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

UNIT – I   **CRM concepts**   8 Hrs

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

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

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 Hrs

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

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 Limted, New Delhi. 2011.
2. S. Shanmugasundaram, Customer RelaTionship Management, Prentice Hall Of India Private Limted, New Delhi, 2008.

Reference Books:

1. Kaushik Mukherjee, Customer Relationship Management, Prentice Hall Of India Private Limted, 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

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(20A03M24) SIX SIGMA AND LEAN MANUFACTURING

Course Objectives:
- Introduce the students, the basic concepts of six sigma and lean manufacturing.
- Expose with various quality issues in Inspection.
- Gain Knowledge on quality control and its applications to real time.
- Know the extent of cellular manufacturing and 5S.
- Understand the importance of Quality standards in manufacturing

Course Outcomes (CO):

At the end of this course, the student will be able to
- summarize various techniques that are related to the six-sigma and lean manufacturing
- outline the concepts of cellular manufacturing, JIT and TPM
- illustrate the principles and implementation of 5S techniques
- discus procedure and principles of value stream mapping
- determine the reliability function using six-sigma

UNIT - I **Introduction to Six-Sigma** 10 Hrs
Introduction to Six-Sigma-Probabilistic models-Six Sigma measures-Yield-DPMO-Quality level-Reliability function using Six-Sigma-MTTF using Six Sigma-Maintenance free operating period-Availability using Six-Sigma-Point availability-Achieved availability-Operational Availability-Examples

UNIT - II **The Elements of Six Sigma and their Determination** 8 Hrs
The Elements of Six Sigma and their Determination-The Quality Measurement Techniques: SQC, Six Sigma, Cp and Cpk- The Statistical quality control (SQC) methods-The relationship of control charts and six sigma-The process capability index (Cp)-Six sigma approach-Six sigma and the 1.5 σ shift-The Cpk Approach Versus Six Sigma-Cpk and process average shift- Negative Cpk-Choosing six sigma or Cpk-Setting the process capability index-Examples.

UNIT - III **Introduction To Lean Manufacturing** 8 Hrs
Introduction To Lean Manufacturing: Conventional Manufacturing versus Lean Manufacturing – Principles of Lean Manufacturing – Basic elements of lean manufacturing – Introduction to LM Tools.

UNIT - IV **Cellular Manufacturing, JIT, TPM** 8 Hrs
Cellular Manufacturing, JIT, TPM: Cellular Manufacturing – Types of Layout, Principles of Cell layout, Implementation. JIT – Principles of JIT and Implementation of Kanban. TPM – Pillars of TPM, Principles and implementation of TPM.

UNIT - V **Set Up Time Reduction, TQM, 5S, VSM 10** 8 Hrs
Set Up Time Reduction, TQM, 5S, VSM 10
Set up time reduction – Definition, philosophies and reduction approaches. TQM – Principles and implementation. 5S Principles and implementation - Value stream mapping - Procedure and principles.

Textbooks:
1. U Dinesh Kumar, Crocker, Chitra and HaritheSaranga, Reliability and Six Sigma, Springer Publishers.
2. Sung H. Park, Six Sigma for Quality and Productivity Promotion, Asian Productivity Organization

Reference Books:
1. Sammy G. Shina, Six Sigma for Electronics Design and Manufacturing, McGraw-Hill.
2. Design and Analysis of Lean Production Systems, Ronald G. Askin& Jeffrey B. Goldberg, John Wiley & Sons, 2003.
3. Mikell P. Groover (2002) _Automation, Production Systems and CIM.

4. Rother M. and Shook J, 1999 _Learning to See: Value Stream Mapping to Add Value and Eliminate Muda' , Lean Enterprise Institute, Brookline, MA.

Online Learning Resources:
- https://nptel.ac.in/courses/110105039
- https://nptel.ac.in/courses/110105123
- https://www.classcentral.com/course/swayam-six-sigma-7967
- https://ocw.mit.edu/courses/engineering-systems-division/esd-60-lean-six-sigma-processes-summer-2004/lecture-notes/
- https://old.amu.ac.in/emp/studym/100012762.pdf
- http://www.snscourseware.org/snscenew/notes.php?cw=CW_5d206368880cf
- https://www.sixsigmacouncil.org/wp-content/uploads/2018/08/Six-Sigma-A-Complete-Step-by-Step-Guide.pdf

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(20A04M01T/P) 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 Madisetti, ArshdeepBahga, "Internet of Things a Hands-On- Approach",2014.

References:
1. Dr SRN Reddy, RachitThukral 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

List of Experiments:
1. Setting up the Keil for ARM IDE and STM32Cube IDE.
2. GPIO programming and interfacing
3. Interacting with basic sensors
4. Interacting with sensors through I2C and SPI protocols
5. Interacting with basic actuators
6. LCD and Keyboard interfacing
7. Interrupt and exception Programming
8. Posting and retrieving the sensor data to a cloud platform
9. Securing online data
10. Send text messages and Email notifications
11. Automation with IFTTT
12. Cloud M2M with IFTTT (Monitor Water Quality)

Software and Hardware Requirements:
Keil for ARM IDE, STM32Cube IDE, STM32 Nucleo Development Board, NucleoWiFi expansion board, Basic sensors and actuators.

Textbook:
1. STM32 Arm Programming for Embedded Systems: Using C Language with STM32F4 ARM, Muhammad Ali Mazidi, Shujen Chen, EshraghGhaemi, Microdigitaled Publishing, 2018.

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(20A04M02T/P) 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 Esplorer 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, Headles 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 Mobel 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.

List of Experiments:

Arduino IDE (Arduino Uno and ESP8266)
1. Installing the Arduino IDE for Arduino Uno and ESP8266 and connecting to Wi-Fi network
2. Controlling the LED from a cloud dashboard
3. Interfacing Basic sensors and actuators
4. Getting and posting sensor data to social media

Micropython (ESP8266)
1. Flashing the microcontroller firmware and executing first program
2. Executing commands in the REPL
3. Interacting with basic sensors and actuators
4. MQTT on ESP8266

Raspberry Pi
1. Getting around Linux on the Raspberry Pi
2. Interfacing I/O devices using Python
3. Download data from a Web Server
4. Posting and retrieving data from cloud

Software and Hardware Requirements:
Arduino IDE, Idle IDE (Micropython, Python), Arduino Uno, ESP8266-12e NodeMCU, ESP32 development board, Raspberry Pi, WiFi expansion board (Arduino Uno), Basic sensors and actuators.

Textbook:
1. Internet of Things with ESP8266, Schwartz, M. (2016). Packt Publishing Ltd.
2. "Getting started with Raspberry Pi", Richardson, M., & Wallace, S. (2012)., O'Reilly Publisher Media, Inc.

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(20A04M03) COMMUNICATION PROTOCOLS FOR IOT

Course Objectives:
- Discuss the characteristics, technologies, and protocols related to IoT
- Study the architecture of Arduino, and Raspberry Pi
- Demonstrate applications of IoT
- Understand business models associated with IoT

Course Outcomes:
- Identify the main components of Internet of Things
- Program the sensors and controller as part of IoT
- Assess different Internet of Things technologies and their applications.
- To learn basic circuits, sensors and interfacing, data conversion process and shield libraries to interface with the real world
- To understand various challenges in designing IoT devices
- Demonstrate and build the project successfully by hardware/sensor requirements, coding, emulating and testing.

UNIT I **IoT Fundamentals** Lecture 8 Hrs

Definition & Characteristics of IoT - Challenges and Issues - Physical Design of IoT, Logical Design of IoT - IoT Functional Blocks, Security. IoT Reference Architecture, Software Design Control Units – Communication modules – Bluetooth – Zigbee – WIFI – GPS- IOT Protocols (IPv6, 6LoWPAN, RPL, CoAP etc..), MQTT, Wired Communication, Power Sources

UNIT II **Technologies behind IoT** Lecture 8 Hrs

Technologies behind IoT, four pillars of IOT paradigm, - RFID, Wireless Sensor Networks, SCADA (Supervisory Control and Data Acquisition), M2M - IOT Enabling Technologies - Big Data Analytics, Cloud Computing, Embedded Systems, Programming the microcontroller for IoT

UNIT III **Communication Protocols for IoT** Lecture 9 Hrs

Working principles of sensors – IOT deployment for Raspberry Pi /Arduino/Equivalent platform – Reading from Sensors, Communication: Connecting microcontroller with mobile devices – communication through Bluetooth, WIFI and USB - Contiki OS- Cooja Simulator.

UNIT IV **Resource management in IoT** Lecture 9 Hrs

Resource management in IoT: Clustering, Clustering for Scalability, Clustering for routing, Clustering Protocols for IOT, From the internet of things to the web of things, The Future Web of Things – Set up cloud environment –Cloud access from sensors– Data Analytics for IOT- Rest Architectures- The web of Things, Resource Identification and Identifier, Richardson Maturity Model.

UNIT V **Applications of IoT** Lecture 8 Hrs

Applications of IoT, Business models for IoT, Green energy buildings and infrastructure, Smart farming, Smart retailing and Smart fleet management, Recent trends.

Textbooks:
1. Simone Cirani, Gianluigi Ferrari, Marco Picone, Luca Veltri. Internet of Things: Architectures, Protocols and Standards, 1st edition, Wiley Publications, 2019.
2. Bahga, Arshdeep, and Vijay Madisetti. Internet of Things: A hands-on approach, 1st edition, University press, 2014.

Reference Books:
1. Vermesan, Ovidiu, and Peter Friess, eds. Internet of things-from research and innovation to market deployment, 1st edition, Aalborg: River publishers, 2014.
2. Tsiatsis, Vlasios, Tsiatsis, Vlasios, Stamatis Karnouskos, Jan Holler, David Boyle, and Catherine Mulligan, Internet of Things: technologies and applications for a new age of intelligence, 2nd edition, Academic Press, 2018.

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(20A04M03) INDUSTRIAL IOT

Course Objectives:
- Acquire theoretical knowledge on Industrial Internet of Things.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms for sensors and data transmission.

Course Outcomes:
- Understand the characteristics of Internet of Things and its industry strategies.
- Apply various Internet of Things models to appropriate problems.
- Identify and integrate more than one technology to enhance the performance.
- Understand the sensors and data transmission used in Internet of Things.
- Analyse the co-occurrence of data to find interesting frequent patterns.
- Pre-process the data before applying to any real-world problem and can evaluate its performance.

UNIT I   Overview of Internet of Things
Introduction, IOT Architecture, Application –based IOT protocols, Cloud Computing, Fog Computing, Sensor Cloud, Big Data.
Overview of Industry 4.0 and Industrial Internet of Things: IIoT- Prerequisites of IIOT, Basics of CPS, CPS and IIOT, Applications of IIoT.

UNIT II   Industrial Internet of Things
Introduction, Industrial Internet Systems, Industrial sensing, Industrial sensing, Industrial Processes.
Business Models and Reference Architecture of IIoT: Definition of a business model, Business models of IOT, Business models of IIOT.

UNIT III   Key and On-site Technologies
Key Technologies: Off-site Technologies- Introduction, Cloud Computing- Necessity, Cloud Computing and IIot, Industrial Cloud Platform Providers, SLA, Requirements of Industry 4.0, Fog Computing.
On-site Technologies- Introduction, Augmented Reality- History, Categorization, Applications, Virtual Reality- History, Categorization, Applications.

UNIT IV   Sensors and Data Transmission
Sensors: Introduction to Sensors, Characteristics-Sensor calibration, Sensor profile, Operating voltage, Sensor Categories. Actuators: Introduction, Thermal Actuators, Hydraulic Actuators, Pneumatic Actuators, Electromechanical Actuators.
Industrial Data Transmission: Foundation fieldbus, Profibus, HART, Interbus, Bitbus.

UNIT V   Machine learning and Data science, applications in healthcare
Machine Learning and Data Science in Industries: Introduction, Machine Learning, Categorization on ML, Applications and Data Science of ML in industries, Deep Learning, Applications of Deep Learning in industries.
Applications of Healthcare in Industries: Smart Devices, Advanced Technologies using in Healthcare, Open Research Issues to be Addressed.

Textbooks:
1. S. Misra, C. Roy, and A. Mukherjee, 2020. Introduction to Industrial Internet of Things and Industry 4.0. CRC Press.

Reference Books:
1. Industrial IoT. Available online: https://medium.com/iotforall/whatproduct-managers-need-to-know-about-industrial-iot-8c92eec1d9d2
2. IIoT Cloud Platforms. Available online: https://fr.farnell.com/willthere-be-a-dominant-iiot-cloud-platform.
3. Kajima, T. and Kawamura, Y., 1995. Development of a high-speed solenoid valve:

Investigation of solenoids. IEEE Transactions on industrial electronics, 42(1), pp.1-8.

Online Learning Resources:
1. https://www.coursera.org/learn/industrial-internet-of-things
2. https://www.coursera.org/specializations/developing-industrial-iot

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(20A05M01T) INTRODUCTION TO DATA SCIENCE

- 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

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B.Tech (CSE)	L	T	P	C
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(20A05M01P) DATA SCIENCE LAB

Course Objectives:
- Understand the process of Importing and Exporting thedata.
- 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 forText 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

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B.Tech (CSE)   **L T P C**
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(20A05M02T) FUNDAMENTALS OF DEEP LEARNING

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 Adversial 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.

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(20A05M02P) DEEP LEARNING FUNDAMENTALS LAB

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

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B.Tech (CSE)   **L   T   P   C**
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(20A05M03) PRINCIPLES OF SOFTWARE DEVELOPMENT & OPERATIONS

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

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B.Tech (CSE)	L	T	P	C
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(20A05M04) APPLICATIONS OF AI & DS

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. DavidStephenson**,** 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

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B.Tech (CSE)   **L T P C**
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(20A30M01) VIRTUAL REALITY

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 Kuijff, 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,

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B.Tech (CSE)	**L**	**T**	**P**	**C**
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(20A30M02T) FREE &OPEN SOURCE SOFTWARE FOR VR-AR

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 WebVRFrameworks: TheWebVR API, What Is MozVR? Is Your Browser WebVR Enabled? WebVR Developer Tools.
Setting Up Your VR Lab and Popular WebVRProjects: Google: Google Cardboard, Oculus Rift, HTCVive, 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/

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(20A30M02P) FREE & OPEN SOURCE SOFTWARE FOR VR-AR LAB

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/

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B.Tech (CSE)   **L   T   P   C**
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(20A30M03T) GAME DEVELOPMENT

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

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B.Tech (CSE)   **L   T   P   C**
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(20A30M03P) 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. Crate 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

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(20A30M04) VR-AR FOR HEALTH CARE

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 PhobiaVirtual Reality and Body Dissatisfaction Across the Eating Disorder's SpectrumA 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, MansafAlam, "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/

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(20A12M01) APPLIED CRYPTOGRAPHY

Course Objectives:
- To understand the basic network security concepts.
- To acquire knowledge of several cryptographic algorithms.
- To illustrate various data integrity algorithms and to design a trusted system.

Course Outcomes (CO):
After completion of this course, the students will be able to
- Recall the basic network security concepts.
- Apply several Cryptographic Algorithms.
- Illustrate data integrity algorithms.
- Apply Email and IP security.
- Design a trusted system.

UNIT - I	**Introduction**	Lecture Hrs: 8

Security Trends- The OSI Security Architecture, Security Attacks, Security Services and Security Mechanisms, A model for Network Security- Classical Encryption Techniques.

UNIT - II	**Cryptographic Algorithms**	Lecture Hrs: 10

Number Theory- Modern Block Ciphers: DES, 3DES, AES, Blowfish, CAST-128 - Stream Cipher - Public Key Cryptography: RSA, Diffie-Hellman, Elgamal, ECC.

UNIT - III	**Data Integrity Algorithms**	Lecture Hrs: 8

MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures - authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm - Authentication Applications: Kerberos and X.509 - directory authentication service - electronic mail security-pretty good privacy (PGP) - S/MIME.

UNIT - IV	**Email and IP Security**	Lecture Hrs: 9

Pretty Good Privacy (PGP) and S/MIME. IP SECURITY: Overview, IP Security Architecture, Authentication Header, Encapsulating Security Payload, Combining Security Associations and Key Management.

UNIT - V	**Web and System Security**	Lecture Hrs: 8

Web Security: Secure socket layer and transport layer security - secure electronic transaction - System Security: Intruders - Viruses and related threads - firewall design principals – trusted systems.

Textbooks:
1. William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI, 2017.
2. William Stallings, Network Security Essentials (Applications and Standards), Pearson Education, India, 2017.

Reference Books:
1. W. Mao, "Modern Cryptography – Theory and Practice", Pearson Education, 2011.
2. Charles P. Pfleeger, Shari Lawrence Pfleeger – Security in computing, Prentice Hall of India, 2015.
3. Atul Kahate, Cryptography and Network Security, Tata McGraw hill, India, 2019.

Online Learning Resources:
1. https://www.udacity.com/course/applied-cryptography--cs387
2. https://www.coursera.org/specializations/introduction-applied-cryptography

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(20A12M02) INTRODUCTION TO CRYPTO CURRENCY

Course Objectives:
1. To understand the fundamentals of network and symmetric ciphers.
2. To apply asymmetric ciphers and data integrity algorithms.
3. To explore the basics of cryptocurrencies and use Ethereum programming.

Course Outcomes (CO):
After completion of this course, the students will be able to
1. Recall the network security fundamentals.
2. Employ various symmetric ciphers.
3. Apply asymmetric ciphers and data integrity algorithms.
4. Explore the basics of cryptocurrencies.
5. Use Ethereum programming

UNIT - I   **Introduction to Cyber Security**   Lecture Hrs: 8
Introduction to Cyber Security, Need for security, Concept of Cyber Space, Cyber Crimes and Cyber- attack. Fundamental security principles – threats, attacks and vulnerability. Key Security triad – Confidentiality, Integrity and Availability. Key components of cybersecurity network architecture. Introduction to basic Security Management and Policies - Authentication, Authorization, Access control, Identification and Accounting.

UNIT - II   **Symmetric Ciphers**   Lecture Hrs: 10
Cryptography – Private key Cryptography - Classical Encryption Techniques - Substitution Techniques - Transposition Techniques - Rotor Machines - Steganography - Data Encryption Standard - Advanced Encryption Standard - Multiple Encryption and Triple DES.

UNIT - III   **Asymmetric Ciphers and Data Integrity Algorithms**   Lecture Hrs: 8
Public-Key Cryptography - RSA algorithm - Diffie-Hellman Key Exchange - Elgamal Cryptographic System - Elliptic Curve Arithmetic - Elliptic Curve Cryptography.
MD5 message digest algorithm - Secure hash algorithm (SHA) Digital Signatures: Digital Signatures – authentication protocols - digital signature standards (DSS) - proof of digital signature algorithm.

UNIT - IV   **Cryptocurrencies**   Lecture Hrs: 9
History, A basic crypto currency, Creation of coins, Payments and double spending, Bitcoin – Digital Signatures as Identities – eWallets – Personal Crypto security - Bitcoin Mining – Mining Hardware – Energy Consumption – Mining Pools – Mining Incentives and Strategies.

UNIT - V   **Ethereum**   Lecture Hrs: 8
The Ethereum Network – Components of Ethereum Ecosystem – Ethereum Programming Languages: Runtime Byte Code, Blocks and Blockchain, Fee Schedule – Supporting Protocols – Solidity Language.

Textbooks:
1. William Stallings, "Cryptography and Network security Principles and Practices", Pearson/PHI,2017.
2. Aravind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, July, 2016.

Reference Books:
1. William Stallings, Network Security Essentials (Applications and Standards), Pearson Education, India,2017.
2. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, Decentralization and Smart Contracts Explained", Second Edition, Packet Publishing, 2018.

Online Learning Resources:
1. https://www.coursera.org/learn/cryptocurrency
2. https://www.simplilearn.com/cryptocurrency-for-beginners-free-course-skillup

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(20A12M03) FOUNDATIONS OF BLOCKCHAIN TECHNOLOGY

Course Objectives:
- To understand the history, types and applications of Blockchain
- To acquire knowledge about cryptography and consensus algorithms.
- Deploy projects using Web3j and design blockchain based applications.

Course Outcomes (CO):
After completion of this course, the students will be able to
- Contentedly discuss and describe the history, types and applications of Blockchain
- Gains familiarity with cryptography and Consensus algorithms.
- Create and deploy projects using Web3j.
- Implement an ICO on Ethereum.
- Design blockchain based application with Swarm and IPFS.

UNIT - I   **Introductionto Blockchain**   Lecture Hrs: 8

Distributed DBMS – Limitations of Distributed DBMS, Introduction to Block chain – History, Definition, Distributed Ledger, Blockchain Categories – Public, Private, Consortium, Blockchain Network and Nodes, Peer-to-Peer Network, Mining Mechanism, Generic elements of Blockchain, Features of Blockchain, and Types of Blockchain.

UNIT - II   **Blockchain Architecture**   Lecture Hrs: 10

Operation of Bitcoin Blockchain, Blockchain Architecture – Block, Hash, Distributer P2P, Structure of Blockchain- Consensus mechanism: Proof of Work (PoW), Proof of Stake (PoS), Byzantine Fault Tolerance (BFT), Proof of Authority (PoA) and Proof of Elapsed Time (PoET).

UNIT - III   **Blockchain- Based Future System**   Lecture Hrs: 8

Project presentation- Futures smart contract: Blockchain oracles- Web3j: Setting up the Web3J- Installing web3j- Wallet creation, Java client: The wrapper generator- Initializing web3j- Setting up Ethereum accounts- Deploying the contract.

UNIT - IV   **Blockchain in Business and Creating ICO**   Lecture Hrs: 9

Public versus private and permissioned versus permission less blockchains- Privacy and anonymity in Ethereum- Why are privacy and anonymity important? - The Ethereum Enterprise Alliance- Blockchain as-a-Service- Initial Coin Offering (ICO): Project setup for ICO implementation- Token contracts- Token sale contracts-Contract security and testing the code.

UNIT - V   **Distributed Storage IPFS and SWARM**   Lecture Hrs: 8

Ethereum Virtual Machine- Swarm and IPFS: Installing IPFS, hosting our frontend: Serving your frontend using IFPS, serving your frontend using Swarm, IPFS file uploader project: Project setup the web page

Textbooks:
1. Imran Bashir, "Mastering Blockchain: Distributed Ledger Technology, decentralization, and smart contracts explained", 2nd Edition, Packet Publishing Ltd, March 2018.
2. BellajBadr, Richard Horrocks, Xun (Brian) Wu, "Blockchain by Example: A developer's guide to creating decentralized applications using Bitcoin, Ethereum, and Hyperledger", Packet Publishing Limited, 2018.

Reference Books:
1. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015.
2. Aravind Narayanan, Joseph Bonneau, Edward Felten, Andrew Miller and Steven Goldfeder, "Bitcoin and Cryptocurrency Technologies: A Comprehensive Introduction", Princeton University Press, 2016.

Online Learning Resources:
1. https://www.coursera.org/courses?query=blockchain
2. https://www.springboard.com/resources/learning-paths/blockchain-foundations/

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(20A12M04) BLOCHCHAIN USE CASES

Course Objectives:
- To deploy Private Blockchain and smart contracts on Ethereum.
- To understand the importance of consensus
- To implement Blockchain for various use cases

Course Outcomes (CO):

After completion of this course, the students will be able to
1. Recall the structure and mechanism of Bitcoin, Ethereum, Hyperledger and Multi chain Blockchain platforms
2. Infer the importance of consensus in transactions and how transactions are stored on Blockchain.
3. Setup your own private Blockchain and deploy smart contracts on Ethereum.
4. Deploy the business network using Hyperledger Composer.
5. Implement Blockchain for various use cases

UNIT - I   **Use Cases**   Lecture Hrs: 8

Blockchain in Supply Chain - Blockchain in Manufacturing - Blockchain in Automobiles - Blockchain in Healthcare - Blockchain in Cyber security - Blockchain in Financial Industry.

UNIT - II   **Use Case Model – Privacy Blockchain**   Lecture Hrs: 10

Use case 1: Blockchain in Financial Software and Systems (FSS): (i) Settlements, (ii) KYC, (iii) Capital markets, (iv) Insurance

Use case 2: Blockchain in trade/supply chain: (i) Provenance of goods, visibility, trade/supply chain finance, invoice management discounting, etc.

UNIT - III   **Use Case Model – Blockchain Digital Identity**   Lecture Hrs: 8

Use case 3: Blockchain for Government: (i) Digital identity, land records and other kinds of record keeping between government entities, (ii) public distribution system social welfare systems Blockchain Cryptography, Privacy and Security on Blockchain

UNIT - IV   **Blockchain Use Cases in IOT Sector**   Lecture Hrs: 9

Autonomous Decentralized peer to peer telemetry- Blockchain Enabled Security for Smart cities Blockchain Enabled Smart Home Architecture- Blockchain based self- managed VANETs- Security and privacy of data.

UNIT - V   **Developing and Future of AI with Blockchains**   Lecture Hrs: 8

Applying SDLC practices in Blockchain: Introduction to DIApp - Architecture of a DIApp - Developing a DIApp - Testing a DIApp - Deploying DIApp - Monitoring a DIApp, Implementing DIApp - Evolution of decentralized applications, building a sample DIApp, Developing Smart Contracts, Solution approach with AI, Developing: Client code, Backend, Frontend, Future of converging AI & Blockchain in enterprises & Government.

Textbooks:
1. Andreas M. Antonopoulos, "Mastering Bitcoin: Unlocking Digital Cryptocurrencies", O'Reilly Media Inc, 2015.
2. Melanie Swan "Blockchain", First Edition, O'Reilly Jan 2015.

Reference Books:
1. Hyperledger Fabric - https://www.hyperledger.org/projects/fabric.
2. Zero to Blockchain - An IBM Redbooks course, by Bob Dill, David Smits - https://www.redbooks.ibm.com/Redbooks.nsf/RedbookAbstracts/crse0401.html.

Online Learning Resources:
1. https://www.udemy.com/course/the-complete-guide-to-blockchain-use-cases/
2. https://www.coursera.org/learn/blockchain-foundations-and-use-cases

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(20A27M01)PRINCIPLES OF FOOD ENGINEERING

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

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(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 industrynamely 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

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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

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(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