



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
(Established by Govt. of A.P., ACT No.30 of 2008)
ANANTAPUR – 515 002 (A.P) INDIA

B.TECH. - FOOD TECHNOLOGY
Course Structure (R20) – III & IV Year

Semester-V						
S.No.	Course Code	Course Name	L	T	P	Credits
1.	20A27501T	Milk and Milk Products Processing	3	0	0	3
2.	20A27502	Bakery & Confectionery Products Processing	3	0	0	3
3.	20A27503T	Food Packaging	3	0	0	3
4.		Professional Elective Course – I				
	20A27504a	Food Nanotechnology	3	0	0	3
	20A27504b	Food Safety Management System				
	20A27504c	Energy Audit Conservation				
5.		Open Elective Course – I	3	0	0	3
6.	20A27501P	Milk and Milk Products Processing Lab	0	0	3	1.5
7.	20A27503P	Food Packaging Lab	0	0	3	1.5
8.		Skill oriented course - III				
	20A52501	Soft Skills	1	0	2	2
9.	20A27506	Evaluation of Community Service Project				1.5
Total						21.5

Open Elective - I

S.No	Course Code	Course Name	Offered by the Dept.
1	20A01505	Building Technology	CE
2	20A02505	Electric Vehicles	EEE
3	20A03505	3D Printing Technology	ME
4	20A04505	Digital Electronics	ECE
5	20A05505a	Java Programming	CSE & Allied/IT
6	20A05602T	Artificial Intelligence	
7	20A12502	Mobile Application Development using Android	
8	20A54501	Optimization Techniques	Mathematics
9	20A56501	Materials Characterization Techniques	Physics
10	20A51501	Chemistry of Energy Materials	Chemistry

Note:

1. A student is permitted to register for Honours or a Minor in IV semester after the results of III Semester are declared and students may be allowed to take maximum two subjects per semester pertaining to their Minor from V Semester onwards.
2. A student shall not be permitted to take courses as Open Electives/Minor/Honours with content substantially equivalent to the courses pursued in the student's primary major.
3. A student is permitted to select a Minor program only if the institution is already offering a Major degree program in that discipline



Semester-VI						
S.No	Course Code	Course Name	L	T	P	Credits
1.	20A27601T	Food Microbiology	3	0	0	3
2.	20A27602T	Unit Operations in Food Processing	3	0	0	3
3.	20A27603T	Meat, Fish, Poultry and Marine Products processing	3	0	0	3
4.		Professional Elective Course- II				
	20A27604a	Food Processing Equipment Design	3	0	0	3
	20A27604b	Food Chemistry of Macro and Micro Nutrients				
	20A27604c	Nutraceuticals and functional Foods				
5.		Open Elective Course - II	3	0	0	3
6.	20A27601P	Food Microbiology Lab	0	0	3	1.5
7.	20A27602P	Unit Operations in Food Processing Lab	0	0	3	1.5
8.	20A27603P	Meat, Poultry, Fish and Marine Products Processing Lab	0	0	3	1.5
9.	20A27606	Skill oriented course - IV Extrusion Processing	1	0	2	2
10.	20A99601	Mandatory Non-credit Course Intellectual Property Rights & Patents	2	0	0	0
Total						21.5
Industry Internship (Mandatory) for 6 - 8 weeks duration during summer vacation						

Open Elective - II

S.No.	Course Code	Course Name	Offered by the Dept.
1	20A01704	Environmental Economics	CE
2	20A02605	Smart Electric Grid	EEE
3	20A03605	Introduction to Robotics	ME
4	20A04605	Signal Processing	ECE
5	20A04701b	Introduction to Internet of Things	ECE/CSE
6	20A05605a	Principles of Operating Systems	CSE & Allied/IT
7	20A05605b	Foundations of Machine Learning	
8	20A05605c	Data Analytics Using R	
9	20A54701	Wavelet Transforms & its applications	Mathematics
10	20A56701	Physics Of Electronic Materials and Devices	Physics
11	20A51701	Chemistry of Polymers and its Applications	Chemistry



Semester-VII						
S.No.	Course Code	Course Name	L	T	P	Credits
1.	20A27701a	Professional Elective Course– III Food Engineering	3	0	0	3
	20A27701b	Food Toxicology				
	20A27701c	Novel Technologies for Food Processing				
2.	20A27702a	Professional Elective Course– IV Brewing Technology	3	0	0	3
	20A27702b	Food Additives				
	20A27702c	Thermal Processing of Foods				
3.	20A27703a	Professional Elective Course– V Extrusion Technology	3	0	0	3
	20A27703b	Food Safety and Standards Act & Regulations in India				
	20A27703c	Food Plant Sanitation and Hygiene				
4.	20A52701a	Humanities Elective – II Entrepreneurship and Incubation	3	0	0	3
	20A52701b	Management Science				
	20A52701c	Enterprise Resource Planning				
5.		Open Elective Course – III	3	0	0	3
6.		Open Elective Course – IV	3	0	0	3
7.	20A27706	Skill oriented course - V Bakery Products	1	0	2	2
8.	20A27707	Evaluation of Industry Internship				3
Total						23

Open Elective - III

S.No	Course Code	Course Name	Offered by the Dept.
1	20A01704	Cost Effective Housing Techniques	CE
2	20A02704	IOT Applications in Electrical Engineering	EEE
3	20A03704	Product Design & Development	ME
4	20A04704	Electronic Sensors	ECE
5	20A05704a	Web Technologies	CSE & Allied/IT
6	20A05704b	VR & AR for Engineers	
7	20A05704c	Software Engineering	
8	20A54702	Numerical Methods for Engineers	Mathematics
9	20A56702	Sensors And Actuators for Engineering Applications	Physics
10	20A51702	Chemistry of Nanomaterials and Applications	Chemistry

Open Elective - IV

S.No	CourseCode	Course Name	Offered by the Dept.
1	20A01705	Health, Safety & Environmental management	CE
2	20A02705	Renewable Energy Systems	EEE
3	20A03705	Introduction to Composite Materials	ME
4	20A04705	Microcontrollers and Applications	ECE
5	20A05705a	Cyber Security	CSE & Allied / IT
6	20A05705b	Introduction to Full Stack Development	
7	20A05705c	Industrial IoT	
8	20A54703	Number theory & its Applications	Mathematics
9	20A56703	Smart Materials and Devices	Physics
10	20A51703	Green Chemistry and Catalysis for Sustainable Environment	Chemistry



Semester-VIII							
S.No.	Course Code	Course Name	Category	L	T	P	Credits
1.	20A27801	Full Internship & Project work	PR				12
Total							12

COURSES OFFERED FOR HONOURS DEGREE IN FOOD TECHNOLOGY

S.No.	Course Code	Course Title	Contact Hours per week		Credits
			L	T	
1	20A27H01	Technology of Oils and Fats	3	1	4
2	20A27H02	Food Storage Engineering	3	1	4
3	20A27H03	TQM in Food Industry	3	1	4
4	20A27H04	Entrepreneurship Development	3	1	4
SUGGESTED MOOCs					
5	20A27H05	MOOC I Introduction to Internet of Things (IIT Kharagpur)			2
6	20A27H06	MOOC II: Novel Technologies for Food Processing & Shelf-life Extension (IIT Kharagpur)			2

LIST OF MINORS OFFERED TO FOOD TECHNOLOGY

S.No.	Minor Title	Department offering the Minor
1.	Construction Technology	Civil Engineering
2.	Environmental Geotechnology	Civil Engineering
3.	Energy Systems	EEE
4.	3D Printing	ME
5.	Industrial Engineering	ME
6.	Internet of Things	ECE
7.	Artificial Intelligence & Data Science	CSE & Allied / IT
8.	Virtual & Augmented Reality	
9.	Cyber Security & Blockchain Technologies	



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-I Sem **L T P C**
3 0 0 3

(20A27501T) MILK AND MILK PRODUCTS PROCESSING

Course Objectives:

- To impart knowledge to the students on milk and milk products processing, manufacturing of indigenous milk products, packaging and storage of milk and milk products.

Course Outcomes

By the end of the course, the students will be able to

- Know about milk, its constituents, nutritive value, collection and its hygienic handling practices
- Study about Pasteurization, Homogenization and Sterilization of milk.
- Learn about manufacture of cream, butter, ghee, yoghurt, cheese, ice-cream, indigenous milk products and milk confectionery

UNIT I

Fluid Milk: Composition of milk and factors affecting it. Physico-chemical characteristics of milk and milk constituents. Production and collection, cooling and transportation of milk. Tests for milk quality and Adulteration. Pasteurization and Sterilization: Process and equipment for milk pasteurization, direct and indirect sterilization; Ultra - High - Temperature (UHT) sterilization. Fouling of pasteurizers and sterilizers. Aseptic packaging, dairy plant sanitization.

UNIT II

Homogenizers: principle of operation, design calculation for laminar and turbulent regimes, technology of homogenized milk production. Technology and standards of commercial liquid milk products: Toned, Double Toned Products, Reconstituted, Recombined, Standardized and Fermented Milks etc, FSSAI Specifications. Dairy Chemistry & Microbiology: Roles of lipids, proteins, carbohydrates, minerals, vitamins and enzymes, importance of psychophilic, mesophilic and thermophilic spoilage organisms in storage.

UNIT III

Dairy Products Manufacturing: Process Technology and standards of manufacturing of Fermented Products like dahi, shrikhand; lassi; mattha/Chhas and Other Milk Products (Casein, Whey Proteins, Lactose Etc.). Manufacturing of Indigenous dairy products like milk based puddings/ desserts- kheer; payasam; rabri, rasagulla, paneer, Channa, Khoa, Kalakhand, FSSAI Specifications.

UNIT IV

Definition, Classification, Composition and physico-chemical properties of Cream. Production processes and quality control. Butter: Definition, Classification, Composition and methods of manufacture, Packaging and storage. Butter oil/Ghee. Ice cream: History, Definition, Classification and Composition, Constituents and their role. Preparation of mixes and freezing of Ice cream, Overrun, Judging, Grading, and defects of Ice cream, FSSAI Specifications.

UNIT V

Evaporated and Condensed milk: Method of manufacture, Packaging and storage. Defects, Causes and prevention. Roller and Spray Drying of milk solids. Instantization. Flowability, Dustiness, Reconstituability, Dispersability, Wettability, Sinkability and appearance of milk powders. Manufacture of Casein, Whey protein, Lactose from milk or use in formulated foods, FSSAI Specifications.

Textbooks:

1. Outlines of dairy technology, Sukumar De. Oxford University Press. New Delhi.
2. P. Walstra, J.T.M.Wouters and T.J. Geurts, "Dairy Science Technology", CRC press, 2nd Edition, 2006.



References:

1. E. Spreer, “Milk and Dairy Product Technology”, 2nd Edition, Marcel Dekker, 1998.
2. R.K. Robinson, “Modern Dairy Technology, Vol. 1: Advances in Milk Processing”, 2nd Edition, Aspen Publishers, 1999.
3. R. K. Robinson, “Modern Dairy Technology, Vol. 2: Advances in Milk Products”, , 2nd Edition, Aspen Publishers 1996.
4. Sukumar De, “Outlines of Dairy Technology”, 3rd Edition, Oxford University Press, 2006.
5. C. Eckles, W. Combs, and H. Macy, “Milk and Milk Products”, 3rd Edition, Tata McGraw Hill, 2003.
6. E. H. Marth and J. L. Eteele, “Applied Dairy Microbiology”, 2nd Edition, Marcel Dekker, 2001.
7. P. Walstra, T.J. Geurts, A.Noomen, and J.S. Van Boekel, “Dairy Technology: Principles of Milk Properties and Processing”, Marcel Dekker, Illustrated Edition, 1999



AWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-I Sem **L T P C**
3 0 0 3
(20A27502) BAKERY & CONFECTIONARY PRODUCTS PROCESSING

Course Objectives

- To impart knowledge to the students on major/ minor ingredients, functions of proteins, carbohydrates, lipids, enzymes.
- To understand the students on bread making process, bread spoilage factors, Gums and Jellies, and Cocoa bean Processing.

Course Outcomes

By the end of the course, the students will be able to

- Know about major/ minor ingredients, functions of proteins, carbohydrates, lipids, enzymes.
- Study about bread, gums and jellies, and cocoa bean making process, and bread spoilage factors, Processing.
- Learn about Bread, biscuits, chewing gum types, quality assessment and formulations

UNIT I

Major ingredients and minor ingredients: wheat flour, components and functions; proteins, carbohydrates, lipids, enzymes, sweeteners and shortenings, functions, sources, types and mechanisms. Yeast functions, types and factors influencing the fermentation. Yeast foods, enzymatic supplements, oxidizing agents, salt, and dairy and egg products mold inhibitors, dough strengtheners/ softeners and enrichment. Miscellaneous flours (rye). Bread types, quality assessment and formulations.

UNIT II

Bread making process: straight dough, rapid processing, mechanical dough development. Mixing and dough processing; functions of mixing, mixer types, fermentation, dough transfer system, dough makeup; dividing rounding and pre-moulding, first proving, moulding, panning and proving. Process developments. Baking process, stages, baking reaction and bread cooling, thermal reactions keeping properties of bread and related products. Bread spoilage and staling, factors and control measures.

UNIT III

Biscuits; biscuits, cookie, crackers, granulation, chemical leaveners. Baking powder, function, composition, and reactivity, neutralizing value. Preparation of biscuits dough's mixing objectives, mixer types, fermentation of shaped dough pieces. Biscuit baking, heat transfer mechanism, changes during baking, cooling, and packaging.

UNIT IV

Gums and Jellies: Technology and Chemistry of Hydrocolloids, Hydrocolloid pretreatment processes, Liquid preparation, Production (Shaping, Drying), Finishing treatments, Faults, Causes and Cures. Chewing gum Technology: Ingredients, Chewing properties, Formulation, Processing methods. Confectionery Products: Ingredients, Formulation, Processing methods.

UNIT V

Cocoa bean Processing: Harvesting, Fermentation, Drying, Roasting. Cocoa mass, Cocoa butter and Cocoa powder. Chocolate Manufacture: Raw materials used, Particle size reduction, Conching, Tempering, Enrobing, Moulding, Cooling, Panning and Packaging.

Textbooks:

1. Khetarpaul, N. (2005). Bakery Science and Cereal Technology. Daya Books.
2. Kent, N. L. (1966). Technology of Cereals, with special reference to wheat.
3. Scott J.H. 1951. Flour Milling Process. Chapman & Hall.
4. Hui, Y. H., Corke, H., De Leyn, I., Nip, W. K., & Cross, N. A. (Eds.). (2008). Bakery Products: Science and Technology. John Wiley & Sons.



References:

1. Faridi, H., & Faubion, J. M. (2012). Dough Rheology and Baked Product Texture. Springer Science & Business Media.
2. Cauvain, S. P., & Young, L. S. (2008). Baked Products: Science, Technology and Practice. John Wiley & Sons.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-I Sem **L T P C**
(20A27503T) FOOD PACKAGING **3 0 0 3**

Course Objectives:

- Need for packaging of foods
- Different packaging materials, packaging machinery
- Recent advances in food packaging and packaging regulations

Course Outcomes: By the end of the course, the students will be able to know

- About the importance of food packaging
- About different types of packaging materials such as paper, glass, metal & plastics
- About advanced packaging techniques and packaging machinery

UNIT I

Introduction: Importance and functions of food packaging, history of food packaging, forms of packaging-rigid, semi-rigid, and flexible, levels of packaging – primary, secondary, tertiary and quaternary, tests on packaging materials-mechanical strength (tensile, elongation at break, notch and tear), gas and water vapor transmission rates.

UNIT II

Paper: Types of paper and paperboards, paper production (pulping, beating, refining, converting), properties and applications in food packaging.

Glass: composition, properties, manufacturing and applications in food packaging.

Metal: Tinsplate, tin-free steel, and aluminum containers - manufacturing, corrosion, protective coatings and applications in food packaging.

UNIT III

Plastic packaging: Thermoplastics & thermosetting plastics, merits & demerits of plastics, polyethylene terephthalate, polyolefines (polyethylene, polypropylene), polyvinyl chloride, polystyrene, polycarbonate, Nylon – structure, mechanical, sealing, barrier properties, recycling symbols, oriented, co-extruded, laminated, metalized films and applications in food packaging.

UNIT IV

Packaging machinery: Vacuum packaging, shrink, stretch packaging, form-fill & sealing machine.

Selection of packaging material for different foods: cereals, bakery products, fruits, vegetables, spices, Oils and Fruit & Carbonated Beverages.

UNIT V

Advances in Food Packaging: Active packaging- absorbers, emitters, antimicrobial, antioxidant systems. Intelligent Packaging – Time-temperature indicators, freshness indicators, radio frequency identification tags (RFIDs).

Biodegradable packaging, edible packaging, packaging and labeling regulations (FSSAI).

Packaging waste management: hierarchy of waste management, composting and biodegradation.

Textbooks:

1. G. L. Robertson, Food Packaging “Principles and Practices” 3rd Edition, CRC Press, 2013.
2. J.H. Han, “Innovation in Food Packaging.”, 1st Edition, Elsevier Publications, 2005.

References:

1. R. Coles, D. McDowell and M. J. Kirwan, “Food Packaging Technology”. 1st Edition CRC Press, 2003.
2. R. Ahvenainen, “Novel Food Packaging Techniques”. 1st Edition Woodhead Publishing, 2003.
3. D.S. Lee, K. L. Yam, and L. Piergiovanni, “Food Packaging Science and Technology”. 1st Edition, CRC Press, 2008.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-I Sem **L T P C**
3 0 0 3

(20A27504a) FOOD NANOTECHNOLOGY
(PROFESSIONAL ELECTIVE-I)

Course Objectives:

- To understand nanotechnology, synthesis and characterization of nanomaterials, nanoscale delivery systems and regulatory aspects in foods.

Course Outcomes: By the end of this course students will attain

- Understand nanotechnology, natural and engineered nanoparticles in food
- Knowledge about synthesis and characterization of nanomaterials.
- Knowledge of nanoscale delivery systems and risk assessment-regulatory approaches to nanotechnology in food.

UNIT I

Introduction: Definition of nanotechnology, a brief history of nanotechnology, potential applications to food, natural nanostructures in food, use of engineered nanoparticles in food.

UNIT II

Synthesis of Nanomaterials: Top-down and bottom-up approaches – Mechanical, Chemical and Biological methods- Characterization of Nano materials: Powder X-ray diffraction, Scanning electron microscopy, Transmission electron microscopy, Dynamic light scattering- Infra-red spectroscopy

UNIT III

Nanoscale delivery systems: Nanoencapsulation- Need for nanoencapsulation- techniques for Nanoencapsulation: Liposome, Nanoemulsion, solid lipid nanoparticles- preparation, stability and applications in the food industry

UNIT IV

Nanotechnology for food quality and safety: nanomaterials as antimicrobial agents, nanosensors for the detection of food contaminants, food spoilage, and pathogen identification.

UNIT V

Regulatory aspects of Nanotechnology in foods: European Union (EU) & non-EU regulation, regulatory aspect related to nanoscale food ingredients, food additives and food contact materials (FCM's).

Textbooks:

1. Padua G. W., Wang Q., “Nanotechnology Research Methods for Foods and Bioproducts”, Wiley-Blackwell 2012.
2. Fulekar M.H., “Nanotechnology - Importance and Applications”, Wiley Publications 2019.

References:

1. Q. Huang, “Nanotechnology in Food, Beverage and Nutraceutical Industries”, Woodhead publishing 2012.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-I Sem **L T P C**
3 0 0 3
(20A27504b) FOOD SAFETY MANAGEMENT SYSTEM
(PROFESSIONAL ELECTIVE-I)

Course Objectives:

- To understand the general aspects of food safety management system.
- To study the importance of implementing Food safety management systems in industries

Course Outcomes: At the end of the course student will gain

- Knowledge on various food safety and regulatory aspects, Food standards regulatory bodies etc.
- Understand Indian and Food Regulatory Regime (Existing and old), FSSAI, PFA Act and Rules
- Acquire Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations.
- Know the necessity of Concept and Implementation of HACCP in a food premises.

UNIT I

Introduction, concept of food safety and Food Security. Indian and Food Regulatory Regime (Existing and old), FSSAI, PFA Act and Rules, Food Licensing and Registration System, Food Import Clearance System. Food hazards and contaminations - biological (bacteria, viruses and parasites), chemical (toxic constituents / hazardous materials) pesticides residues / environmental pollution / chemicals) and physical factors. Preventive food safety systems - monitoring of safety, wholesomeness and nutritional quality of food. Prevention and control of microbiological and chemical hazards.

UNIT II

Food Safety and Standards Act, 2006, Food Safety Standards Regulation, Essential Commodities Act, 1955, Global Scenario, Codex Alimentarius, WHO/FAO Expert Bodies (JECFA/JEMRA/JMPR). Food safety inspection services (FSIS) and their utilization. Legal Metrology act, Weight and Measures act.

UNIT III

Introduction to OIE and IPPC, Other International Food Standards (e.g. European Commission, USFDA etc). WTO: Introduction to WTO Agreements: SPS and TBT Agreement, Export and Import Laws and Regulations, Export (Quality Control and Inspection) Act, 1963. Customs Act and Import Control Regulations, Other Voluntary and mandatory product specific regulations, Other Voluntary National Food Standards: BIS Other product specific standards; AGMARK. Nutritional Labeling, Health claims.

UNIT IV

Risk assessment studies: Risk management, risk characterization and communication, risk assessment tools and techniques. Concept and Implementation of HACCP in a food premises.

UNIT V

Voluntary Quality Standards and Certification. GMP, GHP, GAP, Good Animal Husbandry Practices, ISO 9000, ISO 22000, ISO 14000, ISO 17025, PAS 22000, FSSC 22000, BRC, BRCIOP, IFS, SQF 1000, SQF 2000. Role of NABL, CFLS. Halal & Kosher Standard.

Textbooks:

1. Singal R.S., "Handbook of Indices of Food Quality and Authenticity". Woodhead Publ. Cambridge, UK.
2. Shapton D.A., "Principles and Practices of Safe Processing of Foods". Butterworth Publication, London.

References:

1. Jacob M.B., "The Chemical Analysis of Foods and Food Products". CBS Publications. New Delhi.
2. Pomeranze Y, "Food Analysis - Theory and Practice". CBS Publications, New Delhi.
3. FSSAI website: www.fssai.gov.in
4. Winton AL, "Techniques of Food Analysis". Allied Science Publications New Delhi



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT) – III-I Sem **L T P C**
3 0 0 3

(20A27504c) ENERGY AUDIT AND CONSERVATION
(PROFESSIONAL ELECTIVE-I)

Course Objectives:

- To know different sources of energy
- To understand the technologies used for energy conservation
- To acquire knowledge on energy saving and their utility

Course Outcomes:By the end of course

- Students will gain knowledge on engineering behind energy conservation, technologies used for energy conservation and energy from various wastes and saving of energy.

UNIT I

Fundamentals of Engineering Analysis and Management: Fundamentals of Heat Transfer, Fluid Mechanics, and Thermodynamics in Food Processing, Fundamentals of Energy Auditing, Sustainability in the Food Industry

UNIT II

Energy Conservation Technologies Applied to Food Processing Facilities: Energy Conservation in Steam Generation and Consumption System, in Compressed Air System, in Power and Electrical Systems, in Heat Exchangers, Waste-Heat Recovery and Thermal Energy Storage in Food Processing Facilities, novel Thermodynamic Cycles Applied to the Food Industry for Improved Energy Efficiency

UNIT III

Energy Saving Opportunities in Existing Food Processing Facilities: Energy Consumption pattern, Energy Conservation in Grains and Oilseeds Milling Facilities, in Sugar and Confectionary Processing Facilities, in Fruit and Vegetable Processing Facilities, in Dairy Processing Facilities, in Meat Processing Facilities, in Bakery Processing Facilities

UNIT IV

Energy Conservation in Emerging Food Processing Systems: Membrane Processing of Foods, Energy Efficiency and Conservation in Food Irradiation, in Pulsed Electric Fields Treatment, in High-Pressure Food Processing, in Microwave Heating, in Supercritical Fluid Processing

UNIT V

Conversion of Food Processing Wastes into Energy: Food Processing Waste Utilization, Anaerobic Digestion of Food Processing Wastes, Fermentation of Food Processing Wastes into Transportation Alcohols, Bio-diesel Production from Waste Oils and Fats, Thermo-chemical Conversion of Food Processing Wastes for Energy Utilization

Textbooks:

1. Lijun Wang, “Energy Efficiency and Management in Food Processing Facilities”. CRC Press, 1st Edition, 2009.
2. R.P. Singh, “Energy in Food Processing”. 1st Edition, Elsevier Publishing Co. Amsterdam, 1986.

References:

1. Berit Mattsson and Ulf Sonesson, “Environmentally Friendly Food Processing”, 1st Edition, CRC Press, 2003



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (FT)– III-I Sem

L T P C
0 0 3 1.5

(20A27503P) FOOD PACKAGING LAB

Course Objectives:

- To study the various properties of packaging materials and to measurements various packaging properties.

Course Outcomes: Students will be able to understand

- Measurements of various properties for different packaging materials
- Determination of quality tests for different packaging materials
- Packaging practices followed for packing fruits and vegetables
- Shelf-life calculations for food products

LABORATORY EXPERIMENTS

1. Classification of various packages based on material and rigidity
2. Measurement of thickness of paper, paper boards
3. Measurement of basic weight and grammage of paper and paperboards
4. Measurement of water absorption of paper, paper boards
5. Measurement of bursting strength of paper, paper boards
6. Measurement of tear resistance of papers
7. Measurement of puncture resistance of paper, paperboard and corrugated fiberboard (CFB)
8. Measurement of tensile strength of paper, paper boards
9. Measurement of grease resistance of papers
10. Determination of gas and water transmission rate of package films
11. Determination of laquer integrity test; Drop test, Box compression test
12. Identification of plastic films; Determination of seal integrity, ink adhesion
13. Packaging practices followed for packing fruits and vegetables
14. Head space analysis of packaged food
15. Study of vacuum packaging machine, bottle filling machine and form-fill-seal machine.
16. Thermal shock test for glass containers



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-I Sem **L T P C**
0 0 3 1.5
(20A27501P) MILK AND MILK PRODUCTS PROCESSING LAB

Course Objectives:

- To conduct various quality tests for milk and products prepared from milk.

Course Outcomes:

Students will be able to learn

- Different quality tests for milk
- Various process technologies for preservation and quality of milk
- Processing of value added products from milk

LABORATORY EXPERIMENTS

1. Sampling of milk and milk products
2. Platform tests of raw milk like clot on boiling (COB) test, alcohol test etc.
3. Determination of physical properties of milk
4. Determination of proximate composition and biochemical properties of milk
5. Determination of microbiological load in milk.
6. Detection of adulterants in milk
7. Identification and demonstration of liquid milk processing equipment, pipes and fittings
8. Preparing standardized milk as per requirement
9. Estimation of milk fat Gerber centrifuge.
10. Pasteurization and homogenization of milk
11. Packaging of liquid milk
12. Preparation of sterilized flavored milk
13. Preparation of reconstituted milk/rehydrated milk
14. Preparation of cream
15. Preparation of buttermilk
16. Preparation of curd and yogurt
17. Preparation of lassi

Note: Visit to chilling center and Visit to a dairy plant.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
3 0 0 3

(20A52401) SOFT SKILLS
(Skill Oriented Course – II)

Course Objectives:

- To encourage all round development of the students by focusing on soft skills
- To make the students aware of critical thinking and problem-solving skills
- To develop leadership skills and organizational skills through group activities
- To function effectively with heterogeneous teams

Course Outcomes :By the end of the program students should be able to

- Memorize various elements of effective communicative skills
- Interpret people at the emotional level through emotional intelligence
- apply critical thinking skills in problem solving
- analyse the needs of an organization for team building
- Judge the situation and take necessary decisions as a leader
- Develop social and work-life skills as well as personal and emotional well-being

UNIT I

Soft Skills & Communication Skills

Introduction, meaning, significance of soft skills – definition, significance, types of communication skills - Intrapersonal & Inter-personal skills - Verbal and Non-verbal Communication

Activities:

Intrapersonal Skills- Narration about self- strengths and weaknesses- clarity of thought – self-expression – articulating with felicity

(The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes and literary sources)

Interpersonal Skills- Group Discussion – Debate – Team Tasks - Book and film Reviews by groups - Group leader presenting views (non- controversial and secular) on contemporary issues or on a given topic.

Verbal Communication- Oral Presentations- Extempore- brief addresses and speeches- convincing- negotiating- agreeing and disagreeing with professional grace.

Non-verbal communication – Public speaking – Mock interviews – presentations with an objective to identify non- verbal clues and remedy the lapses on observation

UNIT II

Critical Thinking

Active Listening – Observation – Curiosity – Introspection – Analytical Thinking – Open-mindedness – Creative Thinking

Activities:

Gathering information and statistics on a topic - sequencing – assorting – reasoning – critiquing issues –placing the problem – finding the root cause - seeking viable solution – judging with rationale – evaluating the views of others - Case Study, Story Analysis

UNIT III

Problem Solving & Decision Making

Meaning & features of Problem Solving – Managing Conflict – Conflict resolution – Methods of decision making – Effective decision making in teams – Methods & Styles

Activities:

Placing a problem which involves conflict of interests, choice and views – formulating the problem – exploring solutions by proper reasoning – Discussion on important professional, career and organizational decisions and initiate debate on the appropriateness of the decision. Case Study & Group Discussion



UNIT IV

Emotional Intelligence & Stress Management

Managing Emotions – Thinking before Reacting – Empathy for Others – Self-awareness – Self-Regulation – Stress factors – Controlling Stress – Tips

Activities:

Providing situations for the participants to express emotions such as happiness, enthusiasm, gratitude, sympathy, and confidence, compassion in the form of written or oral presentations.

Providing opportunities for the participants to narrate certain crisis and stress –ridden situations caused by failure, anger, jealousy, resentment and frustration in the form of written and oral presentation, Organizing Debates

UNIT V

Leadership Skills

Team-Building – Decision-Making – Accountability – Planning – Public Speaking – Motivation – Risk-Taking - Team Building - Time Management

Activities:

Forming group with a consensus among the participants- choosing a leader- encouraging the group members to express views on leadership- democratic attitude- sense of sacrifice – sense of adjustment – vision – accommodating nature- eliciting views on successes and failures of leadership using the past knowledge and experience of the participants, Public Speaking, Activities on Time Management, Motivation, Decision Making, Group discussion etc.

NOTE-:

1. The facilitator can guide the participants before the activity citing examples from the lives of the great, anecdotes, epics, scriptures, autobiographies and literary sources which bear true relevance to the prescribed skill.

2. Case studies may be given wherever feasible for example for Decision Making- The decision of King Lear or for good Leadership – Mahendar Singh Dhoni etc.

Textbooks:

1. Personality Development and Soft Skills (English, Paperback, Mitra BarunK.)Publisher: Oxford University Press; Pap/Cdr edition (July 22, 2012)
2. Personality Development and Soft Skills: Preparing for Tomorrow, Dr Shikha KapoorPublisher : I K International Publishing House; 0 edition (February 28, 2018)

Reference Books:

1. Soft skills: personality development for life success by Prashant Sharma, BPB publications 2018.
2. Soft Skills By Alex K. Published by S.Chand
3. Soft Skills: An Integrated Approach to Maximise Personality Gajendra Singh Chauhan, Sangeetha Sharma Published by Wiley.
4. Communication Skills and Soft Skills (Hardcover, A. Sharma) Publisher: Yking books
5. SOFT SKILLS for a BIG IMPACT (English, Paperback, RenuShorey) Publisher: Notion Press
6. Life Skills Paperback English Dr. Rajiv Kumar Jain, Dr. Usha Jain Publisher: Vayu Education of India

Online Learning Resources:

1. https://youtu.be/DUlsNJtg2L8?list=PLLy_2iUCG87CQhELCytvXh0E_y-bOO1_q
2. https://youtu.be/xBaLgJZ0t6A?list=PLzf4HHlsQFwJZel_j2PUy0pwjVUgj7KIJ
3. <https://youtu.be/-Y-R9hDI7IU>
4. <https://youtu.be/gkLsn4ddmTs>
5. <https://youtu.be/2bf9K2rRWwo>
6. <https://youtu.be/FchfE3c2jzc>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem

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3 0 0 3

(20A27601T) FOOD MICROBIOLOGY

Course Objectives:

- To understand the role of beneficial micro-organisms in food processing and preservation.
- To list the major food spoilage microorganisms.
- To analyze methods used to control or destroy micro-organism commonly found in food.
- Fermentation technology and its application in Food industry
- Industrially important Microorganisms and their application in food industry

Course Outcomes:

- The students will become familiar with identification of microorganisms and its activity in various foods.
- The students would understand the spoilage of foods due to harmful microorganisms.
- The students also get to know the various methods to eliminate/inactivate the growth of microorganisms in different foods
- Know about different Industrially important micro-organisms
- Know about Industrial fermentation technique
- Know about different growth regulators (Hormones).
- Know about different products produced by Industrial fermentation process

UNIT I

Historical development, Fundamentals of Microbiology, Microscopy (Optical & Electron Microscopy and types), Classification of Microorganisms, Microorganisms associated with foods (Yeast, molds, bacteria and fungi) – Morphology characteristics, reproduction.

UNIT II

Factors affecting growth of microorganisms (Yeast, molds, bacteria and fungi): – Intrinsic factors and Extrinsic factors. Estimating the number of microorganisms: – Sampling; Serial dilution; Total cell counts; Viable cell count; Plate counters, Indicator organisms, detection of specific microbes and toxins (rapid and alternate methods)

UNIT III

Microbial spoilage in Foods: Types of micro-organisms. Microorganisms associated with meat, poultry, sea foods, vegetables, dairy products, fruits and vegetables. Assessing microbial population with the meat, poultry, sea foods, vegetables, dairy products, fruits and vegetables – microbial spoilage of meat, poultry, sea foods, vegetables, dairy products, fruits and vegetables.

UNIT IV

Food borne diseases (Organism, occurrence, foods involved incubation period, symptoms and prevention). Food poisoning (Botulism, Staphylococcus). Food infections (Salmonella, Clostridium, Bacillus cereus, E. coli, Yersinia, Shigella, Vibrio parahaemolyticus, Listeria, Campylobacter.) Food borne viruses (Hepatitis A & B, Gastroenteritis, Poliovirus, Spongiform encephalopathy)

Beneficial Microorganisms in Food processing: Fermented foods, Beverages, Production of enzymes, Single cell protein

UNIT V

Water: Sources, uses, classification of water. Microbial quality: Sanitary quality of water, Quality of water for food processing, Water Pollution, Water related diseases, Purification and Treatment of water, water quality criteria and standards as per WHO, BIS, FSSAI.

Textbooks:

1. Pelczar, M.J., E.C.S. Chan and N.R. Krieg “Microbiology”. McGraw-Hill New York 1993.
2. Frazier, W.C. and Westhoff, D.C. “Food Microbiology”. 4th Edition. Tata McGraw Hill Publishing Co. Ltd., New Delhi 2008.



References:

1. Banwart, G.J, “Basic Food Microbiology” Van No Strand Reinhold Publishers, New York 1989.
2. Jay, J.M., “Modern Food Microbiology”. CBS Publishers & Distributors, New Delhi 2000.
3. S.C. Prescott and C.G. Dunn, “Industrial Microbiology Agrobios (India)”, 1st Edition, 2007.
4. A. H. Patel, “Industrial Microbiology”, 2nd Edition, McMillan India Ltd., 2009.
5. Kato and Fumitake Yoshida, “Biochemical Engineering Fundamentals”. 1st Edition, Wiley VCH, 2009., J. E. Bailey, F. 2nd Edition, Oilis, Tata Mc Graw Hill, 2010.
6. M. L. Shuller, F. Kargi, “Bioprocess Engineering- Basic Concepts”, 2nd Edition, PHI, 2002
7. P.F. Stanbary, A. Whitaker, Hall, “Principles of Fermentation Technology”, 2nd Edition, Aditya Books vt. Ltd., 2008



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
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(20A27602T) UNIT OPERATIONS IN FOOD PROCESSING

Course Objectives

- To impart knowledge to the students on principles, operation and maintenance of various food processing equipment namely mixing, forming, size reduction, cutting and grinding equipment, centrifugation, filtration material handling equipment like belt, screw and pneumatic conveyors, bucket elevator.

Course Outcomes: By the end of the course, the students will be able to

- Understand different food processing equipment that are being used in food industries, Study about the principles, operation and maintenance of food processing equipment viz., material handling, cleaning, grading, mixing, forming, size reduction, cutting, grinding, centrifugation, filtration, evaporation and drying

UNIT I

Geometrical, physical and mechanical properties of foods. Cleaning, sorting and grading of foods. Peeling, decortications, deseeding of fruits, dehulling of grains, blanching of vegetables. Size Reduction: Principles and types of size reduction equipment, Crushers, Grinders, mills, disintegration of fibrous materials. Energy and power requirement, Mechanical expression of edible oil.

UNIT II

Sedimentation: Theory and principles of sedimentation, minimum area for continuous sedimentation, applications in food industry. Filtration: Principle of Constant pressure and constant rate filtration and types of filtration equipment, Settling classifiers and Flotation Screening, types of screen. Centrifugation: Principle of settling and centrifugation, devices for centrifugal separation. Membrane separation processes: Reverse osmosis, microfiltration, ultra-filtration, Nano-filtration dialysis and pervaporation.

UNIT III

Mixing: Mixing of liquids and solids (powder), mixing equipment, mixing index and mixing time, Agitation and blending, types of agitators, power consumption in mixing. Scope and importance of material handling devices; Study of different material handling systems: Classification, principles of operation, conveyor system selection/design; Separation/Grading: Theory and principles: Types of separators – Disk, Indent cylinder, spiral and specific gravity, stone, inclined belt, pneumatic and aspirator separators- separation based on fluidization techniques – magnetic, cyclone and color separator.

UNIT IV

Belt conveyor: Principle, characteristics, design, relationship between belt speed and width, capacity, inclined belt conveyors, idler spacing, belt tension, drive tension, belt tripper; Chain conveyor: Principle of operation, advantages, disadvantages, capacity and speed, conveying chain; Screw conveyor: Principle of operation, capacity, power, troughs, loading and discharge, inclined and vertical screw conveyors;

UNIT V

Bucket elevator: Principle, classification, operation, advantages, disadvantages, capacity, speed, bucket pickup, bucket discharge, relationship between belt speed, pickup and bucket discharge, buckets types; Pneumatic conveying system: Capacity and power requirement, types, air/product separators; Gravity conveyor design considerations, capacity and power requirement. Storage: Methods of storage, silos and bins, hoppers.

Textbooks:

1. R.L Earle. “Unit operations in Food Engineering”.
2. K.M Sahay and Singh “Unit operations of Agricultural Processing”. K.K. Vikas Publishing House Pvt. Ltd. New Delhi.



References:

1. Mc. Cabe, J.C Smith and P. Harriot. "Unit Operations of Chemical Engineering". McGraw Hill Publishers. New Delhi.
2. N. N. Mohesinin "Physical Properties of Plant and Animal Materials".
3. A. Chakraverty, Pulses and Oilseeds. "Post-Harvest Technology of Cereals", Oxford & IBH Publishers. New Delhi.
4. P.J.Fellows "Food Processing Technology, Principles and Practice", Wood Head Publishing Ltd., Cambridge, England.
5. R. P Singh and D.R. Heldman. "Introduction to Food Engineering", 3rdEdition.
6. P.G Smith "Introduction to Food Process Engineering".



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem

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(20A27603T) MEAT, POULTRY, FISH AND MARINE PRODUCTS PROCESSING

Course Objectives:

- To enable the students to learn about national and international prospects of Meat industry along with processing and preservation technology of Meat, Egg and Poultry Products.
- To impart knowledge on fisheries and other marine foods, their nutritional composition and processing technologies

Course Outcomes: At the end the course students will acquire

- knowledge on composition and structure of Meat, Egg, Poultry & effective preservation techniques along with concepts of value addition & quality assessment of Meat and sanitary measures in meat industry
- Know the importance and status of meat and poultry in India and world
- Understand the characteristics and structure of meat and poultry muscle.
- Explain the various preservation techniques of meat
- Gain knowledge in the areas of fish and other marine food preservation and processing technology

UNIT I

Sources and importance of meat, and poultry; Status of Meat and poultry industry in India; World production of meat and poultry, characteristics and structure of meat and poultry muscle. Abattoir design and layout. Pre-slaughter and slaughtering operations for animals; stunning, methods of stunning –bleeding-skinning of animals. Ante-mortem inspection, Evaluation of animal carcasses.

UNIT II

Biochemical changes in meat-rigor mortis – Factors affecting post-mortem changes, properties and shelf life of meat; meat tenderization-artificial tenderization-muscle stretching-mechanical disruption by artificial enzymes. Mechanical deboning, grading, and aging; Preservation of meat by chilling, freezing, pickling, curing, cooking and smoking, dehydration, radiation, chemical and biological preservatives; Meat emulsions; Eating and cooking quality of meat.

Meat cutting and handling; Preparation, preservation of smoked meat, meat sausages, dehydrated meat products, comminuted meat products: ham, bacon, meat analogues and their quality evaluation; effect of processing on nutritive value; hygiene in meat processing.

Meat plant sanitation and safety; By-products of meat and their utilization; Safety standards in meat industry: HACCP/ISO/FSSAI/Kosher/Halal.

UNIT III

Poultry: Classification, differences between broilers and layers, anti-mortem and postmortem inspection, Pre-slaughter care and consideration; Poultry processing, tenderness and shelf-life of poultry meat, grading of poultry meat and products made from poultry meat, Operations in preparation of dressed poultry, its storage and marketing, processing of poultry. Egg: structure, composition, nutritive value, egg products, dehydrated egg powder. Effect of processing on nutritive value; additives used in poultry products.

UNIT IV

Fish: Types, Classification, composition, characteristics and quality assessment, spoilage of fish-microbiological, physiological, biochemical; Relationship between chilling and storage life.

Methods of Preservation of fish: Drying, Salting, Smoking and Curing. freezing, changes in quality during chilled and frozen storage; Principles of canning, effect of heat processing on fish, storage of canned fish.

Fish products: Fish muscle proteins, surimi process, fish sauce and pastes.

Fish by products - production of fish meal, fish protein extracts, fish protein hydrolysates, fish protein concentrate, fish liver oil.

UNIT V

Marine products: Prawns, crabs, lobsters, shrimps, shell fishes and Oysters – Processing and byproducts.



Textbooks:

1. B.D. Sharma and Kinshuki Sharma. "Outlines of Meat Science and Technology". Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi. 2011.
2. B.D. Sharma. "Modern Abattoir Practices and Animal Byproducts Technology". Jaypee Brothers Medical Publishers Pvt. Ltd., New Delhi. 2003.
3. D.P. Sen. "Advances in Fish Processing Technology". 2005. Allied Publishers Pvt. Ltd., Delhi.
4. "Preservation of Fish and Meat". Brigitte Maas-van Berkel, Brigiet van den Boogaard and Corlien Heijnen. 2004. Agromisa Foundation, Wageningen.

References:

1. Alan H. Varnam and Jane P. Sutherland. "Meat and Meat Products: Technology, Chemistry and Microbiology". Chapman & Hall, London. 1995.
2. William J. Stadelman and Owen J. Cotterill. "Egg Science and Technology". 4th Edition. Food Products Press, NY, USA. 1995.
3. R.A. Lawrie. "Meat Science" 4th Ed. Pergamon Press, Oxford, UK. 1985.
4. Vikas Nanda. "Meat, Egg and Poultry Science & Technology". I.K. International Publishing House Pvt. Ltd., New Delhi. 2014.
5. George Borstorm. "Fish as Food - Vol. I, II, III and IV", Academic Press, New York. 1961.
6. K. Gopakumar. "Textbook of Fish Processing Technology", ICAR, New Delhi.
7. Y Charles L. Cutting. Processing and Preservation of Fish. Agro Bios, New Delhi.
8. G.M. Hall. "Fish Processing Technology", 2nd Edition, Chapman & Hall, London, UK, 1997



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT) – III-II Sem **L T P C**
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(20A27604a) FOOD PROCESSING EQUIPMENT DESIGN
(PROFESSIONAL ELECTIVE -II)

Course Objectives:

- To know materials for fabrication, Design of pressure and storage vessels, and operating conditions.
- To understand the different food processing equipment design
- To acquire knowledge on design concepts of various equipments

Course Outcomes:By the end of course

- Students will gain knowledge on Design of pressure and storage vessels , shell and its component, heat exchangers, evaporators, dryers extruders utilized in Food Processing

UNIT I

Materials and properties: Materials for fabrication: Characteristics of construction material :Stainless steel, Aluminum, Nickel and Monel, Plastic Materials, etc., Design of pressure and storage vessels: Operating conditions, design conditions and stress

UNIT II

Design of shell and its component, mountings and accessories, Design of heat exchangers: Design of shell and tube heat exchanger, plate heat exchanger, scraped surface heat exchanger, Sterilizer and retort.

UNIT III

Design of evaporators: Design of single effect and multiple effect evaporators and its components, Design of rising film and falling film evaporators and feeding arrangements for evaporators, Design of centrifuge separator.

UNIT IV

Design of dryers: Design of tray dryer, tunnel dryer, fluidized dryer, spray dryer, vacuum dryer, freeze dryer and microwave dryer.

UNIT V

Design of extruders: Cold and hot extruder design, design of screw and barrel, design of twin screw extruder, Safety measures in equipment design, pressure relief devices.

Textbooks:

1. Sarvacos G and AthanaciosEK , Handbook of Food Processing Equipment , 2nd Edition, Springer 2016
2. Mahajani and Umarji , Process Equipment Design, Macmillan Publisher India Ltd. 1996

References:

1. R. Paul Singh and Heldman DR, Introduction to Food Engineering, 5th Ed. Elsevier, Amsterdam, The Netherlands. 2014
2. Kenneth JV, Enrique R and RP Singh, Handbook of Food Engineering Practice, CRC Press, Boca Raton, FL, USA. 1997



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT) – III-II Sem **L T P C**
3 0 0 3
(20A27604b) FOOD CHEMISTRY OF MACRO AND MICRO NUTRIENTS
(PROFESSIONAL ELECTIVE-II)

Course Objectives:

- To know concepts of food chemistry, functional properties of role of water
- To understand the importance of macro and micro nutrients
- To acquire knowledge on Food toxicology

Course Outcomes:By the end of course

- Will understand the chemical composition of various food components
- Students will gain knowledge on macro, micro nutrients and food toxicology.

UNIT I

Introduction: Nature Scope and development of food chemistry, role of food chemist. Moisture in foods: Role and type of water in foods; Functional properties of water; role of water in food spoilage; Water activity and sorption isotherm; Molecular mobility and foods stability. Dispersed systems of foods: Physicochemical aspects of food dispersion system (sol, gel, foam, emulsions, etc); Rheology of diphasic systems

UNIT II

Carbohydrates: Changes of carbohydrates on cooking, modification of carbohydrates, dietary fibres and carbohydrates digestibility; Enzymatic and chemical reactions of carbohydrates; Proteins in foods: Processing induced, physical, chemical and nutritional changes in protein, chemical and enzymatic modification of proteins. Lipids in foods: Role and use of lipids/fat, crystallization and consistency, chemical aspects of lipids, lipolysis, auto-oxidation, and thermal rancidity, thermal decomposition

UNIT III

Pigments in animal and plants kingdoms: Haeme pigments, chlorophyll, carotenoids, phenolic and flavonoids, betalins, effect of processing on pigment behaviour; Technology for retention of natural colours of food stuffs. Enzymic Browning and Non-enzymic browning reactions, Enzyme Inhibitors. Food colorants; Regulatory use of regulatory dyes; Colour losses during thermal processing;

UNIT IV

Vitamins and minerals: Requirements, allowances, enrichment, restorations, fortifications, losses of vitamins and minerals, optimization and retention of vitamins and minerals; Chemistry of anti-nutritional factors.

UNIT V

Food toxicology: Inherent toxicants – antinutritional factors their occurrence, effects and methods of elimination or inactivation- protease inhibitions, lectins, lathyragens, phytates and flatulence factors; Terms in toxicology; Safety evaluation using traditional and modern approach; Food Contaminants; Pesticidal residues – permitted limits; Toxicology and public health

Textbooks:

1. Meyer L.H, Food Chemistry, CBS Publishers & Distributors, New Delhi (India) 2004
2. H.-D. Belitz, W. Grosch and P. Schieberle, Food Chemistry, 4th Ed. Springer-Verlag Berlin Heidelberg. 2009
3. DeMan JM, Principles of Food Chemistry, AVI Publishing Co Inc., 1976

References:

1. Swaminathan. M, Essentials of Food and Nutrition, Vol. II, Ganesh & Co., 1974
2. Eskin NAM, Henderson HM and TownsedRJ, Biochemistry of Foods, Academic Press, New York 1971.
3. Fennema, Owen R. "Food Chemistry, Marcel Dekker." Inc, New York, 1996.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT) – III-II Sem **L T P C**
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(20A27604c) NUTRACEUTICALS AND FUNCTIONAL FOODS
(PROFESSIONAL ELECTIVE-II)

Course Objectives:

- To develop comprehensive understanding of different nutraceuticals and functional foods
- To understand the potential of various functional foods in promoting human health.

Course Outcomes:

By the end of completion of the course

- Students will gain knowledge on the functional food concept as related to ingredient efficacy and safety.
- Familiarizes students the potential of various functional foods in promoting human.

UNIT I

Background, status of nutraceuticals and functional food market, definitions, difference between nutraceuticals and functional foods, types of nutraceutical compounds and their health benefits, current scenario

UNIT II

Types of nutraceutical compounds – Phytochemicals, phytosterols and other bioactive compounds, peptides and proteins, carbohydrates (dietary fibers, oligosaccharides and resistant starch), prebiotics, probiotics and synbiotics, lipids (Conjugated Linoleic Acid, omega-3 fatty acids, fat replacers), vitamins and minerals; their sources and role in promoting human health.

UNIT III

Cereal and cereal products, Milk and milk products, egg, oils, meat and meat products, sea foods, nuts and oilseeds, functional fruits and vegetables, herbs and spices, beverages (tea, wine etc), Fermented foods – their health benefits and role in conditions like cardiovascular diseases, hypertension, diabetes etc.

UNIT IV

Future prospects of functional foods and nutraceuticals and their potential for use in improving health. Development in processing of functional foods. Formulation and fabrication of functional foods, Customized foods.

UNIT V

Stability of Nutraceuticals. Safety, Consumer acceptance and assessment of health claims, labeling, marketing and regulatory issues related to Nutraceuticals and functional foods.

Textbooks:

1. Wildman REC, Handbook of Nutraceutical and Functional Foods, CRC Press 2001
2. Ghosh D et al, Innovations in Healthy and Functional Foods, CRC Press 2012

Reference Books:

1. Pathak YV, Handbook of nutraceuticals Volume 2, CRC Press 2011
2. Various journals of food technology, food science and allied subjects.
3. Saarela M., Functional Foods: Concept to Product. 2nd edition. Oxford, Cambridge. Wood



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
(20A27601P) FOOD MICROBIOLOGY LAB **0 0 3 1.5**

Course Objectives:

- This lab gives an idea about counting microorganisms by various techniques in selected foods and identification of specific microorganisms in different foods

Course Outcomes:

- Students will learn the different techniques for useful for microorganisms growth, media and colony counting
- Students will able to identify the specific microorganism present in food by specific procedure.

LABORATORY EXPERIMENTS

1. Different types of growth media and preparation of media.
2. Streaking techniques and dilutions
3. Methylene blue reduction test.
4. Identification of fungi from ground nuts and bread.
5. Identification of Gram-positive and Gram- negative bacteria.
6. Microbial examination of milk and milk products: Identification, isolation, and confirmation
7. Direct total, viable, and non-viable count of microorganisms in milk.
8. Determination of Standard Plate Count (SPC) in natural and/or processed foods.
9. Microbiological examination of potable water: Total and coliform count.
10. Enumeration of coliform organism in poultry
11. Isolation and screening of citric acid/ amylase/ protease /antibiotic producing microbes
12. Starter activity of Baker's yeast in mushroom production.

Laboratory Manuals

1. McLandsborough, L. (2004). Food microbiology laboratory. CRC press.
2. Harrigan, W. F. (1998). Laboratory methods in food microbiology. Gulf professional publishing.
3. Garg, N., Garg, K. L., & Mukerji, K. G. (2010). Laboratory manual of food microbiology. IK International Pvt Ltd.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem

L T P C
0 0 3 1.5

(20A27602P) UNIT OPERATIONS IN FOOD PROCESSING LAB

Course Objectives

- To impart practical orientation of usage of different mills, concept of terminal and settling velocity.
- Calculation of filter cake resistances.

Course Outcomes

By the end of the course, the students will be able to

- Find out screen efficiency, grading efficiency & separation efficiency
- Find out particle size distribution
- Find out grinding index
- How to find out resistances in filtration

LABORATORY EXPERIMENTS

1. Particle size distribution using sieve shaker.
2. To find out the screen effectiveness of a given sample by vibratory screen
3. To find out the grading efficiency of a given sample by destoner
4. To find out the grading efficiency of a given sample in specific gravity separator
5. To find out the grading efficiency of a given sample in spiral separator
6. Estimation of work index of material in grinding
7. Verification of crushing laws with the actual power ratio using hammer mill
8. Verification of the comminution laws and the critical speed of a ball mill
9. Mixing experimentation and determination of mixing index.
10. Determination of power consumption in mixing/agitation.
11. Determination of equivalent and specific cake resistance in filtration.
12. Determine the efficiency of Cyclone separator.
13. Settling velocity of a particle by sedimentation.
14. Determination of separation efficiency of suspension by using tubular bowl/nozzle centrifuge.
15. Determination of specific cake resistance and medium resistance of a leaf filter
16. Determination of drying characteristics and drying coefficient of a wet solid in a tray

Note: Visit to the local Industries for observing the unit operations.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
(20A27603P) MEAT, POULTRY, FISH AND MARINE PRODUCTS PROCESSING
LAB **0 0 3 1.5**

Course Objectives:

- To learn the different preservation methods for meat, poultry and fish and preparation of value added products.

Course Outcomes:

By the end of the course, the students will

- Learn different methods of slaughter, Postmortem changes, preservation techniques and methods of value addition to meat
Develop practical skills in preservation and processing technology of fish and marine products

LABORATORY EXPERIMENTS

1. Study of post-mortem changes;
2. Meat cutting and handling
3. Determination of meat pH
4. Preservation of meat by curing and pickling
5. Value added meat products
6. Preparation and evaluation of meat sausages
7. Tenderization of meat
8. Evaluation of quality of eggs by candling.
9. Grading of eggs by FSSAI Standards
10. Preparation of value added poultry meat products
11. Value added egg products
12. Preparation and evaluation of meat/ chicken patties
13. Study of anatomy and dressing of fish
14. Preparation of value added sea products: Cutlets, bullets, wafers

Note: Visit to Abattoir



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
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(20A27606) EXTRUSION TECHNOLOGY
(Skill Oriented Course - IV)

Course Objectives:

- To learn the different extrusion principles, uses of extruders, hot extrusion process and Cold Extrusions.

Course Outcomes:

By the end of the course, the students will

- Learn different methods of extruders in the food industry, factors affecting extrusion process.
- Develop practical skills in Flour properties for extrusion, counter rotating and co-rotating twin screw extruder.

UNIT I

Extrusion: definition, introduction to extruders, principles and types, Uses of extruders in the food industry, Single screw extruder: principle of working, net flow, factors affecting extrusion process, Twin screw extruder: counter rotating and co-rotating twin screw extruder, Process characteristics of the twin screw extruder

UNIT II

Hot Extrusion: Pre-conditioning of raw materials used in extrusion process, Chemical and nutritional changes in food during extrusion, Classification of Breakfast cereals, Texturized vegetable protein: Definition, processing techniques of preparation. Expanded products
Cold Extrusion: Flour properties for extrusion Pre-conditioning of raw materials, process and quality testing of vermicelli, spaghetti, pasta and macaroni products,

PRACTICALS

1. Physical properties of extruded foods (expansion, density, water absorption index, etc)
2. Physicochemical properties of proteins
3. Preparation of noodles/ vermicelli
4. Preparation of spaghetti
5. Preparation of weaning foods
6. Studies on properties of texturized vegetable protein
7. Determination of oil absorption capacity of extruded products
8. Determination of water absorption capacity of noodles
9. Cooking quality of TVP
10. Studies on Textural Profile Analysis of extruded products
11. Effect of extrusion cooking on antinutritional factors.

Note: Visit to extrusion industry



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
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(20A99601) INTELLECTUAL PROPERTY RIGHTS AND PATENTS
(Mandatory Non-Credit Course)

Course Objectives:

This course introduces the student to the basics of Intellectual Property Rights, Copy Right Laws, Cyber Laws, Trade Marks and Issues related to Patents. The overall idea of the course is to help and encourage the student for startups and innovations

Course Outcomes:

- Understand IPR law & Cyber law
- Discuss registration process, maintenance and litigations associated with trademarks
- Illustrate the copy right law
- Enumerate the trade secret law.

UNIT I

Introduction to Intellectual Property Law – Evolutionary past – Intellectual Property Law Basics – Types of Intellectual Property – Innovations and Inventions of Trade related Intellectual Property Rights – Agencies Responsible for Intellectual Property Registration – Infringement – Regulatory – Overuse or Misuse of Intellectual Property Rights – Compliance and Liability Issues.

UNIT II

Introduction to Copyrights – Principles of Copyright – Subject Matters of Copyright – Rights Afforded by Copyright Law – Copyright Ownership – Transfer and Duration – Right to Prepare Derivative Works – Rights of Distribution – Rights of performers – Copyright Formalities and Registration – Limitations – Infringement of Copyright – International Copyright Law-Semiconductor Chip Protection Act.

UNIT III

Introduction to Patent Law – Rights and Limitations – Rights under Patent Law – Patent Requirements – Ownership and Transfer – Patent Application Process and Granting of Patent – Patent Infringement and Litigation – International Patent Law – Double Patenting – Patent Searching – Patent Cooperation Treaty – New developments in Patent Law- Invention Developers and Promoters.

UNIT IV

Introduction to Trade Mark – Trade Mark Registration Process – Post registration procedures – Trade Mark maintenance – Transfer of rights – Inter parties Proceedings – Infringement – Dilution of Ownership of Trade Mark – Likelihood of confusion – Trade Mark claims – Trade Marks Litigation – International Trade Mark Law.

UNIT V

Introduction to Trade Secrets – Maintaining Trade Secret – Physical Security – Employee Access Limitation – Employee Confidentiality Agreement – Trade Secret Law – Unfair Competition – Trade Secret Litigation – Breach of Contract – Applying State Law. Introduction to Cyber Law – Information Technology Act – Cyber Crime and E-commerce – Data Security – Confidentiality – Privacy – International aspects of Computer and Online Crime.

Textbooks:

1. Deborah E.Bouchoux: “Intellectual Property”. Cengage learning, New Delhi
2. Kompal Bansal & Parishit Bansal “Fundamentals of IPR for Engineers”, BS Publications (Press)
3. Cyber Law. Texts & Cases, South-Western’s Special Topics Collections

References:

1. Prabhuddha Ganguli: ‘ Intellectual Property Rights’ Tata Mc-Graw – Hill, New Delhi
2. Richard Stim: “Intellectual Property”, Cengage Learning, New Delhi.
3. R. Radha Krishnan, S. Balasubramanian: “Intellectual Property Rights”, Excel Books. New Delhi.
4. M. Ashok Kumar and Mohd. Iqbal Ali: “Intellectual Property Right” Serials Pub.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem **L T P C**
3 0 0 3

(20A27701a) FOOD ENGINEERING
(PROFESSIONAL ELECTIVE-III)

Course Objectives

- To know the Physical and mechanical properties of biological materials
- To understand the moisture content, moisture content representation, determination methods of food materials.
- To learn Food Freezing, Blanching, evaporation, dehulling and dehusking methods.

Course OutcomesBy the end of course

- Student will gain knowledge on the Physical and mechanical properties of biological materials, the moisture content, moisture content representation, determination methods of food materials
- Equilibrium moisture content and psychometry
- Food Freezing, Blanching, evaporation, dehulling and dehusking methods.

UNIT I

Physical properties of biological materials: Size, Shape, Sphericity, Radius of curvature, Roundness, Aspect ratio, Bulk density, True density, Porosity, Specific gravity, Angle of repose, Frictional properties, Angle of internal friction, Coefficient of internal friction, oiling friction or resistance, optical properties (Colour); Thermal properties of biological materials: Specific heat, Enthalpy, Thermal conductivity, Thermal diffusivity, heat of respiration, transpiration

UNIT II

Rheology: Bio-materials and mechanical properties, Deformation of the materials, Stress, Strain, Modulus of elasticity, Viscoelastic behaviour, Stress relaxation behavior, Creep behaviour; Flow of material – Newton's Law of Viscosity, Viscous fluids - Newtonian and non-Newtonian, Time Dependency, Classical Ideal materials, Ideal elastic behavior, Ideal plastic behaviour, Ideal viscous behaviour, Rheological models, electrical equivalents of Rheological models, and Rheological equations. Food Texture: Measurement, Fundamental tests, Empirical tests, Imitative tests, Texture Analyzer, Probes of Texture analyzer and type of actions, Texture profile analysis (TPA). Electrical and dielectric properties of biological materials.

UNIT III

Moisture content, moisture content representation, determination methods, direct and indirect methods, Equilibrium moisture content (EMC), EMC determination methods, EMC or isotherm models, Hysteresis, reasons for hysteresis, water activity, relationship between water content and water activity, relationship between water content and food stability, psychometry, psychometry terms, construction and use of psychometric charts.

UNIT IV

Food Freezing: Theory of freezing, Ice crystal formation, Time-temperature characteristic curve for freezing process, Solute concentration; Food thawing, Freezing time, Plank's equation, Pham's method, Freezing equipment, Indirect contact systems, Direct-Contact Systems, Design considerations for freezing equipment, Quality changes during Freezing, Freeze Drying: Theory, Heat and mass transfer during freeze drying and drying time, Rate of heat transfer, Rate of mass transfer, Partial pressure of water at the sublimation front, Freeze drying time, Equipment for freeze drying.

Blanching: Methods of Blanching, Equipment, Steam blanchers, Individual Quick Blanching (IQB), Hot water blanchers, Reel hot water blancher, Pipe blancher, Fluidized bed blancher, Effect of blanching on foods.

UNIT V

Evaporation: Evaporation vs dehydration, Evaporators: Single effect evaporators and Multiple effect evaporators, heat and mass balance in single effect and multiple effect evaporator, Boiling point Elevation, Types of evaporators, Design of single effect evaporator, Design of multiple effect evaporator, Methods of Improving Evaporator Efficiency.



Dehulling and dehusking: Hulling: Dehulling methods, Wet milling method, Dry milling method, Dehulling with and without splitting, Equipment for dehulling and dehusking: Under-runner disk huller, Engle berg huller, Rubber roll sheller, Abrasion Debranner, Dehulling or dehusking efficiency.

Textbooks:

1. Chakraverty A & De DS. 1999. Post-harvest Technology of Cereals, Pulses and Oil seeds. Oxford & IBH
2. Hall CW.. Drying of Farm Crops. Lyall Book Depot. 1970
3. Van Arsdell, Wallace B., Michael J. Copley, and A. I. Morgan."Food dehydration, Vol. 1." *Westport: Principles, AVI* (1973).
4. Fellows, Peter J. Food Processing Technology: Principles and Practice. Elsevier, 2009

Reference books:

1. **Sreenivasula, RB.** 2021. Text Book of Food Engineering. Published by the Directorate of Knowledge Management in Agriculture (DKMA), Indian Council of Agricultural Research (ICAR), New Delhi. ISBN: 978-81-7164-199-4.
2. Kudra, Tadeusz, and Arun S. Mujumdar. *Advanced Drying Technologies*. CRC press, 2009. Earle, Richard Laurence. *Unit Operations in Food Processing*. Elsevier, 2013.
3. Sahay KM and Singh KK. 1994. *Unit Operations of Agricultural Processing*. Vikas Publishing House.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem

L T P C
3 0 0 3

(20A27701b) FOOD TOXICOLOGY
(PROFESSIONAL ELECTIVE-III)

Course Objectives:

- To know the various toxins and their evaluation.
- To understand their tolerance and control measures.

Course Outcomes: By the end of course

- Student will gain knowledge on principles of toxicity and characteristics of toxins and their classification.
- Examination and prevention of toxins in foods etc.

UNIT I

Principles of Toxicology: classification of toxic agents; characteristics of exposure; spectrum of undesirable effects; interaction and tolerance; biotransformation and mechanisms of toxicity. Evaluation of toxicity: risk vs. benefit: experimental design and evaluation: prospective and retrospective studies: Controls :Statistics (descriptive, inferential): animal models as predictors of human toxicity: Legal requirements and specific screening methods: LD50 and TD50: in vitro and in vivo studies; clinical trials. Cell lines used for human toxicity studies.

UNIT II

Natural toxins in food: natural toxins of importance in food- toxins of plant and animal origin; microbial toxins (e.g., bacterial toxins, fungal toxins and Algal toxins), natural occurrence, toxicity and significance, prevention and management of toxicants in foods.

UNIT III

Food allergies and sensitivities: natural sources and chemistry of food allergens; true/untrue food allergies; handling of food allergies; food sensitivities (anaphylactoid reactions, metabolic food disorders and idiosyncratic reactions); Safety of genetically modified food: potential toxicity and allergenicity of GM foods.

UNIT IV

Environmental contaminants and drug residues in food: fungicide and pesticide residues in foods; heavy metal and their health impacts; use of veterinary drugs, other contaminants in food, radioactive contamination of food, Food adulteration and potential toxicity of food adulterants.

UNIT V

Food additives and toxicants added or formed during food processing: safety of food additives; food processing generated toxicants: nitroso-compounds, heterocyclic amines, dietary Supplements and toxicity related to dose: common dietary supplements; relevance of the dose; possible toxic effects.

Textbooks:

1. Helferich, W., and Winter, C.K “Food Toxicology”,. CRC Press, LLC. Boca Raton, FL. 2007.
2. Shibamoto, T., and Bjeldanes, L. “Introduction to Food Toxicology”, 2009, 2nd Edition. Elsevier Inc., Burlington, MA.
3. Watson, D.H. “Natural Toxicants in Food”, CRC Press, LLC. Boca Raton, FL1998.

References:

1. Duffus, J.H., and Worth, H.G. J. “Fundamental Toxicology”, The Royal Society of Chemistry. 2006.
2. Stine, K.E., and Brown, T.M. “Principles of Toxicology”, 2nd Edition. CRC Press. 2006.
3. Tönu, P. “Principles of Food Toxicology”. CRC Press, LLC. Boca Raton, FL. 2007



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem **L T P C**
3 0 0 3

(20A27701c) NOVEL TECHNOLOGIES FOR FOOD PROCESSING
(PROFESSIONAL ELECTIVE-III)

Course Objectives:

- To know the high pressure processing concepts, mechanism of microbial inactivations and applications.
- To understand Pulsed Electric Field processing, Microwave and, Oscillating Magnetic Fields and Infrared technologies for Food Processing

Course Outcomes: By the end of course

- Student will gain knowledge on high pressure processing concepts, mechanism of microbial inactivation and applications.
- Principles of Pulsed Electric Fields, Radio Frequency, Oscillating Magnetic Fields and Infrared technologies for Food Processing.

UNIT I

High Pressure Processing–Concept, Equipment for High-Pressure Processing treatment. Mechanism of Microbial inactivation and its applications in Food Processing. High Hydrostatic Pressure: Introduction, Engineering Principles, Biological Effects.

UNIT II

Pulsed Electric Field (PEF) for Food Processing: Principles, System Components, Applications of pulsed electric fields technology, Factors effecting outcome of Pulse Electric Field Treatment (Technological Factors, Biological effects, Media Factors).

UNIT III

Radio Frequency Electric Fields (RFEF) as a thermal process: RFEF treatment System, Biological effects Mechanisms of Action, Treatment Chamber Design. High Intensity Pulsed Light Technology: Introduction, Principles, Equipment and Applications in Food Processing. Ultrasonic Processing: Introduction, Principles, Equipment, Process parameters, Applications in Food Industry.

UNIT IV

Use of Oscillating Magnetic Fields in Food Processing: Equipment, Applications. Non-Thermal Plasma as Novel Food Processing Technology: Methods to Generate Plasma, Classification of Plasma, Mechanism of Microbial Inactivation by Cold Plasma, Applications of Non-Thermal Plasma Technique in Food Processing.

UNIT V

Infrared technologies: Working principle, Applications in food preservation. Gamma irradiation and application in food processing. New Chemical and Biochemical Hurdles: Introduction, Organic Acids, Plant derived, antimicrobials, Chitin, Nisin, Lactoferrin, Ozone treatment, Electrolyzed water, Chlorine Dioxide gas. Membrane technologies in food processing. Supercritical fluid extraction and ultrasonication. Microencapsulation of bioactive and Technology of oil powder.

Textbooks:

1. Food Chemistry, Revised and Expanded Edition by Owen R Fennema.
2. Modern Food Microbiology by James M Jay.
3. Mechanism of Action of Food Preservation Procedures by G W Gould.

References:

1. Principles of Food Science (Part II): Physical Principles of Food Preservation by
2. M Karel Owen R Fennema and D B Lund.
3. Food Processing Technologies Principles and Practices by P J Fellows.
4. Food Processing Principles and Application by Stephanie Clark and others.
5. Food Processing and Preservation Techniques by Peter Zeuthen and Leif Bagh,
6. Non Thermal Preservation of Foods by Gustavo V Barbosa and others.
7. Food Product and Process Innovations (2 volumes) by Hari Niwas Mishra.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I **L T P C**
3 0 0 3

(20A27702a) BREWING TECHNOLOGY
(PROFESSIONAL ELECTIVE – IV)

Course Objectives:

- To understand the Beer manufacturing, ingredients and their roles.
- To understand overall view of a brewing industry

Course Outcomes:By the end of this course, students will attain the:

- Knowledge of beer making, chemistry of ingredients used for brewing,
- Knowledge on brewing industry, Unit operations and equipment involved

UNIT I

Introduction of brewing, history of brewing; Raw materials: barley, hops, water, yeast; Adjuncts for beer production: Maize, rice, millet, wheat, sugar etc. Malt production, role of enzymes for malting; Barley storage, steeping, germination, kilning, cooling, storage.

UNIT II

Malt from other cereals, caramel malt, roasted malt, smoked malt, malt extract; Malt quality evaluation, Wort production, malt milling, Mashing, Mashing vessels; Wort boiling, clarification, cooling and aeration Enzyme properties, starch degradation, b-glucan degradation; Conversion of fatty matter, Biological acidification

UNIT III

Beer production methods, fermentation technology, changes during fermentation; Filtration procedure and equipment, beer stabilization conditions and durations, beer carbonation process; Packaging equipment and packaging materials, storage conditions and distribution process

UNIT IV

Brewing Equipment. Grain mill, kettles, siphons, carboys, fermentation equipment, wort chillers, pumps beer bottles, cans, labels, bottle caps, sanitation equipments, ling phenomenon of beer, possible measures against staling reactions, oxidation.

UNIT V

Recent advances: Immobilized Cell Technology in Beer Production, immobilized yeast cell technology Energy management in the brewery and smelting's; waste water treatment Automation and plant planning, Regulatory aspects of Brewing industry.

Textbooks:

1. Brewing: "Science and Practice, Brookes and Roger Stevens", Dennis E. Briggs, Chris A. Boulton, Peter A. 2004, Woodhead publishing limited.
2. Die Deutsche "Bibliothek Technology: "Brewing and Malting", Wolfgang Kunze. 2010, Bibliographic information published

References:

1. "Handbook of Brewing": Process, Technology, Markets, Hans Michael Eblinger. 2009, Wiley-VCH Verlag GmbH & Co.
2. Brewing: "New Technologies", Charles W. Bamforth. 2006, Woodhead Pub



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem **L T P C**
3 0 0 3

(20A27702b)FOOD ADDITIVES
(PROFESSIONAL ELECTIVE –IV)

Course Objectives

- To provide theoretical knowledge on the definition of food additives, and their role in the food industry in the context of current food regulations; current national and international regulations on food additives;
- Understanding of functional classification and safety assessment of food additives.
- To develop the scientific approach and critical thinking and communication skills required for the assessment of the impacts of food additive applications on health, food safety, and quality, and the current issues related to food additives.

Course Outcomes:By the end of this course, students will attain the:

- Knowledge on the definition, classification and specifications of permitted food additives and their conditions of use in the context of current regulations.
- Knowledge on current national and international food regulations.
- Knowledge on safety assessment of food additives
- Ability to assess the impacts of food additive applications on health, food safety and quality.
- Ability to critically assess news and information on current issues related to food additives on different media channels

UNIT I

Introduction: Introduction to Food Additives; Scope of food additives; Functions and uses of Food Additives; Classification- Intentional & Unintentional Food additives; Types of food additives Toxicology and Safety Evaluation of Food Additives: Effects of Food Additives; Food Additives generally recognized as safe (GRAS); Tolerance levels & Toxic levels in Foods; Legal safeguard; Risks of food additives

UNIT II

Naturally occurring food additives: Classification; Health Implications; Role in Foods Acidulants: Introduction; Different acidulants; Role in food processing Food colorants: Introduction; Natural & Synthetic food colorants; Classification of Food colorants; Chemical nature; Impact on health. Pigments: Importance; Classification: Utilization as food color

UNIT III

Food Preservatives: Introduction; Classification- Natural & chemical preservatives; Mode of action; Role in Food processing. Antioxidants & chelating agents: Introduction; Role in foods; Types of antioxidants -natural & synthetic; Mode of action of antioxidants in foods; Chelating agents- Naturally & synthetic; Mode of action of chelating agents; Applications of antioxidants and chelating agents

UNIT IV

Stabilizers, thickeners and Emulsifiers: Introduction; Types; Applications in food processing; Sweeteners: Introduction; Classification- Artificial sweeteners & Non-nutritive sweeteners; Health implications; Role in food processing. Bleaching & maturing agents: Introduction; Different bleaching & maturing agents; Role in food processing

UNIT V

Taste and Flavoring agents: Introduction; Classification of flavors- natural & synthetic; Flavor enhancer/ Potentiator; Importance of taste and flavours; Role of flavoring agents in food processing. Anti-caking agents and Humectants: Introduction; Different Anti-caking agents and Humectants; Role in food processing Starch modifiers: Introduction; Chemical nature; Role in food processing. Antimicrobial agents, Clarifying agents, antifoaming agents, Fat mimetics and replacers: Introductions; Role in food processing;



Textbooks:

1. Branen, A. L., Davidson, P. M., Salminen, S., &Thorngate, J. (Eds.). (2001). Food additives. CRC Press.
2. Lewis, R. J. (1989). Food additives handbook. Springer Science & Business Media.
3. Mahindru, S. N. (2008). Food additives: characteristics, detection and estimation (pp. 4435-36). New Delhi-India:: APH Publishing Corporation.

References:

1. Fennema, O. R. (1996). Food chemistry (Vol. 76). CRC Press.
2. Belitz, H. D., Grosch, W., &Schieberle, P. (2008). Food chemistry. Springer Science & Business Media.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem

L T P C
3 0 0 3

(20A27702c) THERMAL PROCESSING OF FOODS
(PROFESSIONAL ELECTIVE-IV)

Course Objectives

- To understand different types of Pasteurization techniques and kinetics of microbial reactions.
- To understand various types of heat exchangers for food process engineering.
- Importance and applications of hot extrusion processing, changes of properties and functional components of extruded foods

Course Outcomes:By the end of this course, students will attain the:

- Determine the extent of nutrient retention and enzyme inactivation during a thermal process.
- Apply basic kinetic equations to various thermal processes
- Knowledge of aseptic processing related equipment design and environment.
- Knowledge on Microwave and radio frequency heating, drying principles and de-humidifiers.

UNIT I

Blanching, different types of Pasteurization, ultra-pasteurization, hot fill and UHT. Thermal processing equipment, canning operations. Temperature distribution and heat penetration, Kinetics of microbial reactions, Z-value, F value, and process requirements.

UNIT II

Quality considerations and process optimization. Fundamentals of aseptic processing, Aseptic processing equipment design, Aseptic process design. Aseptic process environment.

UNIT III

Microwave and radio frequency heating: Principles, interaction of electrical fields. Ohmic heating: Principles, inactivation mechanism, equipment. Frying, vacuum frying, deep frying. Baking: Principles and equipment.

UNIT IV

Drying- Principles, different types of dryers- Solar dryer, Vacuum dryer, Fluidized bed dryer, tunnel dryer, drum drying, spray dryer. Freeze dryer. Drying curves. Hybrid drying technologies. Single stage and multi stage drying. De-humidifier.

UNIT V

Various types of heat exchangers for food process engineering. Importance and applications of hot extrusion processing, Changes of properties and functional components of extruded foods.

Textbooks:

1. Holdsworth S D, Thermal Processing of Packaged Foods, 3rd Edition, Springer
2. Gary Tucker, Susan Featherstone, Essentials of Thermal Processing, Willey

References:

1. Nelson, P.E. (Editor). 2010. Principles of Aseptic Processing and Packaging. 3rd edition. Purdue University Press.
2. Sun, D. (Editor). 2005. Emerging Technologies for Food Processing. Elsevier Academic Press.
3. Metaxas, A.C., Meridith, R.J. 1993. Industrial Microwave Heating. Peter Pergrinus Ltd., London.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem **L T P C**
3 0 0 3

(20A27703a) EXTRUSION TECHNOLOGY
(PROFESSIONAL ELECTIVE –V)

Course Objectives:

- To impart knowledge to the students about extrusion technology, principle of working, classification of extruders according to process and construction, extruded products and their processing.

Course Outcomes: By the end of the course, the students will be able to

- Learn about use of extrusion technology in food industry
- Study about Extrusion cooking, preconditioning of raw material, types of extruders and operating parameters

UNIT I

Extrusion definition, introduction to extruders and their principles, types of extruders. Extruders in the food industry: History and uses of extruders in the food industry. Single screw extruder: principle of working, net flow, factors affecting extrusion process, co-kneaders.

UNIT II

Twin screw extruder: counter rotating and co-rotating twin screw extruder. Process characteristics of the twin screw extruder: feeding, screw design, screw speed, screw configurations, die design. Barrel temperature and heat transfer, adiabatic operation, heat transfer operations and energy balances. Problems associated with twin screw extruder.

UNIT III

Pre-conditioning of raw materials used in extrusion process, Pre-conditioning operations and benefits of pre-conditioning and devolatilization. Interpreted-flight expanders - extruders, dry extruders. Chemical and nutritional changes in food during extrusion. Practical considerations in extrusion processing: pre-extrusion processes, cooker extruder Profiling.

UNIT IV

Practical considerations in extrusion processing: Addition and subtraction of materials, shaping and forming at the die, post extrusion processes. Breakfast cereals: introduction, type of cooking - High shear cooking process, steam cookers, low shear, low pressure cookers and continuous steam pre-cooking, available brands. Cold extrusion processing. Principles and products like sphagetti, noodles, pasta, and macaroni.

UNIT V

Breakfast cereal processes: traditional and extrusion methods, classification of breakfast cereals - flaked cereals, oven puffed cereals, gun puffed cereals, shredded products. Texturized vegetable protein: Definition, processing techniques, and foods. Snack food extrusion: Direct expanded (DX) and third generation (3G) Snacks: types, available brands, co- extruded snacks and indirect-expanded products.

Textbooks:

1. "Extrusion Cooking, Technologies and Applications". Guy R Wood Head Publishing Limited, Abington, Cambridge.
2. Frame N.D. "The Technology of Extrusion Cooking". Blackie Academic & Professional, New York. 1994,

References:

1. Harper. "Extrusion of Foods. Vol. 1 & 2". J.M. CRC Press, Inc; Boca Raton, Florida 1991,.
2. O'Connor C. "Extrusion Technology for the Food Industry". Elsevier Applied Science, New York.
3. Fast R.B. and Caldwell E.F. "Breakfast Cereals" and how they are made. 2000, American Association of Cereal Chemists., St. Paul, Minnesota. 1987,
4. Richardson P. "Thermal Technologies in Food Processing". Wood Head Publishers, Cambridge



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem

L T P C
3 0 0 3

(20A27703b) FOOD SAFETY AND STANDARD ACT & REGULATIONS IN INDIA
(PROFESSIONAL ELECTIVE –V)

Course Objectives:

- To study the Salient features of food safety and standards Act.
- To get knowledge on Food safety standards of licensing and registration of food Business regulations.
- To know about Food safety standards of packaging and labeling regulations.
- To learn about Food safety standards of food product standards and food additives regulations.
- To understand Food safety standards of prohibition and restriction sales regulations.

Course Outcomes: By end of the course students are exposed to know about

- To study the Salient features of food safety and standards Act,

UNIT I

Food Safety and Standards Act: Salient features of food safety and standards Act, 2006, administration at central and state level, functions, duties and responsibilities of food safety regulators, implementation of food regulation –FSS act, 2006 including licensing and registration, inspection and reports, improvement notices and prohibition Orders.

UNIT II

Food safety standards of licensing and registration of food Business regulations: short title, commencement, definitions, licensing and registration of food business, schedule I, II, III, IV. general requirements of hygienic and sanitary practices to be followed by all food business operators applying license, specific hygienic and sanitary practices to be followed by food business operator engaged in manufacturing, processing, storage and selling of milk and milk products, meat and meat products, specific hygienic and sanitary practices to be followed by food business operators engaged in catering/ food service management.

UNIT III

Food safety standards of packaging and labeling regulations-Short title and commencement, definition, registration. Packaging - general requirements, product specific requirements. labeling - manner of declaration, specific requirements and restriction on manner of labeling, restriction on advertisement, exemption from labeling requirement, notice of addition, admixture or deficiency in food.

UNIT IV

Food safety standards of food product standards and food additives regulations-Short title, commencement, definition and regulation of dairy products and analogues, fats, oils and fat emulsions, fruits and vegetable products, nuts and raisins, cereal and cereal products, bakery products, meat and meat products, fish and fish products, sweet and confectionery, sweetening agents, salt, spices, condiments and related products, common salt, beverages- alcoholic and non-alcoholic, irradiation of foods, food additives and other food products.

UNIT V

Food safety standards of prohibition and restriction sales regulations - title, commencement, definitions, prohibition and restriction of sales – sale of certain admixtures prohibited, restriction on the use of certain ingredients, prohibition and restriction on sale of certain products. Food safety and standards of contaminants, toxins and residues regulation -short title, commencement and definition of metal contaminants, crop contaminates and naturally occurring toxic substances, residues, antibiotic another pharmacologically active substances. Food safety standards of laboratory and sample analysis, - short title, commencement and definition of notified laboratories to import, referral laboratories, procedure for sampling.



Textbooks:

1. Gazette of Food Safety and Standards Act, (2006) Food Safety regulations and food safety management. Food Safety and Standards Authority of India. New Delhi.

References:

1. The training manual for Food Safety Regulators. Vol.III, Food Safety regulations and food safety management. Food Safety and Standards Authority of India. New Delhi.
2. To get knowledge on licensing and registration of food Business regulations & packaging and labeling regulations
3. To learn about Food product standards and food additives regulations & prohibition and restriction sales regulations



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem **L T P C**
3 0 0 3

(20A27703c) FOOD PLANT SANITATION AND HYGIENE
(PROFESSIONAL ELECTIVE-V)

Course Objectives

- To explore the knowledge on types of sanitizers and methods to eradicate the pests and good hygienic practices by individual and organization.

Course Outcomes

- Students are exposed to different sanitizers for cleaning the equipment and methods of hygienic practices in food industry.

UNIT I

Sanitation and food industry Sanitation, importance of sanitation in food plants, sanitation laws and guidelines, establishment of sanitary practices. Food contamination sources, Sources of contamination, contamination of foods, protection against contamination.

UNIT II

Cleaning compounds and sanitizers: Classification, selection of cleaning compounds, handling and storage, precautions, sanitizing methods: thermal, steam, hot water, radiation, HHP, Vacuum/Steam/Vacuum, chemical sanitizers: chlorine, iodine, bromine, quaternary ammonium compounds, acid sanitizers, detergent formulations, iodophores. In plant quality control, design of a clean-in-place(CIP) unit, use of detergents, sterilants, and quality system needed for different size factories (small, medium, national, and international level of business).

UNIT III

Pest and Rodent Control Insect infestation, cockroaches, rodents, birds, use of pesticides, integrated pest management. Sanitary design and construction for food processing plant. Site selection, site preparation, building construction considerations, pest control design, construction materials.

UNIT IV

Water quality and treatment Characteristics of drinking water – physical (temperature, colour, turbidity, taste and odour), chemical (pH, hardness, alkalinity), microbiological (total plate count, E.coli, Streptococcus faecalis), waste disposal – industrial waste, influent, effluent, biological oxygen demand, chemical oxygen demand, tolerance limits for industrial effluent discharged into surface water, water treatment – primary (screening, sedimentation, floatation), secondary (trickling filters, activated sludge method, lagoons), tertiary (chemical coagulation and flocculation process), utilization of waste from food processing industry.

UNIT V

Personal hygiene and sanitary food handling Personal hygiene, employee hygiene, sanitary food handling, role of employee supervision, employee responsibility. Role of GAP, GHP, HACCP in sanitation HACCP, HACCP development, interface with GMP and SSOPs, HACCP principles, organization, implementation and maintenance.

Textbooks:

1. S. Roday, “Food Hygiene and Sanitation”. Tata McGraw Hill, 1st Edition, 1998.
2. N. G. Marriott, “Principles of Food Sanitation. Springer”, 5th Edition, 2006.
3. Jim Mclauchlin and Christine Little (Eds), “Hobbs Food Poisoning and Food Hygiene”. 7th Edition, 2007.

References:

1. Bernard L Bruinsma, “Food Plant Sanitation”, Marcell Dekker Inc J Richard Gorham
2. John Troller, “Sanitation in Food Processing”, 2nd Edition. Academic Press, 1993



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem **L T P C**
3 0 0 3
20A52701a) ENTREPRENEURSHIP & INCUBATION
(HUMANITIES ELECTIVE II)

Course Objectives:

- To make the student understand about Entrepreneurship
- To enable the student in knowing various sources of generating new ideas in setting up of New enterprise
- To facilitate the student in knowing various sources of finance in starting up of a business
- To impart knowledge about various government sources which provide financial assistance to entrepreneurs/ women entrepreneurs
- To encourage the student in creating and designing business plans

Course Outcomes:

- Understand the concept of Entrepreneurship and challenges in the world of competition.
- Apply the Knowledge in generating ideas for New Ventures.
- Analyze various sources of finance and subsidies to entrepreneur/women Entrepreneurs.
- Evaluate the role of central government and state government in promoting Entrepreneurship.
- Create and design business plan structure through incubations.

UNIT I

Entrepreneurship - Concept, knowledge and skills requirement - Characteristics of successful entrepreneurs - Entrepreneurship process - Factors impacting emergence of entrepreneurship - Differences between Entrepreneur and Intrapreneur - Understanding individual entrepreneurial mindset and personality - Recent trends in Entrepreneurship.

UNIT II

Starting the New Venture - Generating business idea – Sources of new ideas & methods of generating ideas - Opportunity recognition - Feasibility study - Market feasibility, technical/operational feasibility - Financial feasibility - Drawing business plan - Preparing project report - Presenting business plan to investors.

UNIT III

Sources of finance - Various sources of Finance available - Long term sources - Short term sources - Institutional Finance – Commercial Banks, SFC's in India - NBFC's in India - their way of financing in India for small and medium business - Entrepreneurship development programs in India - The entrepreneurial journey- Institutions in aid of entrepreneurship development

UNIT IV

Women Entrepreneurship - Entrepreneurship Development and Government - Role of Central Government and State Government in promoting women Entrepreneurship - Introduction to various incentives, subsidies and grants – Export- oriented Units - Fiscal and Tax concessions available - Women entrepreneurship - Role and importance - Growth of women entrepreneurship in India - Issues & Challenges - Entrepreneurial motivations.

UNIT V

Fundamentals of Business Incubation - Principles and good practices of business incubation- Process of business incubation and the business incubator and how they operate and influence the



Type/benefits of incubators - Corporate/educational / institutional incubators - Broader business incubation environment - Pre-Incubation and Post - Incubation process - Idea lab, Business plan structure - Value proposition

Textbooks:

1. D F Kuratko and T V Rao, “Entrepreneurship” - A South-Asian Perspective – Cengage Learning, 2012. (For PPT, Case Solutions Faculty may visit : login.cengage.com)
2. Nandan H, “ Fundamentals of Entrepreneurship”, PHI, 2013

References:

1. Vasant Desai, “Small Scale Industries and Entrepreneurship”, Himalaya Publishing 2012.
2. Rajeev Roy “Entrepreneurship”, 2nd Edition, Oxford, 2012.
3. B.JanakiramandM.Rizwanal “Entrepreneurship Development: Text & Cases”, Excel Books, 2011.
4. Stuart Read, Effectual “Entrepreneurship”, Routledge, 2013.

E-Resources

1. Entrepreneurship-Through-the-Lens-of-enture Capital
2. <http://www.onlinevideolecture.com/?course=mba-programs&subject=entrepreneurship>
3. http://nptel.ac.in/courses/122106032/Pdf/7_4.pd
4. <http://freevideolectures.com/Course/3514/Economics-/-Management-/-Entrepreneurhip/50>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
3 0 0 3
(20A52701b) MANAGEMENT SCIENCE
(HUMANITIES ELECTIVE-II)

Course Objectives:

- To provide fundamental knowledge on Management, Administration, Organization & its concepts.
- To make the students understand the role of management in Production
- To impart the concept of HRM in order to have an idea on Recruitment, Selection, Training & Development, job evaluation and Merit rating concepts
- To create awareness on identify Strategic Management areas & the PERT/CPM for better Project Management
- To make the students aware of the contemporary issues in management

Course Outcomes:

- Understand the concepts & principles of management and designs of organization in a practical world
- Apply the knowledge of Work-study principles & Quality Control techniques in industry
- Analyze the concepts of HRM in Recruitment, Selection and Training & Development.
- Evaluate PERT/CPM Techniques for projects of an enterprise and estimate time & cost of project & to analyze the business through SWOT.
- Create Modern technology in management science.

UNIT I INTRODUCTION TO MANAGEMENT

Management - Concept and meaning - Nature-Functions - Management as a Science and Art and both. Schools of Management Thought - Taylor's Scientific Theory-Henry Fayol's principles - Eltan Mayo's Human relations - Systems Theory - **Organisational Designs** - Line organization - Line & Staff Organization - Functional Organization - Matrix Organization - Project Organization - Committee form of Organization - Social responsibilities of Management.

UNIT II OPERATIONS MANAGEMENT

Principles and Types of Plant Layout - Methods of Production (Job, batch and Mass Production), Work Study - Statistical Quality Control- Deming's contribution to Quality. **Material Management** - Objectives - Inventory-Functions - Types, Inventory Techniques - EOQ-ABC Analysis - Purchase Procedure and Stores Management - **Marketing Management** - Concept - Meaning - Nature-Functions of Marketing - Marketing Mix - Channels of Distribution - Advertisement and Sales Promotion - Marketing Strategies based on Product Life Cycle.

UNIT III HUMAN RESOURCES MANAGEMENT (HRM)

HRM - Definition and Meaning – Nature - Managerial and Operative functions - Evolution of HRM - Job Analysis - Human Resource Planning(HRP) - Employee Recruitment-Sources of Recruitment - Employee Selection - Process and Tests in Employee Selection - Employee Training and Development - On-the- job & Off-the-job training methods - Performance Appraisal Concept - Methods of Performance Appraisal – Placement - Employee Induction - Wage and Salary Administration

UNIT IV STRATEGIC & PROJECT MANAGEMENT

Definition & Meaning - Setting of Vision - Mission - Goals - Corporate Planning Process - Environmental Scanning - Steps in Strategy Formulation and Implementation - SWOT Analysis - **Project Management** - Network Analysis - Programme Evaluation and Review Technique (PERT) - Critical Path Method (CPM) Identifying Critical Path - Probability of Completing the project within given time - Project Cost- Analysis - Project Crashing (Simple problems).



UNIT V CONTEMPORARY ISSUES IN MANAGEMENT

The concept of Management Information System(MIS) - Materials Requirement Planning (MRP) - Customer Relations Management(CRM) - Total Quality Management (TQM) - Six Sigma Concept - Supply Chain Management(SCM) - Enterprise Resource Planning (ERP) - Performance Management - Business Process Outsourcing (BPO) - Business Process Re-engineering and Bench Marking - Balanced Score Card - Knowledge Management.

Textbooks:

1. A.R Aryasri, "Management Science", TMH, 2013
2. Stoner, Freeman, Gilbert, Management, Pearson Education, New Delhi, 2012.

References:

1. Koontz & Wehrich, "Essentials of Management", 6th edition, TMH, 2005.
2. Thomas N. Duening & John M. Ivancevich, "Management Principles and Guidelines", Biztantra.
3. Kanishka Bedi, "Production and Operations Management", Oxford University Press, 2004.
4. Samuel C. Certo, "Modern Management", 9th edition, PHI, 2005



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– III-II Sem **L T P C**
3 0 0 3

(20A52701c) ENTERPRISE RESOURCE PLANNING
(HUMANITIES ELECTIVE-II)

Course Objectives:

- To provide a contemporary and forward-looking on the theory and practice of Enterprise Resource Planning
- To enable the students in knowing the Advantages of ERP
- To train the students to develop the basic understanding of how ERP enriches the Business organizations in achieving a multidimensional growth.
- Impart knowledge about the historical background of BPR
- To aim at preparing the students, technologically competitive and make them ready to self-upgrade with the higher technical skills.

Course Outcomes:

- Understand the basic use of ERP Package and its role in integrating business functions.
- Explain the challenges of ERP system in the organization
- Apply the knowledge in implementing ERP system for business
- Evaluate the role of IT in taking decisions with MIS
- Create reengineered business processes with process redesign

UNIT I

Introduction to ERP: Enterprise – An Overview Integrated Management Information, Business Modeling, Integrated Data Model Business Processing Reengineering(BPR), Data Warehousing, Data Mining, On-line Analytical Processing(OLAP), Supply Chain Management (SCM), Customer Relationship Management(CRM),

UNIT II

Benefits of ERP: Reduction of Lead-Time, On-time Shipment, Reduction in Cycle Time, Improved Resource Utilization, Better Customer Satisfaction, Improved Supplier Performance, Increased Flexibility, Reduced Quality Costs, Improved Information Accuracy and Design-making Capability

UNIT III

ERP Implementation Lifecycle: Pre-evaluation Screening, Package Evaluation, Project Planning Phase, Gap Analysis, Reengineering, Configuration, Implementation Team Training, Testing, Going Live, End-user Training, Post-implementation (Maintenance mode)

UNIT IV

BPR: Historical background: Nature, significance and rationale of business process reengineering (BPR), Fundamentals of BPR. Major issues in process redesign: Business vision and process objectives, Processes to be redesigned, Measuring existing processes,

UNIT V

IT in ERP: Role of information technology (IT) and identifying IT levers. Designing and building a prototype of the new process: BPR phases, Relationship between BPR phases. MIS - Management Information System, DSS - Decision Support System, EIS - Executive Information System.

Textbooks:

1. Pankaj Sharma. “Enterprise Resource Planning”. Aph Publishing Corporation, New Delhi, 2004.
2. Alexis Leon, “Enterprise Resource Planning”, IV Edition, Mc.Graw Hill, 2019

References:

1. Marianne Bradford “Modern ERP”, 3rd edition.
2. “ERP making it happen Thomas f. Wallace and Michael
3. Directing the ERP Implementation Michael w pelphrey



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT)– IV-I Sem **L T P C**
1 0 2 2

(20A27706) BAKERY PRODUCTS
(Skill Oriented Course-V)

Course Objectives:

- To impart knowledge on bakery products, to manufacture those products

Course Outcomes:

By the end of the course, the students will be able

- Acquire knowledge on practical aspects of producing bakery products.

UNIT I

Bakery products, role of bakery ingredients (major and minor), from hard wheat: bread processes of bread making using straight and sponge, dough methods role of each ingredient, quality control Testing of raw material testing of final product. Quality control evaluation of bakery products, some texture properties and some sensory quality

UNIT II

Baked Products from soft wheat: cookies, crackers, biscuits, cakes: types, ingredients, process. Other bakery products: using hard wheat, pizza, pastry and its types.

PRACTICALS

1. Preparation of bread
2. Preparation of biscuit
3. Evaluation of physical properties of cookies
4. Preparation of sponge cake
5. Preparation of flour-based confectionery
6. Preparation of pizza base
7. Preparation of fruit biscuits
8. Preparation of fruit bread
9. Preparation of buns
10. Preparation of puffs
11. Preparation of cookies
12. Preparation of burger base
13. Preparation of flat bread

Note: Visit to wheat milling industry, visit to bakery unit



OPEN ELECTIVES



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A01505) BUILDING TECHNOLOGY
(Open Elective-I)

Course Objectives:

- To know different types of buildings, principles and planning of the buildings.
- To identify the termite control measure in buildings, and importance of grouping circulation, lighting and ventilation aspects in buildings.
- To know the different modes of vertical transportation in buildings.
- To know the utilization of prefabricated structural elements in buildings.
- To know the importance of acoustics in planning and designing of buildings.

Course Outcomes (CO):

- Understand the principles in planning and design the buildings
- To get different types of buildings, principles and planning of the buildings
- To know the different methods of termite proofing in buildings.
- Know the different methods of vertical transportation in buildings.
- Know the implementation of prefabricated units in buildings and effect of earthquake on buildings.
- Know the importance of acoustics in planning and designing of buildings.

UNIT I

Overview of the course, basic definitions, buildings-types-components-economy and design-principles of planning of buildings and their importance. Definitions and importance of grouping and circulation-lighting and ventilation-consideration of the above aspects during planning of building.

UNIT II

Termite proofing: Inspection-control measures and precautions-lighting protectionof buildings-general principles of design of openings-various types of fire protection measures to be considered while panning a building.

UNIT III

Vertical transportation in a building: Types of vertical transportation-stairs-different forms of stairs-planning of stairs-other modes of vertical transportation –lifts-ramps-escalators.

UNIT IV

Prefabrication systems in residential buildings-walls-openings-cupboards-shelves etc., planning and modules and sizes of components in prefabrication. Planning and designing of residential buildings against the earthquake forces, principles, seismic forces and their effect on buildings.

UNIT V

Acoustics –effect of noise –properties of noise and its measurements, principles of acoustics of building. Sound insulation-importance and measures.

Textbooks:

1. Building construction by Varghese, PHI Learning Private Limited 2nd Edition 2015
2. Building construction by Punmia.B.C, Jain.A.K and Jain.A.K Laxmi Publications 11th edition 2016

Reference Books:

1. National Building Code of India, Bureau of Indian Standards
2. Building construction-Technical teachers training institute, Madras, Tata McGraw Hill.
3. Building construction by S.P.Arora and S.P.BrndraDhanpat Rai and Sons Publications, New Delh 2014 edition
<https://nptel.ac.in/courses/105102206>
<https://nptel.ac.in/courses/105103206>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A02505) ELECTRIC VEHICLES
(Open Elective-I)

Course Objectives:

- To get exposed to new technologies of battery electric vehicles, fuel cell electric vehicles
- To get exposed to EV system configuration and parameters
- To know about electro mobility and environmental issues of EVs
- To understand about basic EV propulsion and dynamics
- To understand about fuel cell technologies for EV and HVEs
- To know about basic battery charging and control strategies used in electric vehicles

Course Outcomes:

- Understand and differentiate between conventional and latest trends in Electric Vehicles
- Analyze various EV resources, EV dynamics and Battery charging
- Apply basic concepts of EV to design complete EV system
- Design EV system with various fundamental concepts

UNIT I INTRODUCTION TO EV SYSTEMS AND PARAMETERS

Past, Present and Future EV, EV Concept, EV Technology, State-of-the Art EVs, EV configuration, EV system, Fixed and Variable gearing, single and multiple motor drive, in-wheel drives, EV parameters: Weight, size, force and energy, performance parameters.

UNIT II EV AND ENERGY SOURCES

Electro mobility and the environment, history of Electric power trains, carbon emissions from fuels, green houses and pollutants, comparison of conventional, battery, hybrid and fuel cell electric systems

UNIT III EV PROPULSION AND DYNAMICS

Choice of electric propulsion system, block diagram, concept of EV Motors, single and multi motor configurations, fixed and variable geared transmission, In-wheel motor configuration, classification, Electric motors used in current vehicle applications, Recent EV Motors, Vehicle load factors, vehicle acceleration.

UNIT IV FUEL CELLS

Introduction of fuel cells, basic operation, model, voltage, power and efficiency, power plant system – characteristics, sizing, Example of fuel cell electric vehicle.

Introduction to HEV, brake specific fuel consumption, comparison of series, series-parallel hybrid systems, examples

UNIT V BATTERY CHARGING AND CONTROL

Battery charging: Basic requirements, charger architecture, charger functions, wireless charging, power factor correction.

Control: Introduction, modelling of electromechanical system, feedback controller design approach, PI controllers designing, torque-loop, speed control loop compensation, acceleration of battery electric vehicle

Textbooks:

1. C.C Chan, K.T Chau: Modern Electric Vehicle Technology, Oxford University Press Inc., New York 2001.
2. James Larminie, John Lowry, Electric Vehicle Technology Explained, Wiley, 2003.

Reference Books:

1. Electric and Hybrid Vehicles Design Fundamentals, Iqbal Husain, CRC Press 2005.
2. Ali Emadi, Advanced Electric Drive Vehicles, CRC Press, 2015.

Online Learning Resources: 1. https://onlinecourses.nptel.ac.in/noc22_ee53/preview



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A03505) 3D PRINTING TECHNOLOGY
(Open Elective-I)

Course Objectives:

- Familiarize techniques for processing of CAD models for rapid prototyping.
- Explain fundamentals of rapid prototyping techniques.
- Demonstrate appropriate tooling for rapid prototyping process.
- Focus Rapid prototyping techniques for reverse engineering.
- Train Various Pre – Processing, Processing and Post Processing errors in RP Processes.

Course Outcomes:

- Use techniques for processing of CAD models for rapid prototyping.
- Understand and apply fundamentals of rapid prototyping techniques.
- Use appropriate tooling for rapid prototyping process.
- Use rapid prototyping techniques for reverse engineering.
- Identify Various Pre – Processing, Processing and Post Processing errors in RP processes.

UNIT I Introduction to 3D Printing

Introduction to Prototyping, Traditional Prototyping Vs. Rapid Prototyping (RP), Need for time compression in product development, Usage of RP parts, Generic RP process, Distinction between RP and CNC, other related technologies, Classification of RP.

UNIT II Solid and Liquid Based RP Systems

Working Principle, Materials, Advantages, Limitations and Applications of Fusion Deposition Modelling (FDM), Laminated Object Manufacturing (LOM), Stereo lithography (SLA), Direct Light Projection System (DLP) and Solid Ground Curing (SGC).

UNIT III Powder Based & Other RP Systems

Powder Based RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Selective Laser Sintering (SLS), Direct Metal Laser Sintering (DMLS), Laser Engineered Net Shaping (LENS) and Electron Beam Melting (EBM).

Other RP Systems: Working Principle, Materials, Advantages, Limitations and Applications of Three Dimensional Printing (3DP), Ballistic Particle Manufacturing (BPM) and Shape Deposition Manufacturing (SDM).

UNIT IV Rapid Tooling & Reverse Engineering

Rapid Tooling: Conventional Tooling Vs. Rapid Tooling, Classification of Rapid Tooling, Direct and Indirect Tooling Methods, Soft and Hard Tooling methods.

Reverse Engineering (RE): Meaning, Use, RE – The Generic Process, Phases of RE Scanning, Contact Scanners and Noncontact Scanners, Point Processing, Application Geometric Model, Development.

UNIT V Errors in 3D Printing and Applications:

Pre-processing, processing and post-processing errors, Part building errors in SLA, SLS, etc.

Software: Need for software, MIMICS, Magics, SurgiGuide, 3-matic, 3D-Doctor, Simplant, Velocity2, VoXim, Solid View, 3DView, etc., software, Preparation of CAD models, Problems with STL files, STL file manipulation, RP data formats: SLC, CLI, RPI, LEAF, IGES, HP/GL, CT, STEP.

Applications: Design, Engineering Analysis and planning applications, Rapid Tooling, Reverse Engineering, Medical Applications of RP.

Textbooks:

1. Chee Kai Chua and Kah Fai Leong, “3D Printing and Additive Manufacturing Principles and Applications” 5/e, World Scientific Publications, 2017.



2. Ian Gibson, David W Rosen, Brent Stucker, “Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing”, Springer, 2/e, 2010.

Reference Books:

1. Frank W.Liou, “Rapid Prototyping & Engineering Applications”, CRC Press, Taylor & Francis Group, 2011.
2. Rafiq Noorani, “Rapid Prototyping: Principles and Applications in Manufacturing”, John Wiley&Sons, 2006.

Online Learning Resources:

- NPTEL Course on Rapid Manufacturing.
- <https://nptel.ac.in/courses/112/104/112104265/>
- <https://www.hubs.com/knowledge-base/introduction-fdm-3d-printing/>
- <https://slideplayer.com/slide/6927137/>
- <https://www.mdpi.com/2073-4360/12/6/1334>
- <https://www.centropiaggio.unipi.it/sites/default/files/course/material/2013-11-29%20-%20FDM.pdf>
- <https://lecturenotes.in/subject/197>
- https://www.cet.edu.in/noticefiles/258_Lecture%20Notes%20on%20RP-ilovepdf-compressed.pdf
- https://www.vssut.ac.in/lecture_notes/lecture1517967201.pdf
- <https://www.youtube.com/watch?v=NkC8TNts4B4>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A04505) DIGITAL ELECTRONICS
(Open Elective Course- I)

Course Objectives:

- To provide the fundamental concepts associated with the digital logic and circuit design.
- To introduce the basic concepts and laws involved in the Boolean algebra and logic families and digital circuits.
- To familiarize with the different number systems, logic gates, and combinational and sequential circuits, memory elements utilized in the different digital circuits and systems.
- To introduce different digital logic families

Course Outcomes:

- Become familiar with the Boolean algebra, logic gates, logical variables, the truth table, number systems, codes, and their conversion from to others
- Learn the minimization techniques to simply the hardware requirements of digital circuits, implement it, design and apply for real time digital systems
- Understand the working mechanism and design guidelines of different combinational, sequential circuits, memory elements and their role in the digital system design.
- Understand different logic families and use the best combination of ICs during the design of a digital system

UNIT 1

DIGITAL FUNDAMENTALS: Number Systems - Decimal, binary, octal, Hexadecimal, 1's and 2's complements, Codes - Binary, BCD, Excess 3, Gray, Alphanumeric codes, Boolean theorems. Logic gates: Universal gates, Sum of products and product of sums, Minterms and Maxterms, Karnaugh map Minimization.

UNIT II

COMBINATIONAL CIRCUITS: Half and Full Adders, Half and Full Subtractors, Binary Parallel Adder Carry look ahead Adder, BCD Adder, Multiplexer, Demultiplexer, Magnitude Comparator, Decoder, Encoder, Priority Encoder.

UNIT III

SYNCHRONOUS SEQUENTIAL CIRCUITS: Flip flops - SR, JK, T, D, Master/Slave FF- operation and excitation tables, Triggering of FF, conversion of FF. Counters- Ripple Counters, Ring Counters, Shift registers, Universal Shift Register.

UNIT IV

MEMORY DEVICES: Basic memory structure - ROM, PROM, EPROM, EEPROM, EAPROM, RAM, Static and dynamic RAM. Programmable Logic Devices: Programmable Logic Array (PLA), Programmable Array Logic (PAL), Field Programmable Gate Arrays (FPGA).

UNIT V

Digital Logic Families: Logic levels, propagation delay, power dissipation, fan-out and fan-in, noise margin, RTL, TTL, ECL, CMOS.

Textbooks:

1. Modern Digital Electronics (Edition III) : R. P. Jarn; TMH
2. Digital Fundamentals: Thomas I. Floyd
3. Digital circuits and design: S. Salivahanan, and S. Anvzzhagan

References:

1. Digital Integrated Electronics: Taub & Schilling; MGH
2. Digital Design: Morris Mano; PHI. Course



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A05505a) JAVA PROGRAMMING
(Open Elective Course – I)

Course Objectives:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

Course Outcomes:

- Solve real-world problems using OOP techniques.
- Apply code reusability through inheritance, packages and interfaces
- Solve problems using java collection framework and I/O classes.
- Develop applications by using parallel streams for better performance and develop applets for web applications.
- Build GUIs and handle events generated by user interactions and Use the JDBC API to access the database.

UNIT I Introduction

Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods

UNIT II Inheritance, Packages, Interfaces

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,
Packages: Basics, Finding packages and CLASSPATH, Access Protection, Importing packages.
Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

UNIT III Exception handling, Stream based I/O

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

UNIT IV Multithreading, The Collections Framework

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collectionclasses-Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

UNIT V Applet, GUI Programming with Swings, Accessing Databases with JDBC

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers,



layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirmdialog, show input dialog, show option dialog, jdialog, create a modeless dialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Textbooks:

1. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
2. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

Reference Books:

1. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
2. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
3. Java Programming for core and advanced learners, Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
4. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
5. Object Oriented Programming through Java, P. Radha Krishna, University Press.
6. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
7. Java Programming and Object-oriented Application Development, R.A. Johnson, Cengage Learning.

Online Learning Resources:

https://www.w3schools.com/java/java_oop.asp

<http://peterindia.net/JavaFiles.html>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A05602T) ARTIFICIAL INTELLIGENCE
Open Elective Course - I

Course Objectives:

This course is designed to:

- Introduce Artificial Intelligence
- Teach about the machine learning environment
- Present the searching Technique for Problem Solving
- Introduce Natural Language Processing and Robotics

Course Outcomes:

After completion of the course, students will be able to

- Apply searching techniques for solving a problem
- Design Intelligent Agents
- Develop Natural Language Interface for Machines
- Design mini robots
- Summarize past, present and future of Artificial Intelligence

UNIT I Introduction Lecture 9Hr

Introduction: What is AI, Foundations of AI, History of AI, The State of Art.

Intelligent Agents: Agents and Environments, Good Behaviour: The Concept of Rationality, The Na Environments, The Structure of Agents.

UNIT II Solving Problems by searching Lecture 9 Hr

Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Str: Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithm Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic A Searching with partial observations, online search agents and unknown environments.

UNIT III Reinforcement Learning & Natural Language Processing Lecture 8Hr

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Le Generalization in Reinforcement Learning, Policy Search, applications of RL

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Infor Extraction.

UNIT IV Natural Language for Communication Lecture 8 Hr

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Aug Grammars and semantic Interpretation, Machine Translation, Speech Recognition

Perception: Image Formation, Early Image Processing Operations, Object Recognition by appe Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

UNIT V Robotics Lecture 10Hr

Robotics: Introduction, Robot Hardware, Robotic Perception, planning to move, planning ur movements, Moving, Robotic software architectures, application domains

Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Architectures, Are we going in the right direction, What if AI does succeed.

Textbooks:

1. Stuart J.Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, I Education, 2019.



Reference Books:

1. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
2. 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:

<http://peterindia.net/AILinks.html>

<http://nptel.ac.in/courses/106106139/>

<https://nptel.ac.in/courses/106/105/106105152/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A12502) MOBILE APPLICATION DEVELOPMENT USING ANDROID
(Open Elective-I)

Course Objectives:

- Facilitate students to understand android SDK.
- Help students to gain a basic understanding of Android application development.
- Inculcate working knowledge of Android Studio development tool.

Course Outcomes:

- Identify various concepts of mobile programming that make it unique from programming for other platforms.
- Evaluate mobile applications on their design pros and cons.
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- Develop mobile applications for the Android operating system that use basic and advanced phone features.
- Demonstrate the deployment of applications to the Android marketplace for distribution.

UNIT I Introduction and Mobile User Interface Design

Introduction to Android: The Android Platform, Android SDK, Android Studio Installation, Android Installation, building you First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT II Activities, Intents and Android User Interface

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions

UNIT III Advanced User Interface and Data Persistence

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT IV Android Services, Publishing Android Applications

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT V Android Databases

Using Common Android APIs: Using Android Data and Storage APIs, managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Textbooks:

1. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011).
2. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development," Wiley India, FirstEdition,2012.

Reference Books:

1. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
2. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
3. Android Application Development All in one for Dummies by Barry Burd, Edition: I

Online Learning Resources:

1. <https://developer.android.com/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A05505a) JAVA PROGRAMMING
(Open Elective Course – I)

Course Objectives:

- To understand object-oriented concepts and problem-solving techniques
- To obtain knowledge about the principles of inheritance and polymorphism
- To implement the concept of packages, interfaces, exception handling and concurrency mechanism.
- To design the GUIs using applets and swing controls.
- To understand the Java Database Connectivity Architecture

Course Outcomes:

- Solve real-world problems using OOP techniques.
- Apply code reusability through inheritance, packages and interfaces
- Solve problems using java collection framework and I/O classes.
- Develop applications by using parallel streams for better performance and develop applets for web applications.
- Build GUIs and handle events generated by user interactions and Use the JDBC API to access the database.

UNIT I Introduction

Introduction to Object Oriented Programming, The History and Evolution of Java, Introduction to Classes, Objects, Methods, Constructors, this keyword, Garbage Collection, Data Types, Variables, Type Conversion and Casting, Arrays, Operators, Control Statements, Method Overloading, Constructor Overloading, Parameter Passing, Recursion, String Class and String handling methods

UNIT II Inheritance, Packages, Interfaces

Inheritance: Basics, Using Super, Creating Multilevel hierarchy, Method overriding, Dynamic Method Dispatch, Using Abstract classes, Using final with inheritance, Object class,
Packages: Basics, Finding packages and CLASSPATH, Access Protection, Importing packages.
Interfaces: Definition, Implementing Interfaces, Extending Interfaces, Nested Interfaces, Applying Interfaces, Variables in Interfaces.

UNIT III Exception handling, Stream based I/O

Exception handling - Fundamentals, Exception types, Uncaught exceptions, using try and catch, multiple catch clauses, nested try statements, throw, throws and finally, built-in exceptions, creating own exception subclasses.

Stream based I/O (java.io) – The Stream Classes-Byte streams and Character streams, Reading console Input and Writing Console Output, File class, Reading and Writing Files, Random access file operations, The Console class, Serialization, Enumerations, Autoboxing, Generics.

UNIT IV Multithreading, The Collections Framework

Multithreading: The Java thread model, creating threads, Thread priorities, Synchronizing threads, Interthread communication.

The Collections Framework (java.util): Collections overview, Collection Interfaces, The Collectionclasses-Array List, Linked List, Hash Set, Tree Set, Priority Queue, Array Deque. Hashtable, Properties, Stack, Vector, String Tokenizer, Bit Set, Date, Calendar, Random, Formatter, Scanner.

UNIT V Applet, GUI Programming with Swings, Accessing Databases with JDBC

Applet: Basics, Architecture, Applet Skeleton, requesting repainting, using the status window, passing parameters to applets

GUI Programming with Swings – The origin and design philosophy of swing, components and containers,



layout managers, event handling, using a push button, jtextfield, jlabel and image icon, the swing buttons, jtext field, jscrollpane, jlist, jcombobox, trees, jtable, An overview of jmenubar, jmenu and jmenuitem, creating a main menu, show message dialog, show confirmdialog, show input dialog, show option dialog, jdialog, create a modeless dialog.

Accessing Databases with JDBC:

Types of Drivers, JDBC Architecture, JDBC classes and Interfaces, Basic steps in developing JDBC applications, Creating a new database and table with JDBC.

Textbooks:

3. Java The complete reference, 9th edition, Herbert Schildt, McGraw Hill Education (India) Pvt. Ltd.
4. Java How to Program, 10th Edition, Paul Dietel, Harvey Dietel, Pearson Education.

Reference Books:

8. Understanding Object-Oriented Programming with Java, updated edition, T. Budd, Pearson Education.
9. Core Java Volume – 1 Fundamentals, Cay S. Horstmann, Pearson Education.
10. Java Programming for core and advanced learners, Sagayaraj, Dennis, Karthik and Gajalakshmi, University Press
11. Introduction to Java programming, Y. Daniel Liang, Pearson Education.
12. Object Oriented Programming through Java, P. Radha Krishna, University Press.
13. Programming in Java, S. Malhotra, S. Chaudhary, 2nd edition, Oxford Univ. Press.
14. Java Programming and Object-oriented Application Development, R.A. Johnson, Cengage Learning.

Online Learning Resources:

- https://www.w3schools.com/java/java_oop.asp
- <http://peterindia.net/JavaFiles.html>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A05602T)ARTIFICIAL INTELLIGENCE
Open Elective Course - I

Course Objectives:

This course is designed to:

- Introduce Artificial Intelligence
- Teach about the machine learning environment
- Present the searching Technique for Problem Solving
- Introduce Natural Language Processing and Robotics

Course Outcomes:

After completion of the course, students will be able to

- Apply searching techniques for solving a problem
- Design Intelligent Agents
- Develop Natural Language Interface for Machines
- Design mini robots
- Summarize past, present and future of Artificial Intelligence

UNIT I Introduction Lecture 9Hr

Introduction: What is AI, Foundations of AI, History of AI, The State of Art.

Intelligent Agents: Agents and Environments, Good Behavior: The Concept of Rationality, The Na Environments, The Structure of Agents.

UNIT II Solving Problems by searching Lecture 9 Hr

Problem Solving Agents, Example problems, Searching for Solutions, Uninformed Search Str: Informed search strategies, Heuristic Functions, Beyond Classical Search: Local Search Algorithm Optimization Problems, Local Search in Continues Spaces, Searching with Nondeterministic A Searching with partial observations, online search agents and unknown environments.

UNIT III Reinforcement Learning & Natural Language Processing Lecture 8Hr

Reinforcement Learning: Introduction, Passive Reinforcement Learning, Active Reinforcement Le Generalization in Reinforcement Learning, Policy Search, applications of RL

Natural Language Processing: Language Models, Text Classification, Information Retrieval, Infor Extraction.

UNIT IV Natural Language for Communication Lecture 8 Hr

Natural Language for Communication: Phrase structure grammars, Syntactic Analysis, Aug Grammars and semantic Interpretation, Machine Translation, Speech Recognition

Perception: Image Formation, Early Image Processing Operations, Object Recognition by appe Reconstructing the 3D World, Object Recognition from Structural information, Using Vision.

UNIT V Robotics Lecture 10Hr

Robotics: Introduction, Robot Hardware, Robotic Perception, planning to move, planning ur movements, Moving, Robotic software architectures, application domains

Philosophical foundations: Weak AI, Strong AI, Ethics and Risks of AI, Agent Components, Architectures, Are we going in the right direction, What if AI does succeed.

Textbooks:

2. Stuart J.Russell, Peter Norvig, "Artificial Intelligence A Modern Approach", 3rd Edition, I Education, 2019.



Reference Books:

3. Nilsson, Nils J., and Nils Johan Nilsson. Artificial intelligence: a new synthesis. Morgan Kaufmann, 1998.
4. 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:

<http://peterindia.net/AILinks.html>

<http://nptel.ac.in/courses/106106139/>

<https://nptel.ac.in/courses/106/105/106105152/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A12502) MOBILE APPLICATION DEVELOPMENT USING ANDROID
(Open Elective-I)

Course Objectives:

- Facilitate students to understand android SDK.
- Help students to gain a basic understanding of Android application development.
- Inculcate working knowledge of Android Studio development tool.

Course Outcomes:

- Identify various concepts of mobile programming that make it unique from programming for other platforms.
- Evaluate mobile applications on their design pros and cons.
- Utilize rapid prototyping techniques to design and develop sophisticated mobile interfaces.
- Develop mobile applications for the Android operating system that use basic and advanced phone features.
- Demonstrate the deployment of applications to the Android marketplace for distribution.

UNIT I Introduction and Mobile User Interface Design

Introduction to Android: The Android Platform, Android SDK, Android Studio Installation, Android Installation, building your First Android application, Understanding Anatomy of Android Application, Android Manifest file.

UNIT II Activities, Intents and Android User Interface

Android Application Design Essentials: Anatomy of an Android applications, Android terminologies, Application Context, Activities, Services, Intents, Receiving and Broadcasting Intents, Android Manifest File and its common settings, Using Intent Filter, Permissions

UNIT III Advanced User Interface and Data Persistence

Android User Interface Design Essentials: User Interface Screen elements, Designing User Interfaces with Layouts, Drawing and Working with Animation.

UNIT IV Android Services, Publishing Android Applications

Testing Android applications, Publishing Android application, Using Android preferences, Managing Application resources in a hierarchy, working with different types of resources.

UNIT V Android Databases

Using Common Android APIs: Using Android Data and Storage APIs, managing data using SQLite, Sharing Data between Applications with Content Providers, Using Android Networking APIs, Using Android Web APIs, Using Android Telephony APIs, Deploying Android Application to the World.

Textbooks:

3. Lauren Darcey and Shane Conder, "Android Wireless Application Development", Pearson Education, 2nd ed. (2011).
4. Jeff McWherter and Scott Gowell, "Professional Mobile Application Development," Wiley India, First Edition, 2012.

Reference Books:

4. Reto Meier, "Professional Android 2 Application Development", Wiley India Pvt Ltd
5. Mark L Murphy, "Beginning Android", Wiley India Pvt Ltd
6. Android Application Development All in one for Dummies by Barry Burd, Edition: I

Online Learning Resources:

2. <https://developer.android.com/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A54501) OPTIMIZATION TECHNIQUES
(Open Elective- I)

Course Objectives:

This course enables the students to classify and formulate real-life problem for modeling as optimization problem, solving and applying for decision making.

Course Outcomes: Student will be able to

- formulate a linear programming problem and solve it by various methods.
- give an optimal solution in assignment jobs, give transportation of items from sources to destinations.
- identify strategies in a game for optimal profit.
- implement project planning.

UNIT I

Introduction to operational research-Linear programming problems (LPP)-Graphical method-Simplex method-Big M Method-Dual simplex method.

UNIT II

Transportation problems- assignment problems-Game theory.

UNIT III

CPM and PERT –Network diagram-Events and activities-Project Planning-Reducing critical events and activities-Critical path calculations.

UNIT IV

Sequencing Problems-Replacement problems-Capital equipment- Discounting costs- Group replacement.

UNIT V

Inventory models-various costs- Deterministic inventory models-Economic lot size-Stochastic inventory models- Single period inventory models with shortage cost.

Textbooks:

1. Operations Research , S.D. Sharma.
2. Operations Research, An Introduction, Hamdy A. Taha, Pearson publishers.
3. Operations Research, Nita H Shah, Ravi M Gor, Hardik Soni, PHI publishers

Reference Books:

1. Problems on Operations Research, Er. Prem kumargupta, Dr.D.S. Hira, Chand publishers
2. Operations Research, CB Gupta, PK Dwivedi, Sunil kumaryadav

Online Learning Resources:

https://nptel.ac.in/content/storage2/courses/105108127/pdf/Module_1/M1L2slides.pdf
<https://slideplayer.com/slide/7790901/>
<https://www.ime.unicamp.br/~andreani/MS515/capitulo12.pdf>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3

(20A56501) MATERIALS CHARACTERIZATION TECHNIQUES
(Open Elective- I)

Course Objectives:

- To provide an exposure to different characterization techniques.
- To enlighten the basic principles and analysis of different spectroscopic techniques.
- To explain the basic principle of Scanning electron microscope along with its limitations and applications.
- To identify the Resolving power and Magnification of Transmission electron microscope and its applications.
- To educate the uses of advanced electric and magnetic instruments for characterization.

Course Outcomes: At the end of the course the student will be able

- To explain the structural analysis by X-ray diffraction.
- To understand the morphology of different materials using SEM and TEM.
- To recognize basic principles of various spectroscopic techniques.
- To study the electric and magnetic properties of the materials.
- To make out which technique can be used to analyse a material

UNIT I

Structure analysis by Powder X-Ray Diffraction: Introduction, Bragg's law of diffraction, Intensity of Diffracted beams, Factors affecting Diffraction, Intensities, Structure of polycrystalline Aggregates, Determination of crystal structure, Crystallite size by Scherrer and Williamson-Hall (W-H) Methods, Small angle X-ray scattering (SAXS) (in brief).

UNIT II

Microscopy technique -1 –Scanning Electron Microscopy (SEM)

Introduction, Principle, Construction and working principle of Scanning Electron Microscopy, Specimen preparation, Different types of modes used (Secondary Electron and Backscatter Electron), Advantages, limitations and applications of SEM.

UNIT III

Microscopy Technique -2 - Transmission Electron Microscopy (TEM): Construction and Working principle, Resolving power and Magnification, Bright and dark fields, Diffraction and image formation, Specimen preparation, Selected Area Diffraction, Applications of Transmission Electron Microscopy, Difference between SEM and TEM, Advantage and Limitations of Transmission Electron Microscopy.

UNIT IV

Spectroscopy techniques – Principle, Experimental arrangement, Analysis and advantages of the spectroscopic techniques – (i) UV-Visible spectroscopy (ii) Raman Spectroscopy, (iii) Fourier Transform infrared (FTIR) spectroscopy, (iv) X-ray photoelectron spectroscopy (XPS).

UNIT V

Electrical & Magnetic Characterization techniques: Electrical Properties analysis techniques (DC conductivity, AC conductivity) Activation Energy, Effect of Magnetic field on the electrical properties (Hall Effect). Magnetization measurement by induction method, Vibrating sample Magnetometer (VSM) and SQUID.

Textbooks:

1. Material Characterization: Introduction to Microscopic and Spectroscopic Methods –Yang Leng – John Wiley & Sons (Asia) Pvt. Ltd. 2008
2. Handbook of Materials Characterization -by Sharma S. K. - Springer

References:1. Fundamentals of Molecular Spectroscopy – IV Ed. – Colin Neville Banwell and Elaine M. McCash, Tata McGraw-Hill, 2008.

2. Elements of X-ray diffraction – Bernard Dennis Cullity& Stuart R Stocks, Prentice Hall, 2001
3. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods-Yang Leng-John Wiley & Sons
4. Characterization of Materials 2nd Edition, 3 Volumes-Kaufmann E N -John Wiley (Bp)



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-I Sem **L T P C**
3 0 0 3
(20A51501) CHEMISTRY OF ENERGY MATERIALS
(Open Elective- I)

Course Objectives:

- To make the student understand basic electrochemical principles such as standard electrode potentials, emf and applications of electrochemical principles in the design of batteries.
- To understand the basic concepts of processing and limitations of fossil fuels and Fuel cells & their applications.
- To impart knowledge to the students about fundamental concepts of hydrogen storage in different materials and liquification method
- Necessarity of harnessing alternate energy resources such as solar energy and its basic concepts.
- To understand and apply the basics of calculations related to material and energy flow in the processes.

Course Outcomes:

- Ability to perform simultaneous material and energy balances.
- Student learn about various electrochemical and energy systems
- Knowledge of solid, liquid and gaseous fuels
- To know the energy demand of world, nation and available resources to fulfill the demand
- To know about the conventional energy resources and their effective utilization
- To acquire the knowledge of modern energy conversion technologies
- To be able to understand and perform the various characterization techniques of fuels
- To be able to identify available nonconventional (renewable) energy resources and techniques to utilize them effectively

UNIT I: Electrochemical Systems: Galvanic cell, standard electrode potential, application of EMF, electrical double layer, dipole moments, polarization, Batteries-Lead-acid and Lithium ion batteries.

UNIT II: Fuel Cells: Fuel cell working principle, Classification of fuel cells, Polymer electrolyte membrane (PEM) fuel cells, Solid-oxide fuel cells (SOFC), Fuel cell efficiency, Basic design of fuel cell.

UNIT III: Hydrogen Storage: Hydrogen Storage, Chemical and Physical methods of hydrogen storage, Hydrogen Storage in metal hydrides, metal organic frame works (MOF), Carbon structures, metal oxide porous structures, hydrogel storage by high pressure methods. Liquifaction method.

UNIT IV: Solar Energy: Solar energy introduction and prospects, photo voltaic (PV) technology, concentrated solar power (CSP), Solar Fuels, Solar cells.

UNIT V: Photo and Photo electrochemical Conversions: Photochemical cells and applications of photochemical reactions, specificity of photo electrochemical cell, advantage of photoelectron catalytic conversions.

References:

1. Physical chemistry by Ira N. Levine
2. Essentials of Physical Chemistry, Bahl and Bahl and Tuli.
3. Inorganic Chemistry, Silver and Atkins
4. Fuel Cell Hand Book 7th Edition, by US Department of Energy (EG&G technical services and corporation)
5. Hand book of solar energy and applications by Arvind Tiwari and Shyam.
6. Solar energy fundamental, technology and systems by Klaus Jagar et.al.
7. Hydrogen storage by Levine Klebonoff



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR				
B.Tech IV-I Sem	L	T	P	C
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(20A01704) ENVIRONMENTAL ECONOMICS
(Open Elective Course - II)

Course Objectives:

- To impart knowledge on sustainable development and economics of energy
- To teach regarding environmental degradation and economic analysis of degradation
- To inculcate the knowledge of economics of pollution and their management
- To demonstrate the understanding of cost benefit analysis of environmental resources
- To make the students to understand principles of economics of biodiversity

Course Outcomes :

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

- The information on sustainable development and economics of energy
- The information regarding environmental degradation and economic analysis of degradation
- The identification of economics of pollution and their management
- The cost benefit analysis of environmental resources
- The principles of economics of biodiversity

UNIT I

Sustainable Development: Introduction to sustainable development - Economy-Environment inter-linkages - Meaning of sustainable development - Limits to growth and the environmental Kuznets curve – The sustainability debate - Issues of energy and the economics of energy – Nonrenewable energy, scarcity, optimal resources, backstop technology, property research, externalities, and the conversion of uncertainty.

UNIT II

Environmental Degradation: Economic significance and causes of environmental degradation - The concepts of policy failure, externality and market failure - Economic analysis of environmental degradation – Equi –marginal principle.

UNIT - III

Economics of Pollution: Economics of Pollution - Economics of optimal pollution, regulation, monitoring and enforcement - Managing pollution using existing markets: Bargaining solutions – Managing pollution through market intervention: Taxes, subsidies and permits.

UNIT IV

Cost – Benefit Analysis: Economic value of environmental resources and environmental damage - Concept of Total Economic Value - Alternative approaches to valuation – Cost-benefit analysis and discounting.

UNIT V

Economics of biodiversity: Economics of biodiversity conservation - Valuing individual species and diversity of species -Policy responses at national and international levels. Economics of Climate Change – stern Report

Textbooks:

1. An Introduction to Environmental Economics by N. Hanley, J. Shogren and B. White Oxford University Press.(2001)
2. Blueprint for a Green Economy by D.W. Pearce, A. Markandya and E.B. Barbier Earthscan, London.(1989)

Reference Books:

1. Environmental Economics: An Elementary Introduction by R.K. Turner, D.W. Pearce and I. Bateman Harvester Wheatsheaf, London. (1994),
2. Economics of Natural Resources and the Environment by D.W. Pearce and R.K. Turner Harvester Wheat sheaf, London. (1990),
3. Environmental and Resource Economics: An Introduction by Michael S. Common and Michael Stuart 2ndEdition, Harlow: Longman.(1996),



4. Natural Resource and Environmental Economics by Roger Perman, Michael Common, Yue Ma and James Mc Gilvray 3rd Edition, Pearson Education.(2003),

Online Learning Resources:

<https://nptel.ac.in/courses/109107171>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3

(20A02605) SMART ELECTRIC GRID
(Open Elective Course-II)

Course Objectives:

- Understand recent trends in grids, smart grid architecture and technologies
- Analyze smart substations
- Apply the concepts to design smart transmission systems
- Apply the concepts to design smart distribution systems

Course Outcomes:

- Understand trends in Smart grids, needs and roles of Smart substations
- Design and Analyze Smart Transmission systems
- Design and Analyze Smart Distribution systems
- Analyze SCADA and DSCADA systems in practical working environment

UNIT I INTRODUCTION TO SMART GRID

Working definitions of Smart Grid and Associated Concepts – Smart Grid Functions – Traditional Power Grid and Smart Grid – New Technologies for Smart Grid – Advantages – Indian Smart Grid – Key Challenges for Smart Grid

UNIT II SMART GRID TECHNOLOGIES

Characteristics of Smart grid, Micro grids, Definitions, Drives, benefits, types of Micro grid, building blocks, Renewable energy resources, needs in smart grid, integration impact, integration standards, Load frequency control, reactive power control, case studies and test beds

UNIT III SMART SUBSTATIONS

Protection, Monitoring and control devices, sensors, SCADA, Master stations, Remote terminal unit, interoperability and IEC 61850, Process level, Bay level, Station level, Benefits, role of substations in smart grid, Volt/VAR control equipment inside substation

UNIT IV SMART TRANSMISSION SYSTEMS

Energy Management systems, History, current technology, EMS for the smart grid, Synchro Phasor Measurement Units (PMUs), Wide Area Monitoring Systems (WAMS), protection & Control (WAMPC), needs in smart grid, Role of WAMPC smart grid, Drivers and benefits, Role of transmission systems in smart grid

UNIT V SMART DISTRIBUTION SYSTEMS

DMS, DSCADA, trends in DSCADA and control, current and advanced DMSs, Voltage fluctuations, effect of voltage on customer load, Drivers, objectives and benefits, voltage-VAR control, VAR control equipment on distribution feeders, implementation and optimization, FDIR - Fault Detection Isolation and Service restoration (FDIR), faults, objectives and benefits, equipment, implementation

Textbooks:

1. Stuart Borlase, Smart Grids - Infrastructure, Technology and Solutions, CRC Press, 1e, 2013
2. Gil Masters, Renewable and Efficient Electric Power System, Wiley–IEEE Press, 2e, 2013.

Reference Books:

1. A.G. Phadke and J.S. Thorp, Synchronized Phasor Measurements and their Applications, Springer Edition, 2e, 2017.
2. T. Ackermann, Wind Power in Power Systems, Hoboken, NJ, USA, John Wiley, 2e, 2012.

Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_ee82/preview

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech IV-I Sem****L T P C**
3 0 0 3**(20A03605c) INTRODCUTION TO ROBOTICS**
(Open Elective-II)**Course Objectives:**

- Learn the fundamental concepts of industrial robotic technology.
- Apply the basic mathematics to calculate kinematic and dynamic forces in robot manipulator.
- Understand the robot controlling and programming methods.
- Describe concept of robot vision system

Course Outcomes:

After completing the course, the student will be able to,

- Explain fundamentals of Robots
- Apply kinematics and differential motions and velocities
- Demonstrate control of manipulators
- Understand robot vision
- Develop robot cell design and programming

UNIT I Fundamentals of Robots

Introduction, definition, classification and history of robotics, robot characteristics and precision of motion, advantages, disadvantages and applications of robots. Introduction to matrix representation of a point in a space a vector in space, a frame in space, Homogeneous transformation matrices, representation of a pure translation, pure rotation about an axis.

UNIT II Kinematics, Differential motions and velocities of robot

Kinematics of robot: Forward and inverse kinematics of robots- forward and inverse kinematic equations for position and orientation, Denavit-Hartenberg(D-H) representation of forward kinematic equations of robots, the inverse kinematic of robots, degeneracy and dexterity, simple problems with D-H representation.

Differential motions and Velocities: Introduction, differential relationship, Jacobian, differential motions of a frame-translations, rotation, rotating about a general axis, differential transformations of a frame. Differential changes between frames, differential motions of a robot and its hand frame, calculation of Jacobian, relation between Jacobian and the differential operator, Inverse Jacobian.

UNIT III Control of Manipulators

Open- and close-loop control, the manipulator control problem, linear control schemes, characteristics of second-order linear systems, linear second-order SISO model of a manipulator joint, joint actuators, partitioned PD control scheme, PID control Scheme, computer Torque control, force control of robotic manipulators, description of force-control tasks, force control strategies, hybrid position/force control, impedance force/torque control.

UNIT IV Robot Vision

Introduction, architecture of robotic vision system, image processing, image acquisition camera, image enhancement, image segmentation, imaging transformation, Camera transformation and calibrations, industrial applications of robot vision.

UNIT V Robot Cell Design and Programming

Robot cell layouts-Robot centred cell, In-line robot cell, considerations in work cell design, work cell control, interlocks, error detection, work cell controller. methods of robot programming, WAIT, SIGNAL, and DELAY commands, Robotic languages, VAL system.

Textbooks:

1. Mikell P. Groover and Mitchell Weiss, Roger N. Nagel, Nicholas G. Odrey, Industrial Robotics — Mc Graw Hill, 1986.



2. R K Mittal and I J Nagrath, Robotics and control, Illustrated Edition, Tata McGraw Hill India 2003.

References:

1. Saeed B. Niku, Introduction to Robotics – Analysis, System, Applications, 2nd Edition, John Wiley & Sons, 2010.
2. H. Asada and J.J.E. Slotine, Robot Analysis and Control, 1st Edition Wiley- Interscience, 1986.
3. Robert J. Schilling, Fundamentals of Robotics: Analysis and control, Prentice-Hall Of India Pvt. Limited, 1996.

Online Learning Resources:

<https://nptel.ac.in/courses/108105088>

<https://nptel.ac.in/courses/108105063>

<https://nptel.ac.in/courses/108105062>

<https://nptel.ac.in/courses/112104288>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem

L T P C
3 0 0 3

(20A04605) SIGNAL PROCESSING
(Open Elective Course –II)

Course objectives:

- Understand, represent and classify continuous time and discrete time signals and systems, together with the representation of LTI systems.
- Ability to represent continuous time signals (both periodic and non-periodic) in the time domain, sdomain and the frequency domain
- Understand the properties of analog filters, and have the ability to design Butterworth filters
- Understand and apply sampling theorem and convert a signal from continuous time to discrete time or from discrete time to continuous time (without loss of information)
- Able to represent the discrete time signal in the frequency domain
- Able to design FIR and IIR filters to meet given specifications

Course Outcomes:

- Understand and explain continuous time and discrete time signals and systems, in time and frequency domain
- Apply the concepts of signals and systems to obtain the desired parameter/ representation
- Analyse the given system and classify the system/arrive at a suitable conclusion
- Design analog/digital filters to meet given specifications
- Design and implement the analog filter using components/ suitable simulation tools
- Design and implement the digital filter using suitable simulation tools, and record the input and output of the filter for the given audio signal

UNIT I

Signal Definition, Signal Classification, System definition, System classification, for both continuous time and discrete time. Definition of LTI systems

UNIT II

Introduction to Fourier Transform, Fourier Series, Relating the Laplace Transform to Fourier Transform, Frequency response of continuous time systems

UNIT III

Frequency response of ideal analog filters, Salient features of Butterworth filters Design and implementation of Analog Butterworth filters to meet given specifications

UNIT IV

Sampling Theorem- Statement and proof, converting the analog signal to a digital signal. Practical sampling. The Discrete Fourier Transform, Properties of DFT. Comparing the frequency response of analog and digital systems.

UNIT V

Definition of FIR and IIR filters. Frequency response of ideal digital filters Transforming the Analog Butterworth filter to the Digital IIR Filter using suitable mapping techniques, to meet given specifications. Design of FIR Filters using the Window technique, and the frequency sampling technique to meet given specifications Comparing the designed filter with the desired filter frequency response

Textbooks:

1. 'Signals and Systems', by Simon Haykin and Barry Van Veen, Wiley.

References:

1. 'Theory and Application of Digital Signal Processing', Rabiner and Gold
2. 'Signals and Systems', Schaum's Outline series
3. 'Digital Signal Processing', Schaum's Outline series



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3

(20A04701b) INTRODUCTION TO INTERNET OF THINGS
(Open Elective Course-II)

Course Objectives:

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

Course Outcomes:

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

UNIT 1

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

UNIT II

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

UNIT III

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

UNIT IV

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

UNIT V

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

Textbooks:

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

References:

1. Dr SRN Reddy, 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



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B.Tech III-II Sem **L T P C**
3 0 0 3

(20A05605a) PRINCIPLES OF OPERATING SYSTEMS
(Open Elective Course – II)

Course Objectives:

- Understand basic concepts and functions of operating systems
- Understand the processes, threads and scheduling algorithms.
- Expose the students with different techniques of handling deadlocks
- Provide good insight on various memory management techniques
- Explore the concept of file-system and its implementation issues

Course Outcomes:

- Demonstrate and understand of computer systems and operating systems functions
- Distinguish between process and thread and classify scheduling algorithms
- Solve synchronization and deadlock problems
- Compare various memory management schemes
- Explain file systems concepts and i/o management

UNIT I Introduction to Computer and Operating system

Computer Types, Functional Units, Basic Operational Concepts, Number Representation and Arithmetic Operations, Character Representation, Performance, Historical Perspective, Memory Locations and Addresses, Memory operations, Instructions and Instruction Sequencing, Addressing modes Architecture Operating System Structure, Operations Process, Memory, Storage Management, Protection and Security Computing Environments Operating System Services User Operating System Interface System Calls Types System Programs OS Structure OS Generation System Boot.

UNIT II Process, Threads and Scheduling

Process Concept Scheduling Operations on Processes Cooperating Processes Inter-Process Communication Threads - Multithreading Models -Thread Libraries- Threading Issues – Scheduling Criteria Scheduling Algorithms Algorithm Evaluation.

UNIT III Process Synchronization and Deadlocks

The Critical-Section Problem Synchronization Hardware Mutex Locks -Semaphores Classic Problems of Synchronization Critical Regions Monitors Deadlocks System Model Deadlock Characterization Methods for Handling Deadlocks Deadlock Prevention Deadlock Avoidance Deadlock Detection Recovery from Deadlock.

UNIT IV Memory Management

Introduction - Swapping Contiguous Memory Allocation Paging Segmentation- Structure of the Page Table - Virtual Memory- Background Demand Paging Copy on Write Page Replacement Allocation of Frames Thrashing.

UNIT V Input/ Output and Files

Overview of Mass Storage Structure - Disk Structure - Disk Scheduling and Management-File System Interface File Concept - Access Methods -Directory and Disk Structure- Directory Implementation - Allocation Methods- I/O Systems I/O Hardware- Application I/O Interface - Kernel I/O Subsystem.

Textbooks:

1. Carl Hamacher, Zvonko Vranesic, Safwat Zaky and Naraig Manjikian, Computer Organization and Embedded Systems, Sixth Edition, Tata McGraw Hill, 2012.
2. Abraham Silberschatz, Peter B. Galvin and Greg Gagne, Operating Systems Concepts, Ninth Edition, Wiley, 2012.



Reference Books:

1. William Stallings, Operating Systems: Internals and Design Principles, Ninth Edition, Prentice-Hall, 2018.
2. Andrew Tanenbaum, Modern Operating Systems, Third Edition, Prentice Hall, 2009.

Online Learning Resources:

<https://mptel.ac.in/courses/106/106/106106144/>

<http://peterindia.net/OperatingSystems.html>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3

(20A05605b) FOUNDATIONS OF MACHINE LEARNING
Open Elective Course– II

Course Objectives:

- Acquire theoretical knowledge on setting hypothesis for pattern recognition.
- Apply suitable machine learning techniques for data handling and to gain knowledge from it.
- Evaluate the performance of algorithms and to provide solution for various real-world applications.

Course Outcomes (CO):

After completion of the course, students will be able to

1. Understand the characteristics of machine learning strategies.
2. Apply various supervised learning methods to appropriate problems.
3. Identify and integrate more than one technique to enhance the performance of learning.
4. Create probabilistic and unsupervised learning models for handling unknown pattern.
5. Analyse the co-occurrence of data to find interesting frequent patterns.
6. Pre-process the data before applying to any real-world problem and can evaluate its performance

UNIT - I Introduction to Machine Learning Lecture 8Hrs

What is machine learning, learning associations, classification, regression, unsupervised learning, reinforcement learning

Supervised Learning: learning a class from examples, learning multiple classes, model selection and generalization

UNIT - II Parametric, Non-Parametric methods Lecture 9Hrs

Parametric Methods: Introduction, maximum likelihood estimation, evaluating an estimator, parametric classification, regression, model selection procedures

Nonparametric Methods: Introduction, nonparametric density estimation: histogram estimator, kernel estimator, k-nearest neighbour estimator

UNIT - III Multivariate Methods Lecture 9Hrs

Multivariate Methods: Multivariate data, parameter estimation, estimation of missing values, multivariate normal distribution, multi variate classification

UNIT - IV Dimensionality Reduction, Clustering Lecture 8Hrs

Dimensionality Reduction: Introduction, subset selection, principal component analysis, singular value decomposition and matrix factorization

Clustering: Mixture densities, k-means clustering, expectation-maximization algorithm, mixtures of latent variables

UNIT - V Deep Learning Lecture 8Hrs

Deep Learning: Introduction, train multiple hidden layers, improving training convergence, regularization, convolution layers, tuning the network structure, learning sequences.

Textbooks:

1. EthemAlpaydin, Introduction to Machine Learning, Fourth Edition, MIT Press, Fourth Edition, 2020
2. MehryarMohri, Afshin Rostamizadeh, Ameet Talwalkar "Foundations of Machine Learning", MIT Press, 2012

Reference Books:

1. Marc Peter Deisenroth, A. Aldo Faisal, Cheng Soon Ong, "Mathematics for Machine Learning", Cambridge University Press, 2019.
2. Stephen Marsland, "Machine Learning – An Algorithmic Perspective", 2nd Edition, CRC Press, 2015.
3. Charu C. Aggarwal, "Data Classification Algorithms and Applications", CRC Press, 2014.



Online Learning Resources:

1. <https://bloomberg.github.io/foml/>
2. https://d1rkab7tlqy5f1.cloudfront.net/EWI/Over%20de%20faculteit/Afdelingen/Intelligent%20Systems/Pattern%20Recognition%20Laboratory/PR/Reading%20Group/Foundations_of_Machine_Learning.pdf



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (IT)– III-II Sem **L T P C**
3 0 0 3

(20A05605c) DATA ANALYTICS USING R
(Open Elective-II)

Course Objectives:

- Facilitate students to understand R programming
- Help students to gain a basic understanding of Data Analytics
- Inculcate working knowledge of plotting

Course Outcomes:

- Identify and execute basic syntax and programs in R
- Perform the Matrix operations using R built in functions
- Apply nonnumeric values in vectors
- Create the list and data frames
- Exploit the graph using ggplot2.

UNIT I Introduction to R Programming

History and Overview of R- Basic Features of R-Design of the R System- Installation of R- Console and Editor Panes- Comments- Installing and Loading R Packages- Help Files and Function Documentation-Saving Work and Exiting R- Conventions- R for Basic Math- Arithmetic- Logarithms and Exponentials - E-Notation - Assigning Objects – Vectors - Creating a Vector-Sequences, Repetition, Sorting and Lengths – Subsetting and Element Extraction -Vector – Oriented Behavior.

UNIT II Matrices and Arrays

Defining a Matrix – Defining a Matrix- Filling Direction- Row and Column Bindings- Matrix Dimensions-Subsetting- Row, Column, and Diagonal Extractions- Omitting and Overwriting- Matrix Operations and Algebra- Matrix Transpose- Identity Matrix- Matrix Addition and Subtraction- Matrix Multiplication-Matrix Inversion-Multidimensional Arrays-Subsets, Extractions and Replacements.

UNIT III Non-Numeric values

Logical Values- Relational Operators- Characters- Creating a String- Concatenation- Escape Sequences-Substrings and Matching- Factors- Identifying Categories- Defining and Ordering Levels- Combining and Cutting.

UNIT IV Lists and Data frames

List of Objects - Component Access – Naming – Nesting - Data Frames - Adding Data Columns and Combining Data Frames – Logical Record Subsets – Some Special Values – Infinity – NaN – NA - NULL – Attributes – Object - Class-Is-Dot Object-Checking Functions-As-Dot Coercion Functions

UNIT V Basic Plotting

Using plot with Coordinate Vectors-Graphical Parameters-Automatic Plot Types-Title and Axis Labels-Color-Line and Point Appearances-Plotting Region Limits-Adding Points, Lines, and Text to an ExistingPlot-ggplot2 Package-Quick Plot with qplot-Setting Appearance Constants with Geoms— Reading and Writing Files- R-Ready Data Sets- Contributed Data Sets- Reading in External Data Files- Writing Out Data Files and Plots-AdHoc Object Read/Write Operations

Textbooks:

1. Tilman M. Davies, “The Book of R-A First Programming, Statistics” Library of Congress Cataloging-in-Publication Data, 2016.

Reference Books:

1. Hadley Wickham, Garrett Golemund, ”R for Data Science”,Oreilly Publication,2017.
2. Roger D. Peng, “R Programming for Data Science” Lean Publishing, 2016.
3. Steven Keller, “R ProgrammingforBeginners”,CreateSpaceIndependentPublishingPlatform2016.

Online Learning Resources:

1. <https://www.coursera.org/learn/data-analysis-r>
2. <https://www.careers360.com/courses-certifications/data-analysis-with-r-courses-brpg>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3
(20A54701) WAVELET TRANSFORMS AND ITS APPLICATIONS
(Open Elective-II)

Course Objectives:

This course provides the students to understand Wavelet transforms and its applications.

Course Outcomes:

- Understand wavelets and wavelet expansion systems.
- Illustrate the multi resolution analysis and scaling functions.
- Form fine scale to coarse scale analysis.
- Find the lattices and lifting.
- Perform numerical complexity of discrete wavelet transforms.
- Find the frames and tight frames using fourier series.

UNIT I Wavelets

Wavelets and Wavelet Expansion Systems - Wavelet Expansion- Wavelet Transform- Wavelet System- More Specific Characteristics of Wavelet Systems -Haar Scaling Functions and Wavelets - effectiveness of Wavelet Analysis -The Discrete Wavelet Transform the Discrete-Time and Continuous Wavelet Transforms.

UNIT II A Multiresolution Formulation of Wavelet Systems

Signal Spaces -The Scaling Function -Multiresolution Analysis - The Wavelet Functions - The Discrete Wavelet Transform- A Parseval's Theorem - Display of the Discrete Wavelet Transform and the Wavelet Expansion.

UNIT III Filter Banks and the Discrete Wavelet Transform

Analysis - From Fine Scale to Coarse Scale- Filtering and Down-Sampling or Decimating -Synthesis - From Coarse Scale to Fine Scale -Filtering and Up-Sampling or Stretching - Input Coefficients - Lattices and Lifting - -Different Points of View.

UNIT IV Time-Frequency and Complexity

Multiresolution versus Time-Frequency Analysis- Periodic versus Nonperiodic Discrete Wavelet Transforms -The Discrete Wavelet Transform versus the Discrete-Time Wavelet Transform- Numerical Complexity of the Discrete Wavelet Transform.

UNIT V Bases and Matrix Examples

Bases, Orthogonal Bases, and Biorthogonal Bases -Matrix Examples - Fourier Series Example - Sine Expansion Example - Frames and Tight Frames - Matrix Examples -Sine Expansion as a Tight Frame Example.

Textbooks:

1. C. Sidney Burrus, Ramesh A. Gopinath, "Introduction to Wavelets and Wavelets Transforms", Prentice Hall, (1997).
2. James S. Walker, "A Primer on Wavelets and their Scientific Applications", CRC Press, (1999).

Reference Books:

1. Raghuvver Rao, "Wavelet Transforms", Pearson Education, Asia.

Online Learning Resources:

<https://www.slideshare.net/RajEndiran1/introduction-to-wavelet-transform-51504915>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem **L T P C**
3 0 0 3
(20A56701) PHYSICS OF ELECTRONIC MATERIALS AND DEVICES
(Open Elective-II)

Course Objectives:

- To impart the fundamental knowledge on various materials, their properties and applications.
- To provide insight into various semiconducting materials, and their properties.
- To enlighten the characteristic behavior of various semiconductor devices.
- To provide the basics of dielectric and piezoelectric materials and their properties.
- To explain different categories of magnetic materials, mechanism and their advanced applications.

Course Outcome: At the end of the course the student will be able

- To understand the fundamentals of various materials.
- To exploit the physics of semiconducting materials
- To familiarize with the working principles of semiconductor-based devices.
- To understand the behaviour of dielectric and piezoelectric materials.
- To identify the magnetic materials and their advanced applications.

UNIT I Fundamentals of Materials Science

Introduction, Phase rule, Phase Diagram, Elementary idea of Nucleation and Growth, Methods of crystal growth. Basic idea of point, line and planar defects. Concept of thin films, preparation of thin films, Deposition of thin film using sputtering methods (RT and glow discharge).

UNIT II Semiconductors

Introduction, charge carriers in semiconductors, effective mass, Diffusion and drift, Diffusion and recombination, Diffusion length. The Fermi level & Fermi-Dirac distribution, Electron and Hole in quantum well, Change of electron-hole concentration- Qualitative analysis, Temperature dependency of carrier concentration, Conductivity and mobility, Effects of temperature and doping on mobility, High field effects.

UNIT III Physics of Semiconductor devices

Introduction, Band structure, PN junctions and their typical characteristics under equilibrium and under bias, Construction and working principles of: Light emitting diodes, Heterojunctions, Transistors, FET and MOSFETs.

UNIT IV Dielectric Materials and their applications:

Introduction, Dielectric properties, Electronic polarizability and susceptibility, Dielectric constant and frequency dependence of polarization, Dielectric strength and dielectric loss, Piezoelectric properties.

UNIT V Magnetic Materials and their applications

Introduction, Magnetism & various contributions to para and dia magnetism, Ferro and Ferri magnetism and ferrites, Concepts of Spin waves and Magnons, Anti-ferromagnetism, Domains and domain walls, Coercive force, Hysteresis, Nano-magnetism, Super-paramagnetism – Properties and applications.

Textbooks

1. Principles of Electronic Materials and Devices- S.O. Kasap, McGraw-Hill Education (India) Pvt. Ltd., 3rd edition, 2007.
2. Electronic Components and Materials- Grover and Jamwal, Dhanpat Rai and Co.

Reference Books:

1. Solid State Electronic Devices -B.G. Streetman and S. Banerjee, PHI Learning, 6th edition
2. Electronic Materials Science- Eugene A. Irene, Wiley, 2005
3. An Introduction to Electronic Materials for Engineers-Wei Gao, Zhengwei Li, Nigel Sammes, World Scientific Publishing Co. Pvt. Ltd., 2nd Edition, 2011
4. A First Course In Material Science- by Raghvan, McGraw Hill Pub.
5. The Science and Engineering of materials- Donald R. Askeland, Chapman & Hall Pub.

NPTEL courses links: <https://nptel.ac.in/courses/113/106/113106062/>

https://onlinecourses.nptel.ac.in/noc20_mm02/preview,

<https://nptel.ac.in/noc/courses/noc17/SEM1/noc17-mm07>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech III-II Sem

L T P C
3 0 0 3

(20A51701) CHEMISTRY OF POLYMERS AND ITS APPLICATIONS

Course Objectives:

- To understand the basic principles of polymers
- To synthesize the different polymeric materials and their characterization by various instrumental methods.
- To impart knowledge to the students about fundamental concepts of Hydro gels of polymer networks, surface phenomenon by micelles
- To enumerate the applications of polymers in engineering

Course Outcome

- At the end of the course, the student will be able to:
- Understand the state of art synthesis of Polymeric materials
- Understand the hydro gels preparation, properties and applications in drug delivery system.
- Characterize polymers materials using IR, NMR, XRD.
- Analyze surface phenomenon fo micelles and characterise using photoelectron spectroscopy, ESCA and Auger spectroscopy

UNIT I : Polymers-Basics and Characterization

Basic concepts: monomers, repeat units, degree of polymerization, linear, branched and network polymers, classification of polymers, Polymerization: condensation, addition, radical chain, ionic and coordination and copolymerization. Average molecular weight concepts: number, weight and viscosity average molecular weights, polydispersity and molecular weight distribution Measurement of molecular weight: end group, viscosity, light scattering, osmotic and ultracentrifugation methods, analysis and testing of polymers.

Unit II : Synthetic Polymers

Addition and condensation polymerization processes – Bulk, Solution, Suspension and Emulsion polymerization.

Preparation and significance, classification of polymers based on physical properties, Thermoplastics, Thermosetting plastics, Fibers and elastomers, General Applications.

Preparation of Polymers based on different types of monomers, Olefin polymers, Diene polymers, nylons, Urea - formaldehyde, phenol - formaldehyde and melamine Epoxy and Ion exchange resins. Characterization of polymers by IR, NMR, XRD.

UNIT III : Natural Polymers & Modified cellulotics

Natural Polymers: Chemical & Physical structure, properties, source, important chemical modifications, applications of polymers such as cellulose, lignin, starch, rosin, shellac, latexes, vegetable oils and gums, proteins.

Modified cellulotics: Cellulose esters and ethers such as Ethyl cellulose, CMC, HPMC, cellulose acetals, Liquid crystalline polymers; specialty plastics- PES, PAES, PEEK, PEAK.

Learning Outcomes:

UNIT IV: Hydrogels of Polymer networks and Drug delivery

Definitions of Hydrogel, polymer networks, Types of polymer networks, Methods involved in hydrogel preparation, Classification, Properties of hydrogels, Applications of hydrogels in drug delivery.

Introduction to drug systems including, drug development, regulation, absorption and disposition, routes of administration and dosage forms. Advanced drug delivery systems and controlled release.

UNIT V : Surface phenomena



Surface tension, adsorption on solids, electrical phenomena at interfaces including electrokinetics, micelles, reverse micelles, solubilization. Application of photoelectron spectroscopy, ESCA and Auger spectroscopy to the study of surfaces.

References :

1. A Text book of Polymer science, Billmayer
2. Organic polymer Chemistry, K.J.Saunders, Chapman and Hall
3. Advanced Organic Chemistry, B.Miller, Prentice Hall
4. Polymer Chemistry – G.S.Mishra
5. Polymer Chemistry – Gowarikar
6. Physical Chemistry –Galston
7. Drug Delivery- Ashim K. Misra



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3

(20A01704) COST EFFECTIVE HOUSING TECHNIQUES
(Open Elective Course - III)

Course Objectives:

- To understand the requirements of structural safety for future construction.
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- To know the traditional practices of rural housing
- To know the different innovative cost effective construction techniques
- To know the alternative building materials for low cost housing.

Course Outcomes :

- To know the repair and restore action of earthquake damaged non engineered buildings and ability to understand the requirements of structural safety for future construction
- To know about the housing scenario, housing financial systems land use and physical planning for housing and housing the urban poor
- Apply the traditional practices of rural housing
- Understand the different innovative cost effective construction techniques
- Suggest the alternative building materials for low cost housing

UNIT I

- Housing Scenario** :Introducing - Status of urban housing - Status of Rural Housing
- Housing Finance**: Introducing - Existing finance system in India - Government role as facilitator - Status at Rural Housing Finance - Impediment in housing finance and related issues
- Land use and physical planning for housing** :Introduction - Planning of urban land - Urban land ceiling and regulation act - Efficiency of building bye lass - Residential Densities
- Housing the urban poor** :Introduction - Living conditions in slums - Approaches and strategies for housing urban poor

UNIT II

Development and adoption of low cost housing technology

Introduction - Adoption of innovative cost effective construction techniques - Adoption of precast elements in partial prefabrication - Adopting of total prefabrication of mass housing in India- General remarks on pre cast roofing/flooring systems -Economical wall system - Single Brick thick load bearing wall - 19cm thick load bearing masonry walls - Half brick thick load bearing wall – Fly-ash gypsum thick for masonry - Stone Block masonry - Adoption of precast R.C. plank and joint system for roof/floor in the building

UNIT III

Alternative building materials for low cost housing

Introduction - Substitute for scarce materials – Ferro-cement - Gypsum boards - Timber substitutions - Industrial wastes - Agricultural wastes - alternative building maintenance

Low cost Infrastructure services:

Introduce - Present status - Technological options - Low cost sanitation - Domestic wall - Water supply, energy

UNIT IV

Rural Housing: Introduction traditional practice of rural housing continuous - Mud Housing technology Mud roofs - Characteristics of mud - Fire treatment for thatch roof - Soil stabilization - Rural Housing programs



UNIT V

Housing in Disaster prone areas:

Introduction – Earthquake - Damages to houses - Traditional prone areas - Type of Damages and Railways of non-engineered buildings - Repair and restore action of earthquake Damaged non-engineered buildings recommendations for future constructions. Requirement's of structural safety of thin precast roofing units against Earthquake forces Status of R& D in earthquake strengthening measures - Floods, cyclone, future safety

Textbooks:

1. Building materials for low – income houses – International council for building research studies and documentation.
2. Hand book of low cost housing by A.K.Lal – Newage international publishers.
3. Low cost Housing – G.C. Mathur by South Asia Books

Reference Books:

1. Properties of concrete – Neville A.m. Pitman Publishing Limited, London.
2. Light weight concrete, Academic Kiado, Rudhai.G – Publishing home of Hungarian Academy of Sciences 1963.
3. Modern trends in housing in developing countries – A.G. Madhava Rao, D.S. Rama chandra Murthy &G.Annamalai. E. & F. N. Spon Publishers

Online Learning Resources:

<https://nptel.ac.in/courses/124107001>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A02704) IoT APPLICATIONS IN ELECTRICAL ENGINEERING
(Open Elective Course – III)

Course Objectives:

- Understand basics of Internet of Things and Micro Electro Mechanical Systems (MEMS) fundamentals in design and fabrication process
- Analyze motion less and motion detectors in IoT applications
- Understand about Analyze applications of IoT in smart grid
- Apply the concept of Internet of Energy for various applications

Course Outcomes:

- Understand the concept of IoT in Electrical Engineering
- Analyze various types of motionless sensors and various types of motion detectors
- Apply various applications of IoT in smart grid
- Design future working environment with Energy internet

UNIT I SENSORS

Definitions, Terminology, Classification, Temperature sensors, Thermoresistive, Resistance, temperature detectors, Silicon resistive thermistors, Semiconductor, Piezoelectric, Humidity and moisture sensors. Capacitive, Electrical conductivity, Thermal conductivity, time domain reflectometer, Pressure and Force sensors: Piezoresistive, Capacitive, force, strain and tactile sensors, Strain gauge, Piezoelectric

UNIT II OCCUPANCY AND MOTION DETECTORS

Capacitive occupancy, Inductive and magnetic, potentiometric - Position, displacement and level sensors, Potentiometric, Capacitive, Inductive, magnetic velocity and acceleration sensors, Capacitive, Piezoresistive, piezoelectric cables, Flow sensors, Electromagnetic, Acoustic sensors - Resistive microphones, Piezoelectric, Photo resistors

UNIT III MEMS

Basic concepts of MEMS design, Beam/diaphragm mechanics, electrostatic actuation and fabrication, Process design of MEMS based sensors and actuators, Touch sensor, Pressure sensor, RF MEMS switches, Electric and Magnetic field sensors

UNIT IV IoT FOR SMART GRID

Driving factors, Generation level, Transmission level, Distribution level, Applications, Metering and monitoring applications, Standardization and interoperability, Smart home

UNIT V INTERNET of ENERGY (IoE)

Concept of Internet of Energy, Evaluation of IoE concept, Vision and motivation of IoE, Architecture, Energy routines, information sensing and processing issues, Energy internet as smart grid

Textbooks:

1. Jon S. Wilson, Sensor Technology Hand book, Newnes Publisher, 2004
2. Tai Ran Hsu, MEMS and Microsystems: Design and manufacture, 1st Edition, Mc Grawhill Education, 2017
3. Ersan Kabalci and Yasin Kabalci, From Smart grid to Internet of Energy, 1st Edition, Academic Press, 2019

Reference Books:

1. Raj Kumar Buyya and Amir Vahid Dastjerdi, Internet of Things: Principles and Paradigms, Kindle Edition, Morgan Kaufmann Publisher, 2016
2. Yen Kheng Tan and Mark Wong, Energy Harvesting Systems for IoT Applications: Generation, Storage and Power Management, 1st Edition, CRC Press, 2019
3. RMD Sundaram Shriram, K. Vasudevan and Abhishek S. Nagarajan, Internet of Things, Wiley, 2019



Online Learning Resources:

1. https://onlinecourses.nptel.ac.in/noc22_cs96/preview
2. <https://nptel.ac.in/courses/108108123>
3. <https://nptel.ac.in/courses/108108179>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A03704) PRODUCT DESIGN AND DEVELOPMENT
(Open Elective-III)

Course Objectives:

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

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

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

UNIT I Product Development Process

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

UNIT II Task Clarification

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

UNIT III Conceptual Design

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

UNIT IV Embodiment Design

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

UNIT V Mechanical Connections, Mechatronics And Adaptronics:

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



Textbooks:

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

References:

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

Online Learning Resources:

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



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem

L T P C
3 0 0 3

(20A04704) ELECTRONIC SENSORS
(Open Elective Course –III)

Course Objectives:

- Learn the characterization of sensors.
- Known the working of Electromechanical, Thermal, Magnetic and radiation sensors
- Understand the concepts of Electro analytic and smart sensors
- Able to use sensors in different applications

Course Outcomes:

- Learn about sensor Principle, Classification and Characterization.
- Explore the working of Electromechanical, Thermal, Magnetic, radiation and Electro analytic sensors
- Understand the basic concepts of Smart Sensors
- Design a system with sensors

UNIT I

Sensors / Transducers: Principles, Classification, Parameters, Characteristics, Environmental Parameters (EP), Characterization

Electromechanical Sensors: Introduction, Resistive Potentiometer, Strain Gauge, Resistance Strain Gauge, Semiconductor Strain Gauges -Inductive Sensors: Sensitivity and Linearity of the Sensor – Types-Capacitive Sensors: Electrostatic Transducer, Force/Stress Sensors Using Quartz Resonators, Ultrasonic Sensors

UNIT II

Thermal Sensors: Introduction, Gas thermometric Sensors, Thermal Expansion Type Thermometric Sensors, Acoustic Temperature Sensor ,Dielectric Constant and Refractive Index thermo sensors, Helium Low Temperature Thermometer ,Nuclear Thermometer ,Magnetic Thermometer ,Resistance Change Type Thermometric Sensors, Thermo emf Sensors, Junction Semiconductor Types, Thermal Radiation Sensors, Quartz Crystal Thermoelectric Sensors, NQR Thermometry, Spectroscopic Thermometry, Noise Thermometry, Heat Flux Sensors

UNIT III

Magnetic sensors: Introduction, Sensors and the Principles Behind, Magneto-resistive Sensors, Anisotropic Magneto resistive Sensing, Semiconductor Magneto resistors, Hall Effect and Sensors, Inductance and Eddy Current Sensors, Angular/Rotary Movement Transducers, Synchros.

UNIT IV

Radiation Sensors: Introduction, Basic Characteristics, Types of Photo resistors/ Photo detectors, Xray and Nuclear Radiation Sensors, Fibre Optic Sensors

Electro analytical Sensors: The Electrochemical Cell, The Cell Potential - Standard Hydrogen Electrode (SHE), Liquid Junction and Other Potentials, Polarization, Concentration Polarization, Reference Electrodes, Sensor Electrodes, Electro ceramics in Gas Media.

UNIT V

Smart Sensors: Introduction, Primary Sensors, Excitation, Amplification, Filters, Converters, Compensation, Information Coding/Processing - Data Communication, Standards for Smart Sensor Interface, the Automation Sensors –Applications: Introduction, On-board Automobile Sensors (Automotive Sensors), Home Appliance Sensors, Aerospace Sensors, Sensors for Manufacturing – Sensors for environmental Monitoring

Textbooks:

1. “Sensors and Transducers - D. Patranabis” –PHI Learning Private Limited., 2003.
2. Introduction to sensors- John veteline, aravindraghu, CRC press, 2011

References:

1. Sensors and Actuators, D. Patranabis, 2nd Ed., PHI, 2013.
2. Make sensors: Terokarvinen, kemo, karvinen and villeyvaltokari, 1st edition, maker media,2014.
3. Sensors handbook- Sabriesoloman, 2nd Ed. TMH, 2009



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

L T P C
3 0 0 3

(20A05704a) WEB TECHNOLOGIES
(Open Elective-III)

Course Objectives:

The course is designed to Introduce the key technologies that have been developed as part of the birth and maturation of the World Wide Web.

Course Outcomes:

- Understand the Web essentials.
- Develop web pages using XHTML
- Apply style to web pages using CSS
- Write scripts for client side
- Develop and transform XML documents.

UNIT I Web Essentials: Clients, Servers, and Communication

The Internet, Basic Internet protocols, WWW, HTTP request message, HTTP response message, Web clients, Web Servers, Case study.

UNIT II Markup Languages: XHTML 1.0

An introduction to HTML, Basic XHTML syntax and semantics, fundamental HTML elements, Relative URLs, Lists, Tables, Frames, Forms, Defining XHTML's abstract syntax, Creating HTML documents.

UNIT III Cascading Style Sheets

Introduction, features, core syntax, style sheets and HTML, style rule cascading and inheritance, text properties, Box model, normal flow box layout, beyond the normal flow, lists, tables, cursor styles.

UNIT IV Client-side programming: JavaScript

Basic syntax, variables and data types, statements, operators, literals, functions, objects, Arrays, built-in objects, JavaScript debuggers.

UNIT V Representing Web Data: XML

Documents and vocabularies, Versions and declaration, Namespaces, Ajax, DOM and SAX parsers, transforming XML documents, XPath, XSLT, Displaying XML documents in Web browsers.

Textbooks:

1. J.C. Jackson, Web technologies: A computer science perspective, Pearson.

Reference Books:

1. Sebesta, Programming world wide web, Pearson.
2. Dietel and Nieto , Internet and World Wide Web – How to program, Pearson Education
3. Chris Bates , Web Programming, building internet applications, 2nd edition, WILEY, Dreamtech

Online Learning Resources:

<http://getbootstrap.com/>

<https://www.w3schools.com/whatis/>

<https://nptel.ac.in/courses/106105084>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

L T P C
3 0 0 3

(20A05704b) VR & AR FOR ENGINEERS
(Open Elective Course – III)

Course Objectives:

- Introduce to the design of visualization tools
- Demonstrate Virtual reality
- Learn Virtual reality animation and 3D Art optimization
- Understand the foundational principles describing how hardware, computer vision algorithms function
- Explore the history of spatial computing and design interactions

Course Outcomes:

- Apply VR/MR/AR in various fields in industry
- Design Data visualization tools
- Design audio and video interaction paradigms
- Apply technical and creative approaches to make successful applications and experiences.
- Explain how the humans interact with computers

UNIT I

Computer generated worlds: what is augmented reality? what is virtual reality?

Understanding virtual space: defining visual space and content, defining position and orientation in three dimensions, navigation

The Mechanics of Sight: the visual path way, spatial vision, and Depth Cues.

Component Technologies of Head mounted Displays: Display fundamentals, related terminology and concepts, optical Architectures.

UNIT II

Augmented Displays: Binocular augmenting displays, Monocular augmenting displays.

Fully immersive Displays: PC-Console driven displays, smartphone based displays, CAVES and Walls, Hemispheres and Domes.

The Mechanics of hearing: Defining sound, the auditory pathway, sound cues and localization, the vestibular system.

Audio displays: Conventional audio

UNIT III

The Mechanics of Feeling: The Science of feeling, Anatomy and Composition of the skin.

Tactile and force feedback Devices: Haptic illusions, tactile feedback devices, Force feedback devices.

Sensors for tracking Position, and orientation and motion: introduction to sensor technologies, optical trackers, beacon trackers, electromagnetic trackers, inertial sensors, acoustic sensors.

Devices to enable navigation and interaction: 2D vs 3D interaction and navigation, the importance of a manual interface, hand and gesture tracking, whole body tracking, gaming and entertainment interfaces, navigating with your mind.

UNIT IV

Gaming and Entertainment: Virtual reality and the arts, gaming, immersive video/ cinematic virtual reality.

Architecture and Construction: Artificial spaces, architectural design: Manage group architectures, Construction management, real estate sales applications, architectural acoustics.



Science and engineering: Simulate and innovate, naval architecture and marine engineering, automotive engineering, aerospace engineering, nuclear engineering and manufacturing.

Health and medicine: advancing the field of medicine, training applications, treatment applications.

UNIT V

Aerospace and Defence: Flight simulation and training, mission planning and rehearsal, dismounted soldier situational awareness, advanced cockpit avionics, space operations.

Education: Tangible skills education, theory, knowledge acquisition and concept formation.

Information control and big data visualization: What is big data?, big data analytics and human vision.

Telerobotics and Telepresence: Defining Telerobotics and Telepresence, space applications and robonaut, undersea applications, Terrestrial and airborne applications.

Textbooks:

1. Steve Aukstakalnis, "Practical Augmented Reality", Pearson Education, 2017.

Reference Books:

1. Erin Pangilinan, Steve lukas, and Vasanth Mohan, "Creating Augmented& Virtual Realities", O'REILLY

Online Learning Resources:

1. <https://www.coursera.org/learn/intro-augmented-virtual-mixed-extended-reality-technologies-applications-issues>
2. <https://www.coursera.org/learn/ar>

**JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR****B.Tech IV-I Sem****L T P C**
3 0 0 3**(20A05704c) SOFTWARE ENGINEERING**
(Open Elective Course – III)**Course Objectives:**

- To learn the basic concepts of software engineering and life cycle models
- To explore the issues in software requirements specification and enable to write SRS documents for software development problems
- To elucidate the basic concepts of software design and enable to carry out procedural and object oriented design of software development problems
- To understand the basic concepts of black box and white box software testing and enable to design test cases for unit, integration, and system testing
- To reveal the basic concepts in software project management

Course Outcomes (CO):

After completion of the course, students will be able to

- Obtain basic software life cycle activity skills.
- Design software requirements specifications for given problems.
- Implement structure, object oriented analysis and design for given problems.
- Design test cases for given problems.
- Apply quality management concepts at the application level.

UNIT – I Basic concepts in software engineering and software project management Lecture 8Hrs

Basic concepts: abstraction versus decomposition, evolution of software engineering techniques, Software development life cycle (SDLC) models: Iterative waterfall model, Prototype model, Evolutionary model, Spiral model, RAD model, Agile models, software project management: project planning, project estimation, COCOMO, Halstead's Software Science, project scheduling, staffing, Organization and team structure, risk management, configuration management.

UNIT – II Requirements analysis and specification Lecture 8Hrs

The nature of software, The Unique nature of Webapps, Software Myths, Requirements gathering and analysis, software requirements specification, Traceability, Characteristics of a Good SRS Document, IEEE 830 guidelines, representing complex requirements using decision tables and decision trees, overview of formal system development techniques, axiomatic specification, algebraic specification.

UNIT - III Software Design Lecture 9Hrs

Good Software Design, Cohesion and coupling, Control Hierarchy: Layering, Control Abstraction, Depth and width, Fan-out, Fan-in, Software design approaches, object oriented vs. function oriented design. Overview of SA/SD methodology, structured analysis, Data flow diagram, Extending DFD technique to real life systems, Basic Object oriented concepts, UML Diagrams, Structured design, Detailed design, Design review, Characteristics of a good user interface, User Guidance and Online Help, Mode-based vs Mode-less Interface, Types of user interfaces, Component-based GUI development, User interface design methodology: GUI design methodology.

UNIT – IV Coding and Testing Lecture 9Hrs

Coding standards and guidelines, code review, software documentation, Testing, Black Box Testing, White Box Testing, debugging, integration testing, Program Analysis Tools, system testing, performance testing, regression testing, Testing Object Oriented Programs.

UNIT – V Software quality, reliability, and other issues Lecture 9Hrs

Software reliability, Statistical testing, Software quality and management, ISO 9000, SEI capability maturity model (CMM), Personal software process (PSP), Six sigma, Software quality metrics, CASE and its scope, CASE environment, CASE support in software life cycle, Characteristics of software maintenance, Software reverse engineering, Software maintenance processes model, Estimation maintenance cost. Basic issues in any reuse program, Reuse approach, Reuse at organization level.

Textbooks:



1. Rajib Mall, “Fundamentals of Software Engineering”, 5th Edition, PHI, 2018.
2. Pressman R, “Software Engineering- Practioner Approach”, McGraw Hill.

Reference Books:

1. Somerville, “Software Engineering”, Pearson 2.
2. Richard Fairley, “Software Engineering Concepts”, Tata McGraw Hill.
3. JalotePankaj, “An integrated approach to Software Engineering”, Narosa

Online Learning Resources:

<https://nptel.ac.in/courses/106/105/106105182/>

<http://peterindia.net/SoftwareDevelopment.html>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A54702) NUMERICAL METHODS FOR ENGINEERS
(OPEN ELECTIVE-III)

Course Objectives:

This course aims at providing the student with the knowledge on various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.

Course Outcomes:

- Apply numerical methods to solve algebraic and transcendental equations.
- Understand fitting of several kinds of curves.
- Derive interpolating polynomials using interpolation formulae.
- Solve differential and integral equations numerically.

UNIT I Solution of Algebraic & Transcendental Equations

Introduction-Bisection Method-Iterative method-Regula falsi method-Newton Raphson method.
System of Algebraic equations: Gauss Jordan method-Gauss Siedal method.

UNIT II Curve Fitting

Principle of Least squares- Fitting of curves- Fitting of linear, quadratic and exponential curves.

UNIT III Interpolation

Finite differences-Newton's forward and backward interpolation formulae – Lagrange's formulae
Gauss forward and backward formula, Stirling's formula, Bessel's formula

UNIT IV Numerical Integration

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule

UNIT V Solution of Initial value problems to Ordinary differential equations

Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

Textbooks:

1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers.
2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole, PNIE.
3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India

Reference Books:

1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers.
2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.

Online Learning Resources:

<https://slideplayer.com/slide/8588078/>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A56702) SENSORS AND ACTUATORS FOR ENGINEERING APPLICATIONS
(OPEN ELECTIVE-III)

Course Objectives:

- To provide exposure to various kinds of sensors and actuators and their engineering applications.
- To impart knowledge on the basic laws and phenomenon behind the working of sensors and actuators
- To enlighten the operating principles of various sensors and actuators
- To educate the fabrication of sensors
- To identify the required sensor and actuator for interdisciplinary application

Course Outcomes:

- To recognize the need of sensors and actuators
- To understand working principles of various sensors and actuators
- To identify different type of sensors and actuators used in real life applications
- To exploit basics in common methods for converting a physical parameter into an electrical quantity
- To make use of sensors and actuators for different applications

UNIT I Introduction to Sensors and Actuators

Sensors: Types of sensors: temperature, pressure, strain, active and passive sensors, General characteristics of sensors (Principles only), Materials used and their fabrication process: Deposition: Chemical Vapor Deposition, Pattern: photolithography and Etching: Dry and Wet Etching.

Actuators: Functional diagram of actuators, Types of actuators and their basic principle of working: Hydraulic, Pneumatic, Mechanical, Electrical, Magnetic, Electromagnetic, piezo-electric and piezo-resistive actuators, Simple applications of Actuators.

UNIT II Temperature and Mechanical Sensors

Temperature Sensors: Types of temperature sensors and their basic principle of working: Thermo-resistive sensors: Thermistors, Resistance temperature sensors, Silicon resistive sensors, Thermo-electric sensors: Thermocouples, PN junction temperature sensors

Mechanical Sensors: Types of Mechanical sensors and their basic principle of working: Force sensors: strain gauges, tactile sensors, Pressure sensors: semiconductor, piezoresistive, capacitive, VRP.

UNIT III Optical and Acoustic Sensors

Optical Sensors: Basic principle and working of: Photodiodes, Phototransistors and Photo-resistors based sensors, Photomultipliers, Infrared sensors: thermal, PIR, thermopiles

Acoustic Sensors: Principle and working of Ultrasonic sensors, Piezo-electric resonators, Microphones.

UNIT IV Magnetic, Electromagnetic Sensors and Actuators

Motors as actuators (linear, rotational, stepping motors), magnetic valves, inductive sensors (LVDT, RVDT, and Proximity), Hall Effect sensors, Magneto-resistive sensors, Magneto-strictive sensors and actuators, Voice coil actuators (speakers and speaker-like actuators).

UNIT V Chemical and Radiation Sensors

Chemical Sensors: Principle and working of Electro-chemical, Thermo-chemical, Gas, pH, Humidity and moisture sensors.

Radiation Sensors: Principle and working of Ionization detectors, Scintillation detectors, Geiger-Mueller counters, Semiconductor radiation detectors and Microwave sensors (resonant, reflection, transmission)



Textbooks:

1. Sensors and Actuators – Clarence W. de Silva, CRC Press, 2nd Edition, 2015
2. Sensors and Actuators, D.A.Hall and C.E.Millar, CRC Press, 1999

Reference Books:

1. Sensors and Transducers- D.Patranabhis, Prentice Hall of India (Pvt) Ltd. 2003
2. Measurement, Instrumentation, and Sensors Handbook-John G.Webster, CRC press 1999
3. Sensors – A Comprehensive Sensors- Henry Bolte, John Wiley.
4. Handbook of modern sensors, Springer, Stefan Johann Rupitsch.
5. Principles of Industrial Instrumentation By D. Patranabhis

NPTEL courses links

https://onlinecourses.nptel.ac.in/noc21_ee32/preview



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A51702) CHEMISTRY OF NANOMATERIALS AND APPLICATIONS
(OPEN ELECTIVE-III)

Course Objectives:

- To understand synthetic principles of Nanomaterials by various methods
- To characterize the synthetic nanomaterials by various instrumental methods
- To enumerate the applications of nanomaterials in engineering

Course Outcomes:

- Understand the state of art synthesis of nano materials
- Characterize nano materials using ion beam, scanning probe methodologies, position sensitive atom probe and spectroscopic ellipsometry.
- Analyze nanoscale structure in metals, polymers and ceramics
- Analyze structure-property relationship in coarser scale structures
- Understand structures of carbon nano tubes

UNIT I

Introduction: Scope of nanoscience and nanotechnology, nanoscience in nature, classification of nanostructured materials, importance of nano materials.

Synthetic Methods: Bottom-Up approach: Sol-gel synthesis, microemulsions or reverse micelles, co-precipitation method, solvothermal synthesis, hydrothermal synthesis, microwave heating synthesis and sonochemical synthesis.

UNIT II

Top-Down approach: Inert gas condensation, arc discharge method, aerosol synthesis, plasma arc technique, ion sputtering, laser ablation, laser pyrolysis, and chemical vapour deposition method, electrodeposition method, high energy ball milling.

UNIT III

Techniques for characterization: Diffraction technique, spectroscopy techniques, electron microscopy techniques for the characterization of nanomaterials, BET method for surface area analysis, dynamic light scattering for particle size determination.

UNIT IV

Studies of Nano-structured Materials: Synthesis, properties and applications of the following nanomaterials, fullerenes, carbon nanotubes, core-shell nanoparticles, nanoshells, self-assembled monolayers, and monolayer protected metal nanoparticles, nanocrystalline materials, magnetic nanoparticles and important properties in relation to nanomagnetic materials, thermoelectric materials, non-linear optical materials, liquid crystals.

UNIT V

Engineering Applications of Nanomaterials

Textbooks:

1. NANO: The Essentials: T Pradeep, McGraw-Hill, 2007.
2. Textbook of Nanoscience and nanotechnology: B S Murty, P Shankar, BaldevRai, BB Rath and James Murday, Univ. Press, 2012.

References:

1. Concepts of Nanochemistry; Ludovico Cademrtiri and Geoffrey A. Ozin & Geoffrey A. Ozin, Wiley-VCH, 2011.
2. Nanostructures & Nanomaterials; Synthesis, Properties & Applications: Guozhong Cao, Imperial College Press, 2007.
3. Nanomaterials Chemistry, C. N. R. Rao, Achim Muller, K.Cheetham, Wiley-VCH, 2007.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3

(20A01705) HEALTH, SAFETY AND ENVIRONMENTAL MANAGEMENT PRACTICES
(Open Elective Course-IV)

Course Objectives:

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard control, environmental issues and management
- To get exposed to accidents modeling, accident investigation and reporting, concepts of HAZOP and PHA
- To be familiar with safety measures in design and process operations.
- To get exposed to risk assessment and management, principles and methods

Course Outcomes:

- To understand safety, health and environmental management.
- To be familiar with hazard classification and assessment, hazard evaluation and hazard control, environmental issues and management
- To get exposed to accidents modelling, accident investigation and reporting control, environmental issues and management
- To get concepts of HAZOP and PHA.
- To be familiar with safety measures in design and process operations.

UNIT I

Introduction to safety, health and environmental management - Basic terms and their definitions - Importance of safety - Safety assurance and assessment - Safety in design and operation - Organizing for safety.

UNIT II

Hazard classification and assessment - Hazard evaluation and hazard control. Environmental issues and Management - Atmospheric pollution - Flaring and fugitive release - Water pollution - Environmental monitoring - Environmental management.

UNIT III

Accidents modelling - Release modelling - Fire and explosion modelling - Toxic release and dispersion Modelling

UNIT IV

Accident investigation and reporting - concepts of HAZOP and PHA. Safety measures in design and process operations - Inserting, explosion, fire prevention, sprinkler systems.

UNIT V

Risk assessment and management - Risk picture - Definition and characteristics - Risk acceptance criteria - Quantified risk assessment - Hazard assessment - Fatality risk assessment - Risk management principles and methods.

Textbooks:

1. Process Safety Analysis, by Skelton. B, Gulf Publishing Company, Houston, 210pp., 1997.
2. Risk Management with Applications from Offshore Petroleum Industry, by TerjeAven and Jan Erik Vinnem, Springer, 200pp., 2007.

Reference Books:

1. Introduction to Safety and Reliability of Structures, by Jorg Schneider
2. Structural Engineering Documents Vol. 5, International Association for Bridge and Structural Engineering (IABSE), 138pp., 1997.
3. Safety and Health for Engineers, by Roger L. Brauer, John Wiley and Sons Inc. pp. 645-663, 2006.
4. Health, Safety and Environmental Management in Offshore and Petroleum Engineering, Srinivasan Chandrasekaran, John Wiley and Sons, 2016.

Online Learning Resources:<https://nptel.ac.in/courses/114106017>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3

(20A02705) RENEWABLE ENERGY SYSTEMS
(Open Elective Course – IV)

Course Objectives:

- Understand various sources of Energy and the need of Renewable Energy Systems.
- Understand the concepts of Solar Radiation, Wind energy and its applications.
- Analyze solar thermal and solar PV systems
- Understand the concept of geothermal energy and its applications, biomass energy, the concept of Ocean energy and fuel cells.

Course Outcomes:

- Understand various alternate sources of energy for different suitable application requirements
- Understand the concepts of solar energy generation strategies and wind energy system
- Analyze Solar and Wind energy systems
- Understand the basics of Geothermal Energy Systems, various diversified energy scenarios of ocean, biomass and fuel cells

UNIT I SOLAR ENERGY

Solar radiation - beam and diffuse radiation, solar constant, earth sun angles, attenuation and measurement of solar radiation, local solar time, derived solar angles, sunrise, sunset and day length. flat plate collectors, concentrating collectors, storage of solar energy-thermal storage.

UNIT II PV ENERGY SYSTEMS

Introduction, The PV effect in crystalline silicon basic principles, the film PV, Other PV technologies, Electrical characteristics of silicon PV cells and modules, PV systems for remote power, Grid connected PV systems.

UNIT III WIND ENERGY

Principle of wind energy conversion; Basic components of wind energy conversion systems; windmill components, various types and their constructional features; design considerations of horizontal and vertical axis wind machines: analysis of aerodynamic forces acting on wind mill blades and estimation of power output; wind data and site selection considerations.

UNIT IV GEOTHERMAL ENERGY

Estimation and nature of geothermal energy, geothermal sources and resources like hydrothermal, geo-pressured hot dry rock, magma. Advantages, disadvantages and application of geothermal energy, prospects of geothermal energy in India.

UNIT V MISCELLANEOUS ENERGY TECHNOLOGIES

Ocean Energy: Tidal Energy-Principle of working, performance and limitations. Wave Energy-Principle of working, performance and limitations.

Bio mass Energy: Biomass conversion technologies, Biogas generation plants, Classification, advantages and disadvantages, constructional details, site selection, digester design consideration

Fuel cell: Principle of working of various types of fuel cells and their working, performance and limitations.

Textbooks:

1. Stephen Peake, “Renewable Energy Power for a Sustainable Future”, Oxford International Edition, 2018.
2. G. D. Rai, “Non-Conventional Energy Sources”, 4th Edition, Khanna Publishers, 2000.



Reference Books:

1. S. P. Sukhatme, “Solar Energy”, 3rd Edition, Tata Mc Graw Hill Education Pvt. Ltd, 2008.
2. B H Khan , “ Non-Conventional Energy Resources”, 2nd Edition, Tata Mc Graw Hill Education Pvt Ltd, 2011.
3. S. Hasan Saeed and D.K.Sharma, “Non-Conventional Energy Resources”, 3rd Edition, S.K.Kataria& Sons, 2012.
4. G. N. Tiwari and M.K.Ghosal, “Renewable Energy Resource: Basic Principles and Applications”, Narosa Publishing House, 2004.

Online Learning Resources:

1. <https://nptel.ac.in/courses/103103206>
2. <https://nptel.ac.in/courses/108108078>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3

(20A03705) INTRODUCTION TO COMPOSITE MATERIALS
(Open Elective-IV)

Course Objectives:

- Introduce composite materials and their applications.
- Build proper background for stress analysis in the design of composite structures.
- Familiarize various properties of composite materials.
- Focus on biodegradable composites.

Course Outcomes:

- Identify the practical applications of composites. (L3)
- Identify the polymer matrix composites. (L3)
- Classify of bio- degradable composites. (L2)
- Outline the various types of ceramic matrix materials. (L2)

UNIT I Introduction to composites

Fundamentals of composites – Definition – classification– based on Matrix – based on structure – Advantages and applications of composites - Reinforcement – whiskers – glass fiber – carbon fiber - Aramid fiber – ceramic fiber – Properties and applications.

UNIT II Polymer matrix composites

Polymers - Polymer matrix materials – PMC processes - hand layup processes – spray up processes – resin transfer moulding – Pultrusion – Filament winding – Autoclave based methods - Injection moulding – sheet moulding compound – properties and applications of PMCs.

UNIT III Metal matrix composites

Metals - types of metal matrix composites – Metallic Matrices. Processing of MMC – Liquid state processes – solid state processes – In-situ processes. Properties and applications of MMCs.

UNIT IV Ceramic matrix composites

Ceramic matrix materials – properties – processing of CMCs –Sintering - Hot pressing – Infiltration – Lanxide process – Insitu chemical reaction techniques – solgel polymer pyrolysis –SHS - Cold isostatic pressing (CIPing) – Hot isostatic pressing (HIPing). Properties and Applications of CCMs.

UNIT V Advances & Applications of composites

Advantages of carbon matrix – limitations of carbon matrix carbon fibre – chemical vapour deposition of carbon on carbonfibre perform. Properties and applications of Carbon-carbon composites. Composites for aerospace applications. Bio degradability, introduction of bio composites, classification, processing of bio composites, applications of bio composites - Mechanical, Biomedical, automobile Engineering.

Textbooks:

1. Chawla K.K, Composite materials, 2/e, Springer – Verlag, 1998.
2. Mathews F.L. and Rawlings R.D., Chapman and Hall, Composite Materials: Engineering and Science, 1/e, England, 1994.

Reference Books:

1. H K Shivanand, B V Babu Kiran, Composite Materials, ASIAN BOOKS, 2011.
2. A.B. Strong , Fundamentals of Composite Manufacturing, SME Publications, 1989.
3. S.C. Sharma, Composite materials, Narosa Publications, 2000.
4. Maureen Mitton, Hand Book of Bio plastics & Bio composites for Engineering applications, John Wiley publications, 2011.

Online Learning Resources:

- <https://nptel.ac.in/courses/112104229>
- <https://nptel.ac.in/courses/112104168>
- <https://nptel.ac.in/courses/101104010>
- <https://nptel.ac.in/courses/105108124>
- <https://nptel.ac.in/courses/112104221>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3

(20A04705) MICROCONTROLLERS & APPLICATIONS
(Open Elective Course –IV)

Course Objectives:

- Describe the Architecture of 8051 Microcontroller and Interfacing of 8051 to external memory.
- Write 8051 Assembly level programs using 8051 instruction set.
- Describe the Interrupt system, operation of Timers/Counters and Serial port of 8051.
- Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to 8051.

Course Outcomes:

- Understand the importance of Microcontroller and Acquire the knowledge of Architecture of 8051 Microcontroller.
- Apply and Interface simple switches, simple LEDs, ADC 0804, LCD and Stepper Motor to using 8051 I/O ports.
- Develop the 8051 Assembly level programs using 8051 Instruction set
- Design the Interrupt system, operation of Timers/Counters and Serial port of 8051

UNIT 1 8051 Microcontroller:

Microprocessor Vs Microcontroller, Embedded Systems, Embedded Microcontrollers, 8051 Architecture- Registers, Pin diagram, I/O ports functions, Internal Memory organization. External Memory (ROM & RAM) interfacing.

UNIT II

Addressing Modes, Data Transfer instructions, Arithmetic instructions, Logical instructions, Branch instructions, Bit manipulation instructions. Simple Assembly language program examples to use these instructions.

UNIT III

8051 Stack, Stack and Subroutine instructions. Simple Assembly language program examples to use subroutine instructions. 8051 Timers and Counters – Operation and Assembly language programming to generate a pulse using Mode-1 and a square wave using Mode- 2 on a port pin.

UNIT IV

8051 Serial Communication- Basics of Serial Data Communication, RS- 232 standard, 9 pin RS232 signals, Simple Serial Port programming in Assembly and C to transmit a message and to receive data serially. 8051 Interrupts. 8051 Assembly language programming to generate an external interrupt using a switch.

UNIT V

8051 C programming to generate a square waveform on a port pin using a Timer interrupt. Interfacing 8051 to ADC-0804, DAC, LCD and Interfacing with relays and opto isolators, Stepper Motor Interfacing, DC motor interfacing, PWM generation using 8051.

Textbooks:

1. Muhammad Ali Mazidi and Janice Gillespie Mazidi and Rollin D. McKinlay; “The 8051 Microcontroller and Embedded Systems – using assembly and C”, PHI, 2006 / Pearson, 2006.
2. Kenneth J. Ayala, “The 8051 Microcontroller”, 3rd Edition, Thomson/Cengage Learning.

References:

1. Manish K Patel, “The 8051 Microcontroller Based Embedded Systems”, McGraw Hill, 2014, ISBN: 978-93-329-0125-4.
2. Raj Kamal, “Microcontrollers: Architecture, Programming, Interfacing and System Design”, Pearson Education, 2005.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

L T P C
3 0 0 3

(20A05705a) CYBER SECURITY
(Open Elective-IV)

Course Objectives:

The course is designed to provide awareness on different cyber crimes, cyber offenses, tools and methods used in cybercrime.

Course Outcomes:

- Classify the cybercrimes and understand the Indian ITA 2000
- Analyse the vulnerabilities in any computing system and find the solutions
- Predict the security threats of the future
- Investigate the protection mechanisms
- Design security solutions for organizations

UNIT I Introduction to Cybercrime

Introduction, Cybercrime, and Information Security, Who are Cybercriminals, Classifications of Cybercrimes, And Cybercrime: The legal Perspectives and Indian Perspective, Cybercrime and the Indian ITA 2000, A Global Perspective on Cybercrimes.

UNIT II Cyber Offenses: How Criminals Plan Them

Introduction, How Criminals plan the Attacks, Social Engineering, Cyber stalking, Cyber Cafe and Cybercrimes, Botnets: The Fuel for Cybercrime, Attack Vector, Cloud Computing

UNIT III Cybercrime: Mobile and Wireless Devices

Introduction, Proliferation of Mobile and Wireless Devices, Trends in Mobility, Credit card Frauds in Mobile and Wireless Computing Era, Security Challenges Posed by Mobile Devices, Registry Settings for Mobile Devices, Authentication service Security, Attacks on Mobile/Cell Phones, Mobile Devices: Security Implications for Organizations, Organizational Measures for Handling Mobile, Organizational Security Policies and Measures in Mobile Computing Era, Laptops.

UNIT IV Tools and Methods Used in Cybercrime

Introduction, Proxy Servers and Anonymizers, Phishing, Password Cracking, Keyloggers and Spywares, Virus and Worms, Trojan Horse and Backdoors, Steganography, DoS and DDoS attacks, SQL Injection, Buffer Overflow.

UNIT V Cyber Security: Organizational Implications

Introduction, Cost of Cybercrimes and IPR issues, Web threats for Organizations, Security and Privacy Implications, Social media marketing: Security Risks and Perils for Organizations, Social Computing and the associated challenges for Organizations.

Textbooks:

1. Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives, Nina Godbole and Sunil Belapure, Wiley INDIA.

Reference Books:

1. Cyber Security Essentials, James Graham, Richard Howard and Ryan Otson, CRC Press.
2. Introduction to Cyber Security, Chwan-Hwa(john) Wu, J. David Irwin. CRC Press T&F Group

Online Learning Resources:

- <http://nptel.ac.in/courses/106105031/40>
- <http://nptel.ac.in/courses/106105031/39>
- <http://nptel.ac.in/courses/106105031/38>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A05705b)INTRODUCTION TO FULL STACK DEVELOPMENT
(Open Elective Course – IV)

Course Objectives:

- To build foundation on HTML this will help developer to use HTML concepts for building responsive web application.
- To Develop HTML based Single application for Browsers.
- To Understand OOPs concepts and its applications by building competency in object –oriented Programming.
- To implement frontend and backend scenarios using Web Sockets.
- To become proficient in Bootstrap concepts.

Course Outcomes:

- Able to how to program a browser like using JavaScript, jQuery, Angular, or Vue.
- Distinguishing trends in multi-device implementation.
- Create webpages that function using external data.
- Disambiguate the different structures that a no SQL database may represent.
- Derive information from data and implement data into applications.

UNIT I

e The Modern Web: Rise of the Web, Mobile Web, The State of HTML, Applications vs Web Sites, Keeping Up.

Planning Your Work: Identifying Requirements, Defining the Work, Tracking the Work Continuous Improvement, Prioritization & Estimation, Managing Bugs, Continuous Delivery

User Experience: Information Architecture, Getting the User Experience Right, Polishing the User Experience, Implementing the User Experience.

UNIT II

Designing Systems: System Architectures, Identifying Concepts, Identifying User Interactions, Handling Commonalities, Working with Legacy and External Dependencies, Component Interactions, Applications vs. Modules, Cross-Functional Requirements, Caching, Designing for Failure, Designing Modules, Refactoring, Tools, Changing Your Architecture.

Ethics: Privacy, Cognitive Load, Energy Usage, Trust.

Front End: HTML, From Server to Browser, Styling, Components, Responsive Design, Progressive Enhancement to Progressively Enhance, or Not? Mobile First, Feature Detection, Progressive Enhancement of Style, When Not Using Progressive Enhancement, Search Engine Optimization, Build Tools.

UNIT III

Testing: Test-Driven Development, Test Pyramid, Behaviour-Driven Development, Three Amigos, Manual Testing, Visual Testing, Cross-Functional Testing,

JavaScript: Asynchronicity, JavaScript in the Browser, Offline-First Development, Document Object Model, Server-Side JavaScript, Table of Contents viii JavaScript Modules, Structuring Your JavaScript, JavaScript Types, Object-Oriented Programming, Functional Programming, Communicating Between Components, Connecting Components Together, Testing, Build Tools.

Accessibility: Accessible from the Start, Working with Assistive Technologies, Dealing with Interactive UI, Testing for Accessibility, Avoiding Common Mistakes.

UNIT IV

APIs: API Responsibilities, designing a REST API, Securing Your API, Event-Based APIs, Discovering APIs, Using APIs

Storing Data: Types of Databases, To SQL, or NoSQL?, Where to Store Your Data, Accessing Data from Your App, Managing Your Data, Protecting Your Data.



Security: Trust, Responding to Incidents, The Golden Rule, Threats, Security Checklists, Passwords, Indirect Attacks.

UNIT V

Deployment: Twelve Factor Apps, Developer Machines, Production Environments, Moving Code into Production, Configuring Your Box, Infrastructure, Immutable Infrastructure, Continuous Delivery & Continuous Deployment.

In Production: Fire Drills, Run Books, Monitoring, Responding to Incidents

Constant Learning: Collecting, Experiments, Analysing Results, Hypothesis-Driven.

Textbook:

1. Chris Northwood, The full Stack Developer, Apress, 2018.

Reference Books:

1. Modern Full-Stack Development: Using TypeScript, React, Node.js, Webpack, and Docker, Frank Zammetti.
2. Full Stack Web Development for Beginners, Riaz Ahmed.

Online Learning Resources:

1. Learn Full Stack Web Development with 40+ Projects and Exercises | Udemy



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech IV-I Sem

L T P C
3 0 0 3

(20A05705c) INDUSTRIAL IOT
(Open Elective-IV)

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-iiot>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A54703) NUMBER THEORY AND ITS APPLICATIONS
(OPEN ELECTIVE-IV)

Course Objectives:

This course enables the students to learn the concepts of number theory and its applications to information security.

Course Outcomes:

- Understand number theory and its properties.
- Understand principles on congruences
- Develop the knowledge to apply various applications
- Develop various encryption methods and its applications.

UNIT I Integers, Greatest common divisors and prime Factorization

The well-ordering property-Divisibility-Representation of integers-Computer operations with integers-Prime numbers-Greatest common divisors-The Euclidean algorithm -The fundamental theorem of arithmetic-Factorization of integers and the Fermat numbers-Linear Diophantine equations

UNIT II Congruences

Introduction to congruences -Linear congruences-The Chinese remainder theorem-Systems of linear congruences

UNIT III Applications of Congruences

Divisibility tests-The perpetual calendar-Round-robin tournaments-Computer file storage and hashing functions. Wilson's theorem and Fermat's little theorem- Pseudo primes- Euler's theorem- Euler's ϕ -function- The sum and number of divisors- Perfect numbers and Mersenne primes.

UNIT IV Finite fields & Primality, factoring

Finite fields- quadratic residues and reciprocity-Pseudo primes-rho method-fermat factorization and factor bases.

UNIT V Cryptology

Basic terminology-complexity theorem-Character ciphers-Block ciphers-Exponentiation ciphers-Public-key cryptography-Discrete logarithm-Knapsack ciphers- RSA algorithm-Some applications to computer science.

Textbooks:

1. Elementary number theory and its applications, Kenneth H Rosen, AT & T Information systems & Bell laboratories.
2. A course in Number theory & Cryptography, Neal Koblitz, Springer.

Reference Books:

1. An Introduction To The Theory Of Numbers, Herbert S. Zuckerman, Hugh L. Montgomery, Ivan Niven, wiley publishers
2. Introduction to Analytic number theory-Tom M Apostol, springer
3. Elementary number theory, VK Krishnan, Universities press

Online Learning Resources:

<https://www.slideshare.net/ItishreeDash3/a-study-on-number-theory-and-its-applications>



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A56703) SMART MATERIALS AND DEVICES
(OPEN ELECTIVE-IV)

Course Objectives:

- To provide exposure to smart materials and their engineering applications.
- To impart knowledge on the basics and phenomenon behind the working of smart materials
- To enlighten the properties exhibited by smart materials
- To educate various techniques used to synthesize and characterize smart materials
- To identify the required smart material for distinct applications/devices

Course Outcomes:

- to recognize the need of smart materials
- to understand the working principles of smart materials
- to know different techniques used to synthesize and characterize smart materials
- to exploit the properties of smart materials
- to make use of smart materials for different applications

UNIT I

Introduction: Historical account of the discovery and development of smart materials, Two phases: Austenite and Martensite, Temperature induced phase changes, Shape memory effect, Pseudoelasticity, One-way shape memory effect, Two-way shape memory effect.

UNIT II: Properties of Smart Materials: Physical principles of optical, Electrical, Dielectric, Piezoelectric, Ferroelectric, Pyroelectric and Magnetic properties of smart materials

UNIT III: Synthesis of smart materials: Solid state reaction technique, Chemical route: Chemical vapour deposition, Sol-gel technique, Hydrothermal method, Co-precipitation. Green synthesis, Mechanical alloying and Thin film deposition techniques: Chemical etching, Sol-gel, spray pyrolysis.

UNIT IV: Characterization techniques: X-ray diffraction, Raman spectroscopy (RS), Fourier-transform infrared reflection (FTIR), UV-Visible spectroscopy, Scanning electron microscopy (SEM), Transmission electron microscopy, Atomic force microscopy (AFM) and Differential Scanning Calorimetry (DSC).

UNIT V: Materials and Devices: Characteristics of shape memory alloys, Magnetostrictive, Optoelectronic, Piezoelectric, Metamaterials, Electro-rheological and Magneto-rheological materials and Composite materials.

Devices based on smart materials: Sensors & Actuators, MEMS and intelligent devices, Future scope of the smart materials.

Textbooks:

1. Encyclopaedia of Smart Materials- Mel Schwartz, John Wiley & Sons, Inc.2002
2. Smart Materials and Structures - M. V. Gandhi and B.S. Thompson, Chapman and Hall, 1992

References:

1. Smart Materials and Technologies- M. Addington and D. L. Schodek, Elsevier, 2005.
2. Characterization and Application of smart Materials -R. Rai, Synthesis, Nova Science, 2011.
3. Electroceramics: Materials, Properties, Applications -A.J. Moulson and J.M. Herbert, 2ndEdn., John Wiley & Sons, 2003.
4. Piezoelectric Sensorics: Force, Strain, Pressure, Acceleration and Acoustic 1. Emission Sensors, Materials and Amplifiers, G. Gautschi, Springer, 2002.
5. Optical Metamaterials: Fundamentals and Applications -W. Cai and V. Shalaev, Springer, 2010.
6. Smart Materials and Structures - P. L Reece, New Research, Nova Science, 2007

NPTEL courses links

<https://nptel.ac.in/courses/112/104/112104173/>

<https://nptel.ac.in/courses/112/104/112104251/>

https://nptel.ac.in/content/storage2/courses/112104173/Mod_1_smart_mat_lec



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech IV-I Sem **L T P C**
3 0 0 3
(20A51703) GREEN CHEMISTRY AND CATALYSIS FOR SUSTAINABLE ENVIRONMENT (OPEN ELECTIVE-IV)

Course Objectives:

- Learn an interdisciplinary approach to the scientific and societal issues arising from industrial chemical production, including the facets of chemistry and environmental health sciences that can be integrated to promote green chemistry and the redesign of chemicals, industrial processes and products.
- Understand the use of alternatives assessments that combine chemical, environmental health, regulatory, and business considerations to develop safer products.

Course Outcomes:

- Recognize and acquire green chemistry concepts and apply these ideas to develop respect for the inter connectedness of our world and an ethic of environmental care and sustainability.

UNIT I: PRINCIPLES AND CONCEPTS OF GREEN CHEMISTRY

Introduction, Green chemistry Principles, sustainable development and green chemistry, atom economy, atom economic: Rearrangement and addition reactions and un-economic reactions: Substitution, elimination and Wittig reactions, Reducing Toxicity. Waste - problems and Prevention: Design for degradation, Polymer recycling.

UNIT II: CATALYSIS AND GREEN CHEMISTRY

Introduction to catalysis, Heterogeneous catalysts: Basics of Heterogeneous Catalysis, Zeolites and the Bulk Chemical Industry, Heterogeneous Catalysis in the Fine Chemical and Pharmaceutical Industries, Catalytic Converters, Homogeneous catalysis: Transition Metal Catalysts with Phosphine Ligands, Greener Lewis Acids, Asymmetric Catalysis, Heterogenising the Homogenous catalysts, Phase transfer catalysis: Hazard Reduction, C-C Bond Formation, Oxidation Using Hydrogen Peroxide, Bio-catalysis and photo-catalysis with examples.

UNIT III: ORGANIC SOLVENTS: ENVIRONMENTALLY BENIGN SOLUTIONS

Organic solvents and volatile organic compounds, solvent free systems, supercritical fluids: Super critical carbon dioxide, super critical water and water as a reaction solvent: water-based coatings, Ionic liquids as catalyst and solvent

UNIT IV: EMERGING GREENER TECHNOLOGIES AND ALTERNATIVE ENERGY SOURCES

Biomass as renewable resource, Energy: Fossil Fuels, Energy from Biomass, Solar Power, Other Forms of Renewable Energy, Fuel Cells, Chemicals from Renewable feedstocks: Chemicals from Renewable Feedstocks: Chemicals from Fatty Acids, Polymers from Renewable Resources, Some Other Chemicals from Natural Resources, Alternative Economies: The Syngas Economy, The Biorefinery, Design for energy efficiency: Photochemical Reactions: Advantages of and Challenges Faced by Photochemical Processes, Examples of Photochemical Reactions, Chemistry Using Microwaves: Microwave Heating, Microwave-assisted Reactions, Sonochemistry: Sonochemistry and Green Chemistry, Electrochemical Synthesis: Examples of Electrochemical Synthesis. Industrial applications of alternative environmentally benign catalytic systems for carrying out the important reactions such as selective oxidation, reduction and C-C bond formations (specific reactions).

UNIT V: GREEN PROCESSES FOR GREEN NANOSCIENCE

Introduction and traditional methods in the nanomaterials synthesis, Translating green chemistry principles for practicing Green Nanoscience. Green Synthesis of Nanophase Inorganic Materials and Metal Oxide Nanoparticles: Hydrothermal Synthesis, Reflux Synthesis, Microwave-Assisted Synthesis, Other methods for Green synthesis of metal and metal oxide nanoparticles, Green chemistry applications of Inorganic nanomaterials

Textbooks:

1. M. Lancaster, Green Chemistry an introductory text, Royal Society of Chemistry, 2002.
2. Paul T. Anastas and John C. Warner, Green Chemistry Theory and Practice, 4th Edition, Oxford University Press, USA



References:

1. Green Chemistry for Environmental Sustainability, First Edition, Sanjay K. Sharma and AckmezMudhoo, CRC Press, 2010.
2. Edited by AlvisPerosa and Maurizio Selva , Hand Book of Green chemistry Volume 8:Green Nanoscience, wiley-VCH, 2013.



HONOURS



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (FT)

L T P C

3 1 0 4

(20A27H01) TECHNOLOGY OF OILS AND FATS

(Honours)

Course Objectives:

- To familiarize production of oils & oil seeds in India & world; distinction between oils & fats
- To understand Principles of refining of oils and process types.
- To understand handling and storage of oil seeds, hydrogenation of oil/fats—types of oils used for hydrogenation.

Course Outcomes (CO):

- Students will learn the production of oils & oil seeds in India & world; distinction between oils & fats
- Students will understand Principles of refining of oils, handling and storage of oil seeds; hydrogenation of oil/fats

UNIT I

Production of oils & oil seeds in India & world. Definition, structure, composition, of oils & fats, Distinction between oils & fats. Glycerides:-Definition, types—simple, mixed triglycerides, mono & diglycerides, random,- distribution of fatty-acids in glyceride molecule. Fatty acids:-definition types with examples saturated, unsaturated, fatty acids with keto-acids, artificially produced fatty acids. Nonglyceride components of oils and fats, constituents present in Crude & Refined oils— Eg:- phosphatides, sterols, pigments, tocopherols, antioxidants vitamin A, D & E.

UNIT II

Classification of oils & fats with examples and detailed glyceride composition with important characteristic of oils. Physico-chemical properties of oils & fats:- solubility, specific gravity, refractive index, color, viscosity, smoke flash & fire points, melting points, anisidine value, saponification value etc. Importance of oils & fats in human Diet & nutrition. Chemical reactions of oils & fats in relation to triglycerides, carboxyl groups & fatty acids.

UNIT III

Handling and storage of oil seeds- Mechanical pretreatment principles and process types- preparation of animal matter, preparation of oil seeds -Cleaning, dehulling & separation of hulls, Reduction in size of oil seeds. Heat treatment of oil bearing material principles and process types- Animal origin Dry rendering, wet rendering, digestive rendering. Plant origin: Cooking, Hydraulic pressing, continuous pressing. Mechanical expression of oil seed principles and process types Batch process- Open type, closed type. Continuous Pressing, Low pressure presses. Solvent extraction of oil principles and process types- Solvent used for oil extraction, type of Extractors-Batch, continuous.

UNIT IV

Refining of oils —principles and process types- Alkali refining using caustic soda, batch refining by dry method, Batch refining by wet method continuous caustic refining Liquid, liquid refining, steam refining, micelle refining. Bleaching—principles and process types Adsorbents-batch bleaching, continuous process, recovery of oil from spent clay, chemical bleaching. Deodorization:- batch process, Continuous process. Filtration of oils—principles types and process.

UNIT V

Hydrogenation of oil/fats—types of oils used for hydrogenation, process of hydrogenation, Products based on Hydrogenation-shortenings, margarine, salad dressings, mayonnaise, Low calorie spreads.



Winterizations of oils e.g.:- salad oils Fortification of oils & fats with nutrients processing of non-edible oils and animal fats. Fractionation, inter esterification and esterification of oils.

Textbooks:

1. EIRI Board, Technology of Oilseeds Processing, Oils & Fats and Refining, Engineers India Research Institute
2. Richard D. O'Brien, Fats and Oils: Formulating and Processing for Applications, Second Edition, CRC Press.
3. NIIR Board, Modern Technology of Oils, Fats & Its Derivatives (2nd Revised Edition) ASIA Pacific Business Press.
4. M.M. Chakravarthy, Chemistry, Technology of oils and fats, Allied Publishers Pvt. Ltd



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR

B.Tech (FT)

L T P C
3 1 0 4

(20A27H02) FOOD STORAGE ENGINEERING
(Honours)

Course Objectives:

- To familiarize production and storage of grains, physical, chemical, and bio-chemical changes occurring during storage.
- To understand cold Chain management, nutritional aspects of freezing, Glass transition temperature and stability of frozen foods.
- To understand controlled atmospheric storage, hypobaric Storage and warehousing

Course Outcomes (CO):

- Students will learn the physical, chemical, and bio-chemical changes occurring during storage
- Students will understand cold Chain management, nutritional aspects of freezing, Glass transition temperature and stability of frozen foods and controlled atmospheric storage, hypobaric Storage and warehousing

UNIT I

Introduction: production and storage of grains, principles of storage, grain storage. Structures: traditional, improved, modern storage. Structure: godown- bag storage, bulk storage (Silos storage). Design of structures, location, stacking arrangements, specifications, advantages and disadvantages. Changes occurring in grain on storage, physical, chemical, and bio-chemical changes. Economics of storage, causes of losses in storage, stored food. Weight loss, food loss, and quality loss, monetary loss. Loss of goodwill, seed, seed loss, post harvest processing (harvesting, shelling, drying, cooling, aeration, cleaning, milling, conveying).

UNIT II

Cold Chain management: Refrigerated storage, cold rooms, walk-in-coolers, Different types of freezers. Frozen Storage Quality losses in frozen foods- Physical changes, Chemical changes in food components, Nutritional aspects of freezing, Glass transition temperature and stability of frozen foods, Temperature requirements during frozen storage, Modeling loss of quality in frozen foods, Time-Temperature integrators.

UNIT III

Controlled Atmospheric Storage Biochemical considerations of CAS, Gas exchange mechanisms, Mass balance principles, Gas generators, Equipment for producing and regulating controlled atmosphere, Design of controlled atmosphere storage chambers.

UNIT IV

Hypobaric Storage: History of hypobaric storage, Experimental errors in hypobaric storage setups, Gas and vapor mass transfer at low pressure, requirements for installation. Measurement devices (Relative humidity, Pressure, Air-change rate, Oxygen, Carbon dioxide, Ethyl alcohol, Acetaldehyde, hypobaric acid vapor), Flow control, Humidity control, Effects on food, Effects on microbes.

UNIT V

Warehousing: Principles, types of warehouses, utility of warehouses. Warehouse management. Cocoon storage. Benefits from warehouses: Regular production, Time utility, Storage of surplus goods, Price stabilization, Minimization of risk, Packing and grading, Financing

Textbooks:

1. Hypobaric storage in food industry- Advances in technology and theory- Stanley.P.Berg
2. Frozen food science and Technology- Judith.A.Evans
3. Engineering for storage of fruits and vegetables- Chandra Gopala Rao



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT) **L T P C**
3 1 0 4
(20A27H03) TQM IN FOOD INDUSTRY
(Honours)

Course Objectives:

- To familiarize quality management, quality management and quality management tools
- To understand Quality management certifications and regulations for food industry.
- To understand the Environmental management system and Eco-friendly food processing system

Course Outcomes (CO):

- Students will learn the quality management, quality management tools. Adulterant identification techniques for milk, honey, oils, spices, etc.,
- Students will understand the and regulations for food industry, Environmental management system and Eco-friendly food processing system

UNIT I

Introduction to quality management - Definition, Scope, Significance and Objectives of Qualitymanagement; Dimensions of quality in foods, Food quality evaluation techniques, Qualitycontrol Vs Quality assurance.

UNIT II

Adulteration - Types of adulterants, Adulterant identification techniques for milk, honey, oils, spices, sugar, pulses, tea powder, coffee, etc as per the FSSAI manual. Quality assurance for raw materials, work in process and finished goods, Safe handling of food product, equipment and machineries; personal hygiene- MPL for adulterants

UNIT III

Quality Management Tools- Seven old and new Quality management tools, Statistical process control – Mean & range chart, P chart and C chart, Seven deadly wastages, PDCA cycle, Quality circle, Quality audit, Internal audit, Continuous improvement of productivity- proficiency testing for product quality- Six Sigma Concept.

UNIT IV

Quality management certifications and regulations for food industry, Implementation procedure for HACCP (ISO 22000), QMS, ISO 9001, BIS, APEDA and Sixsigma certifications; AGMARK and Codex Alimentary Commission regulations; Packaging and labeling regulations for food products; Regulations for food products export and imports.

UNIT V

Environmental management system (EMS) -ISO 14001, Effluent treatment plant location and maintenance- Eco-friendly food processing system, green plant, challenges in EMS.

Textbooks:

1. Poornimacharantimath, Total quality management, Dorling Kindersley, Publishers South Asia Ltd., 2009.
2. Sohrab, 2001 Integrated ISO 9001 HACCP for food processing industries, Allied Publishers Ltd, Mumbai

References:

1. Krammer, A. and Twigg, B.A. 2006. Quality control for the food industry, Volume 2
2. Applications. The AVI Publishing Company. Inc., Westport, Connecticut.
3. Ranganna, S. 1994. Handbook of analysis and Quality control for fruits and Vegetable Products. Tata McGraw hill. New Delhi.



JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY ANANTAPUR
B.Tech (FT) **L T P C**
3 1 0 4
(20A27H04) ENTREPRENEURSHIP DEVELOPMENT
(Honours)

Course Objectives:

- To familiarize Entrepreneur, entrepreneurial flair, Trade license, trademarks registration and registration marks
- To understand the role of agencies for promotion of food processing industries.
- To understand the Preparation of detailed project report and Project economics

Course Outcomes (CO):

- Students will learn the small, medium and large scale manufacturing industries.
- Students will understand the trade license, trademarks registration, FSSAI registration, DPR and Project economics

UNIT I

Entrepreneur and entrepreneurial flair; Classification of small, medium and large scale manufacturing industries; Opportunities of food processing industries.

UNIT II

Trade license, trademarks registration and registration marks; Sources of finance; Selection of land and factory sheds.

UNIT III

Agencies for promotion of food processing industries; Source of machine and equipment. FSSAI registration and licensing. Exports and imports policies and licensing, EXIM Bank procedures, IPR and patent registration process.

UNIT IV

Preparation of detailed project report (DPR); Market feasibility reports; Techno-economic feasibility report on fruits and vegetable processing, bakery and confectionery, mushroom manufacture and soybean processing

UNIT V

Project economics- Cost of operations, Fixed and variable costs- plant and machinery, pre operative cost, post operative cost, working capital.

Textbooks/ References:

1. Entrepreneurial Development by Sarwate (Everest Publication).
2. Entrepreneurship Development by Abha Mathur, Taxmann Publications, 1st Edition 2021.
3. Entrepreneurship, by Robert D. Hisrich, Michael P. Peters, and Dean A. Shepherd, Mc Graw Hills, 11th Edition.