REVISED DIPLOMA CURRICULUM OF FOOD PROCESSING & PRESERVATION (PART-II)

For the State of Meghalaya

(2024-2025)

National Institute of Technical Teachers' Training & Research, Kolkata
Block – FC, Sector – III, Salt Lake City, Kolkata – 700 106

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Program Name: Food Processing & Preservation

Semester - III

Sl. No	Category of course	Code No.	Course Title	Study Scheme				Evaluation scheme							Total Marks	Credits
								Theory				Practical				
				Pre-requisite	Contact Hours/Week			End Term	Progressive Assessment				Progressive Assessment			
					L	T	P		Class Test	Assignment	Attendance	End Term	Sessional	Viva Voce		
1	Program Core Course	**FPPC** 201	Organic & Physical Chemistry		2	1	0	60	20	15	5	-	-	-	100	3
2		**FPPC** 203	Chemistry of Food		2	0	0	60	20	15	5	-	-	-	100	2
3		**FPPC** 205	Food Microbiology		2	0	0	60	20	15	5	-	-	-	100	2
4		**FPPC** 207	Food Process Calculation		2	0	0	60	20	15	5	-	-	-	100	2
5		**FPPC** 209	Heat Transfer		2	0	0	60	20	15	5	-	-	-	100	2
6		**FPPC** 211	Food Engineering Drawing		0	1	2	-	-	-	-	40	40	20	100	2
7		**FPPC** 213	Engineering Economics & Accountancy		2	1	0	60	20	15	5	-	-	-	100	3
8		**FPPC** 215	Organic & Physical Chemistry Lab.		0	0	2	-	-	-	-	40	40	20	100	1
9		**FPPC** 217	Chemistry of Food Lab.		0	0	2	-	-	-	-	40	40	20	100	1
10		**FPPC** 219	Food Microbiology Lab.		0	0	2	-	-	-	-	40	40	20	100	1
11	Internship	I-201	Internship - I		0	0	4	-	-	-	-	40	40	20	100	2
Total					**12**	**3**	**12**	**360**	**120**	**90**	**30**	**200**	**200**	**100**	**1100**	**21**

Program Name: Food Processing & Preservation

Semester - IV

Sl. No	Category of course	Code No.	Course Title	Study Scheme				Evaluation scheme							Total Marks	Credits
								Theory				Practical				
				Pre-requisite	Contact Hours/Week			End Term	Progressive Assessment				Progressive Assessment			
					L	T	P		Class Test	Assignment	Attendance	End Term	Sessional	Viva Voce		
1	Program Core Course	**FPPC** 202	Food Engg.-I		2	1	0	60	20	15	5	-	-	-	100	3
2		**FPPC** 204	Cereals, Pulses Processing & Preservation Technology		2	0	0	60	20	15	5	-	-	-	100	2
3		**FPPC** 206	Fruits, vegetables products, processing & Preservation Technology		2	0	0	60	20	15	5	-	-	-	100	2
4		**FPPC** 208	Mechanical Operation		2	0	0	60	20	15	5	-	-	-	100	2
5		**FPPC** 210	Biochemistry & Nutrition		2	0	0	60	20	15	5	-	-	-	100	2
6		**FPPC** 212	Fluid Mechanics		2	0	0	60	20	15	5	-	-	-	100	2
7		**FPPC** 214	Food Engg. Lab		0	0	2	-	-	-	-	40	40	20	100	1

8		**FPPC** 216	Food Processing and Preservation Lab I		0	0	2	-	-	-	-	40	40	20	100	1
9		**FPPC** 218	Fluid Mechanics Lab		0	0	2	-	-	-	-	40	40	20	100	1
10	Open Elective	**FPOE** 202	Open Elective I A. Disaster Management B. Renewable Energy Technologies		3	0	0	60	20	15	5	-	-	-	100	3
11	Minor Project	**FPPR** 202	Minor Project		0	0	4	-	-	-	-	40	40	20	100	2
12	Mandatory	**AU**202	Essence of Indian Knowledge and Tradition		2	0	0	0	0	0	0	0	0	0	0	0
Total					**17**	**1**	**10**	**420**	**140**	**105**	**35**	**160**	**160**	**80**	**1100**	**21**

SEMESTER - III

ORGANIC & PHYSICAL CHEMISTRY

L	T	P		Course Code No.: **FPPC201**
2	1	0		
Total Contact hrs.: Lecture: 30 Tutorial: 15 Practical: 0 **Credit : 3**			**Total marks: 100**	**Theory:** End Term Exam.: 60 P.A: 40

RATIONALE

The phenomenal progress of technology in the twentieth century has brought dramatic changes in human lifestyles. The technology, which has thus enhanced the quality of human life, is evolved based on scientific research, primarily in organic and physical chemistry. Use of various organic compounds and their physical phenomenon are very much essential for food processing industry. Therefore, knowledge of organic and physical chemistry is necessary for the success of food processing technologist.

COURSE OUTCOMES:

After completion of the course, students will be able to

CO1: Explain fundamental concepts of carbohydrate, protein and fat chemistry.

CO2: Analyze the Structures of the organic compounds.

CO3: Determine the structure of organic molecules

CO4: Apply the basic concept of physical chemistry and knowledge of Chemical reactions to industries, and technical fields.

DETAILS COURSE CONTENTS:

UNIT NO. & TITLE	CONTENT	TIME ALLOTTED (HRS.)
1. Organic Chemistry	1) Carbohydrates, monosaccharides, disaccharides and poly-saccharides; lipids-glycerides of fatty acid (a preliminary discussion); simple ring compounds (alicyclic hydrocarbons, epoxy compound etc.); nitro compounds and nitriles; proteins (a preliminary discussion)	**12**
	2) Aromatic organic Compounds – origin and synthesis of aromatic nitro compounds, ethers, azo diazonium compounds, alcohols, aldehydes, ketones, organic acid like citric acid, maleic acid, tartaric acid, lactic acid, acetic acid.	**5**
	3) Raw Materials, Preparations, Properties and uses Amino Compounds like Urea, Melamine, Sulphonamine etc., Di / Poly functional acids like Phthalic anhydride; Terephthalic acid, Adipic acid, sebacic Acid, Maleic acid, Fumaric acid, Glycols, Glycerine, Penta Erithritol, Antioxidants, Emulsifier	**8**

2. Physical Chemistry	1) Gas Laws, equation of gaseous state, ideal gases and real gases, absolute temperature, compression of gases, liquefaction of gases-critical temperature and critical pressure.	**7**
	2) Evaporation, vapour pressure, partial pressure in gas mixtures, diffusion, absorption and adsorption.	**4**
	3) Viscosity and surface tension of liquids, colligative properties, freezing and boiling, solvents, solutes and solution, vapour pressure lowering, osmotic pressure, freezing point depression and boiling point elevation, molecular weight determination by cryoscopy and ebulliometry.	**7**
	Chemical Kinetics: Order and Molecularity of Reaction	**2**

CHEMISTRY OF FOOD

L	T	P		Course Code No.: **FPPC203**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit : 2**			**Total marks: 100**	**Theory:** End Term Exam.: 60 P.A: 40

RATIONALE

For a professional in the field of Food processing the fundamental knowledge of biochemistry comprising biomolecules, bioenergetics, metabolism etc. as also of human biochemistry including metabolism, endocrine regulation and human nutrition. Human biochemistry and nutrition are intricately related. Nutrition is not simply a matter of knowing that a given vitamin serves as part of a Coenzyme It might be said that the science of nutrition is one of the biochemistry's greatest contribution to human welfare. It is very important for the food processing technologist, therefore, to have a basic understanding the concepts of biochemical characteristics of human organisms and nutrition – how complex human organization are sustained and kept in metabolic health by intake of nutrients.

COURSE OUTCOMES:

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

CO1: Explain the structure and composition of different nutrients.

CO2: Interpret the chemistry underlying the properties and reactions of various food components and along with the function of the nutrients in different food materials.

CO3: Analyze processing conditions are likely to change the reactivity of food components.

CO4: Apply fundamental concepts to identifying the principles behind analytical techniques associated with food.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
1.	Proximate composition of foods. Water in foods, Carbohydrate: Definition, nomenclature, classification, general properties of sugar (physical and chemical), physiological functions of carbohydrates. Dietary fibre.	**6**
2.	Proteins: Physical and chemical properties of amino acids, classification of Proteins, amino acid sequence in proteins, essential amino acids, Physical and chemical properties of proteins, protein denaturation, food proteins and their characteristics.	**6**
3.	Lipids: Classification of lipids, fatty acid, essential fatty acids, fats and oils, Saponification number, acid number, Iodine value, acetyl value, Reichert-Meissl number, oxidative and hydrolytic rancidity, reversion, peroxide	**6**

	value, thiobarbituric acid value.	
4.	Natural pigments and flavouring agents: Chlorophyll, Carotenoids, Anthocyanins Anthoxanthins, flavonoids, tannins, Natural flavour Constituents.	**6**
5.	Vitamins: Occurrence, chemistry and its functions, loss during storage, transport and Processing of foods, Minerals & their function.	**6**

REFERENCES

Text Book:

1. Essentials of Food & Nutrition by Swaminathan, Vol. 1 &2
2. Food Chemistry by L. H.Meyer

Reference books:

1. Hand Book of Analysis of fruits & vegetables by S.Ranganna
2. Chemical changes in food during processing byRichardson
3. Food Science by Norman N. Potter & JosephH.Hotchkiss
4. Food Chemistry by H. K. Chopra & P. S.Panesar

FOOD MICROBIOLOGY

L	T	P		Course Code No.: **FPPC205**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit : 2**			**Total marks: 100**	**Theory:** End Term Exam.: 60 P.A: 40

RATIONALE:

This course is to familiarize students with procedures and techniques used to detect and enumerate microorganisms in foods and develop an understanding of spoilage microorganisms and their effects on food and integrate their basic knowledge of microbiology, chemistry, biochemistry, food processing.

COURSE OUTCOMES:

After completion of the course. students will be able to:

CO1: Classify different types of microorganism present in the environment with special reference to food.

CO2: Describe the internal and external factors and prediction of growth of microorganisms, causing food spoilage.

CO3: Interpret the microbiology of various food materials and causes of food borne diseasesand their etiology.

CO4: Evaluate the measures required to control undesired microorganisms in food based onthe knowledge about disinfection and disinfectants.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
1.	The importance of microbes in food and fermentation industries. The types and basic principles of microscope.	2
2.	Morphology of bacteria moulds and yeast. Dyes and staining techniques. Nutrition of microbes.	5
3.	Techniques of pure culture. Bacterial genetics. Differentiation and classification of bacteria. Bacterial viruses.	5
4.	Microbial respiration. Fermentation of carbohydrates. Microbial decomposition of proteins, fat, sauerkraut, vinegar, alcohol.	3
5.	Disinfection and disinfectants. Pasteurization, sterilization and arnoldization.	5
6.	Energy metabolism of aerobic and anaerobic microbes.	1
7.	Nitrogen fixation. Bacteriology of air, water, milk and milk products, fish, fruit and vegetable.	5

8.	Aseptic processing concept	1
9.	Fumigation, sanitization and Hygiene concept in relation to microbial contamination.	3

REFERRENCES:

Text Book:

1. Essentials of Microbiology; K. S. Bilgrami; CBS Publishers,Delhi
2. Food Microbiology; WC Frazier; Tata McGraw Hill,Delhi

Reference books:

1. Modern Food Microbiology; James M Jay; CBS Publishers,Delhi
2. Microbiology; Pelczar, Chan and Krieg; Tata McGraw Hill,Delhi
3. Basic Food Microbiology; Bannett, Chapman andHall
4. Food Microbiology; M. R.Adams
5. Hand Book of Microbiology;Bisen

FOOD PROCESS CALCULATION

L	T	P		Course Code No.: **FPPC207**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit: 2**			**Total marks: 100**	**Theory:** End Term Exam.: 60 P.A: 40

RATIONALE:

This course helps the students in developing the concepts of different unit conversions, material balance and energy balances in different engineering systems by applying different mathematical interpretations.

COURSE OUTCOMES:

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

CO1. Explain the stoichiometric importance of an engineering process.

CO2. Analyze with different systems of units and conversion of units from one system to another.

CO3. Apply graphical methods for representation of engineering data.

CO4. Calculate mass and energy balance equations to engineering problems by optimizing the process requirements.

CO5. Predict how processing conditions are likely to change with respect to enthalpy requirements of a process.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
1.	Units & Dimensions: Basic & derived units; different ways of expressing units of quantities and physical constants	**3**
2.	Stoichiometric Principles	**2**
3.	Properties of gases, liquids & solids; Properties of mixtures & solutions.	**4**
4.	Dry & Wet bulb thermometry	**2**
5.	Material balance : Stagewise and continuous operations in systems without and with chemical reactions. Recycling, bypass in batch	**7**
6.	Energy balance : concepts and calculations involving energy; Heat work, enthalpy of reversible reactions	**7**
7.	Thermochemistry : Heats of formation & combustion	**2**
8.	Fuels : Flame temperature & calculation involving combustion of different fuels.	**3**

REFERENCES

1. Houghen, O.A. & Watson, K.M: Chemical Process Principles, Part – I, John Wiley & Sons, Inc., N.Y.
2. Himmelblau, D.M.: Basic Principles and Calculations in Chem. Engg., Prentice Hall of India Pvt. Ltd., New Delhi.
3. Ghosal, Sanyal & Datta: Introduction to Chemical Engineering, Tata McGraw Hill

HEAT TRANSFER

L	T	P		Course Code No.: **FPPC209**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit: 2**			**Total marks: 100**	**Theory:** End Term Exam.: 60 P.A: 40

RATIONALE:

Many important operations carried out in chemical engineering and food processing engineering practices involve production and absorption of energy in the form of heat. It is important to understand the fundamental laws governing flow of heat, principles of various heat flow mechanisms viz., conduction, convection and radiation. Besides, study of different equipment such as, heat exchangers, evaporators etc. that have their main object the control of heat flow and are frequently used in process industries.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Explain the basic principles of heat transfer

CO2: Analyze the data of different heat transfer mechanisms

CO3: Solve conduction, convection and radiation problems

CO4: Design the performance of heat exchangers.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
1.	Heat Transfer : Classification of heat transfer processes, simple problems on conduction through circular & straight bodies, Fourier's Law, Resistance in series, Logmean area; convection, Film concept, Elementary idea of film co-efficient (derivation not required), Varying temperature drop, Logmean temperature Difference (derivation not required) parallel and counter Current flow; Radiation, Elementary idea, Stefan's Law; General description of tubular heaters, Liquid to Liquid heat exchanger. Type of boilers & its maintenance. Plate heat Exchanger. **Heat exchanger, different types of heat exchanger used in food industries.**	20
2.	Evaporation: Types of evaporators, vertical tube evaporators forced circulation type evaporator, evaporator's capacity factor & rate of evaporation, elementary principle of multiple effect and vacuum evaporator.	10

REFERENCES:

Text Book:

1. Unit Operations of Chemical Engineering: McCabe, Smith & Harriot, TMH,5th edition
2. Heat Transfer: D.Q. Kern, MGH
3. Introduction to Chemical Engineering: Walter L. Badger,Julius T.Banchero, Julius T. Bancheo

Reference books:

1. Chemical Engineering, Vol-I & II: Coulson & Richardson, ButterworthHeinemann

FOOD ENGINEERING DRAWING

L	T	P		Course Code No.: **FPPC211**
0	1	2		
Total Contact hrs.: Lecture: 0 Tutorial: 15 Practical: 30 **Credit: 2**			**Total marks: 100**	**Practical:** End Term Exam: 40 P. A: 60

RATIONALE:

Drawing is the language of the engineers. Any engineering pursuit viz. Design fabrication, servicing etc. as also of flow charting of processes, symbols etc. call for an detailed engineering drawings that bridges the communication barrier between designer – manager – supervisor and worker. Use of various chemical process equipment is very common in food processing industrials practices. Therefore, a detailed understanding of fundamental aspects of engineering drawing (viz. Projections, isometric etc.) as also those of specific process equipment viz. Reaction vessel, storage vessel, drier, heat exchangers, evaporators and such other equipment as also for representing various food engineering related processes e.g. baking, parboiling of rice, drying, canning etc. are of almost importance for a food processing technologist.

COURSE OUTCOMES

After Completion of the course, students will be able to:

CO1: Demonstrate aspects of Engineering Graphics and visual aspects of design.
CO2: Use common drafting tools with the knowledge of drafting standards.
CO3: Apply computer aided drafting techniques to represent line, surface or solid models in different Engineering viewpoints.
CO4: Demonstrate Produce part models; carry out assembly operation
CO5: Show working procedure of a designed project work using animation.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
1.	Drawing of IS standard hexagonal and square bolts and nuts	2
2.	Pipe joints; Flange joint; Rectangular Tee Joint and bend joint	2
3.	Shaft coupling; Knuckle and cotter joints, flange coupling	2
4.	Isometric projection of rectangular solids, cubes; and sketching and drawing of simple machine parts, e.g., split pulley, stop valve piston and connecting rod of engine, etc.	4

5.	Engineering drawing of following equipment: i) Storage vessel ii) Reaction vessel iii) Drier iv) Heat exchanger (Multipass type) v) Evaporators (single and multiple effect) vi) Freezer vii) Extruder	10
6.	Drawing of flow sheets of the following process: a) Symbols of equipment used in Food Processing Industries b) Baking process c) Canning process d) Parboiling of rice e) Freezing process / cold storage f) Drying process g) Aseptic packaging system.	15

REFERENCES

Text Books:

1. Bhatt N.D., Panchal V.M. & Ingle P.R., (2014), Engineering Drawing, Charotar Publishing House

2. (Corresponding set of) CAD Software Theory and User Manuals

Reference Books:

1. K. Venugopal**,** Engineering Drawing + AutoCAD, New Age International publishers
2. Agrawal B. & Agrawal C. M. (2012), Engineering Graphics, TMH Publication.
3. Shah, M.B. & Rana B.C. (2008), Engineering Drawing and Computer Graphics, Pearson Education
4. Narayana, K.L. & P Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

ENGINEERING ECONOMICS & ACCOUNTANCY

L	T	P		Course Code No.: **FPPC213**
2	1	0		
Total Contact hrs.: Lecture: 30 Tutorial: 15 Practical: 0 **Credit: 3**			**Total marks: 100**	**Theory:** End Term Exam: 60 P.A: 40

RATIONALE:

The knowledge of Engineering Economics and Accountancy is needed by personnel dealing with the cost of products of any kind related to quality and standards of production including its financial control. Engineers / Technicians, in general, need to know the cost of the final products for marketing purposes. The knowledge of Economics as well as Accountancy is required by all people dealing in any business or enterprise.
This particular subjects deals in basic concepts of economics, production of commodities, different types of industries, market forms, objective of economic planning, concept of value of money, causes of unemployment, industrial policy, business transaction and accountancy, maintenance of cash and balances, receipt and expenditures and final accounts.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Identify various uses for scarce resources

CO2: Explain key economic concepts and implement in real world problems

CO3: Analyze financial data and their impacts

CO4: Assess business performance through the knowledge of cost accounting principles

DETAILS COURSE CONTENTS:

UNIT NO. & TITLE	CONTENT	TIME ALLOTTED (HRS.)
1. Introduction	1.1 Introduction to Economics and its Utility of study 1.2 Importance of the study of Economics	1
2. Basic concepts of economics	2.1 Definition of Utility, Consumption, Want, Value, Price, Goods, National Income. 2.2 Classification of goods, characteristics and classification of wealth. 2.3 Basic Laws of demand and supply. 2.4 Concept and Measurement of Elasticity of demand	3
3. Production	3.1 Meaning and factors of production. 3.2 Land, Labour, Capital and Organisation 3.3 Formation of Capital, Break even chart-its uses.	3
4. Scale of industries	4.1 Definition, advantages and disadvantages of small, medium and large scale production 4.2 Internal and External Economies	2

5. Market forms	5.1 Definition and types of Markets in respect of present trends. 5.2 Features of Perfect, Imperfect and monopoly markets. 5.3 Price determination under perfect competition and monopoly	3
6. Economic planning	6.1 Features of Under-developed and Developing Countries. 6.2 Meaning, objectives and needs of planning. 6.3 Introduction to industrial development in India during the five year plans.	3
7. Money	7.1 Meaning and functions of Money 7.2 Introduction to the concept of the value of money 7.3 Meaning of Inflation, Deflation, Stagnation.	3
8. Unemployment	8.1 Meaning, types and causes of Unemployment 8.2 Unemployment problems in India	2
9. Industrial policy	9.1 Current Industrial Policy 9.2 Industrial licensing Policy, De-licensing 9.3 Monopolistic and Restricted Trade practices (MRTP) Foreign Exchange Regulation Act (FERA).	3
10. Business transactions & accountancy	10.1 Transactions and classifications, need and objectives of proper records including double entry system. 10.2 Classification of Accounts and its description (in respect of real accounts, personal accounts and nominal accounts) 10.3 Debit and credit concept; golden rules of debit and credit. 10.4 Objectives and principles of double entry book-keeping.	5
11. Books of accounts	11.1 Journal and Ledger, their sub-divisions; posting from journals to ledger. 11.2 Balancing of Accounts	2
12. Cash book	12.0 Objective of Cash Book (in respect of all kinds of Cash transactions) 12.1 Single column, double column and triple column cash book 12.3 Imprest system of Petty Cash Book.	2
13. Trial balance	13.1 Objective, Preparation, errors and rectification (in respect of balance of accounts for the total period).	2
14. Final accounts	14.1 Steps of preparing accounts; Trading Account; Profit and Loss Account 14.2 Revenue and Depreciation adjustment 14.2 Introduction to balance sheet	5
15. Capital & revenue expenditure distribution	15.1 Receipts and payments 15.2 Income and Expenditure differences	3
16. Meaning & purpose of costing	16.1 Elements of Cost-Analysis and classification of expenditure for cost accounts. 16.2 Cost Control – Prime cost, Overhead cost, and Indirect materials and tools.	2

17. Electronics commerece-meaning-scope	17.1 Accounting Software – Tally latest version	1

REFERENCES

1. Agrawal, A.N., Indian Economy, New Delhi ; wish Prahashan, 2005
2. Wali, B.M., and A.B. Kalkundrikar – Managerial Economics, New Delhi

ORGANIC & PHYSICAL CHEMISTRY LAB

L	T	P		Course Code No.: **FPPC215**
0	0	2		
Total Contact hrs.: Lecture: 0 Tutorial: 0 Practical: 30 **Credit: 1**			**Total marks: 100**	**Practical:** End Term Exam: 40 P.A: 60

RATIONALE

To provide an opportunity to the students to define chemistry as the study of the composition, structure, properties of food materials and identify methods and instruments that can be used to study of food chemistry and To focus on the development of skills to control the quality of food by providing an opportunity to the students prioritize different controlling parameters to improve shelf-life of food and to prevent adulteration

COURSE OUTCOMES

After Completion of the course, students will be able to:

CO1: Identify methods and instruments used to study of food chemistry.
CO2: Identify the structure of of simple and organic compounds
CO3: Measure the physical characteristics of simple compounds
CO4: Design innovative experiments applying the fundamentals of chemistry

DETAILS COURSE CONTENTS

UNIT NO. & TITLE	CONTENT	TIME ALLOTTED (HRS.)
Group I : Chemistry Lab Organic	Acid value, Iodine and Saponification value of lipids; Estimation of Food Colors and preservatives, peroxide value, melting point & cloud point estimation of glucose, sucrose. Identification of simple & organic compounds with melting points or boiling points. Melting points and Softening ranges of raw food materials like shortenings, flavoring compounds etc. in confectionery industry.	15
Group II : Physical Chemistry Lab	Measurements of vapor pressure, Determination of freezing point depression and molecular weight of simple compound; measurement of surface tension; measurement of osmotic pressure. Measurement of average size of fat globules in fresh and homogenized milk	15

CHEMISTRY OF FOOD LAB.

L	T	P		Course Code No.: **FPPC217**
0	0	2		
Total Contact hrs.: Lecture: 0 Tutorial: 0 Practical: 30 **Credit: 1**			**Total marks: 100**	**Practical:** End Term Exam: 40 P.A: 60

RATIONALE:

This course provides an opportunity to the students to define chemistry as the study of the composition, structure, properties of food materials. It enables them to identify methods and instruments that can be used to study of food chemistry. It also develops skills to control the quality of food by providing an opportunity to the students prioritize different controlling parameters to improve shelf-life of food and to prevent adulteration.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Identify methods and instruments that can be used to study of food chemistry.
CO2: Recognize the importance of proximate analysis.
CO3: Ensure quality of food
CO4: Prioritize different controlling parameters to improve shelf-life of food.
CO5: Evaluate data generated by experimental methods for chemical characterization of food materials.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
1.	i) Errors and accuracy in analysis of food materials; sampling ii) Preparation of samples for proximate analysis; determination of moisture, ash, lipids, nitrogen, (protein and non-protein), reducing and non-reducing sugar in samples of food. iii) Estimation of iron, phosphorous, copper, lead, arsenic and tin	30

FOOD MICROBIOLOGY LAB.

L	T	P		Course Code No.: **FPPC219**
0	0	2		
Total Contact hrs.: Lecture: 0 Tutorial: 0 Practical: 30 **Credit: 1**			**Total marks: 100**	**Practical:** End Term Exam: 40 P.A: 60

RATIONALE:

This course aims to develop understanding of various methods of isolation, characterization and screening of bacteria, fungi and other related organisms and apply different preservation techniques relative to food safety and spoilage.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1. Explain various methods of isolation, characterization and screening of bacteria, fungi and other related organisms

CO2. Develop skills to monitor various food processing operations in food industries.

CO3. Apply different preservation techniques relative to food safety and spoilage.

CO4. Illustrate the growth requirements of common food borne pathogens and spoilage microorganisms.

CO5. Identify the organisms that are likely to grow in a specific food product.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
1.	i) General procedure aseptic work ii) Study microscope iii) Staining of bacteria and observation of size, motility, metachromatic granules, and spores iv) Morphology of yeasts and moulds *S.cerevisiae, C.utilis, Mucor, Aspergillus and Penicillium* v) Preparation of nutrient broth and media with agar, gelatin and special media for culture of microbes vi) Technique of pure culture, plating by pour plate and streak plate methods viii) Anaerobic cultures ix) Determination of thermal death time x) Methyline blue reduction test xi) Detection and accounting of coliform bacteria and salmonella. xii) Bacteriological examination of water and milk	30

INTERNSHIP-I

L 0	T 0	P 4		**Course Code No.: I-201**
Total Contact hrs.: **Credit: 2**			**Total Marks: 100**	**Evaluation Scheme:** End Term Exam: 40 P.A.: 60

RATIONALE:

Internship provides an in-depth knowledge on engineering students. This internship enables the students to understand and learn the current trend in the job market. Internship provides great opportunity to get real life experience and exposure.

Students will be exposed to structured and practical learning experience that prepares individuals for their future careers, helps them make informed career choices, and equips them to build their profile for their jobs and also for their higher studies.

INTERNSHIP PROTOCOL:

Students are required to take up an Internship/ Entrepreneurial activities / Project work/ Seminar and Inter/ Intra Institutional Training.

As per AICTE guideline the institutes have the flexibility to schedule internship, Project work, Seminar etc. according to the availability of the opportunities. Students are required to be involved in Inter/ Intra Institutional Activities viz.,

- Training with higher Institutions;
- Soft skill training organized by **Training and Placement Cell of the respective institutions**;
- Contribution at incubation/ innovation /entrepreneurship cell of the institute;
- Participation in conferences/ workshops/ competitions etc.;
- Learning at Departmental Lab/ Idea Lab/ Institutional workshop;
- Working for consultancy/ research project within the institutes and
- Participation in all the activities of Institute's Innovation Council for eg: IPR workshop/Leadership Talks/ Idea/ Design/ Innovation/ Business Completion/ Technical Expos etc.

SEMESTER - IV

FOOD ENGINEERING-I

L	T	P		Course Code No.: **FPPC202**
2	1	0		
Total Contact hrs.: Lecture: 30 Tutorial: 15 Practical: 0 **Credit: 3**			**Total marks: 100**	**Theory:** End Term Exam.:60 P.A: 40

RATIONALE:

In order to design equipment for food processing operations, it is necessary it know the engineering principles involved. Various type of processing equipment like pasteurizer, homogeniser, driers, freezers need clear idea about the thermo-physical properties of the food materials, and rheological behaviour for successful design of processing equipment. Apart from this heat and mass transfer problems should also be well understood for such biological systems.

COURSE OUTCOMES

After Completion of the course, students will be able to:
CO1: Explain the basic principles of food preservation
CO2: Apply preservation methods that make use of heat/cold, drying, acid, added chemicals, controlled air, pressure, and high-energy radiation
CO3: Design different canning unit
CO4: Use indirect approaches to food preservation– packaging, food hygiene, sanitation, Gas packaging.

DETAILS COURSE CONTENTS

UNIT NO.	CONTENT	TIME ALLOTTED (Hrs.)
1.	General introduction to food technology. Principles of preservation	3
2.	Construction of sanitary cans and testing of cans, can lacquers and can scaling compounds. Preservation by application of heat. Various canning techniques.	5
3.	Evaluation of process time in canning. Different types of sterilizers, and other accessories used in canning	4
4.	Dehydration, water activity of food, intermediate food	4
5.	Preservation of food by removal of heat, cold storage and freezing including cryogenic freezing of food.	6
6.	Curing, prickling. Preservation by ionization radiation use of chemicals and preservatives in food preservation. Preservation by fermentation, controlled and modified atmospheric storage.	8

REFERENCES:

Text Book:

1. Technology of Food Preservation by Desrosier
2. Food Science by Potter

Reference books:

1. Fruits and vegetable processing by Cruess
2. Preservation of Fruits & Vegetables by IRRI
3. Principles of Food Preservation- Fennema
4. Handbook of Food Presrevation-M. Shafiur Rahman

CEREALS, PULSES PROCESSING & PRESERVATION TECHNOLOGY

L	T	P		Course Code No.: **FPPC204**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit: 2**			**Total marks: 100**	**Theory:** End Term Exam.:60 P.A: 40

RATIONALE:

Processing of different raw food materials are practiced all over the world. There are important principles that govern the activities related to food processing not only to economise the process but also to ensure the all important aspects – quality and shelf-life. For a food technologist, it is therefore, essential to understand and effectively apply as much of the scientific and biochemical principles related to food stuff and nutrition and the technologies underlying the unit processes and realise the objectives of quality and longevity of the processed food and economy.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Explain the Processing and storage of cereals.
CO2: Describe the processing methods of some cereal product.
CO3: Apply the knowledge to enhance the self-life and quality of product
CO4: Design new product

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED
I	Cereals of world, chemical composition and nutritional attributes	2
II	General grain milling operations	2
III	Milling and parboiling of rice	2
IV	Milling of wheat, corn and coarse cereals	2
V	Grain drying and dryers	2
VI	Milling of pulses	2
VII	Storage of cereals	2
VIII	Infestation control and use of pesticides	2
IX	Production of wheat products including flour, bread, biscuits and cakes	3
X	Production of other bakery confectionery products, Soyabean processing, (Soya milk, Soya Panir (TOFU) & Soyachunk	3
XI	Breakfast cereals, extruded products	3
XII	By-products utilization	3
XIII	Problems in the materials and processing, causes and remedies	2

REFERENCES:

Text Books:

1. Food Science by Potter
2. Food Science by Mudambi
3. Food Science by B. Srilakhsmi
4. Food Additives by Udipi

Reference Books:

1. Handbook of Postharvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices – A. Chakraverty, Arun S. Mujumdar, G. S. V. Raghavan& H. S. Ramaswamy - Marcel Dekker, 2003
2. Postharvest Technology and Food Process Engineering – A Chakraverty& R. Paul Singh, CRC Press, 2014
3. Principles of Food Science, Vol-I by FennmaKarrel

FRUITS, VEGETABLES PRODUCTS, PROCESSING & PRESERVATION TECHNOLOGY

L	T	P		Course Code No.: **FPPC206**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit: 2**			**Total marks: 100**	**Theory:** End Term Exam.:60 P.A: 40

RATIONALE:

This course aims to provide the students an opportunity to gain knowledge about the storage procedure of different fruits and vegetables and to help students to understanding the different procedure of production of various fruit based and vegetable based products.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Explain Processing and storage of fruits and vegetables.
CO2: Discuss processing methods of vegetable products through quality control of food and food products
CO3: Apply the principles underpinning the safe and effective production of fruits and vegetables products.
CO4: Implement manufacturing technologies of nonalcoholic beverages consumed in daily life in food industries.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED
1.	Role of plant growth regulators in post-harvest storage; Physical and chemical treatments for increasing post-harvest life of fruits and vegetables; physiology of ripening. MA & CA storage.	3
2.	Handling and storage of fresh fruits and vegetables; Preservation of fruits and vegetables by heat treatment; Freezing and dehydration of fruits and vegetables. Fermentation Technology and addition of preservatives for fruits & Vegetable preservation.	3
3.	Preparation of jam, jelly and marmalade, pickles chutneys, vinegar and tomato products.	2
4.	Processing and preservation of fruits and vegetable juices; Concentration of fruit and vegetable juices	2
5.	Fermented foods, Pickling and curing of food	2
6.	Intermediate moisture foods; Coconut and its derivatives by-product and their utilization.	3
7.	Effects of processing on the nutritive value of fruits and vegetables	2
8.	Preparation of spice powder and condiment products	2
9.	Preparation non-alcoholic beverages; Tea, Coffee and Cocoa & their	2

	processing technology.	
10.	Food spoilage & Essential principle of food preservation & food waste treatment.	3
11.	Food Laws: the Act, the Rules and the standards, Food Patents	3
12.	Quality control of food and food products; HACCP, FSSAI, Sensory evaluation of food colour, flavour, texture, shape, etc., Instrumental methods of analysis of food, quality control & food laws, ISO – 22000.	3

REFERENCES:

Text Books:

1. Food Science by Potter
2. Food Science by Mudambi
3. Food Science by B. Srilakhsmi
4. Food Additives by Udipi

Reference Books:

1. Postharvest Technology of Fruits & Vegetables (vol 1 & 2): Handling, Processing, Fermentation and Waste Management – L. R. Verma& V. K. Joshi, Indus Pub, New Delhi, 2000.
2. Fruit and Vegetable Preservation by Srivastava and Sanjeev Kumar
3. Principles of Food Science, Vol-I by FennmaKarrel
4. Preservation of Fruits & Vegetables by

MECHANICAL OPERATION

L	T	P		Course Code No.: **FPPC208**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit: 2**			**Total marks: 100**	**Theory:** End Term Exam.:60 P.A: 40

RATIONALE:

Operations related to size, transportation in bulk, separation of size, mixing etc. of different solid-solid and solid-liquid systems are important in many chemical, food processing, hydrometallurgical industrial practice from the point of view of consequence and process economy. It is therefore, important to study the principles governing the operations named above (known collectively as mechanical operations), the construction of different equipment, advantages / disadvantages selection of equipment for specific purposes from host of different alternatives.

COURSE OUTCOMES

After Completion of the course, students will be able to:

CO1: Identify different disintegration processes

CO2: Explain different types of separation processes

CO3: Solve the problems of filtration

CO4: Explain the modern separation and mixing processes

DETAILS COURSE CONTENTS:

UNIT NO. & TITLE	CONTENT	TIME ALLOTTED
1. Size Reduction	Objectives of size reduction; classification of crushers; coarse intermediate and fine crushers; details of construction and operation; Kick's law and Rittinger's law; closed and open circuit grinding; wet and dry grinding (only simple problems on Kick's law and Rittinger's law). Fruit mills, Extractor, Pulper.	**6**
2. Size Separation	Screens, Industrial Screens, Air Filter and Air separators, Magnetic and electrostatic separator, Hydraulic classifiers, Theory of settling. Stoke's law, free settling and hindered Settling, sedimentation.	6
3. Filtration	Classification of equipment, sand filter, plate and frame filter press and its operation, filter aid, types of filter cake. Theory of filtration (derivation problems not required). Rotary vacuum filter.	8
4. Mixing:	Objective of mixing: equipment for mixing of solid, liquid and gases with one another, Bakery mixing for dough development, Propeller mixing. Transportation of solids by belt conveyor, bucket Conveyor, Pneumatic Conveyor etc. Mechanical handling of solid	10

	materials	
	Choice of mixers, decanter & centrifuge : batch and continuous	

REFERENCES:

Text Book:

1. Unit Operations of Chemical Engineering: McCabe, Smith & Harriot, TMH,5th edition
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rdedition
3. Introduction to Chemical Engineering: Walter L. Badger,Julius T.Banchero, Julius T. Bancheo

Reference books:

1. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
2. Foust, A.S., Wenzel, L.A., et.al. Principles of Unit Operations, 2nd edition, JWS
3. Perry, Chilton & Green, Chemical Engineers' Handbook, MGH
4. Fundamentals of Food Process Engineering R.T. Toledo CBS publication
5. Food Processing Technology P.J. Fellows CRC press

BIOCHEMISTRY & NUTRITION

L	T	P		Course Code No.: **FPPC210**
2	0	0		
Total Contact hrs.: 30 Lecture: 30 Tutorial: 0 Practical: 0 **Credit: 2**			**Total marks: 100**	**Theory:** End Term Exam.:60 P.A: 40

RATIONALE:

This course is to introduce the students to the biological basis of nutrition and the mechanisms by which diet can influence health and help them develop laboratory skills required for modern biochemical and molecular studies of nutrition.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Describe the major metabolic pathways involved in the metabolism of nutrients in the human body.

CO2: Use the principles of biochemical methods with appropriate instruction.

CO3: Interpret the basis of reactivity of biologically relevant molecules and their interactions.

CO4: Validate experimental data.

CO5: Explain the synthesis of proteins, lipids, nucleic acids, and carbohydrates and their role in metabolic pathways

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED
1.	Introduction to biochemical science. Enzymes and coenzymes : mechanism of enzyme action , effect of temperature, pH, enzyme concentration and substrate concentration on the rate of enzyme reaction, specificity of enzymes, enzyme inhibition, kinetics of enzyme action, activation of enzymes & isoenzymes, nature and functions of enzymes involved in digestion.	8
2.	Metabolism of carbohydrates: Embden-Meyerhoff pathway, Kreb's cycle, Oxidative phophorylation and energy balance.	6
3.	Metabolism of lipids : Digestion and absorption of lipids.	4
4.	Metabolism of proteins: Amino acid and nitrogen pool, Nitrogen balance, Essential amino acids.	4
5.	Nutritional requirement under different conditions, deficiency	8

	disease condition, Protein Efficiency Ratio (PER), Besal Metabolic Rate (BMR). Deficiency diseases, dietary fibre and functional foods and nutraceuticals.	
	Class test	

REFERENCES:

Text Books

1. Lehninger, Nelson & Cox, Principle of Biochemistry, CBS Publication
2. Modern Experimental Biochemistry, Boyer, Pearson Education
3. Lubert stryer, Biochemistry, Freeman & Co, N.Y.

Reference books:

1. Voet & Voet, Fundamentals of Biochemistry, Jonh Willey & Sons
2. Instant Notes in Biochemistry by D. Hames & N. Hooper
3. Biochemistry by Debojyoti Das
4. Textbook of Biochemistry by E. S. West & W. R. Tod

FLUID MECHANICS

L	T	P		Course Code No.: **FPPC212**
2	0	0		
Total Contact hrs.: Lecture: 30 Tutorial: 0 Practical: 0 **Credit: 2**			**Total marks: 100**	**Theory:** End Term Exam.:60 P.A: 40

RATIONALE:

Besides the use of solids, as important engineering material, numerous are the examples of use/ application and handling of fluids (e.g. both liquids and gasses) in wide spectrum of engineering practice.
Flow of fluids through pipelines, conducts, different flow control equipment etc. in an industry is essentially important. There are many unit processes particularly in chemical, petrochemical, pharmaceutical, food processing, hydrometallurgical etc. Plants in which characteristics related to flow of fluid are of fundamental importance in design considerations.
It is therefore, necessary for an engineer planning career in Chemical/Food processing/Pharmaceutical etc. industries to study the characteristics associated with the flow of fluid, nature of fluids as also and selection of the characteristics of different fluid transformation and flow control devices.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Explain the basic principles of fluid mechanics
CO2: Analyze pipe flows as well as fluid machinery
CO3: Explain the transportation of fluid
CO4: Solve the problems of fluid mechanics

DETAILS COURSE CONTENTS

UNIT NO. & TITLE	CONTENT	TIME ALLOTTED (Hrs.)
1. Fluid dynamics:	Mechanism of fluid flow in pipe, viscous and turbulent flow. Reynold's number and critical velocity, Viscosity fluid head, Bernoulli's Theorem, Friction losses in pipe, Fannings equation, enlargement and contraction losses in fittings; Measurement of flow rate, Orifice and losses in fittings and Venturimeter, Orifice meter, Pitot tube, Weir, Rotameter (Simple problems)	15
2. Fluid Transportation	Transportation of fluid, pipes and tubes, Materials of construction standard pipe fittings, joints, valves and cocks, reducing and controlling valves, water hammer, air lift, Reciprocating and Centrifugal pumps, cavitation , pump heads and economic pipe diameter	15

REFERENCES:

Text Book:

1. Unit Operations of Chemical Engineering: McCabe, Smith & Harriot, TMH, 5th edition
2. Transport Processes & Unit operations: Geankopolis, PHI, 3rdedition
3. Introduction to Chemical Engineering: Walter L. Badger, Julius T.Banchero, Julius T. Bancheo

Reference books:

1. Chemical Engineering, Vol-I & II: Coulson & Richardson, Butterworth Heinemann
2. Foust, A.S., Wenzel, L.A., et.al. Principles of Unit Operations, 2nd edition,JWSPerry, Chilton & Green, Chemical Engineers' Handbook, MGH

FOOD ENGINEERING LAB

L	T	P		Course Code No.: **FPPC214**
0	0	2		
Total Contact hrs.: Lecture: 0 Tutorial: 0 Practical: 30 **Credit : 1**			**Total marks: 100**	**Practical:** End Term Exam.:40 P.A: 60

RATIONALE:

Aim of this course is to assist the students in using laboratory techniques common to basic Food Processing and to provide an opportunity to the students to evaluate the effective test methods used in sensory evaluation and analyze the resulting information

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Use laboratory techniques common to basic Food Processing.
CO2: Apply the principles that make a food product safe for consumption.
CO3: Interpret government regulations pertaining to food manufacturing.
CO4: Evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED
I	Testing of can	**30**
II	Preservation of fruits and vegetables by canning	
III	Dehydration of fruits and vegetables	
IV	Preparation and preservation of fruit juice	
V	Preparation of pickle, chutney, vinegar	
VI	Preparation of osmodried fruits & vegetables	
VII	Intermediate moisture food.	

FOOD PROCESSING AND PRESERVATION LAB I

L	T	P		Course Code No.: **FPPC216**
0	0	2		
Total Contact hrs.: Lecture: 0 Tutorial: 0 Practical: 30 **Credit: 1**			**Total marks: 100**	**Practical:** End Term Exam.:40 P.A: 60

RATIONALE:

This course aims to assist the students use laboratory techniques common to basic Food Processing/ Preservation and to provide an opportunity to the students to evaluate the effective test methods used in sensory evaluation and analyze the resulting information.

COURSE OUTCOMES:

After Completion of the course, students will be able to:

CO1: Use laboratory techniques common to basic Food Processing.
CO2: Apply the principles that make a food product safe for consumption.
CO3: Interpret government regulations pertaining to food manufacturing.
CO4: Identify the effective test methods used in sensory evaluation
CO5: Analyze the resulting information

DETAILS COURSE CONTENTS:

UNIT NO.	CONTENT	TIME ALLOTTED (Hrs.)
I	Preparation of dry onion/ chilli/ garlic	30
II	Preparation of bread	
III	Preparation of extruded food products	
IV	Manufacture of potato powder.	
V	Manufacture of candied fruits.	
VI	Production of milk powder by spray drying	
VII	Comparison of shelf life (nutritional Value and sensory test) of slow frozen and quick frozen food.	

FLUID MECHANICS LAB

L	T	P		Course Code No.: **FPPC218**
0	0	2		
Total Contact hrs.: Lecture: 0 Tutorial: 0 Practical: 30 **Credit : 1**			**Total marks: 100**	**Practical:** End Term Exam.:40 P.A: 60

RATIONALE:

This course aims to develop understanding of students regarding analytical experimental methods using sophisticated instruments and interpretation of experimental data

COURSE OUTCOMES:

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

CO1: Define process equipment via hands-on learning.

CO 2: Calibrate different flow meters

CO3: Analyze the experiments on flow regime and different flow meter

CO4: Measure the efficiency of pump

DETAILS COURSE CONTENTS

UNIT NO.	CONTENT	TIME ALLOTTED
I	To study different types of pressure gauges, manometers and valves	
II	To study and calibrate orifice meter and to find out the orifice Co-efficient	
III	To study and find out the co-efficient of discharge of venturimeter	
IV	To study and calibrate a rotameter and to determine the flow of fluids through a rotameter	
V	To study and find out the efficiency of a centrifugal pump.	

OPEN ELECTIVE

DISASTER MANAGEMENT

L	T	P		**Course Code: FPOE202A**
3	0	0		
Total Contact hrs.: Lecture: 45 Tutorial: 0 Practical: 0 **Credit : 3**			**Total marks: 100**	**Theory:** End Term Exam.:60 P.A: 40

RATIONALE

Disasters can be caused by both natural and man-made factors. They cannot be anticipated, and once they do, they must be handled with maturity, subtlety, and responsibility. Numerous immediate decisions must be made, and relief efforts must be planned and managed. Thus this course provides to all the engineers, a proper knowledge regarding the disasters along with how they affect the environment and living things.

COURSE OUTCOME

After completion of the course the students will be able to

CO1: Use of basic information on various types of disasters to control the disaster

CO2: Take the precautions during various disasters

CO3: Decide first action to be taken under various disasters

CO4: Communicate with others in India which are dealing with disasters

CO5: Select IT tools to help in disaster management

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	TIME ALLOTTED (HOURS)
UNIT-I	**Understanding Disaster** • Understanding the Concepts and definitions of Disaster, Hazard, Vulnerability, Risk, Capacity • – Disaster and Development, and disaster management	**05**
UNIT-II	**Types, Trends, Causes, Consequences and Control of Disasters** ▪ Geological Disasters (earthquakes, landslides, tsunami, mining); Hydro-Meteorological Di- sasters (floods, cyclones, lightning, thunder-storms, hail storms, avalanches, droughts, cold and heat waves) Biological Disasters (epidemics, pest attacks, forest fire); • Technological Disasters (chemical, industrial, radiological,	**10**

	nuclear) and Manmade Disasters(building collapse, rural and urban fire, road and rail accidents, nuclear, radiological, chemi-cals and biological disasters) Global Disaster Trends – Emerging Risks of Disasters – ClimateChange and Urban Disasters	
UNIT-III	**Disaster Management Cycle and Framework** ▪ Disaster Management Cycle – Paradigm Shift in Disaster Management. ▪ Pre-Disaster – Risk Assessment and Analysis, Risk Mapping, zonation and Microzonation, Prevention and Mitigation of Disasters, Early Warning System; Preparedness, Capacity De- velopment; Awareness. ▪ During Disaster – Evacuation – Disaster Communication – Search and Rescue – Emergency Operation Centre – Incident Command System – Relief and Rehabilitation – • Post-disaster – Damage and Needs Assessment, Restoration of Critical Infrastructure – Early Recovery – Reconstruction and Redevelopment; IDNDR, Yokohama Stretegy, Hyogo Frame-work of Action	**10**
UNIT-IV	**Disaster Management in India** • Disaster Profile of India – Mega Disasters of India and Lessons Learnt. • Disaster Management Act 2005 – Institutional and Financial Mechanism, • National Policy on Disaster Management, National Guidelines and Plans on Disaster Manage- ment; Role of Government (local, state and national),Non-Government and Inter Governmen-tal Agencies	**10**
UNIT-V	**Applications of Science and Technology for Disaster Management** • Geo-informatics in Disaster Management (RS, GIS, GPS and RS). • Disaster Communication System (Early Warning and Its Dissemination). • Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters • S&T Institutions for Disaster Management in India	**10**
	Total	**45**

SUGGESTED ACTIVITIES / FIELD OR SITE VISITS:

Disaster Management in India:

Disaster Profile of India – Mega Disasters of India and Lessons Learnt. Disaster Management Act 2005 – Institutional and Financial Mechanism, National Policy on Disaster Management, National Guidelines and Plans on Disaster Management; Role of Government (local, state and national),Non-Government and Inter Governmental Agencies.

Applications of Science and Technology for Disaster Management:

Geo-informatics in Disaster Management (RS, GIS, GPS and RS). Disaster Communication System (Early Warning and Its Dissemination). Land Use Planning and Development Regulations, Disaster Safe Designs and Constructions, Structural and Non Structural Mitigation of Disasters S&T Institutions for Disaster Management in India.

REFERENCES:

1. Publications of National Disaster Management Authority (NDMA) on Various Templates andGuidelines for Disaster Management
2. Bhandani, R. K., An overview on natural & man-made disasters and their reduction, CSIR,New Delhi
3. Srivastava, H. N., and Gupta G. D., Management of Natural Disasters in developing countries,Daya Publishers, Delhi
4. Alexander, David, Natural Disasters, Kluwer Academic London
5. Ghosh, G. K., Disaster Management, A P H Publishing Corporation
6. Murthy, D. B. N., Disaster Management: Text & Case Studies, Deep & Deep Pvt. Ltd.

RENEWABLE ENERGY TECHNOLOGIES

L	T	P		Course Code No.: **FPOE202B**
3	0	0		
Total Contact hrs.: Lecture: 4 5 Tutorial: 0 Practical: 0 **Credit : 3**			**Total marks: 100**	**Theory:** **End Term Exam.:60** **P.A: 40**

Rationale:

The aim of this course is to provide students an opportunity to study renewable energy and energy efficiency. A detailed study of bioenergy, solar energy, wind energy, and other sources are included in this course to provide a thorough understanding of the ideas and practises of renewable energy technology.

Course outcomes:

At the end of the course student will be able to

- Recognise present and future energy scenario of the world.
- Explain various methods of solar energy harvesting.
- Identify various wind energy systems.
- Evaluate appropriate methods for Bio energy generations from various Bio wastes.
- Identify suitable energy sources for a location.
-

Course Content:

UNIT NO.	CONTENT	TIME ALLOTTED (HRS.)
I	**Introduction:** World Energy Use; Reserves of Energy Resources; Environmental Aspects of Energy Utilisation; Renewable Energy Scenario in India and around the World; Potentials; Achieve- ments / Applications; Economics of renewable energy systems.	5
II	**Solar energy:** Solar Radiation; Measurements of Solar Radiation; Flat Plate and Concentrat- ing Collectors; Solar direct Thermal Applications; Solar thermal Power Generation Fundamentals of Solar Photo Voltaic Conversion; Solar Cells; Solar PV Power Generation; Solar PV Applications.	7
III	**Wind Energy:** Wind Data and Energy Estimation; Types of Wind Energy Systems; Perfor- mance; Site Selection; Details of Wind Turbine Generator; Safety and Environmental Aspects.	6

IV	**Bio-Energy:** Biomass direct combustion; Biomass gasifiers; Biogas plants; Digesters; Ethanol production; Bio diesel; Cogeneration; Biomass Applications.	6
V	**Other Renewable Energy Sources:** Tidal energy; Wave Energy; Open and Closed OTEC Cy- cles; Small Hydro-Geothermal Energy; Hydrogen and Storage; Fuel Cell Systems; Hybrid Systems.	6

Reference Books:

1. O.P. Gupta, Energy Technology, Khanna Publishing House, Delhi (ed. 2018)
2. Renewable Energy Sources, Twidell, J.W. & Weir, A., EFN Spon Ltd., UK, 2006.
3. Solar Energy, Sukhatme. S.P., Tata McGraw Hill Publishing Company Ltd., New Delhi, 1997.
4. Renewable Energy, Power for a Sustainable Future, Godfrey Boyle, Oxford University Press, U.K., 1996.
5. Fundamental of Renewable Energy Sources, GN Tiwari and MK Ghoshal, Narosa, New Delhi,2007.
6. Renewable Energy and Environment-A Policy Analysis for India, NH Ravindranath, UK Rao, BNatarajan, P Monga, Tata McGraw Hill.
7. Energy and The Environment, RA Ristinen and J J Kraushaar, Second Edition, John Willey &Sons, New York, 2006.
8. Renewable Energy Resources, JW Twidell and AD Weir, ELBS, 2006.

MINOR PROJECT

L 0	T 0	P 4	**Total Marks: 100**	**Course Code. No.: FPPR202**
Total Contact hrs.: **Practical : 60** **Credit: 2**				**Practical:** End Term Exam. :40 P.A. : 60

RATIONALE

Minor Project offers students an opportunity to apply theoretical knowledge in a practical setting, thereby enhancing their technical skill and problem solving skill. This course has been designed for students to understand the basics of carrying out any engineering project which includes Literature survey, methodology, setting up objective and scope of the project work.

COURSE OUTCOMES:

After completing this course, student will be able to:

CO1: Identify the objective and scope of work

CO2: Undertake interdisciplinary literature survey.

CO3: Prepare methodology of the project work.

CO4: Demonstrate necessary field and laboratory experiments.

CO5: Handle necessary equipment.

COURSE CONTENT DETAILS

UNIT NO.	CONTENT	HOURS
UNIT –I	**Objective and Scope of work** • Introduction to the project. • Clear statement of project objectives. • Explanation of the scope and limitations of the project. • Justification for why the project is important or relevant.	**12**
UNIT –II	**Literature Survey** • Review of existing literature and research related to the project. • Identification of gaps in current knowledge. • Discussion of relevant theories, models, and previous work in the field. • Proper citations and references to sources.	**12**
UNIT –III	**Methodology**	**12**

	• Detailed explanation of the research methods and approaches to be used. • Description of data collection techniques (if applicable). • Explanation of any experiments or simulations to be conducted. • Ethical considerations and research ethics, if applicable.	
UNIT –IV	**Handling of Instruments and Experiments** • Description of the tools, equipment, or software to be used. • Details on how experiments or simulations will be conducted. • Safety precautions and protocols, if relevant. • Data collection and analysis methods.	**12**
UNIT –V	**Comprehensive Progress Presentation** • Regular progress reports or presentations to track the development of the project. • Presentation of findings, data, and results obtained so far. • Discussion of any challenges encountered and how they were addressed. • Feedback received from mentors or advisors and any adjustments made to the project plan.	**12**

ESSENCE OF INDIAN KNOWLEDGE & TRADITION

L 2	T 0	P 0		Course Code No.: AU202
Total Contact hrs.: 30 Credit: 0				Progressive Assessment only

RATIONALE:

Considering the need of protecting Indian knowledge and tradition, the diploma level students of Automobile Engineering should be facilitated the concepts Indian traditional knowledge and to make them understand the importance of roots of knowledge system and methods of application in today's life and how to protect traditional knowledge system. Interpretation of the concepts of Intellectual property to protect the traditional knowledge as well as importance of Traditional knowledge in Agriculture and Medicine must be known.

COURSE OUTCOME:

On successful completion of the course, students will be able to:

CO1: Discuss the concepts of traditional Indian knowledge and roots of knowledge system and indigenous knowledge system
CO2: Explain the technique of protection of traditional Indian knowledge
CO3: Discuss legal frameworks of traditional knowledge
CO4: State intellectual property rights
CO5: State traditional knowledge in Different Sectors

COURSE CONTENT

UNIT	• TOPIC/SUB-TOPIC	HRS.	TOTAL HRS.
1	• Introduction to traditional knowledge: Define traditional knowledge, nature and characteristics, scope and importance, kinds of traditional knowledge (Unani / Siddha/ Ayurveda), Indigenous Knowledge (IK), characteristics, traditional knowledge vis-a-vis indigenous knowledge, traditional knowledge of Meghalaya	07	**30**
2	Protection of traditional knowledge (TK): The need for protecting traditional knowledge, Significance of TK Protection, value of TK in global economy, Role of Governmentto harness TK.	07	
3	Legal framework and TK: The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006, Plant Varieties Protection and Farmer's Rights Act, 2001 (PPVFR Act); The Biological Diversity Act 2002 and Rules 2004, the protection of traditional knowledge bill, 2016.	06	
4	Traditional knowledge and intellectual property: Systems of traditional knowledge protection, Legal concepts for the protection of traditional knowledge, Patents and traditional knowledge, Strategies to increase protection of traditional knowledge, Geographical Indications (GI).	04	
5	Traditional Knowledge in Different Sectors: Traditional knowledge and engineering, Traditional medicine system, TK in agriculture, Traditional societies depend on it for their food and healthcare needs, Importance of conservation and sustainable development of environment, Management of biodiversity, Food security of the country and protection of TK	06	

REFERENCE BOOKS:

1. Traditional Knowledge System in India, by Amit Jha, 2009.
2. "Knowledge Traditions and Practices of India" Kapil Kapoor.
3. Madhya Himalayi Sanskriti mein Gyan, Vigyan evam Paravigyan by Prof PC Pandey.

Suggested Online Link:

Web Links:
1.https://www.youtube.com/watch?v=LZP1StpYEPM
2.http://nptel.ac.in/courses/12110600/