

## STATE COUNCIL FOR TECHNICAL EDUCATION AND VOCATIONAL TRAINING, ODISHA

**TEACHING AND EVALUATION SCHEME FOR 4th Semester (FOOD TECHNOLOGY)(wef 2019-20)**

Subject Number	Subject Code	Subject	Periods/week			Evaluation Scheme			
			L	T	P	Internal Assessment/ Sessional	EndSem Exams	Exams (Hours)	Total
<b>Theory</b>									
Th.1		Organic Chemistry(C)	3	1	-	20	80	3	100
Th.2		Food Microbiology	3	1	-	20	80	3	100
Th.3		Fluid Mechanics and Heat Transfer	3	1	-	20	80	3	100
Th.4		Food chemistry	4	-	-	20	80	3	100
		<b>Total</b>	<b>13</b>	<b>3</b>	<b>-</b>	<b>80</b>	<b>320</b>	<b>-</b>	<b>400</b>
<b>Practical</b>									
Pr.1		Organic Chemistry Laboratory(c)	-	-	5	50	50	4	75
Pr.2		Food Microbiology Laboratory	-	-	5	50	50	4	75
Pr.3		Fluid Mechanics and Heat Transfer Laboratory	-	-	5	50	50	4	75
Pr.4		Food chemistry Laboratory	-	-	5	25	25	4	50
		Student Centered Activities(SCA)	-	-	3	-	-	-	-
		<b>Total</b>	<b>-</b>	<b>-</b>	<b>23</b>	<b>175</b>	<b>175</b>	<b>-</b>	<b>350</b>
		<b>Grand Total</b>	<b>13</b>	<b>3</b>	<b>23</b>	<b>255</b>	<b>495</b>	<b>-</b>	<b>750</b>

Abbreviations: L-Lecturer, T-Tutorial, P-Practical . Each class is of minimum 55 minutes duration

**Minimum Pass Mark in each Theory subject is 35% and in each Practical subject is 50% and in Aggregate is 40%**

**SCA shall comprise of Extension Lectures/ Personality Development/ Environmental issues /Quiz /Hobbies/ Field visits/ cultural activities/Library studies/Classes on MOOCS/SWAYAM etc. ,Seminar and SCA shall be conducted in a section.**

**There shall be 1 Internal Assessment done for each of the Theory Subject. Sessional Marks shall be total of the performance of individual different jobs/ experiments in a subject throughout the semester**

# Th-1 ORGANIC CHEMISTRY

Common to Chemical, Biotechnology & Food Technology

<b>Theory:4 Periods per Week</b>	<b>Internal Assessment: 20 Marks</b>
<b>Total periods:60 Periods</b>	<b>Term End Examination: 80 Marks</b>
<b>Examination: 3 Hours</b>	<b>Total Marks: 100 Marks</b>

## Rationale:

Study of organic chemistry as a separate subject is more practical and fruitful. The knowledge of structure and function of a large no. of compounds built of relatively few elements is important for future food-technologist.

## Objective:

On completion of study of Organic Chemistry, the student will be able to:

1. Name organic compound in IUPAC system
2. Understand the concept of isomerisation
3. Acquaint themselves with methods preparation, properties and use of common aromatic and aliphatic compounds.
4. Acquire knowledge carbohydrates, proteins and amino acids.

## Topic wise distribution of periods

Sl. No.	Topics	Periods
1	Nomenclature	08
2.	Aliphatic Compounds	20
3.	Aromatic Compounds	09
4.	Carbohydrates, Proteins & fats	23
	<i>Total</i>	<b>60</b>

## COURSE CONTENT

### 1.0 IUPAC NOMENCLATURE

- 1.1 Scope of organic chemistry
- 1.2 Differentiate organic compound and inorganic compounds
- 1.3 Importance of organic Chemistry in modern life.
- 1.4 Classification and sources of organic compounds
- 1.5 IUPAC naming of mono functional and poly functional Organic Compound.
- 1.6 Concept, type and example of isomerism

## 2.0 ALIPHATIC COMPOUNDS

- 2.1 Methods of preparations, properties and uses of  $\text{CH}_4$  and  $\text{C}_2\text{H}_6$ .
- 2.2 Methods of preparations properties of ethylene.
- 2.3 Methods of preparation, properties and uses of acetylene.
- 2.4 Methods of preparation properties and uses of methanol and ethanol.
- 2.5 Absolute alcohol and denatured alcohol.
- 2.6 Methods of preparation properties and uses of formic acid and acetic acid.
- 2.7 Methods of preparation properties and uses of formaldehyde and acetone.

## 3.0 AROMATIC COMPOUNDS

- 3.1 Methods of preparation, properties and uses of  
(a) Benzene (b) Toluene
- 3.2 Methods of preparation, properties and uses of Benzene derivative  
compound  
(a) Phenol (b) Benzaldehyde

## 4.0 CARBOHYDRATES, PROTEINS & FATS

- 4.1 Classification of carbohydrates
- 4.2 Synthesis and inter conversions of monosaccharides
- 4.3 Manufacturing properties and uses of glucose, fructose, sucrose, and starch.
- 4.4 Preparation, properties and uses of Amino acid
- 4.5 Classification of proteins, Peptides
- 4.6 Properties and uses of proteins.
- 4.7 Sources, Properties and uses of fats.

### Syllabus Coverage up to I.A

- Chapter 1,2,3

### Learning Resources:

Sl No	Author	Title	Publication
1	B.S. Bahl, Arun Bahl	A Text Book of Organic Chemistry	S. Chand

## Th-2 FOOD MICROBIOLOGY

<b>Theory: 4 Periods per Week</b>	<b>Internal Assessment: 20 Marks</b>
<b>Total periods: 60 Periods</b>	<b>Term End Examination: 80 Marks</b>
<b>Examination: 3 Hours</b>	<b>Total Marks: 100</b>

### Rationale :

There are enormous annual issues of food materials, throughout the world, which are attributable directly to spoilage by the action of “micro-organisms”. Such losses may have far reaching economic and political results as for example, the great potato blight in Ireland during the nineteenth century.

Many bacteria, fungi and viruses cause food poisoning infections and information which may vary in severity from the very mild to the fatal. Food commodities such as bread, fermented milk and vegetables and alcoholic beverages have a significant place in the diet of today. Knowledge of the organisms responsible for such products is essential to improve or control the quality of such foods. Newer foods and food processes may depend on the use of micro-organisms, the production of “single cell” protein and fermented foods being typical examples. Additionally, the use of micro-organisms for the utilization of food processing waste and the growth of the food industry on economic grounds and the community at large on ecological grounds. An application of microbiology is therefore essential to food technologists if they are to control or exploit the natural metabolic processes to the community.

### Topic wise distribution of periods

<b>Sl. No.</b>	<b>Topics</b>	<b>Periods</b>
1	Introduction	10
2.	Culture Method	10
3.	Microscopy	05
4.	Morphology	05
5.	Physiology	15
6.	Growth & inhibition	15
	<b>Total</b>	<b>60</b>

## CONTENTS: Theory

Sl. No.	Name of the Topics
1	INTRODUCTION 1.1 History of microbiology, micro-organisms and men 1.2 Classification of micro-organisms : Bacteria, Yeast, Fungi, Algae, Protozoa, Viruses
2.	CULTURE METHODS 2.1 Methods of isolation of pure culture, Media preparation, Culture maintenance media 2.2 Techniques of culturing, asepsis
3.	MICROSCOPY 3.1 Microscope, Different types of microscopes methods of microscopic examination 3.2 Staining techniques
4.	MORPHOLOGY 4.1 Morphological and cultural characteristics of bacteria and fungi 4.2 Vegetative cells, spores, motility
5.	PHYSIOLOGY 5.1 Physiology of micro-organisms 5.2 Autotrophs & Heterotrophs, chemosynthetic, saprophytes & parasites, Aerobes & Anaerobes, microaerophilic, psychrophiles, mesophiles and thermophiles.
6.	GROWTH & INHIBITION 6.1 Factors affecting growth and death, Cell division, Budding, Sporulation, Fragmentation 6.2 Growth optima, Phases of growth 6.3 Control of Microbial spoilage by various food preservation methods(Low temperature, high temperature, irradiation, dehydration, chemicals) in fruit & vegetables.

### **Syllabus Coverage up to I.A**

Chapter 1,2,3,4

### **Learning Resources:**

Sl No	Author	Title	Publication
1	W.C.Frazier & D.C.Westhoff ,TMH, New York	Food Microbiology	
2	James Jay ,CBS, New Delhi	Modern Food Microbiology	
3	G. J. Banwart	Basic Food Microbiology	

## Th 3 FLUID MECHANICS & HEAT TRANSFER

<b>Theory:4 Periods per Week</b>	<b>Internal Assessment: 20 Marks</b>
<b>Total periods: 60 Periods</b>	<b>Term End Examination: 80 Marks</b>
<b>Examination: 3 Hours</b>	<b>Total Marks: 100</b>

### Rationale :

Fluid statics, fluid flow phenomena, flow measurement, fluid flow through pipe lines, fluidized bed etc. in an industry are essentially important. There are many unit processes particularly in chemical, petrochemical, pharmaceutical, hydro-metallurgical etc. plants in which fluid flow phenomena are of fundamental importance in design consideration. It is therefore, necessary for an engineer planning career in chemical, petrochemical etc. industries to study fluid flow phenomena, selection of the characteristics of different fluid transportation and flow control devices.

**Objectives:** On completion of studies of fluid mechanics the student will be able to

- (i) Distinguish the fundamental and derived units, derived dimensional formula of various physical quantities
- (ii) Understand and explain between fluid statics and fluid dynamics
- (iii) Solve problems on flow measurement, Bernoulli's equation etc.
- (iv) Acquaint themselves with various kinds of pumps, blowers & fans
- (v) Understand various fluid properties like density, viscosity and critical velocity, Reynolds number etc.
- (vi) Acquire problem solving skill and improvisation of the process.

### Topic wise distribution of periods

SI. No.	Topics	Periods
1	INTRODUCTION TO FLUID STATICS	10
2.	FLUID FLOW PHENOMENA AND FLUIDISATION	10
3.	FLOW MEASUREMENT AND TRANSPORTATION OF FLUID	10
4.	CONDUCTION	10
5.	CONVECTION	10
6.	HEAT EXCHANGERS AND EVAPORATORS	10
	<b>TOTAL</b>	<b>60</b>

### Contents:

#### 1.0 INTRODUCTION TO FLUID STATICS

- 1.1 Classify fluid
- 1.2 Properties of fluid
- 1.3 Newton's Law of viscosity
- 1.4 Differentiate Newtonian & Non-Newtonian fluid
- 1.5 Derive an equation of pressure head.

## **2.0 FLUID FLOW PHENOMENA AND FLUIDISATION**

- 2.1 Types of flow
- 2.2. Reynolds's experiment
- 2.3 Mechanism of fluid flow in pipes
- 2.4 Derived Bernoulli's theorem
- 2.5 Friction factor and estimate friction loss in pipes
- 2.6 Fluidisation
- 2.7 Pressure drop equation in fluidised bed.
- 2.8 Fluid flow characteristic in packed bed.

## **3.0 FLOW MEASUREMENT AND TRANSPORTATION OF FLUID**

- 3.1 Flow measurement and Transportation of fluid.
- 3.2 Fluid flow through orifice meter, venturi meter and derive an expression for flow measurement, solve simple problems on it.
- 3.3 Construction and working of rotameter.
- 3.4 Differentiate pipe and tube.
- 3.5 Standard pipe fittings
- 3.6 Construction and operation of different types of valves.
- 3.7 Classify pumps.
- 3.8 Construction and operation of centrifugal pump.

## **4.0 CONDUCTION**

- 4.1 Heat low concept in conduction.
- 4.2 Steady state and unsteady state conduction.
- 4.3 Fourier's law of conduction.
- 4.4 Derive an equation of hear flow in a composite wall and a cylinder.
- 4.5 Optimum thickness of insulation.
- 4.6 Solve problems on conduction.

## **5.0 CONVECTION**

- 5.1 Classify convection
- 5.2 Heat flow phenomenon in convection
- 5.3 Derive equation of individual and overall heat transfer co-efficient.
- 5.4 Different dimensionless no. used in convection and discuss different empirical equation on heat flow by convection.
- 5.5 Parallel, co-current and counter current flow.
- 5.6 Log mean temperature difference.

## **6.0 HEAT EXCHANGERS AND EVAPORATORS**

- 6.1 Classify heat exchanger.
- 6.2 Construction and working of single pass, and multipass, shell and tube heat exchangers.
- 6.3 Energy balance for shell and tube heat exchanger and solve problems.
- 6.4 Classify evaporator
- 6.5 Construction and operation of different types of evaporators
- 6.6 Solve simple material balance and energy balance problems

### **Syllabus Coverage up to I.A**

Chapter 1,2,3,4

### **Learning Resources:**

SI No	Author	Title	Publication
1	Macable & J.M.Smith	'Unit operation for Chemical Engineers'	McGraw-Hill
2	Badgero and Banchemo	Introduction to Chemical Engineering	McGraw-Hill
3	Ghosh, Sanyal and Dutta	Introduction to Chemical Engineering	McGraw-Hill
4	Richardson & Coulson.	Chemical Engineering Vol.II	



## Th-4 FOOD CHEMISTRY

<b>Theory: 4 Periods per Week</b>	<b>Internal Assessment: 20 Marks</b>
<b>Total periods:60 Periods</b>	<b>Term End Examination: 80 Marks</b>
<b>Examination: 3 Hours</b>	<b>Total Marks: 100 Marks</b>

### Rationale :

Food chemistry has its roots in fermentation, Nutrition , Agriculture , Medicine and Natural products. Today, it is principally concerned with the chemistry of molecules found in and associated with living system especially the chemistry of the interaction of this molecule. Developing this understanding has required the careful application of physical & chemical laws and methods in combination with the careful biological manipulation of the system under study. Several modern biochemical approaches take advantage of technology advances to study intact system.

### *Topic wise distribution of periods*

<b>Topics</b>	<b>Hours</b>
1.0 Carbohydrate	10
2.0 Proteins	10
3.0 Lipids	10
4.0 Vitamins	05
5.0 Enzymes	05
6.0 Metabolism of Carbohydrates	05
7.0 Metabolism of lipids	05
8.0 Metabolism of proteins	05
9.0 Minerals	05
<b>Total</b>	<b>60</b>

<b>Topics</b>
<b>10.0 Carbohydrate</b>
10.1 Introduction
10.2 Structure
10.3 Classification and general properties of sugar(physical and chemical)
10.4 Physiological functions of carbohydrates

<b>11.0 Proteins</b>	11.1 Introduction 11.2 Amino Acid sequence in proteins 11.3 Physical and Chemical Properties of amino acids and proteins 11.4 Food protein and their characteristics
<b>12.0 Lipids</b>	12.1 Introduction 12.2 Classification of Lipids. 12.3 Acid number, iodine value, acetyl value, Reichert-Meissl number 12.4 Hydrolytic and oxidative rancidity, preservation of rancidity, reversion
<b>13.0 Vitamins</b>	13.1 Occurrence, Chemistry, Classification 13.2 Deficiency diseases and high intakes
<b>14.0 Enzymes</b>	14.1 Classification and nomenclature, 14.2 mechanism of enzyme action 14.3 Effect of temperature, PH, enzyme concentration and substrate concentration on the rate of enzyme reaction. 14.4 Specificity of enzyme, enzyme inhibition, kinetics of enzyme action, activation of enzymes 14.5 Functions of enzymes involved in digestion.
<b>15.0 Metabolism of Carbohydrates</b>	15.1 Embolden Meyer Hoff pathway 15.2 Kerb's Cycle 15.3 Glycogenesis, Glycogenolysis, Gluconeogenesis
<b>16.0 Metabolism of lipids</b>	16.1 Digestion and absorption of lipids
<b>17.0 Metabolism of proteins</b>	17.1 Nitrogen pool, nitrogen balance 17.2 Evaluate quality of proteins 17.3 Metabolism of proteins and amino acids.
<b>18.0 Minerals</b>	18.1 Macronutrients 18.2 Micronutrients

**Syllabus Coverage up to I.A**

Chapter 1,2,3,4,5

**Learning Resources:**

SI No	Author	Title	Publication
1	M.A.Siddiqi & A.Q. Siddiqi,	Hand Book of Biochemistry	Unique offset Press
2	A.Lehninger	Text Book of Biochemistry	
3	Eric E. Con	Outlines of Biochemistry	

# Pr-1 ORGANIC CHEMISTRY LABORATORY

Common to Chemical, Biotechnology & Food Technology

Name of the Course: Diploma in Food Technology			
Total period	75	Examination	3hrs
Lab periods	5p/week	Internal assessment	50
Maximum Marks	100	End Semester Exam.	50

Sl. No.	List of Experiments	No. of Periods
1.	Detect the following elements in the organic compound	30
	i) Nitrogen	
	ii) Sulphur	
	iii) Halogen	
2.	Determine different functional groups of	30
	i) Carboxylic group	
	ii) Phenolic group	
	iii) Alcoholic group	
	iv) Aldehyde group	
	v) Ketonic group	
3.	Prepare in Laboratory	15
	(i) Oxalic acid (ii) Benzoic acid (iii) Methyl Orange	

## Learning Resources:

Sl No	Author	Title	Publication
1	Dr S K Nayak,	Practical Chemistry for +2 students	ABC Publication
2	O.P. Pandey D.N. Bajpai	Practical Chemistry for B.Sc Students	S Chand

## Pr-2 FOOD MICROBIOLOGY LABORATORY

Name of the Course: Diploma in food Technology			
Course period		Semester	3rd
Total period	75	Examination	3hrs
Lab periods	5p/week	Internal assessment	50
Maximum Marks	100	End Semester Exam.	50

Sr No.	Content	No of periods
1	Study of Microscope and their parts.	05
2	Straining of Bacteria and observe size , motility, metachromatic granular and spores.	05
3	Morphology of Bacteria , moulds, yeasts	10
4	Prepare nutrition growth and media with agar, gelatine and special media for culture of microbes.	05
5	Sterilisation of glassware and media.	05
6	Isolate pure culture from water, milk,. Fruit juice, fish, meat etc.	05
7	Determine bacterial species .	10
8	Determine thermal death time.	05
9	Methylene blue reduction test.	05
10	Bacteriological examination of water and milk.	10
11	Quality assessment of processed food.	05
12	Isolate the faecal coliform from sewage water and determine the MPN(most probable No.)of sample	05

## Pr-3 FLUID MECHANICS AND HEAT TRANSFER LABORATORY

Name of the Course: Diploma in food Technology			
Course period		Semester	3rd
Total period	75	Examination	3 hours
Lab periods	5p/week	Internal assessment	50
Maximum Marks	100	End Semester Exam.	50

### List of experiments :

Sr. No.	Name of experiment	No of Periods
1	Demonstrate operation of Reynolds's apparatus and find out critical velocity	10
2	Verify Bernoulli's equation	10
3	Demonstrate operation of venturi meter and determine the venturi co-efficient	10
4	Demonstrate operation of Orifice meter and determine the Orifice co-efficient	10
5	Demonstrate operation of a Rotameter and determine rate of flow through Rotameter	05
6	Demonstrate operation of a centrifugal pump	05
7	Demonstrate operation of a fluidized bed column packed bed column	05
8	Demonstrate heat transfer through composite wall and find the resistance of wall	05
9	Demonstrate operation of multi pass, horizontal hear exchanger and determine H & U	05
10	Demonstrate heat transfer in forced convection	05
11	Study of valves & pipe fittings	05

## Pr-4 FOOD CHEMISTRY LABORATORY

Name of the Course: Diploma in Food Technology			
<b>Course period</b>		<b>Semester</b>	<b>3rd</b>
<b>Total period</b>	<b>75</b>	<b>Examination</b>	<b>3 hours</b>
<b>Lab periods</b>	<b>5p/week</b>	<b>Internal assessment</b>	<b>25</b>
<b>Maximum Marks</b>	<b>50</b>	<b>End Semester Exam.</b>	<b>25</b>

<b>Sl.No.</b>	<b>Name of Experiment</b>	<b>No. of periods</b>
1	Determination of moisture content.	03
2	Detection of reducing sugar by Fehling and Benedict test.	03
3	Quantitative determination of reducing sugar by Lane and Eynon method.	03
4	Determination of fibre content of different food material and compare them.	03
5	Detection of amino acid, protein and peptides by Ninhydrin test.	06
6	Determination of protein quantity by Kjeldahl method.	06
7	Determination of acid test.	03
8	Extraction of fat by Soxhlet apparatus.	06
9	Determination of Ash content.	03
10	Detection of presence of starch by Iodine test.	03
11	Determination of water activity of different food materials.	03
12.	To distinguish between mono-saccharides and di-saccharides of Barfoed test.	03