Teaching Scheme and Syllabi of B.E. (Food Tech.)
(2023-2027)

Note:

- NSS/NCC/Sports proficiency/Community services/Professional society activities/placement activities/clubs/technical magazine/conferences/research papers/Technical activities related to the field of Engineering (1st to 3rd year, 1credits to be earned in 7th semester)

L: Lectures/Week, T: Tutorials/Week, P: Practical Hours/Week

Assessment will consist of the following components

Teaching Scheme and Syllabi of B.E. (Food Tech.)
(2023-2027)

First Year
1st SEMESTER

S. No.	Course code	Courses	Contact hrs per week			Mid Term	End Term	Total Marks	Credits
			L	T	P				
1	BS101	Mathematics –I	3	1	-	50	50	100	**4**
2	BS105	Organic Chemistry	3	-	-	50	50	100	3
3	ESC 103	Electrical & Electronics Engineering	3	1	-	50	50	100	4
4	PCC 101	Introduction to Engg and Technology	2	1	-	50	50	100	3
5	HSMC 101	Communication Skills	2	-	-	50	-	50	2

Teaching Scheme and Syllabi of B.E. (Food Tech.)

(2023-2027)

3rd SEMESTER

7thSEMESTER

S. No.	Course code	Courses	Contact hrs per week			Mid Term	End Term	Total Marks	Credits
			L	T	P				
	PCC 116	Process Dynamics & Control	3	1	-	50	50	100	4
1.	OEC 101	**Open Elective I** Spices and Flavour Technology	3	-	-	50	50	100	3
2.	PCC 214	Food Regulation and Quality Control	3	-	-	50	50	100	3
4.	PCC 215	Packaging Technology	3	-	-	50	50	100	3
5.	OEC102	**Open Elective – II** Biochemical Engg	3	1	-	50	50	100	4
6.	PCC260	Quality Control and Packaging Lab.	-	-	2	50	-	50	1
	PCC 159	Process Dynamics & Control Lab.	-	-	3	50	-	50	1.5
8.	CHE 103	Major Project	-	-					

LIST OF ELECTIVES

S.No.	Department Electives	S.No.	Open Electives
1.	Chemical Engineering Thermodynamics	1.	Spices and Flavor Technology
2.	Process Instrumentation	2.	Biochemical Engineering
3.	Project Management	3.	Industrial Safety & Hazards
4.	Functional foods and nutraceuticals	4.	Industrial microbiology
5.	Food plant sanitation and waste management	5.	Plant design & Sanitization
6.	Food Product development	6.	Post harvest Engineering
7.	Food Engineering	7.	Fuel Cell Technology

COURSES- Minor Engineering in Software Applications

S.NO	COURSE NAME	Semester	CREDITS (20)
1	Joy Of Computing Using Python	3rd Semester	3
2	Database Management System	4th Semester	2
3	Data Analytics With Python	5th Semester	4
4	Introduction To Machine Learning	6th Semester	3
5	Ethical hacking	7th Semester	4
6	Modern Application Development	8th Semester	4

1. Joy of computing using python-NPTEL-IIT Ropar

Week 4: Hypothesis testing
Week 5: Two sample testing and introduction to ANOVA
Week 6: Two way ANOVA and linear regression
Week 7: Linear regression and multiple regression
Week 8: Concepts of MLE and Logistic regression
Week 9: ROC and Regression Analysis Model Building
Week 10: c test and introduction to cluster analysis
Week 11: Clustering analysis
Week 12:Classification and Regression Trees (CART)

4. Introduction to Machine Learning -NPTEL-IIT KHARAGPUR
Course Duration -8 weeks
No. of hours – 30
Credits - 3

Course content
Week 01 : Introduction: Basic definitions, types of learning, hypothesis space and inductive bias, evaluation, cross-validation
Week 02 : Linear regression, Decision trees, over fitting.
Week 03 : Instance based learning, Feature reduction
Week 04 : Probability and Bayes learning.
Week 05 : Logistic Regression, Support Vector Machine, Kernel function and Kernel SVM.
Week 06 : Neural network: Perceptron, multilayer network, backpropagation, introduction to deep neural network.
Week 07 : Computational learning theory, PAC learning model, Sample complexity, VC Dimension, Ensemble learning.
Week 08 : Clustering: k-means, adaptive hierarchical clustering, Gaussian mixture model.

5. Ethical hacking -NPTEL-IIT Kharagpur
Course Duration -12 weeks
No. of hours – 45
Credits - 4

Course Content
Week 1 : Introduction to ethical hacking. Fundamentals of computer networking. TCP/IP protocol stack.
Week 2 : IP addressing and routing. Routing protocols.
Week 3 : Introduction to network security. Information gathering: reconnaissance, scanning, etc.
Week 4 : Vulnerability assessment: OpenVAS, Nessus, etc. System hacking: password cracking, penetration testing, etc.
Week 5 : Social engineering attacks. Malware threats, penetration testing by creating backdoors.
Week 6 : Introduction to cryptography, private-key encryption, public-key encryption.
Week 7 : Key exchange protocols, cryptographic hash functions, applications.
Week 8 : Steganography, biometric authentication, lightweight cryptographic algorithms.
Week 9 : Sniffing: Wireshark, ARP poisoning, DNS poisoning. Hacking wireless networks, Denial of service attacks.
Week 10 : Elements of hardware security: side-channel attacks, physical unclonable functions.
Week 11 : Hacking web applications: vulnerability assessment, SQL injection, cross-site scripting.
Week 12 : Case studies: various attacks scenarios and their remedies.

6. Modern Application Development NPTEL-IIT Madras
Course Duration -12 weeks
No. of hours – 45
Credits - 4
Course Content
Week 1 and 2 : From desktop application to internet application

Week 3 and 4 : Stateful applications
Week 5 and 6 : The front end
Week 7 and 8 : Databases and Simple files
Week 9 : Setting up a website
Week 10 : Using third party web services
Week 11 and 12: Extended project

FIRST YEAR

1st SEMESTER

Title	**MATHEMATICS-I**		**Credits**	04
Code	BS101		**L T P**	3 1 0
Max. Marks	**End term- 50**	**Mid Term- 50**	**Elective**	N
Pre requisites				
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**			
Course Objectives	To make the students 1. Learn the concepts related to multivariable functions their differentials andvector differential calculus. 2. Understand the behavior and use of infinite series. To convert line integral to surface integral to volume integral. 3. Learn the methods of evaluating multiple integrals and their applications to various problems. 4. Learn the methods to formulate and solve linear differential equations.			
Course Outcomes	CO 1: Understand the concept of multivariable functions, their differentials and vector differential calculus. CO 2: To test the behavior of infinite series, operating vectors and converting line integral to surface integral to volume integral. CO 3: Evaluate multiple integrals and apply them to practical problems. CO 4: Formulate and solve linear differential equations.			

Unit I

Multivariable Functions:

Limit, Continuity and Partial Derivatives; Euler's Theorem for Homogeneous functions; Differentiability, Linearization and Differentials; Chain rule; Extreme values and Saddle Points; Lagrange multipliers; Taylor's Formula.

Vector Differential Calculus:

Scalar and vector fields, Gradient of a scalar field, Divergence and Curl of vector field.

15 hrs.

Unit II

Infinite Series:

Infinite series and convergence, alternating series, power series and convergence. Taylor's and Maclaurin's Series.

Vector Integral Calculus/Theorems:

Stateme(a)-1.783( )-3.01205( )-3.01205( )-3.01205( )-3.01205( )97(s)3.45915 s

	2. E. Kreyszig: Advanced Engineering Mathematics, Eighth Edition, John Wiley.
Reference Books:	1. B. V. Ramana: Higher Engineering Mathematics, Tata McGraw Hill. 2. B. S. Grewal: Higher Engineering Mathematics, 41st Edition, Khanna Publishers, Delhi. 3. Differential Equations, Frank Ayers, TMH

Title	**Organic Chemistry**			**Credits**	3
Code	BS105			**L T P**	3 - -
Max marks	**End term- 50**	**Mid Term- 50**		**Elective**	N
Pre-requisites					
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**				
Course Objectives	1.Learn and understand the concept of molecular orbital structures, intermediates and basic knowledge regarding acidity and basicity. 2. To understand the stereochemistry of organic compounds . 3. To explain the formation and mechanism of different reaction –free redical, elimination, addition and subtitution reactions and polymerization reactions. 4 . To understand the mechanism of electrophilic and nucleophilic substitution reactions and synthetic utilty of organometallic compound and grignard reagent.				
Course Outcomes:	On completion of this course, students will be able to:				

Title

principleandconstructionofDCMachines,typesofDCMachine&E.M.Fequations.

(10)

Unit III
SemiconductorDiodesandTransistors

GeneralintroductiontoElectronics.ConceptofstiffVoltageandCurrentSource.PNJunction,Depletionlayer,BarrierPotential,ForwardandReverseBias,Breakdownvoltage,V-Icharacteristics,Halfwaveandfullwaverectifiers,Zenerdiode.Introductiontojunctiontransistors,Transistoramplifyingaction,CB,CE, CC-configurationcharacteristics.

(10)

Unit IV
DigitalElectronics

BinaryandHexadecimalnumbersystem,conversionofnumbersfromonesystemtoother,BooleanAlgebraandLaws:Commutative,AssociativeandDistributiveLaws.Concept of flip-flops, K-maps, RS, JK flip flopsops,

process instrumentation, process control and economics.
UNIT II

Course Objectives	1. To inculcate effective communication skills in students for better performance in professional as well as personal life. 2. To improve Speaking skills of sudents so that they can effectively handle interviews, GD's and public speaking. 3. To understand and acknowledge the influence of media, culture, power on communication. 4. To improve technical writing skills of students.
Course Outcomes	1. Holistic development of students by thorough knowledge of effective and enhanced communication skills, learning proper social and professional etiquettes 2. Students will understand the importance of communication in both professional and personal life 3. Increase in employment prospective of students by developing effective speaking skills. 4. Improved technical writing skills of students.

UNIT 1	
Topic	**No. of Hours**
Advanced Communication Skills Scope, Significance, Process of Communication in an Organization, Types and Levels, Communication Networks, Technical Communication, Tools of Effective Communication, Barriers of Communication.	**3**
Personality Development Body Language and importance of Non Verbal communication, Social and Professional etiquettes.	**6**

UNIT 2	
Topic	**No. of Hours**
Speaking Skills Learning Interpersonal Communication, Presentation Skills, Voice Modulation, Persuasion, Negotiation and Linguistic Programming.	**5**

Title	**COMMUNICATION SKILLS LAB.**		**Credits**	1
Code	**HSMC 151**	**Semester:- 2nd**	**L T P**	- - 2
Max. Marks	**Practical –** 50		**Elective**	N
Pre-requisites				

2	**eaking Techniques** Preparation of Interviews, Participation in Group Discussions and Case Studies, Making and Presenting Power Point Lectures.	15
3	**vanced Sp**	

Competence in professional ethics: a. Ability to utilize the professionalcompetence for augmenting universal human order b. Ability to identify the scopeand characteristics of people friendly and eco-friendly production systems, c.Abilitytoidentifyanddevelopappropriatetechnologiesandmanagementpatterns for above productionsystems.

Case studies of typical holistic technologies, management models andproductionsystems

Strategy for transition from the present state to Universal Human Order: a. Atthe level of individual: as socially and ecologically responsible engineers,technologists and managers b. At the level of society: as mutually enrichinginstitutionsand organizations

Sumup.

Include practice Exercises and Case Studies will be

course, without including anything else or excludingany part of this content. Additional content may be

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	2. To understand the basic constructs and syntax of C++ to develop programs. 3. To develop programs using derived datatypes. 4. To develop an understanding of user defined datatypes and MS-Excel to solve engineering computation program
Course Outcomes	1. The students will understand the need for computers and computer programming. 2. The students will be able to develop logical skills for problem-solving thereby developing programs. 3. The students will efficiently develop programs using arrays for matrix calculations,

Reference Books:	1. Kamthane, "Object Oriented Programming in ANSI and Turbo C++" Pearson Education India 2. Lafore ,Robert "Object Orients Programming in C++"
Course Assessment Methods	Assessment will consist of the following components 1.Mid-Term a. One best of two minor tests (50% of Mid -term marks) b. Assignments (20% of Mid-term marks) c. Class Surprise Tests/ Quizzes/Presentations/Term paper (20% of Mid-term marks) d. Attendance. (10% of Mid-term marks) 2.End –Term

Title	**ENGINEERING GRAPHICS**		**Credits**	2
Code	ESC 102		**L T P**	2 - -
Max. Marks	**End term- 50**	**Mid Term- 50**	**Elective**	N
Pre requisites				
Note for Examiners:	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**			

THEORY

cylinder, frustum and truncated solids, Projection of solids, section plane, Sectioning of solids, full section view, half section view. (7 Hours)

UNIT-IV

Isometric Projection:Principle of isometric projection, isometric scale, isometric view and isometric projection, isometric projections of planes and solids in different positions. (4 Hours)

Development of Surfaces: Importance of development of surface of objects, parallel line method and radial line method, development of surfaces of simple and truncatedprism, cylinder, pyramid and cone. Introduction to assembly drawingusing freehand sketching. (4 Hours)

***Boo co nd d*:**

Recommended Books:

1. P.S. Gill: Engineering Drawing
2. R.K. Dhawan : A textbook of engineering Drawing,

(Number of lab. Hrs. 3 per experiment)

Total 48 lab. Hrs.

1. To find the energy band gap of the given semiconductor by four probe method.
2. To study the Hall Effect of a given semiconductor
3. To determine the dielectric constant of the given materials.
4. To study the B-H curve of the ferromagnetic materials.
5. To determine the value of e/m for electron by long solenoid (helical) method.
6. To study the variation of magnetic field with distance along the axis of a circular coil carrying current by plotting a graph
7. To find the wavelength of sodium light using Fresnel's biprism.(3)
8. (i) To determine the wavelength of He-Ne laser using transmission grating.
   (ii) To determine the slit width using the diffraction pattern.
9. To determine the wave length of sodium light by Newton's rings method.
10. To determine the wave length of sodium light using

Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**

Course Objective: The course objective is to inculcate fundamental aspects of fluid flow and apply basic principles of fluid static and fluid dynamics to various chemical engineering problems.

Course Outcome :

- Understand and solve hydrostatic problems related to forces on submerged bodies and pressure measurement.
- To understand fluid flow phenomena and study basic equations of fluid flow
- Study of incompressible fluids to energy losses in pipes and Dimentional analysis
- To understand the concept of compressible flow and study of flow measuring devices.

Unit I

Fluid Statics: Hydrostatic equilibrium, Manometers, Pressure measurements, Normal forces in fluids, Forces on submerged bodies, Buoyancy and stability

Unit II

Fluid Flow Phenomena: Potential flow, Newtonian and non-Newtonian fluids, Viscosity, Reynolds number,Nature of turbulence, Eddy viscosity, Flow in boundary layers (laminar and turbulent flow), Transition length, Boundary layer separation.

Unit III

Fluid flow of incompressible fluids: Bernoulli's equation, Kinetic energy and momentumcorrection factors, Pump work in Bernoulli's equation, Navier-Stokes equation.

Dimensional analysis: Rayleigh’s and Buckingham’s theorem, applications of dimensional analysis to Fluid Flow

	particle sizes of particles in mixtures, sphericity, and laws of crushing. Classification of SR equipments, power consumption of various machines, description and working of Size reduction equipments and their applications, understand various screening techniques and equipments, capacity and effectiveness of screens, standard screens
CO2:	Understanding and applying concepts of Flow around a single particle drag force and drag coefficient, settling velocity of particles in a fluid, hindered and free settling of particles, thickening and gravity separation, types of settling devices.
CO3:	Understand and apply knowledge of Filtration Processes, constant pressure and constant

Max.Marks	**End term-50**	**Mid term-50**	**Practical --**	**Elective**	N
Pre requisites					
THEORY			**Time**		3 Hours
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2**				

vitamins: A, B, C, D, E, K, Losses during processing and storage.Food Additives: Types; Methods for safety

Open to students currently enrolled in science/engineering/management undergraduate,postgraduate, and PhD programme at Panjab University. The course has a maximum capacity of 60 participants.

Syllabus

Unit I

Financial statements: Introduction to balance sheet and income statement. Introduction to cash flow statement, ratios – profitability, efficiency, liquidity and leverage.

Unit II

Financial Planning: are you ready to raise capital?,financial plans and pro-forma financial statements, planning a cash flow statement, burn rate.

Unit III

Funding options: Bootstrapping, types of funding – debt, equity. creative ways to structure long-term

3. To determine drag coefficient for the fall of particle in quiescent liquid.
4. To study batch settling of slurries.
5. To study the process of grinding and determining critical speed of a ball mill.
6. To determine screen effectiveness of a sieve shaker.
7.

CO2 Use aseptic technique to properly handle microorganisms to avoid contamination.
CO3 Identify the microorganisms using staining techniques.
CO4 Understand and apply the knowledge to handle microscopes to observe stained microorganisms.
CO5 Isolate the pure culture from mixed population found in contaminated foods.

List of Experiments:

1. Guidelines for safety and introduction to various equipments commonly used in laboratory.
2. Sterilization of glassware used in microbiology laboratory.
3. Use of microscopic technique for identification of microorganisms on the basis of cell morphology.
4. Specific staining techniques: simple staining, gram staining
5. Preparation of nutrient broth, media with nutrient agar, PDA and special media.
6. Isolation of microorganisms using serial dilution and streak plate method.
7. Isolation and enumeration of microorganisms using spread plate method.
8. Microbiological assay of water.
9. Effect of blanching on quality of food.

Paper Title: FOOD CHEMISTRY Lab.

Paper Code PCC 252 Max. Marks: 25 Credits : 1

1. Preparation of samples for analyses.
2. Determination of moisture content (wet basis and dry basis).
3. Ash: total, acid soluble, alkali soluble and water soluble.
4. Lipids, protein, crude fibre, reducing and non-reducing sugar.
5. Estimation of ascorbic acid, vitamin-A, chlorophyll, carotenoids etc.
6. Estimation of iron, copper, lead, tin etc.

Course Objectives

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CO2: Understanding experimental techniques for measurement of ascor-1.78252(l)0.89126( )-15.0602(m)18.9636(e)-1.78252(d)-6.024

Title	**BIOCHEMISTRY & NUTRITION**			**Credits**	3	
Code	PCC 203			**L T P**	3 - -	
Max. Marks	**End term-50**	**End term-50**	**Practical- -**	**Elective**	N	
Pre requisites						
THEORY			**Time**	3 Hours		
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**					
Course Objectives						
Course Outcomes						

structural and functional constituents in human metabolism, specific role of iron, calcium, phosphorus, iodine, sodium, chlorine, potassium, copper, and magnesium.	

UNIT III

processing on the nutritive value of fruits and vegetables. Intermediate moisture foods Process design of cleaning, cutting, blanching, and thermal processing equipments. Plant layout.

Books Recommended:

1. Giridhari Lal : : Preservation of Fruits & Vegetables, ICAR Publication, India.
2. Ranganna : : Analysis of Fruits land Vegetables, Tata MacGraw Hill, India.
3. Luh & Woodroof : : Commercial Vegetable Process

UNIT 3 Structure, composition and nutritive value of poultry eggs. Quality of eggs and its preservation. Egg Spoilage. Spray dried and frozen egg products.
UNIT 4 Fish structure and composition, cold storage, freezing preservation and canning of fish. Pickling of fish, fish protein concentrates, fish meal and by-products of fish processing industry. Sanitation in meat, fish, egg and poultry processing plants.

***Boo co nd d*:**

1. Henricksons, R.L : Meat, Poultry and Sea Food Te

1 Preparation of various solutions and buffers .
2 Determination of pka of acids.
3 Determination of pI for casein
4 Estimation of sugars in fruits by Anthrone method
5 Estimation of protein by Lowry method
6 Estimation of amino acid using Biuret reaction
7 Separation of amino acids using paper chromatography
8 Separation of amino acids using thin layer chromatography
9 Separation of nucleic acids using electrophoresis

Paper Title : FOOD MICROBIOLOGY Lab.
Paper Code PCC 254 Max. Marks : 50 Credits : 1

Course Objective(s)
Helping students understand various methods of isolation, characterization and screening of bacteria, fungi and other related organisms and apply various preservation techniques relative to food safety and spoilage.

Course outcome(s):

1. Student will acquire knowledge about fish processing and preservations by salting, canning etc.
2. Student will acquire knowledge about slaughtering, dressing and handling
3. Student will acquire knowledge about quality of eggs and egg powder
4. Student will acquire knowledge about preparation, preservation of fish and poultry based products.

Course Outcome

CO 1: Students will be able to apply their knowledge in fish processing industry to optimize several fish preservation processes
CO2: Students will be able to implement their knowledge poultry processing industry to optimize several poultry preservation processes
CO3: Students will be able to apply their knowledge egg processing industry to optimize several egg preservation processes
CO4: Students will be able to implement their knowledge to maintain quality of meat, fish, poultry based processed product during storage.

Paper Title : FRUITS & VEGETABLES PROCESSING LAB
Paper Code PCC 256 Max. Marks : 50 Credits : 1

Course Objectives :

1. To enable the students to understand the processing of fruits and vegetables
2. To impart technical knowledge of about how to develop products and preservation
3. The students will be able to learn the methods of processing and preservation of freshly harvested and cut fruits and vegetables.

Course Outcomes :

1. The students will gain knowledge about the manufacturing technology of Fruits and vegetable products.
2. Understand the importance of various ingredients required for preparation of products.
3. C.00911(f)7.743841(n)6.0241(o)-18.0723(w)11t /R9 9.96 Tf8-0.8911.52 Td 4.96 Tf8-0.6(e)-1.78252(t)-1189126(h)6.0241(e)-1.7804

THIRD YEAR

5th SEMESTER

Title	**MASS TRANSFER – I**		**Credits**	4
Code	PCC110		**L T P**	3 1 -

7 [illegible] 7682s

Boo co nd d

1. Wrigley, C. 2004. :Encyclopedia of Grain Science. Academic Press, London, UK
2. B. Tiwari and N. Singh (RSC) :Pulse Chemistry and Technology.
3. Kent, N.L. and Evers, A.D. 1994. :Kent's Technology of Cereals: An Introduction for Students of Food Science and Agriculture, 4th Ed. Elsevier Science Ltd., Oxford, UK.
4. Chakraverty, A., Mujumdar, A.S., VijayaRaghavan G.S. and Ramaswamy, H. S. 2003. :Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.
5. Tanley A Watson and Paul E. Ramstad :Corn chemistry and Technology.
6. Ruth H.Matthews, 1989 : Legumes: Chemistry, Technology and Human Nutrition.

Title	**Principles of Food Preservation**			**Credits**	**3**
Code	**PCC 209**			**L T P**	**3**
Max. Marks	**End term- 50**	**Mid term-50**	**Practical-**	**Elective**	**N**
Pre requisites					

THEORY

Unit IV

Quality standards. Sampling and specifications of materials/products to be used for testing the quality. Unit operations in food processing. Packaging of processed foods-materials and methods.

Recommended Books:

Author Title

1. Desrosier Technology of food preservation
2. Fennema. Karrel Principles of Food Science Vol-I

Title	**Dairy Technology**			**Credits**	**3**
Code	**PCC 210**			**L T P**	**3**
Max. Marks	**End term- 50**	**Mid term-50**	**Practical-**	**Elective**	**N**
Pre requisites					
THEORY			**Time**	3 Hours	
Note for the Examiner	The examiner will set seven questions of equal marks. The first question ,which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of paper will be divided into two parts (SECTIONS) having three questions each and candidate is required to attempt at least two questions from each part.The duration of End Term exam will be 3 hrs.				

UNIT 1

Present status of milk & milk products in India and Abroad; market milk Composition of milk of various species, qu and testing of milk, procurement, transportation and processing of market milk, cleaning & sanitization of dairy equ

UNIT 2

Special milks such as flavoured, sterilized, recombined & reconstituted toned & double toned. Condensed milk-

Preparation of special milks;
Cream separation & standardization of milk; Preparation and evaluation of table butter, icecream, cheese and indigenous milk product such as khoa, chhana, paneer, ghee, rosogolla, gulab jamun, shrikhand, lassi, burfi etc.; Visit to dairy plants.

***Boo co nd d*:**

1. Aneja RP, Mathur BN, Chandan RC & Banerjee AK. : Technology of Indian Milk Products. Dairy India Publ. 2002.
2. De S. : Outlines of Dairy Technology. OxfordUniv. Press. 1980.
3 Henderson JL. : 1971. Fluid Milk Industry. AVI Publ.
4 Spreer E. : 1993. Milk and Dairy Products. Marcel Dekker.
5 Walstra P. 1999 : Dairy Technology. Marcel Dekker, 1999

Course objectives: objectives of this cource is to impart knowledge about

1 Milk components and its various properties and adultrations
2 Working equipments for various mil products
3 Process technology for milk and fermented milk products
4 Cleaning and sanitization of dairy industry

Course outcomes:
CO1: discuss about current status of dairy industry and composition and properties of milk
CO2: implement the technology of fluid milk and manufacturing fat rich milk based products.
CO3: interpret the technological aspects in manufacturing of frozen concentrate and dried milk products
CO4: use the technology to manufacture the fermented milk based and indigenous products

Paper Title : CEREALS & PULSES PROCESSING LAB.

Paper Code PCC 257 Max. Marks : 50 Credits : 1

1. Milling of rice, assessment of degree of polishing.
2. Evaluation of Physical, chemical properties of wheat and milled products
3. Baking of bread
4. Baking of biscuit cake
5. Evaluation of baked bread.
6. Evaluation of properties of rice (physical and chemical).
7. Cooking quality of rice.
8. Experiment on parboiling, evaluation of quality.
9. Milling of pulses.
10. Visit to flour mill, rice mill and pulse mill industries.

CO3: To acquire practical knowledge on milling and parboiling of rice

Course outcome
Student will be able to apply their knowledge in the cereal processing industry. As well as able to op

6. Determination of salt in butter.
7. Preparation of cream,
8. Preparation of butter, ghee,
9. Preparation of ice-cream
10. Determination of
0.176(v)-1.78252(e)-1.78319(-)7.69925(c)-1.78252(r)-4.34894(e)-1.78252(a)-13.8307(m)6.91556( )]TJ ET Q 1 1 1 rg

THIRD YEAR

6th SEMESTER

Title	**REACTION ENGINEERING**			**Credits**	4
Code	PCC 109			**L T P**	3 1 -
Max.Marks	**End term 50**	**Mid term 50**	**Practical : -**	**Elective**	N
Pre requisites	**-**				

THEORY

Note for the Examiner **Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) rnst05(40 0 8.(s)3.4552(t05(40 0(o)-6.0241(r)-1.7825)-13.8314( )-2906.63(**

Title	**MASS TRANSFER-II**			**Credits**	4
Code	PCC 115		**Semester:-**6th	**L T P**	3 1 -
Max.Marks	**End term 50**	**Mid term 50**	**Practical :**	**Elective**	N
Pre requisites	**Mass Transfer I**			**Hours/week**	4
THEORY					
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**				
Course Objective	The course objective is to study the concepts of mass transfer equilibria and operating lines for various systems like vapour-liquid, liquid-liquid, solid liquid and solid-gas systems, liquid - liquid extraction, leaching, adsorption and to apply the concepts to real problems.				

Course Outcomes

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

- To understand the concepts of mass transfer equilibria for vapour-liquid and to generate operating line for various mass transfer systems like absorption, distillation, liquid-liquid extraction. Leachin, adsorption and principles of crystallization.
- The students are able to comprehend the concepts of co current & counter current processes, cascades and concept of Ideal stage and stage efficiencies, continuous contact equipments, number of transfer units and height of a transfer unit (NTU & HTU) concepts, packed column for absorption, equipment for gas absorption
- The students will get acquaintance about McCabe–Thiele methods & Ponchon Savarit method to calculate the number of stages for distillation column and able to design the column.
- The students will be able to 8w490(f)2.99805(or)(pm)-2(e)4(n)-10(t)-2(f)3.16 -1

criteria for solvent, Multistage extraction using partially miscible & immiscible solvents. Stagewise contact for countercurrent and crosscurrent extraction. Constructional details of equipment like mixer-settler, packed columns, pulsed extractor, sieve-tray extractor and centrifugal extractor.

UNIT IV

: Preparation of solid, countercurrent and crosscurrent multistage contact Shank's system. Constructional details of equipment like Rotocel extractor, Hildebrandt extractor, Bollman extractor, Kennedy Extractor & Beet-Sugar Diffusion battery extractor.

: Types of adsorption, nature of adsorbents, equilibria for adsorption systems. Brief manufacture and commercial applications and characteristics for common adsorbents. Stagewise& continuous contacting of fluid and solid phase. Description of contact filtration adsorption system. Hypersorber Ion-exchange system.

〃 : Growth and properties of crystals saturation, nucleation, growth of crystals, effect of impurities on crystal formation, effect of temperature on solubility, fractional crystallization, yield of crystals, crystal purity, yield calculation using phase diagram, energy requirements using enthalpy-concentration diagram. Methods of creating super saturation-Meirs supersolubility curve. Mechanism and methods for nucleation. Derivation for ideal growth of crystals and discussion of actual growth. Swanson-Walker and various vacuum crystallizers.

Recommended Books

1. Treybal, Robert E. : Mass Transfer Operations, 3rd Edition, McGraw-Hill, 1981.
2. Sherwood,T.K., Pigford, R.L &Wilke,C.R. : Mass Transfer, McGraw-Hill, Chemical Engineering Series, 1975.
3. Skelland, A.H.P. : Diffusion Mass Transfer, John Wiley &Sons., New York, 1974.
4. McCabe, Warren L., Smith Julian C. and Harriot, H.P. : Unit-Operations of Chemical Engg., 7th Edition, McGraw-Hill, 2005.

Title	**PCC 211 BEVERAGE TECHNOLOGY**			
THEORY		**Time**	3 Hours	
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**			

Course Objectives

1.

3. Philip R. Ashurst. 2005. :Chemistry and Technology of Soft Drinks and Fruit Juices, 2nd Ed. Blackwell Publishing Ltd., Oxford, UK.
4. AmalenduChakraverty, Arun S. Mujumdar, G.S. VijayaRaghavan and Hosahalli S. Ramaswamy. 2003. :Handbook of Post Harvest Technology: Cereals, Fruits, Vegetables, Tea, and Spices. Marcel Dekker, Inc., NY, USA.
5. Varnam AH & Sutherland JP :Beverages- Technology, Chemistry and Microbiology
6. Hui YH et al 2004. :Handbook of Food and Beverage Fermentation Technology. Marcel Dekker.

Title	**CONFECTIONARY TECHNOLOGY**				**Credits**	3
Code	PCC 212				**L T P**	3 - -
Max.Marks	**End term 50**	**Mid term 50**	**Practical :**		**Elective**	N
Pre requisites	**-**					
THEORY				**Time**		3 Hours
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**					
Unit I						

CO4: To know about the specification, packaging and labeling of different confectionary items.

Course outcome

(i)Students will be able to implement their knowledge in diverse confectionary manufacturing processes in selection of suitable raw material, optimize process conditions and maintain the quality of the product.
(ii)Students also will be able to choose suitable packaging material and also will be able to optimize the storage conditions for confectionary products.

Paper Title : BEVERAGE & CONFECTIONARY PROCESSING LAB. (Practical)
Paper Code PCC 213 Max. Marks: 50 Credits : 1

1. Water hardness, acidity, basicity, chlorination, total dissolved solids, chlorides, iron, phosphorus in water.
2. Determination of alcoholic content in beer and wine using the distillation method. 47
3. Sulphur dioxide content in juices, squash, wine etc.
4. Acidity and total soluble solids determination in different beverages.
5. Manufacture of whey.

4. Verification of Rayleigh’s equation for differential distillation.
5. Study of absorption of carbon dioxide in a packed bed absorption tower.
6. Determination of HETP for packed distillation columns.
7. Study the operation of a rotary drier.
8. Study the solid-liquid extraction operation in a packed bed extraction unit.
9. Study of different mass transfer equipments.

7. To study the particulate matter (PM 10/PM 2.5) air sampler

Title	**Minor Project Literature Survey, Report Writing & Seminar**			**Credits**	**1.5**
Code	CHE 102			**L T P**	- - 3
Max.Marks	**End term**	**Mid term**	**Practical: 50**	**Elective**	N
Pre requisites	**-**				

Course Objectives

- To gain an understanding of the existing research relevant to a particular topic or area of study and define the problem statement
- Critical analysis of the published work and develop

FOURTH YEAR

7th

PCC 214 FOOD REGULATION & QUALITY CONTROL(Theory)

THEORY		**Time**	3 Hours
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units**		

knowledge in labelling, printing of different packaged foods also able to design packaging machines.

QUALITY CONTROL & PACKAGING LAB. (Practical)
PCC 260 **Marks: 50** **Credit: 1**

Course Objectives:
Assisting students use laboratory techniques and methods common to Food processing and packaging and to provide an opportunity to the students to evaluate the effective test methods used in sensory evaluation and analyse the resulting information.

Course Outcomes:

CO1	Understand the need and functions of quality control and various methods used for assessing the quality of food products.
CO2	Assessing the importance of packaging as a solution to various factors affecting food.
CO3	Gain knowledge on shelf life of food and various methods of estimating it.
CO4	Explain the different packaging materials and their properties.

List of experiments:
1. Quality examination of canned food sample
2. Determination of color of food sample using Hunter Colorimeter.
3. Preparation and sensory evaluation of food sample (cookies).
4. Recognition of threshold concentration of primary taste.
5. Physical properties of packaging films.
6. Determination of water absorption of paperboard and CFB.
7. Uniformity and amount of wax determination.
8. WVTR of different packaging material.

Process Dynamics & Control Lab.
PCC 159 **Marks: 50** **Credit: 1.5**

Objective: To impart hands on experience on various process control systems.
Course Outcome: Capability to apply the theoretical knowledge while performing experiments for different Chemical Engineering Processes.

Practical
1. U-Tube manometer
   (a) To plot the response curve for a given input to a U-tube manometer.
   (b) To determine the transfer function from the response curve obtained in part (a).
2. Time constant of a mercury thermometer
   To study the dynamics of the given thermometer and compare the experimental value of its time constant with the theoretical value.

response for step change in the inlet flow.
(b) To plot the experimental response curve and comment on the response obtained.

8. Compurec
   Pressure control simulation with step input and sinusoidal input.

MAJOR PROJECT

CHE 103 **Marks: 50** **Credit: 1.5**

Each student is required to submit a project report on the design of a chemical plant, selecting the best process with optimum equipment size and operating conditions. The object is to test the ability of the student to apply his entire knowledge of Chemical Engineering principles to conceptualize, analyze and solve the problems. To judge his knowledge and originality and capacity for application of laboratory data in designing chemical plants and to determine the level of his proficiency at the end of the course.

Title	**COMPREHENSIVE VIVA**			**Credits**	01
Code	CHE 104			**L T P**	- - -
Max. Marks	**End term--50**	**Mid term- -**	**Practical-**	**Elective**	N
Pre requisites					
The viva-voce examinations will be comprehensive and covering mainly chemical engineering and technology subjects covered during all the semester including the Eight Semester.					

8th Semester

CHE 106	Six month Industrial Training/Research Training	Credits:13

Department Elective
Chemical Engineering Thermodynamics
Note for the Examiner

***Boo co nd d*:**

1. Smith, J.M., Van Ness, H.C. and Abbott, M.M. : Introduction to Chemical Engineering Thermodynamics, 7th Edition, McGraw Hill Professional, 2005
2. Elliott, J.R and Lira, C.T. : Introductory Chemical Engineering Thermodynamic, Prentice Hall PTR., 1999.
3. Rao, Y.V.C. : Chemical Engg. Thermodynamics, Orient Blackswan, 1997.
4. Dodge, B.F. : Chemical Engg. Thermodynamics, McGraw Hill, 1944, Original from the University of Michigan, 2007.
5. Narayanan, K.V. : A Textbook of Chemical Engineering Thermodynamics, PHI Learning Pvt. Ltd., 2004.

Title	**Process Instrumentation**		
Course Objectives	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**		
Course Objectives	➢ To provide knowledge of pressure, temperature, level, viscosity, conductivity, density and weight measurements. ➢ To provide knowledge of recording instruments, indicating and signalling instruments, control centre, transmission of instrument reading and instrumentation diagrams.		
Course Outcomes	Upon successful completion of the course, the students will be able to: CO1: Classify elements and types of instruments, static and dynamic characteristics of instruments.Illustrate the different methods for the measurement of temperature. CO2: Elucidate the construction and working of various industrial devices used to measure pressure and vacuum.Discuss methods for measurement of viscosity. CO3: Explicate the construction and working of various industrial devices used to measure level. Discuss methods for measurement of conductivity. CO4: Describe recorders, indicating & signalling instruments and Control Centre. Construct instrumentation diagrams. Discuss methods for measurement of density and weight.		

THEORY

UNIT-I

General Concept: Need and classification of measurements and instruments, Basic and auxiliary functional elements of a measurement system. Static and Dynamic Characteristics of Instruments: Static Characteristics: Range and span, accuracy and static error, reproducibility and drift, sensitivity and dead zone. Dynamic Characteristics: Speed of response and lag, fidelity and dynamic error, dead time. 5 Hrs.

Temperature measurement: Bimetallic thermometers, filled-in system thermometers. Thermocouples, metal resistance thermometers and thermistors, optical and radiation pyrometers, radiation receiving elements. 10 Hrs.

UNIT-II

Pressure measurement: Bourdon gauge, Bellows type gauge. Vacuum measurement– Mcleod gauge & pirani vacuum gauge. Measurement of pressure in corrosive fluids: Diaphragm seal, liquid seal and purge system. 10 Hrs.

Viscosity measurement: Float viscometer, rotational viscometer 5Hrs.

UNIT-III

Liquid level measurement: Direct measurement of liquid level– Float & tape liquid level gauge, float and shaft liquid level unit, hydraulic remote transmission of liquid level. Level measurement in open vess

		Hours
UNIT-I	Project Management: concept of project management, project management systems, responsibilities and qualities of a project manager, project management team-composition, functions and responsibilities, co-ordination procedures. Planning Framework and its importance, project life cycle, Work Breakdown Structure, Types of Work Breakdown Structure. Market and Demand Analysis, Feasibility studies: Preparation of techno-economic feasibility report, feasibility analysis technical economic, commercial and financial planning, Project Identification: Principles of project identification.	10
UNIT-II	Capital Investments: Importance and Difficulties, Types of Capital Investments, objectives of capital Budgeting, Appraisal criteria and selection of investment: Non discounting criteria, discounting criteria, appraisal and selection in practice, time value of money, project appraisal techniques: payback period, accounting rate of return, net present value, internal rate of return, benefit cost ratio. Brief outline of social cost benefit analysis: rationale, UNIDO and little Mirrlees approaches.	15
UNIT-III	Project scheduling/network techniques in project management: CPM and PERT analysis, float times, crashing of activities, contraction of network for cost optimization, updating, cost analysis of resources allocation, Pre-construction planning, Project Scheduling control and Monitoring: Resource Scheduling, manpower scheduling, multi project scheduling, cost scheduling, PERT/Cost scheduling optimisation, crash costing and updating and leveling of resources	10
UNIT-IV	Project Risk Analysis, Sources, Measures, and Perspectives on Risk, Sensitivity Analysis, Scenario Analysis, Break-even Analysis, Hillier Model, Simulation Analysis, Decision Tree Analysis, Managing Risk, Project Selection under Risk. Project Implementation and project Review and Administrative Aspects, Financing of Project, Financial Control: Budgeting and cost control, sources of long term funds for business, Planning and capital structure, problems of working capital management and liquidity.	10
Text books	1. Prasanna Chandra: Projects: Preparation, Appraisal Budgeting and Control, 7th edition, TMH. 2. Vasanta Desai: Dynamics of entrepreneurial development and management, 11th edition, Himalaya publishing.	
Reference books	1. UNIDO: Guidelines for Project Evaluation, United Nations, reprinted, 1993. 2. Manual for the preparation of Industrial Feasibility Studies, United Nations 1995. 3. Manual for Evaluation of Industrial Projects, United Nations, reprinted on 1993. 4. IMD little and J.A. Mirrlees: Project Apraisal and Planning in Developing Countries, 5. Vasanta Desai: Entrepreneurial development, and Management, 13th edition, Himalaya pub., Harper Collins, edition- Paperback. Peter F. Drucker: Innovation and development	

Course Assessment Methods

Assessment will consist of the following components

1. Mid-Term Assessment:
   - One best of two minor tests (50% of Mid -term marks)
   - Assignments (20% of Mid-term marks)
   - Class Surprise Tests/ Quizzes/Presentations/Term paper (20% of Mid-term marks)
   - Attendance. (10% of Mid-term marks)

will be divided into FOUR Units having TWO questions each and candidate is required to attempt at

CO4: Understand the consumer needs for product development .

.UNIT 1

Concepts of food product design, Product success and failure. Product Design Procedure, Categories of food product. Need for product development (Customer and societal needs), Customer preference.

UNIT 2

Ideas and innovation in food product development. Life cycle analysis of food products, case studies. Product development process-product strategy, product design and process development, product commercialization, product launch and evaluation.

UNIT 3

Product manufacturing, specifications, scale up/scale down, Economics, Specifications of food products. Microstrucure of food products, case studies.

Unit 4

Sensory analysis.Sensory evaluation methods. Difference Testing, Descriptive analysis, Affective Testing.Analysis of sensory data in relation to instrumental analysis. Preference ans acceptance mapping.

Reference Books

1. Earle and Earle. 2001. Creating New Foods, Chadwick House Group. Fuller 2004. New food Product development-from concept to market place, CRC.

2. Harry T Lawless and H Leymann. 2010. Sensory evaluation of foods: Principles and Practices.Springer, New York.

3. EL Cussler and GD Moggridge. 2012. Chemical Product Design. Cambridge University Press, UK.

4. Anita R Linneman, Catharina GPH Schroen and MAJS van Boekel. 2011. Food Product Design: An Integrated approach. Wageningen Academic Publishers, Netherland.

Avni new

CO2 Determine thermal processing time for pasteurization / sterilization.
CO3 To know the drying and size reduction equipments
CO4 Determine the freezing time of food and discuss different types of freezer.

Books Recommended:
Author Title
1. R.T. Toledo Fundamentals of food process Engineering
2. Brennan and Cowell Food Engineering Operations
3. Heldman and Singh Food Process Engineering
4. Smith P.G. Intro to Food Process Engineering
5. Geankoplis Transport Process & Unit operations

Title	**NUMERICAL METHODS IN CHEMICAL ENGINEERING**		
THEORY			
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**		
Course Objectives	**To learn students:** **1. Solve algebraic and transcendental equations, apply Least Square Curve Fitting Procedures to fit various curves and understand the concept of Finite differences.** **2. Apply the concept of Finite differences to carry out Forward, Backward and Central Interpolation and Inverse Interpolation with equispaced and unequispaced data.Use suitable methods to perform numerical differentiation.** **3. Use various methods to carry out numerical integration. Solve numerically ordinary differential equations of First order, higher order and Simultaneous differentialequations.** **4. Solve linear system of equations by Direct and Iterative methods. Further, apply Finite Difference Approximation method to solve Partial differential equations.**		
Course Outcomes	**Upon successful completion of the course, the students will be able to:** **CO 1:Apply numerical methods for solving algebraic and transcendental equations,apply Least Square Curve Fitting Procedures to fit various curves and understand the concept of Finite differences.**		

	CO 2:Apply the concept of Finite Differences to carry out Forward, Backward and Central Interpolation and Inverse Interpolation with equispaced and unequispaced data. Also, apply suitable methods to perform numerical differentiation. **CO 3: Use various methods to carry out numerical integration.Solve, numerically,** **ordinary differential equations of First order, higher order and** **Simultaneous differentialequations.** **CO 4: Solve linear system of equations by Direct and Iterative methods.** **Further, apply Finite Difference Approximation method to solve Partial differential equations.**

Unit I

Solution of Algebraic and Transcendental Equations:
Bisection Method, Method of False Position, Iteration Method / Fixed Point Iteration Method, Newton-Raphson Method.**06 hrs**.

Curve Fitting: Least-Squares Curve Fitting Procedures for Fitting the Straight Line, theSecond-degree Parabola and Fitting of other Curves.
04 hrs Finite Differences: Forward, Backward and Central Differences**,** Differences of a Polynomial, Factorial Notation. **05 hrs.**

Unit II

Interpolation:
Newton's Formulae for Forward and Backward Interpolation, Central Difference Interpolation Formulae: Stirling's Formula, Bessel's Formula, Interpolation with unevenly Spaced Points:Lagrange's Interpolation Formula, Divided Differences, Newton's Divided Difference Formula.
09hrs.
Inverse Interpolation: Lagrange's Method, Iterative Method.
03hrs.
Numerical Differentiation:
Formulae for Derivatives, Maxima and Minima of a Tabulated Function.
03 hrs.

Unit III

Numerical Integration:
Newton-Cotes Quadrature Formula: Trapezoidal Rule, Simpson's 1/3-Rule, Simpson's 3/8-Rule, Weddle's Rule.**04 hrs.**

Numerical Solution of Ordinary Differential Equation:
Picard's Method, Euler's Method, Taylor's Series Expansion Method, Runga-Kutta Method, Predictor-Corrector Methods- Euler's modified m'1fiedds-1.701.78389126(e)-ENn9126(e)-1.782mpsoe'sr440soe'srab s dnd THog

Solution of Linear System of Equations: Gaussian Elimination Method, Gauss-Jordan Method, Jacobi Iteration Method, Gauss-Seidel Iteration Method, Condition of Convergence.
6 hrs.
Numerical Solution of Partial Differential Equations:
Classification of Second order equations, Finite-Difference Approximation toPartial Derivatives, Elliptic Equations- Solution of Laplace's Equation, Solution of Poisson's Equation, Parabolic Equations-Solution of one-dimensional heat equation (Schmidt method), Hyperbolic Equations-Solution of wave equation.
9hrs.

***Boo co nd d*:**

1. Hildebrand, F.B. : Introduction to Numerical Analysis.
2. Scarborough, J.B. : Numerical Mathematical Analysis, Oxford and ISH Pub. Co.
3. Chopra, S.C., & Canale, R.P. : Numerical Methods for Engineers.
4. Sastry, S. S. : Introductory Methods of Numerical Analysis, 4th Edition, Prentice Hall.
5. Grewal, B. S. Numerical Methods in Engineering and Science.

PETROLEUM PROCESSING ENGINEERING (Theory)

THEORY		**Time**	3 Hours
Note for the Examiner	**Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to 9) will be divided into FOUR Units having TWO questions each and candidate is required to attempt at least ONE question from each Unit. The duration of End Term exam will be 3 hrs.**		

Course Objectives: The course aims at understanding the basic concepts of Petroleum Refining , refining operations and processes. Various aspects of refinery operations such as petroleum sources, technology and techniques

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components of an engine, otto cycle, diesel cycle, spark ignition (SI) engine, compression ignition (CI) engine, two stroke and four stroke engines, Carburation, Air-fuel mixture, simple Carburettor, Fuel injection system, cooling system, lubrication system, Gas turbines, classification of gas turbine, open cycle and closed cycle gas turbines,methods to improve the thermal efficiency, introduction to steam power plants.

***Boo co nd d*:**

1. Jouganson, R. : Fan Engineering, Buffalo Rorge Co., 1970.
2. Wangham, D.A. : Theory and Practice of Heat Engines, ELBSCambridgeUniversity Press, 1960.
3. Lyle, O..

2. Gupta, “Hand Book of Spices and Packaging with Formulae”, 2nd edition, Engineers India Research Institute, 2002.

REFERENCE BOOKS:

1. D. K. Salunkhe and S. S. Kadam, “Handbook of Fruit Science and Technology: Production,

Radioactive hazards. Good housekeeping in industrial environment. -06 hours

Unit III

Fire prevention, design to prevent fire and explosion (inverting static electricity, sprinkler system), boiling

Books recommended:

1. Industrial Microbiology by Prescott and Dunn. Agrobios (India)
2. Industrial Microbiology: An Introduction. Michael J. Waites, Neil L. Morgan, Gary Higton. Wiley-blackwell
3. Industrial Microbiology by Patel. Macmillan Publishers India
4. Principles of Fermentation Technology. Stanbury Pf, Whitaker A, Hall Sj. Elsevier India P Ltd
5. Industrial Microbiology by Casida
6. Industrial Microbiology by Cruger&Cruger

PLANT DESIGN AND SANITIZATION

Note for the Examiner: Question No. 1, which is compulsory, will cover the entire syllabus, having ten conceptual questions of one mark each or five questions of two marks each. Rest of the Questions (2 to

Service after sale, Customer delight)

Unit II

Role of Logistics in Supply Chains: Definition of Logistics Management; Scope and role of Transportation, Traffic & transportation; Relationship between transportation and other business functions, Transport Economics: Distance – volume-density, Freight Cost, Handling, Liability, market factors; Third party logistics (3 PL) & fourth party logistics service provider (4 PL), Logistics equipment; Reverse Logistics, Government rule & regulations related to Logistics; Purchase Cycle, Make or Buy, Price analysis, Negotiations.

Unit III

Inventory Management: Inventory Control, Planning & Managing Inventories; Warehouse Management (Receipt, issue, storage and preservation, stock verification, In bound and out bound distribution operations); Order Management; Competitive advantage through logistics and supply chain management; Responsive Supply Chain; Supply chain process integration, performance measurement; Value Chain, Value System and Supply Chain.

Unit IV

Planning demand and supply: Planning & Sourcing in Supply Chain, Demand forecasting, Type and Time horizon of forecast and category of forecasting, aggregate planning; Financial issues in Supply Chain - Macro and micro view, Asset management, Du Pont Model, Supply Chain Costing; Decision environment in SCM; Global supply chain perspectives - New business models, role of IT in SCM.

Books Recommended:

1. Harald Dyckhoff et al, Ed.: Supply Chain Management and Reverse Logistics, Springer (India).
2. Jayashree Dubey and M.L. Saikumar Ed.: Supply Chain Management, IIPE Hyderabad and New Century Publication.
3. Sarika Kulkarni, Ashok Sharma: Supply Chain Management-Creating Linkages for Faster Business Turnaround, McGraw Hill.
4. RP Mohanty: Supply Chain Management - Theories and MSCs
4.

entrepreneur
CO4: To identify personal attributes that enable best use of entrepreneurial opportunities
CO5: Explain the concept and attributes of projects, project management system, process and its principles, and various stages of a project.
CO6: Perform technical feasibility, marketing feasibility and commercial viability using NPV, and further to understand tax and legal aspects of a project.

1989.
- Bansal, J.C. and Ghosh, B.: Project Management of Process Plants, Panjab University, 1985
- Vasanta Desai: Dynamics of entrepreneurial development and management, 11th edition, Himalaya pub.
- UNIDO: Guidelines for Project Evaluation, United Nations, reprinted,1993..
- Manual for the preparation of Industrial Feasibility Studies, United Nations 1995.
- Manual for Evaluation of Industrial Projects, United Nations, reprinted on 1993..
- IMD little and J.A. Mirrlees: Project Apraisal and Planning in Developing Countries,
- Vasanta Desai: Entrepreneurial development, and Management, 13th edition, Himalaya pub., Harper Collins, edition- Paperback.
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