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

Food Technology

Semester-III

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A54402	Numerical Methods and Probability Theory	BS	3	0	0	3
2.	20A27301	Food Chemistry	PC	3	0	0	3
3.	20A27302T	Processing of Cereals, Pulses and Oilseeds	PC	3	0	0	3
4.	20A27303T	Fluid Flow in Food Processing	PC	3	0	0	3
5.	20A27304	Principles of Food Engineering	PC	3	0	0	3
6.	20A27305	Food Analysis Lab	PC	0	0	3	1.5
7.	20A27302P	Processing of Cereals, Pulses and Oilseeds Lab	PC	0	0	3	1.5
8.	20A27303P	Fluid Flow in Food Processing Lab	PC	0	0	3	1.5
9.	20A27306	Skill oriented course – I Principles of Food Preservation	SC	1	0	2	2
10.	20A99201	Mandatory noncredit course – II Environmental Science	MC	3	0	0	0
			Total				**21.5**

Semester-IV

S.No.	Course Code	Course Name	Category	Hours per week			Credits
				L	T	P	
1.	20A27401	Food Biochemistry and Nutrition	BS	3	0	0	3
2.	20A05406T	Introduction to Python Programming	ES	3	0	0	3
3.	20A27402T	Processing of Fruits and Vegetables, Spices and Plantation Crops	PC	3	0	0	3
4.	20A27403T	Heat and Mass Transfer	PC	3	0	0	3
5.	20A52301 20A52302 20A52303	Humanities Elective - I Managerial Economics & Financial Analysis Organizational Behavior Business Environment	HS	3	0	0	3
6.	20A05301P	Python Programming Lab	ES	0	0	3	1.5
7.	20A27402P	Processing of Fruits and Vegetables, Spices and Plantation Crops Lab	PC	0	0	3	1.5
8.	20A27403P	Heat and Mass Transfer Lab	PC	0	0	3	1.5
9.	20A27404	Skill oriented course – I Basic Microbiology	SC	1	0	2	2
10.	20A99401	Mandatory noncredit course – III Design Thinking for Innovation	MC	2	1	0	0
11.	20A99301	NSS/NCC/NSO Activities	-	0	0	2	0
						Total	**21.5**

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Community Service Internship/Project(Mandatory) for 6 weeks duration during summer vacation

Note:

1. Eligible and interested students can register either for Honors or for a Minor in IV Semester as per the guidelines issued by the University
2. Students shall register for NCC/NSS/NSO activities and will be required to participate in an activity for two hours in a week during fourth semester.
3. Lateral entry students shall undergo a bridge course in Mathematics during third semester

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Food Technology

Course Code	**Numerical Methods & Probability theory**		**L**	**T**	**P**	**C**
20A54402	**(Food Technology)** **B.Tech II Year**		**3**	**0**	**0**	**3**
Pre-requisite		**Semester**	**III**			

Course Objectives:

This course aims at providing the student with the knowledge on

- Various numerical methods for solving equations, interpolating the polynomials, evaluation of integral equations and solution of differential equations.
- The theory of probability and random variables.

Course Outcomes (CO): Student will be able to

- Apply numerical methods to solve algebraic and transcendental equations
- Derive interpolating polynomials using interpolation formulae
- Solve differential and integral equations numerically
- Apply probability theory to find the chances of happening of events.
- Understand various probability distributions and calculate their statistical constants.

UNIT - I	**Solution of Algebraic & Transcendental Equations:**	8 Hrs

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

UNIT - II	**Interpolation**	8 Hrs

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

UNIT - III	**Numerical Integration & Solution of Initial value problems to Ordinary differential equations**	9 Hrs

Numerical Integration: Trapezoidal rule – Simpson's 1/3 Rule – Simpson's 3/8 Rule
Numerical solution of Ordinary Differential equations: Solution by Taylor's series-Picard's Method of successive Approximations-Modified Euler's Method-Runge-Kutta Methods.

UNIT - IV	**Probability theory:**	9 Hrs

Probability, probability axioms, addition law and multiplicative law of probability, conditional probability, Baye's theorem, random variables (discrete and continuous), probability density functions, properties, mathematical expectation.

UNIT - V	**Random variables & Distributions:**	9 Hrs

Probability distribution - Binomial, Poisson approximation to the binomial distribution and normal distribution-their properties-Uniform distribution-exponential distribution

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Textbooks:
1. Higher Engineering Mathematics, B.S.Grewal, Khanna publishers. 2. Probability and Statistics for Engineers and Scientists, Ronald E. Walpole,PNIE. 3. Advanced Engineering Mathematics, by Erwin Kreyszig, Wiley India
Reference Books:
1. Higher Engineering Mathematics, by B.V.Ramana, Mc Graw Hill publishers. 2. Advanced Engineering Mathematics, by Alan Jeffrey, Elsevier.
Online Learning Resources:
1. https://onlinecourses.nptel.ac.in/noc17_ma14/preview 2. nptel.ac.in/courses/117101056/17 3. http://nptel.ac.in/courses/111105090

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Food Technology

Course Code	FOOD CHEMISTRY		L	T	P	C
20A27301			3	0	0	3
Pre-requisite		Semester	III			

Course Objectives:

- To impart knowledge to the students on the Techniques in food analysis
- To read them with the Analytical techniques in Quality control laboratory.

Course Outcomes (CO):

- Understand the concepts of Techniques in food analysis,
- Analyse the proximate analysis of foods
- Summarize the biochemical methods and approaches used in Food analysis.

UNIT - I		8 Hrs

Sampling and sampling techniques. Proximate analysis- Moisture, ash, crude fat, crude fibre, crude protein and carbohydrates by difference. Principles and methods of food analysis.

UNIT - II		12 Hrs

Basic principles: Refractometry, polarimetry, densitometry, HPLC, GLC, spectrophotometry, electrophoresis, automatic amino acid analyzer.

UNIT - III		8 Hrs

Determination of starch. Test for unsaturation of fats, rancidity of fats. Quantitative analysis of protein by Biuret method, Ninhydrin method, Lowry's method and Dye-binding method Bioassays for protein quality of grains.

UNIT - IV		10 Hrs

Chemical, microbiological, flurometric and colorimetric methods of analysis of fat soluble and water soluble vitamins.

UNIT - V		8 Hrs

Principles and methods for estimation of minerals: Atomic absorption spectroscopy, colorimetric, titrimetric and gravimetric methods Methods for determining physical and rheological properties of food.

Textbooks:

1. Suzanne **Nielsen**, "Food Analysis", Springer Publishers, 5th Edition, 2017.
2. Y. Pomeranz and C.E. Meloan, "Food Analysis", A.V.I Publishing Company, INC West Port, Connecticut, U.S.A.

Reference Books:

1. Plummer, D.T. "An Introduction to Practical Biochemistry", Tata Mc Graw-Hill Publishing Co., New Delhi.2079.
2. Sadasivam, S. and Manickam, A. "Biochemical methods for Agricultural Sciences", New Age International Publisher, New Delhi,2096.
3. ManoRanjanKalia "Food Analysis and Quality Control", 1st Edition, Kalyani Publishers, New Delhi, 2002.
4. Jayaraman, J. "Laboratory Manual in Biochemistry", Wiley Eastern Publishers, New Delhi,2080.

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Food Technology

Course Code	PROCESSING OF CEREALS, PULSES & OILSEEDS		L	T	P	C
20A27302T			3	0	0	3
Pre-requisite		Semester	III			

Course Objectives:

- To learn about the processing of major cereals and pulses.
- To gain knowledge about grain storage structure and handling devices.

Course Outcomes (CO):

- Students will get information about the classification of various grains
- Students also exposed to various processing methods and machinery used
- Students will learn value added products from all grains

UNIT - I — **8 Hrs**

Importance of Cereals Pulses and Oilseeds, Composition, Structure and processing characteristics of Cereal grains, Legumes and Oilseeds, Post-harvest technology, Post processing practices for safe storage. Rice: Structure, types, composition, quality characteristics and physicochemical properties of Rice. Milling and parboiling of paddy, Curing and ageing of paddy and rice. Criteria and assessment of milling, cooking, nutritional and storage qualities of raw & parboiled rice. Processed rice products (flaked, expanded and puffed rice), By-products.

UNIT - II — **12 Hrs**

Wheat-Structure, Composition, Types, quality characteristics for milling into flour and Semolina. Flour milling, Turbo grinding and air classification, Blending of flours, Flour grades and their suitability for baking purposes, Milling equipment and milled products (Dalia, Atta, Semolina and flour). Assessment of flour quality and characteristics, Macaroni products. Dough rheology- influence of flour constituents in dough rheology.

Baked products-Ingredients Technology and quality parameters: Bread, Biscuits, Cakes and Crackers.

UNIT - III — **8 Hrs**

Other Cereals: Corn- Structure, types and composition. Dry and wet milling of Corn. Starch and conversion products. Processed corn products (popped corn, corn flakes etc.) Structure and composition of Barley, Malting of barley, Bajra, Jowar and other cereal grains and millets. Pearling of millets. Parched and snack products. Breakfast cereals – types and manufacturing methods.

UNIT - IV — **10 Hrs**

Pulses: Pulses production, types, chemical composition, anti-nutritional factors, milling of pulses, milling equipment, factors affecting quality, secondary processing of pulses, processed products, fermented products, traditional products, Value addition; effect of processing on nutritive value.

UNIT - V — **8 Hrs**

Processing of oil seeds for direct use and consumption, Oil extraction methods- mechanical (Ghani and Expellers) and chemical methods (solvent extraction), Processing of extracted oil: Refining, Hydrogenation, Interesterification. Processing of deoiled cake into protein concentrates and isolates, Texturized vegetable protein, Functional protein preparations. Peanut butter, Margarine and Spread.

Textbooks:

- K. Kulp and J. G. Ponte. Jr., “Hand Book of Cereal Science and Technology”, 2nd Edition, CRC, 2000.

- G. Owens, "Cereals Processing Technology", 2nd Edition, Wood head Publishing, 2001.

Reference Books:

1. D.A.V. Dendy and B.J. Dobraszczyk, "Cereals and Cereal products: Chemistry and Technology", Vol. 4, Springer, 1st Edition, 2001.
2. B.O.Juliano, "Rice: Chemistry and Technology", 2nd Edition, AACC,1985.
3. Y.Pomeranz, "Wheat: Chemistry and Technology", 3rd Edition, AACC,1988.
4. A. Karleskind, "Oils and Fats manual", 1st Edition, Lavoisier Publisher, Paris,2096.
5. R.H. Mathews, Marcel Dekker, "Legumes: Chemistry, Technology and Human Nutrition", 1st Edition,2089.
6. D. Swer, "Bailey's Industrial Oil & Fat Products", 5th Edition, John Wiley & Sons, 2005.

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Food Technology

Course Code	FLUID FLOW IN FOOD PROCESSING		L	T	P	C
20A27303T			3	0	0	3
Pre-requisite		Semester	III			

Course Objectives:

- The basic concepts of fluid types and fluid-flow phenomena
- To enable the students to understand the concept and importance of friction factor by using
- To understand the application of friction losses through pipes
- To classify and select the pumps depending on suitability and acquire knowledge on power requirements in pumps

Course Outcomes (CO):

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

- Gain knowledge on various types of fluids available and their classification with examples
- Acquires knowledge on different types of flow regimes that fluid can flow
- Know the applications and usage of Bernoulli's theory, Buckingham's Pi theorem, Hagen-Poiseuilli and Rabinowitsch-Mooney equation
- Gain the knowledge on significance of friction factor and their calculations
- Understand frictional losses through pipes and pipe fittings
- Have knowledge on selection of pumps and their performance evaluation

UNIT - I **8 Hrs**

Types of Fluids: Newtonian & Non-Newtonian Fluids-dilantant, pseudoplastic, bingham plastic, bingham pseudoplastic; classification of fluids based on time dependance: Thixotropic and rheopectic classification of fluids based on density Compressible and In compressible fluids.

UNIT - II **12 Hrs**

Fluid Flow: Laminar and turbulent flows, Reynolds Number; Equation of Continuity, Bernoulli's equation, applications of Bernoulli's equation, Cavitation, laminar and turbulent flow in pipes (Concept of Boundary Layer & Entrance Length)

UNIT - III **8 Hrs**

Friction Factor: Definition of Friction Factor; relationship between Friction factor and Reynolds Number by using Dimensionless analysis, Friction Factor: Derivation of friction factor for Laminar Flow by using Hagen-Poiseuille equation; Friction Factor: Turbulent Flow, Moody Chart, Rabinowitsch-Mooney equation: Non- Newtonian Fluids (Power Law Fluids); Generalized Reynolds Number; Friction Chart.

UNIT - IV **10 Hrs**

PressureLosses in Pipes & Flow Measurement: Energy equation for steady flow of fluids: Pressure, Kinetic & Potential Energy. Major Losses: Frictional Losses; Minor losses: Energy Losses due to sudden expansion, contraction & energy losses due to pipe fittings; Measurement of Flow in Pipes: Venturimeter, Pitot tube, Rotameter and others.

UNIT - V **8 Hrs**

Pumps, Pipes & Fittings: Classification of Pumps: Centrifugal pumps, Reciprocating pumps, Rotary Pumps; Pressure Head, Suction Head, Discharge Head, Net Positive Suction Head; Power requirement of

Pump; Selection of Pumps & Performance Evaluation. Pipe & Pipe Fittings & their selection.
Textbooks:
1. D. G. Rao, Fundamentals of Food Engineering, Prentice-Hall of India, New Delhi, 2010 2. P.G. Smith, Introduction to Food Process Engineering, 2nd Edition, Lincoln, UK, 2010.
Reference Books:
1. Christie John Geankoplis. 2003. Transport Processes and Separation Process Principles (Includes Unit Operations), 4th Ed. Prentice-Hall, NY, USA. 2. R. Paul Singh and Dennis R. Heldman, Introduction to Food Engineering, 4th Edition, Academic Press, 2009. 3. Z. Berk, Food Process Engineering and Technology, Food Science and Technology, 1st Edition, International Series, Elsevier, 2009.

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Food Technology

Course Code	PRINCIPLES OF FOOD ENGINEERING		L	T	P	C
20A27304			3	0	0	3
Pre-requisite		Semester	III			

Course Objectives:

- To familiarize the importance and usage of units.
- To interpret the fundamental laws and principles and its application

Course Outcomes (CO):

- Students will learn the importance of units.
- Students will understand the basic laws and principles and its application in food engineering.

UNIT - I		8 Hrs

Introduction to Food Engineering: Definition of terms, System of measurements, The S.I System, Conversion of Units. Steam Generation & Utilization: Concept of normal boiling point, Properties of Steam, Forms of Steam. Pressure-Enthalpy diagram, Problems; Boilers: Classification, Types, Criteria for selection, Maintenance & Applications.

UNIT - II		12 Hrs

Basic principles of Physics & Chemistry: Ideal Gas law, Vander Waal's equation, Amagat's law, Dalton's law, Problems; Kinetic Theory of gases. Thermodynamics: Basic concepts, First law of thermodynamics, Second law of thermodynamics, Zero law of thermodynamics Refrigeration: Basic concepts, Joule-Thomson effect, Refrigerants, Problems, Refrigeration types (VCC, VAC), Applications.

UNIT - III		8 Hrs

Humidity: Humidity & Relative Humidity, Saturation Humidity, Percentage Humidity, Psychometric chart – Utilization, problems; Humidifiers & Dehumidifiers; Applications.
Material balance and Energy balance in various unit operations – Problems, significance in food processing.

UNIT - IV		10 Hrs

Dimensional Analysis, Fundamental -derived units. Conversion of Dimensional equations – Uses, Methods (Rayleigh's & Buckingham's) Examples: Nusselts Number, Reynolds number, Prandtl's number, Froude's number. Engineering properties of Food Materials: Mass- volume- area related properties of foods, rheological properties of solid foods, thermal properties of frozen & unfrozen foods, electrical conductivity of foods, dielectric properties of foods.

UNIT - V		8 Hrs

Measurement & Control of Process Parameters: Various Process Parameters, On-line & Off-line parameters, Critical & non-critical parameters, Measurement of various parameters, controlling methods (Manual, Automatic & Computer control)

Textbooks:

1. R. Paul Singh and Dennis R. Heldman, "Introduction to Food Engineering". Academic Press, 4th Edition, 2009.
2. P.G. Smith, "Introduction to Food Process Engineering". Springer, 2nd Edition, 2011.

Reference Books:

1. J.M. Smith, H.C. Van Ness and M.M. Abbott "Introduction to Chemical Engineering Thermodynamics", 7th Edition, McGraw-Hill, Inc., NY, USA. 2005.
2. Z. Berk, "Food Process Engineering and Technology, Food Science and Technology", 1st Edition, International Series, Elsevier, 2009.
3. D. G. Rao, "Fundamentals of food engineering", Prentice-Hall of India, New Delhi, 2010.
4. R.K. Rajput. "Engineering Thermodynamics", 3rd Edition, Laxmi Publications (P) Ltd., Bangalore, 2007.
5. Warren L. McCabe, "Unit Operations of Chemical Engineering", 7th Edition, Julian Smith, Peter Harriott, McGraw-Hill, Inc., NY, USA, 2004.
6. Christie John Geankoplis "Transport Processes and Separation Process Principles" (Includes Unit Operations), 4th Edition, Prentice-Hall, NY, USA. 2003.

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Food Technology

Course Code	FOOD ANALYSIS LAB		L	T	P	C
20A27305			0	0	3	1.5
Pre-requisite		Semester	III			

Course Objectives:

- To expertise the students to analyze the proximate composition and other important constituents present in the food.

Course Outcomes (CO):

By the end of the practical exercises, the students will be able to

- Adapt suitable method for food analysis
- Apply the knowledge of Techniques in Food Analysis,
- Differentiate between Qualitative identification and Quantitative estimations

List of Experiments:

1. Sampling plan; Sampling requirements, Sample collection and preparation for analysis procedures and methods
2. Determination of pH
3. Determination of moisture content of foods by oven drying and distillation methods
4. Determination of Total and Acid insoluble ash content in foods
5. Determination of crude fat content by solvent extraction methods in foods
6. Determination of crude Protein by Kjeldhal Lowry method & other methods
7. Determination of reducing and total sugar content in foods
8. Determination of crude fibre content in foods
9. Determination of specific mineral contents in foods such as Calcium, Iron, Phosphorus, Chloride etc.
10. Determination of specific vitamin content of food such as ascorbic acid, carotenes etc.
11. Determination of specific Natural and/ or added Colouring Matters in foods
12. Determination of specific added food Preservatives in foods.

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Food Technology

Course Code	PROCESSING OF CEREALS, PULSES AND OIL SEEDS LAB		L	T	P	C
20A27302P			0	0	3	1.5
Pre-requisite		Semester	III			

Course Objectives:

- Determination of parameters by qualitative and quantitative methods
- Study on some important unit operations used for some grains
- Preparation of standard food products.

Course Outcomes (CO):

- Students are exposed to learn various parameters determination and quantification
- Students will able to prepare and understand the technology involved in foods from grains
- Students will acquire more knowledge by visiting industries.

List of Experiments:

1. Determination of physical properties (Bulk Density, Porosity, Sphericity, Angle of repose, Test weight, Particle size, Sieve analysis) of different grains.
2. Estimation of Gluten content, sedimentation value, alcoholic acidity, water absorption capacity and Polenske value of wheat flour.
3. Determination of adulterant ($NaHCO_3$) in wheat flour/ Maida.
4. Determination of alkali score and gelatinization temperature of rice.
5. Traditional and improved pre-treatments and their effect on dehusking of some legumes.
6. Removal of anti-nutritional compounds from selected pulses and oilseeds.
7. Study of cooking quality of Dhal.
8. Pearling of millets.
9. Determination of yeast activity.
10. Estimation of different quality parameters of oils.
11. Determination of efficiency of oil extraction techniques (mechanical expelling and solvent extraction).
12. Preparation of Bread.
13. Preparation of Biscuits.
14. Preparation of Cookies.
15. Preparation of Cake.
16. Preparation of Rusk.
17. Preparation of Crackers.
18. Visit to a Bakery, Confectionery Unit
19. Visit to a working modern roller flour mill and FCI godowns.
20. Visit to working rice mill.

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Food Technology

Course Code	FLUID FLOW IN FOOD PROCESSING LAB		L	T	P	C
20A27303P			0	0	3	1.5
Pre-requisite		Semester	III			

Course Objectives:

- To impart knowledge on coefficient of discharge, friction factor, pressure drop on different fluids.
- Importance of pipe fittings and application of various pumps in food industry.

Course Outcomes (CO):

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

- Know the measurement of fluid pressure, measurement of discharge and measurement of time
- Know how to determine the Coefficient of discharge from the pitot tube experiment
- How to measure the water level from 'U' tube manometer.

List of Experiments:

1. To determine the coefficient of discharge of an orifice (or a mouth piece) of a given shape.
2. To calibrate an orifice meter and study the variation of the coefficient of discharge with the Reynolds number.
3. To study the transition from laminar to turbulent flow and to determine the lower critical Reynolds number.
4. To study the velocity distribution in a pipe and also to compute the discharge by integrating the velocity profile.
5. To study the variation of friction factor, 'f' for turbulent flow in smooth and rough commercial pipes.
6. To determine the loss coefficients for the pipe fittings.
7. To verify Bernoulli's equation experimentally.
8. To determine the flow rate and coefficient of discharge using Venturimeter.
9. Determination of discharge through Rotameter.
10. To determine the Reynolds number and types of flow (Laminar or Turbulent), the flow rate and coefficient of discharge using Orifice meter.
11. To determine losses due to pipe fitting, sudden enlargement and contraction.
12. Measurement of viscosity and surface tension of liquids.
13. To determine the characteristics of centrifugal pump and to find out total head, pump efficiency and overall efficiency of pump.
14. Study of various types of pipes and pipe fittings.
15. Study of different types of valves.
16. Study of reciprocating pump.
17. Determination of frictional coefficient of given pipe.

Online Learning Resources/Virtual Labs:

http://ce-iitb.vlabs.ac.in/exp7/Aim.html?domain=%20Chemical%20Engineering&lab=Chemical%20Engineering

https://eerc03-iiith.vlabs.ac.in/exp/reynolds/

https://eerc03-iiith.vlabs.ac.in/exp/bernoullis/

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Course Code	PRINCIPLES OF FOOD PRESERVATION		L	T	P	C
20A27306			1	0	2	2
Pre-requisite		Semester	III			

Course Objectives:

- Emphasis on importance of food technology into reduce the spoilage and improve the quality
- To explore the various preservation methods.

Course Outcomes (CO):

Upon completion of this course students should be able to understand

- The changes occurring during various food processing techniques
- Technologies involved in storage and preservation
- The effect of enzymes on spoilage reactions of foods.

UNIT - I **8 Hrs**

Definition and scope of Food Science and Technology, Historical development of food processing and preservation, general principles of food preservation. Degree of perishability of unmodified foods, Causes of quality deterioration and spoilage of perishable foods, intermediate moisture foods, wastage of foods.

UNIT - II **12 Hrs**

Preservation of foods by low temperatures: (A) Chilling temperatures: Consideration relating to storage of foods at chilling temperatures, Chilling injury, Applications and procedures, Controlled and Modified atmospheric storage of foods, Post storage Handling of foods.

(B) Freezing temperatures: Freezing process, Slow and quick freezing of foods; effect on foods, other occurrences associated with freezing of foods. Technological aspects of pre freezing, Actual freezing, Frozen storage and thawing of foods, Individual Quick Freezing.

UNIT - III **8 Hrs**

Preservation of foods by high temperatures: Basic concepts in thermal destruction of microorganisms D, Z and F values. Heat resistance and thermophilic microorganisms. Cooking, blanching, pasteurization and sterilization of foods. Extrusion, baking, roasting, frying, dielectric heating, ohmic, microwave and infrared heating. Assessing efficacy of thermal processing of foods, General process of canning of foods.

UNIT - IV **10 Hrs**

Preservation by water removal: (a) Principles, Technological aspects and application of evaporative concentration process; Freeze concentration and membrane process for food concentrations. (b) Principles, Technological aspects and application of drying and dehydration of foods, Cabinet, tunnel, belt, bin, drum, spray, vacuum, foam mat, fluidized-bed and freeze drying of foods.

UNIT - V **8 Hrs**

Chemical & Natural Preservatives: Classification, Principles, Radiations: Sources of radiations, units and dosages, effect on microorganisms and different nutrients; dose requirements for radiation preservation of foods., safe limits, irradiation mechanism and survival curve, technological aspects; applications of sugar and salt, antimicrobial agents, biological agents, Hurdle technology. Effects of various food processing operations on the nutritive value of foods.

Textbooks:

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1. Norman N. Potter and J.H. Hotchkiss, Chapman and Hall, "Food Science", 5th Edition,2098.
2. P. J. Fellows, "Food processing technology: Principles and Practice", 3rd Edition, Taylor and Francis, 2009.

Reference Books:

1. M. Karel, O.R. Fennema and D.B. Lund, "Principles of Food Science-Part-II: Physical Method of Food Preservation", 2nd Edition, Marcel Dekkar Inc., 2001.
2. V. Kyzlink, "Principles of Food Preservation", 2nd Edition, Elsevier Press, 2003.
3. J. M. Jay, D. Van Nostrand, "Modern Food Microbiology", 7th Edition, 2005.

EXPERIMENTS:

1. Demonstration of various perishable food items and degree of spoilage
2. Preservation of food by high concentration of sugar
3. Preservation of food by using salt
4. Blanching of selected food items
5. Preservation of food by heat treatment- pasteurization
6. Demonstration of preserving foods under cold vs. freezing process
7. To study IQF processing of fruits/ vegetable
8. Drying of fruit slices pineapple slices, apple slices in cabinet drier
9. Effect of irradiation on sprouting of potatoes and onions
10. Preservation of food by using acidulants i.e. pickling by acid, vinegar or acetic acid
11. Preservation of food by using chemical preservatives
12. Preservation of bread, cake using mold inhibitors
13. Processing of foods using fermentation technique, i.e. preparation of sauerkraut
14. Study on ohmic heating system
15. Study on effect of high pressure on microbe
16. Visit to food processing industry

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Food Technology

Course Code	ENVIRONMENTAL SCIENCE		L	T	P	C
20A99201	(Common to All Branches of Engineering)		3	0	0	0
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- To make the students to get awareness on environment
- To understand the importance of protecting natural resources, ecosystems for future generations and pollution causes due to the day to day activities of human life
- To save earth from the inventions by the engineers.

Course Outcomes (CO):

At the end of the course, the student will be able to

- Grasp multidisciplinary nature of environmental studies and various renewable and nonrenewable resources.
- Understand flow and bio-geo- chemical cycles and ecological pyramids.
- Understand various causes of pollution and solid waste management and related preventive measures.
- About the rainwater harvesting, watershed management, ozone layer depletion and waste land reclamation.
- Casus of population explosion, value education and welfare programmes.

UNIT - I		**8 Hrs**

Multidisciplinary Nature Of Environmental Studies: – Definition, Scope and Importance – Need for Public Awareness.

Natural Resources : Renewable and non-renewable resources – Natural resources and associated problems – Forest resources – Use and over – exploitation, deforestation, case studies – Timber extraction – Mining, dams and other effects on forest and tribal people – Water resources – Use and over utilization of surface and ground water – Floods, drought, conflicts over water, dams – benefits and problems – Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies – Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies. – Energy resources:

UNIT - II		**12 Hrs**

Ecosystems: Concept of an ecosystem. – Structure and function of an ecosystem – Producers, consumers and decomposers – Energy flow in the ecosystem – Ecological succession – Food chains, food webs and ecological pyramids – Introduction, types, characteristic features, structure and function of the following ecosystem:

a. Forest ecosystem.
b. Grassland ecosystem

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c. Desert ecosystem
d. Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

Biodiversity And Its Conservation : Introduction 0 Definition: genetic, species and ecosystem diversity – Bio-geographical classification of India – Value of biodiversity: consumptive use, Productive use, social, ethical, aesthetic and option values – Biodiversity at global, National and local levels – India as a mega-diversity nation – Hot-sports of biodiversity – Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts – Endangered and endemic species of India – Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT - III		**8 Hrs**

Environmental Pollution: Definition, Cause, effects and control measures of :

a. Air Pollution.
b. Water pollution
c. Soil pollution
d. Marine pollution
e. Noise pollution
f. Thermal pollution
g. Nuclear hazards

Solid Waste Management: Causes**,** effects and control measures of urban and industrial wastes – Role of an individual in prevention of pollution – Pollution case studies – Disaster management: floods, earthquake, cyclone and landslides.

UNIT - IV		**10 Hrs**

Social Issues and the Environment: From Unsustainable to Sustainable development – Urban problems related to energy – Water conservation, rain water harvesting, watershed management – Resettlement and rehabilitation of people; its problems and concerns. Case studies – Environmental ethics: Issues and possible solutions – Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case Studies – Wasteland reclamation. – Consumerism and waste products. – Environment Protection Act. – Air (Prevention and Control of Pollution) Act. – Water (Prevention and control of Pollution) Act – Wildlife Protection Act – Forest Conservation Act – Issues involved in enforcement of environmental legislation – Public awareness.

UNIT - V		**8 Hrs**

Human Population And The Environment: Population growth, variation among nations. Population explosion – Family Welfare Programmes. – Environment and human health – Human Rights – Value Education – HIV/AIDS – Women and Child Welfare – Role of information Technology in Environment and human health – Case studies.

Field Work: Visit to a local area to document environmental assets River/forest grassland/hill/mountain – Visit to a local polluted site-Urban/Rural/Industrial/Agricultural Study of common plants, insects, and birds – river, hill slopes, etc..

Textbooks:

1. Text book of Environmental Studies for Undergraduate Courses ErachBharucha for University Grants Commission, Universities Press.
2. Palaniswamy, "Environmental Studies", Pearson education
3. S.AzeemUnnisa, "Environmental Studies" Academic Publishing Company
4. K.Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", Scitech Publications (India), Pvt. Ltd.

Reference Books:

1. Deeksha Dave and E.Sai Baba Reddy, "Textbook of Environmental Science", Cengage Publications.
2. M.Anji Reddy, "Text book of Environmental Sciences and Technology", BS Publication.
3. J.P.Sharma, Comprehensive Environmental studies, Laxmi publications.
4. J. Glynn Henry and Gary W. Heinke, "Environmental Sciences and Engineering", Prentice hall of India Private limited
5. G.R.Chatwal, "A Text Book of Environmental Studies" Himalaya Publishing House
6. Gilbert M. Masters and Wendell P. Ela, "Introduction to Environmental Engineering and Science, Prentice hall of India Private limited.

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Course Code	FOOD BIOCHEMISTRY & NUTRITION		L	T	P	C
20A27401			3	0	0	3
Pre-requisite		Semester	IV			

Course Objectives:

- At the end of this course, the student will have an idea about the various constituents of foods, sources, energy and nutritional requirements and their functions.

Course Outcomes (CO):

- Students will able to learn the usefulness of cells and organisms
- Students will understand the metabolic pathways
- Students will get information on types and importance of nutrients

UNIT - I — **8 Hrs**

Concepts of food and nutrition: Definition of terms – nutrition, malnutrition (undernutrition, overweight, obesity), health and nutritional status, functions of food, basic food groups – energy yielding, body building and protective, nutrients supplied by food, nutritional needs – requirements and recommended allowances of foods under normal conditions for all age groups. Nutrients: Sources, functions, digestion, absorption, assimilation and transport of carbohydrates, proteins and fats in human beings.

UNIT - II — **12 Hrs**

Mechanism of enzyme action Introduction to enzymes, coenzymes, regulation of enzymatic activity, enzyme kinetics, inhibition effects of pH, allosteric enzymes, derivation of Michaelis-Menten Equation. Nucleic acids Definition and composition of RNA and DNA, structure of various components, viz, bases and sugars, hydrolysis of nucleic acids, structure of RNA and double helical structure of DNA

UNIT - III — **8 Hrs**

Metabolism of carbohydrates Biological role of carbohydrates, glycolysis and respiration (TCA cycle), production of ATP- a brief description of electron transport chain, oxidative and substrate phosphorylation. Metabolism of lipids Biological role of lipids, breakdown of triglycerides and phospholipids, β-oxidation of long chain fatty acids, ketosis, biosynthesis of fatty acids, triglycerides and phospholipids.

UNIT - IV — **10 Hrs**

Metabolism of proteins Breakdown of proteins, transamination, deamination, decarboxylation, nitrogen fixation, urea cycle. Minerals Functions, sources, factors affecting absorption of minerals, absorption promoters – Vit C for Fe, absorption inhibitors – phytates, tannins, oxalates, effect of deficiency – Calcium, phosphorus, iron, zinc, iodine, fluorine and copper.

UNIT - V — **8 Hrs**

Vitamins and hormones Classification, functions, sources, effects of deficiency, fat soluble vit (A,D,E,K), water soluble vitamin (thiamine, riboflavin, niacin, cyanocobalamin, folic acid, and ascorbic acid), relationship between vitamins and hormones in terms of their biological role. Physico chemical and nutritional changes during processing Changes during food processing treatment – drying and dehydration, irradiation, freezing, fermentation, canning, restoration, enrichment, fortification and supplementation of foods.

Textbooks:

David L. Nelson and Michael M. Cox. 2012. Lehninger Principles of Biochemisry, 6th Ed. Macmillan

Learning, NY, USA.
2. Donald Voet and Judith G. Voet. 2011. Biochemistry, 4th Ed. John Wiley and Sons, Inc., NY, USA.

Reference Books:

1. Carolyn D. Berdanier, Elaine B. Feldman and Johanna Dwyer. 2008. Handbook of Nutrition and Food, 2nd Ed. CRC Press, Boca Raton, FL, USA.
2. Bob B. Buchanan, Wilhelm Gruissem and Russell L. Jones. 2002. Biochemistry & Molecular Biology of Plants. John Wiley and Sons, Inc., NY, USA.
3. Jeremy M. Berg, John L. Tymoczko, LubertStryer and Gregory J. Gatto, Jr. 2002. Biochemisry, 7th Ed. W.H. Freeman and Company, NY, USA.
4. Gaile Moe, Danita Kelley, Jacqueline Berning and Carol Byrd-Bredbenner. 2013. Wardlaw's Perspectives in Nutrition: A Functional Approach. McGraw-Hill, Inc., NY, USA.

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Course Code	**INTRODUCTION TO PYTHON PROGRAMMING**		L	T	P	C
20A05406T			3	0	0	3
Pre-requisite	NIL	Semester	III			

Course Objectives:

This course aims at providing the student with the knowledge on

- To learn the fundamentals of Python
- To elucidate problem-solving using a Python programming language
- To introduce a function-oriented programming paradigm through python
- To get training in the development of solutions using modular concepts
- To introduce the programming constructs of python

Course Outcomes (CO):

At the end of the course, student will be able to

- Apply the features of Python language in various real applications.
- Select appropriate data structure of Python for solving a problem.
- Design object oriented programs using Python for solving real-world problems.
- Apply modularity to programs.

UNIT - I

Introduction: What is a program, Running python, Arithmetic operators, Value and Types. Variables, Assignments and Statements: Assignment statements, Script mode, Order of operations, string operations, comments.
Functions: Function calls, Math functions, Composition, Adding new Functions, Definitions and Uses, Flow of Execution, Parameters and Arguments, Variables and Parameters are local, Stack diagrams, Fruitful Functions and Void Functions, Why Functions.

UNIT - II

Case study: The turtle module, Simple Repetition, Encapsulation, Generalization, Interface design, Refactoring, docstring.
Conditionals and Recursion: floor division and modulus, Boolean expressions, Logical operators, Conditional execution, Alternative execution, Chained conditionals, Nested conditionals, Recursion, Infinite Recursion, Keyboard input.
Fruitful Functions: Return values, Incremental development, Composition, Boolean functions, More recursion, Leap of Faith, Checking types,

UNIT - III

Iteration: Reassignment, Updating variables, The while statement, Break, Square roots, Algorithms.
Strings: A string is a sequence, len, Traversal with a for loop, String slices, Strings are immutable, Searching, Looping and Counting, String methods, The in operator, String comparison.
Case Study: Reading word lists, Search, Looping with indices.
Lists: List is a sequence, Lists are mutable, Traversing a list, List operations, List slices, List methods, Map filter and reduce, Deleting elements, Lists and Strings, Objects and values, Aliasing, List arguments.

UNIT - IV

Dictionaries: A dictionary is a mapping, Dictionary as a collection of counters, Looping and dictionaries, Reverse Lookup, Dictionaries and lists, Memos, Global Variables.
Tuples: Tuples are immutable, Tuple Assignment, Tuple as Return values, Variable-length argument tuples, Lists and tuples, Dictionaries and tuples, Sequences of sequences.
Files: Persistence, Reading and writing, Format operator, Filename and paths, Catching exceptions, Databases, Pickling, Pipes, Writing modules.

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Classes and Objects: Programmer-defined types, Attributes, Instances as Return values, Objects are mutable, Copying. Classes and Functions:
UNIT - V
Classes and Functions: Time, Pure functions, Modifiers, Prototyping versus Planning Classes and Methods: Object oriented features, Printing objects, The init method, The strmethod, Operator overloading, Type-based Dispatch, Polymorphism, Interface and Implementation Inheritance: Card objects, Class attributes, Comparing cards, decks, Printing the Deck, Add Remove shuffle and sort, Inheritance, Class diagrams, Data encapsulation. The Goodies: Conditional expressions, List comprehensions, Generator expressions, any and all, Sets, Counters, defaultdict, Named tuples, Gathering keyword Args,
Textbooks:
1. Allen B. Downey, “Think Python”, 2nd edition, SPD/O’Reilly, 2016.
Reference Books:
1. Martin C.Brown, “The Complete Reference: Python”, McGraw-Hill,2018. 2. Kenneth A. Lambert, B.L. Juneja, “Fundamentals of Python”, CENGAGE,2015. 3. R. Nageswara Rao, “Core Python Programming”, 2nd edition, Dreamtech Press,2019

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Course Code	PROCESSING OF FRUIT AND VEGETABLES, SPICES AND PLANTATION CROPS		L	T	P	C
20A27402T			3	0	0	3
Pre-requisite		Semester	IV			

Course Objectives:

At the end of this course the students get an outline about

- Various methods intended for preserving fruits and vegetables.
- Different operations inferred in processing fruits and vegetables
- Technology behind intermediate moisture and minimally processed fruit and vegetable.

Course Outcomes (CO):

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

- Train the students in the field of Fruit and Vegetable Processing and enable the students learn different preservation techniques to curb post-harvest losses inthe field of agriculture.
- Learn processing of fruits & vegetables - different preservation techniques to improve theshelf life of seasonal fruits.
- Know history of spices, uses of spices, classification of processed spices according to marketing standards, packaging and different grades
- Learn about flavor development during processing, classification of spices according to economic importance, post-harvest technology and treatments, specifications for marketed products.

UNIT - I		8 Hrs

Fruit and Vegetables Processing: Postharvest field operations including methods to reduce the post-harvest losses, Precooling, In-house packing, cold storage etc., General methods of preservation of fruits and vegetables. Canning of fruits and vegetables: Canning unit operations and machinery - Blanching: Method and its Importance. Precautions in canning, Spoilage of canned foods. Preservation by hurdle technology.

UNIT - II		12 Hrs

Fruit and Vegetables Products: Jams, Jellies, Marmalades, Fruit beverages, Fruit Bars, Fruit Powders, Candies, Preserves, Crystallized fruit, Pickles, etc. Products from Jamun, Tamarind, Jack fruit, Wood apple, Tomato, Potato and Mushroom. Fruit juice concentrates: Methods of concentration, aroma recovery.

UNIT - III		8 Hrs

Plantation crops: Primary and secondary processing of Coffee, Tea, Cocoa, Cashew nut, Areca nut & Vanilla, Value added products.

UNIT - IV		10 Hrs

Spices: Classification of Spices, Primary and secondary processing of spices like Pepper, Ginger, Turmeric, Cardamom, Chilies, Cinnamon Coriander, Saffron etc. Value added products: Spice powders, Curry powders, Sterilized spices, Enriched Spices, Encapsulation, aqueous flavourants. Spice Oils & Oleoresins: Flavor extraction from spices by different methods. Estimation of principle constituents in spices & spice products, residual solvent in spice oleoresins.

UNIT - V		8 Hrs

Herbs: Classification of herbs, Processing of Coriander, Curry leaves, Rosemary, Sage, Mint,

Dill Spearmint, Basil, Borage, Thyme, etc and their health benefits. **Natural Colors:** Extraction techniques and color estimation from plant materials like Red beet, Safflower, blue grapes, Red chilies, Turmeric, Annatto etc. Food application and Stability studies of flavourant& colorants.

Textbooks:

1. A.K. Thompson., Fruit and Vegetables: Harvesting, Handling and Storage, Blackwell publishing, 2003.
2. Dauthy, M. E., Fruit and Vegetable Processing. FAO Agricultural Service Bulletin, 1st Edition, International Book Distributing Co. Lucknow, India, 1997.
3. J. S. Pruthi, Spices & Condiments National Book Trust, 5th Edition, New Delhi, 2001.
4. R.P. Srivastava&Sanjeev Kumar., Fruit and Vegetable Preservation, 3rd revised & enlarged edition, IBDC, 2010.

Reference Books:

1. D.K. Salunkhe& S.S. Kadam., Handbook of Fruit Science and Technology: Production, Composition, Storage and Processing, 1st Edition, CRC Press, 2013.
2. J. W. Parry.,Spices: Morphology, History, Chemistry, Volume II, 2nd Edition, Chemical Publishing Co., New York 1969.
3. VijayaKhader, Preservation of Fruits and vegetables, 2nd Edition, Kalyani Publications, 2000.
4. W.V. Cruess, Commercial Fruit and Vegetable Products, 3rd Edition, AGROBIOS, India, 2011.

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Course Code	HEAT AND MASS TRANSFER		L	T	P	C
20A27403T			3	0	0	3
Pre-requisite		Semester	IV			

Course Objectives:

- To impart knowledge to students on different modes of heat transfer through extended surfaces, study of heat exchanges and evaporators. Basic concepts of mass transfer and mechanism of mass transfer operations like distillation, extraction, leaching, crystallization and drying.

Course Outcomes (CO):

- Students acquire knowledge from different modes of heat transfer, extended surfaces, boiling and condensation process and principles of heat exchangers which are very essential in dairy and food industries.
- Students are exposed to mass transfer laws and concerning unit operations and their principles, equipment used.

UNIT - I **8 Hrs**

Introduction to heat transfer and general concepts of heat transfer by conduction, convection and radiation. Conduction:through plane walls, cylindrical and spherical surfaces, composite layers, etc. steady state and unsteady state heat transfer.Insulation materials, critical and optimum insulation thickness. Extended surfaces, fins and their practical applications. Convection: Fundamentals of convection, Basic concepts and definitions, natural and forced convection.

UNIT - II **12 Hrs**

Radiation: Basic laws of heat transfer by radiation, black body and gray body concepts, view factors, Kirchoff's law, solar radiations, combined heat transfer coefficients by convection and radiation. Heat Transfer Equipment: Classification, principles and design criteria, types of exchangers, viz., double pipe, shell and tube, plate type, extended surface, Furnaces and their classification and application.

UNIT - III **8 Hrs**

Evaporation: Elementary principles, parts of evaporator, types of evaporators. Single and multiple effect evaporators and their area calculations, boiling point elevation, selection, types of energy use, thermo vapour recompression, mechanical vapor recompression. Fouling prevention, cleaning and hygiene. Applications in food processing.Mass Transfer Laws: Introduction, Fick's law, diffusion coefficients in gas, liquid and solid, numerical solution of steady state diffusion, Fick's 2nd law and unsteady state operation, mass transfer coefficients, interphase mass transfer, diffusion of gases in porous solids and capillaries. fugacity & water activity.

UNIT - IV **10 Hrs**

Drying: types of drying, constant and falling rate, equilibrium moisture content, drying curve and drying time, types of dryers. Solid-liquid extraction: Countercurrent, co-current, multistage continuous contact operations. Liquid-liquid extraction: Ternary liquid–liquid equilibrium and tie line data, choice of solvents, extraction equipment. Leaching principle and equipment.Gas Absorption: Equilibrium solubility of gases in liquids, ideal and non-ideal solutions. Equipment. Concept of NTU, HTU and HEPT. Ideal stage and stage efficiency.

UNIT - V **8 Hrs**

Distillation: Vapour liquid equlibria, boiling point diagram, relative volatility, enthalpy concentration

diagram, flash vapourization, differential distillation, steam distillation, azeotropic distillation and extractive distillation for binary system. Continuous rectification, McCabe Thiele method, bubble cap distillation column. Crystallization-rate of crystallization, crystallization equilibrium. Super saturation – Crystallizers type – batch and continuous. Adsorption and Ion Exchange: Types of Adsorption, nature of adsorbents, adsorption equilibrium, adsorption of a single component from a gas mixture/liquid solution. Principle of ion exchange, equilibria and rate of ion-exchange.
Textbooks:
1. Coulson, J.M. & Richardson, J.F. "Chemical Engineering: Vol-1", 6th ed. Butterworth-Heinemann (1999) 2. Holman, J.P.: "Heat Transfer" 9 th ed. McGraw Hill (1989).
Reference Books:
1. McAdams W.H. "Heat Transmission", 3rd ed., McGraw-Hill, (1954) 2. Kern D.Q. "Process Heat Transfer" McGraw Hill Book (1950) 3. Badger W.L. &Bancharo J.T.," Introduction to chemical engineering" Tata McGraw Hill

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Food Technology

Course Code	**MANAGERIAL ECONOMICS AND FINANCIAL ANALYSIS (Common to All branches of Engineering)**		**L**	**T**	**P**	**C**
20A52301			**3**	**0**	**0**	**3**
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

- To inculcate the basic knowledge of micro economics and financial accounting
- To make the students learn how demand is estimated for different products, input-output relationship for optimizing production and cost
- To Know the Various types of market structure and pricing methods and strategy
- To give an overview on investment appraisal methods to promote the students to learn how to plan long-term investment decisions.
- To provide fundamental skills on accounting and to explain the process of preparing financial statements

Course Outcomes (CO):

- Define the concepts related to Managerial Economics, financial accounting and management.
- Understand the fundamentals of Economics viz., Demand, Production, cost, revenue and markets
- Apply the Concept of Production cost and revenues for effective Business decision
- Analyze how to invest their capital and maximize returns
- Evaluate the capital budgeting techniques
- Develop the accounting statements and evaluate the financial performance of business entity.

UNIT - I	**Managerial Economics**	

Introduction – Nature, meaning, significance, functions and advantages. Demand-Concept, Function, Law of Demand - Demand Elasticity- Types – Measurement. Demand Forecasting- Factors governing Forecasting, Methods. Managerial Economics and Financial Accounting and Management.

UNIT - II	**Production and Cost Analysis**	

Introduction – Nature, meaning, significance, functions and advantages. Production Function– Least-cost combination– Short run and Long run Production Function- Isoquants and Isocosts, MRTS - Cobb-Douglas Production Function - Laws of Returns - Internal and External Economies of scale. Cost&Break Even Analysis - Cost concepts and Cost behavior- Break-Even Analysis (BEA) - Determination of Break-Even Point (Simple Problems)-Managerial significance and limitations of Break-Even Analysis.

UNIT - III	**Business Organizations and Markets**	

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Introduction – Nature, meaning, significance, functions and advantages. Forms of Business Organizations- Sole Proprietary - Partnership - Joint Stock Companies - Public Sector Enterprises. Types of Markets - Perfect and Imperfect Competition - Features of Perfect Competition Monopoly-Monopolistic Competition–Oligopoly-Price-Output Determination - Pricing Methods and Strategies		
UNIT - IV	**Capital Budgeting**	
Introduction – Nature, meaning, significance, functions and advantages. Types of Working Capital, Components, Sources of Short-term and Long-term Capital, Estimating Working capital requirements. Capital Budgeting– Features, Proposals, Methods and Evaluation. Projects – Pay Back Method, Accounting Rate of Return (ARR) Net Present Value (NPV) Internal Rate Return (IRR) Method (sample problems)		
UNIT - V	**Financial Accounting and Analysis**	
Introduction – Nature, meaning, significance, functions and advantages. Concepts and Conventions- Double-Entry Book Keeping, Journal, Ledger, Trial Balance- Final Accounts (Trading Account, Profit and Loss Account and Balance Sheet with simple adjustments). ***Financial Analysis*** **-** Analysis and Interpretation of Liquidity Ratios, Activity Ratios, and Capital structure Ratios and Profitability.		
Textbooks: 1. Varshney&Maheswari: Managerial Economics, Sultan Chand, 2013. 2. Aryasri: Business Economics and Financial Analysis, 4/e, MGH, 2019		
Reference Books:		
1. Ahuja Hl Managerial economics Schand,3/e,2013 2. S.A. Siddiqui and A.S. Siddiqui: Managerial Economics and Financial Analysis, New Age International, 2013. 3. Joseph G. Nellis and David Parker: Principles of Business Economics, Pearson, 2/e, New Delhi. 4. Domnick Salvatore: Managerial Economics in a Global Economy, Cengage, 2013.		
Online Learning Resources:		
https://www.slideshare.net/123ps/managerial-economics-ppt https://www.slideshare.net/rossanz/production-and-cost-45827016 https://www.slideshare.net/darkyla/business-organizations-19917607 https://www.slideshare.net/balarajbl/market-and-classification-of-market https://www.slideshare.net/ruchi101/capital-budgeting-ppt-59565396 https://www.slideshare.net/ashu1983/financial-accounting		

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Course Code	**ORGANISATIONAL BEHAVIOUR**		**L**	**T**	**P**	**C**
20A52302	**(Common to All branches of Engineering)**		**3**	**0**	**0**	**3**
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

- To enable student's comprehension of organizational behavior
- To offer knowledge to students on self-motivation, leadership and management
- To facilitate them to become powerful leaders
- To Impart knowledge about group dynamics
- To make them understand the importance of change and development

Course Outcomes (CO):

- Define the Organizational Behaviour, its nature and scope.
- Understand the nature and concept of Organizational behaviour
- Apply theories of motivation to analyse the performance problems
- Analyse the different theories of leadership
- Evaluate group dynamics
- Develop as powerful leader

UNIT - I	**Introduction to Organizational Behavior**	

Meaning, definition, nature, scope and functions - Organizing Process – Making organizing effective -Understanding Individual Behaviour –Attitude -Perception - Learning – Personality.

UNIT - II	**Motivation and Leading**	

Theories of Motivation- Maslow's Hierarchy of Needs - Hertzberg's Two Factor Theory - Vroom's theory of expectancy – Mc Cleland's theory of needs–Mc Gregor's theory X and theory Y– Adam's equity theory – Locke's goal setting theory– Alderfer's ERG theory .

UNIT - III	**Organizational Culture**	

Introduction – Meaning, scope, definition, Nature - Organizational Climate - Leadership - Traits Theory–Managerial Grid - Transactional Vs Transformational Leadership - Qualities of good Leader - Conflict Management -Evaluating Leader- Women and Corporate leadership.

UNIT - IV	**Group Dynamics**	

Introduction – Meaning, scope, definition, Nature- Types of groups - Determinants of group behavior - Group process – Group Development - Group norms - Group cohesiveness - Small Groups - Group decision making - Team building - Conflict in the organization– Conflict resolution

UNIT - V	**Organizational Change and Development**	

Introduction –Nature, Meaning, scope, definition and functions- Organizational Culture - Changing the Culture – Change Management – Work Stress Management - Organizational management – Managerial implications of organization's change and development

Textbooks:

1. Luthans, Fred, Organisational Behaviour, McGraw-Hill, 12 Th edition 2011
2. P Subba Ran, Organisational Behaviour, Himalya Publishing House 2017

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Reference Books:
▪ McShane, Organizational Behaviour, TMH 2009 ▪ Nelson, Organisational Behaviour, Thomson, 2009. ▪ Robbins, P. Stephen, Timothy A. Judge, Organisational Behaviour, Pearson 2009. ▪ Aswathappa, Organisational Behaviour, Himalaya, 2009
Online Learning Resources:
httphttps://www.slideshare.net/Knight1040/organizational-culture-9608857s://www.slideshare.net/AbhayRajpoot3/motivation-165556714 https://www.slideshare.net/harshrastogi1/group-dynamics-159412405 **https://www.slideshare.net/vanyasingla1/organizational-change-development-26565951**

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Course Code	Business Environment (Common to All branches of Engineering)		L	T	P	C
20A52303			3	0	0	3
Pre-requisite	**NIL**	**Semester**	**III**			

Course Objectives:

- To make the student to understand about the business environment
- To enable them in knowing the importance of fiscal and monitory policy
- To facilitate them in understanding the export policy of the country
- To Impart knowledge about the functioning and role of WTO
- To Encourage the student in knowing the structure of stock markets

Course Outcomes (CO):

- Define Business Environment and its Importance.
- Understand various types of business environment.
- Apply the knowledge of Money markets in future investment
- Analyse India's Trade Policy
- Evaluate fiscal and monitory policy
- Develop a personal synthesis and approach for identifying business opportunities

UNIT - I	**Overview of Business Environment**

Introduction – meaning Nature, Scope, significance, functions and advantages. Types-Internal &External, Micro and Macro. Competitive structure of industries -Environmental analysis-advantages & limitations of environmental analysis& Characteristics of business.

UNIT - II	**Fiscal & Monetary Policy**

Introduction – Nature, meaning, significance, functions and advantages. Public Revenues - Public Expenditure - Evaluation of recent fiscal policy of GOI. Highlights of Budget- Monetary Policy - Demand and Supply of Money –RBI -Objectives of monetary and credit policy - Recent trends- Role of Finance Commission.

UNIT - III	**India's Trade Policy**

Introduction – Nature, meaning, significance, functions and advantages. Magnitude and direction of Indian International Trade - Bilateral and Multilateral Trade Agreements - EXIM policy and role of EXIM bank -Balance of Payments– Structure & Major components - Causes for Disequilibrium in Balance of Payments - Correction measures.

UNIT - IV	**World Trade Organization**

Introduction – Nature, significance, functions and advantages. Organization and Structure - Role and functions of WTO in promoting world trade - GATT -Agreements in the Uruguay Round –TRIPS, TRIMS - Disputes Settlement Mechanism - Dumping and Anti-dumping Measures.

UNIT - V	**Money Markets and Capital Markets**

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Introduction – Nature, meaning, significance, functions and advantages. Features and components of Indian financial systems - Objectives, features and structure of money markets and capital markets - Reforms and recent development – SEBI – Stock Exchanges - Investor protection and role of SEBI, Introduction to international finance.
Textbooks:
1. Francis Cherunilam (2009), International Business: Text and Cases, Prentice Hall of India. 2. K. Aswathappa, Essentials of Business Environment: Texts and Cases & Exercises 13th Revised Edition.HPH2016
Reference Books:
1.K. V. Sivayya, V. B. M Das (2009), Indian Industrial Economy, Sultan Chand Publishers, New Delhi, India. 2. Sundaram, Black (2009), International Business Environment Text and Cases, Prentice Hall of India, New Delhi, India. 3. Chari. S. N (2009), International Business, Wiley India. 4.E. Bhattacharya (2009), International Business, Excel Publications, New Delhi.
Online Learning Resources:
https://www.slideshare.net/ShompaDhali/business-environment-53111245 https://www.slideshare.net/rbalsells/fiscal-policy-ppt https://www.slideshare.net/aguness/monetary-policy-presentationppt https://www.slideshare.net/DaudRizwan/monetary-policy-of-india-69561982 https://www.slideshare.net/ShikhaGupta31/indias-trade-policyppt https://www.slideshare.net/viking2690/wto-ppt-60260883 https://www.slideshare.net/prateeknepal3/ppt-mo

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Course Code	PYTHON PROGRAMMING LABORATORY		L	T	P	C
20A05406P			0	0	3	1.5
Pre-requisite		Semester	IV			

Course Objectives:

- To train the students in solving computational problems
- To elucidate solving mathematical problems using Python programming language
- To understand the fundamentals of Python programming concepts and its applications.
- To understand the object-oriented concepts using Python in problem solving.

Course Outcomes (CO):

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

- Design solutions to mathematical problems.
- Organize the data for solving the problem.
- Develop Python programs for numerical and text based problems.
- Select appropriate programming construct for solving the problem.
- Illustrate object oriented concepts.

List of Experiments:

1. Install Python Interpreter and use it to perform different Mathematical Computations. Try to do all the operations present in a Scientific Calculator
2. Write a function that draws a grid like the following:

```
+ - - - -  + - - -  +
|          |       |
|          |       |
|          |       |
|          |       |
+ - - - -  + - - -  +
|          |       |
|          |       |
|          |       |
|          |       |
+ - - - - + - - - - +
```

3. Write a function that draws a Pyramid with # symbols

```
          #
        # # #
      # # # # #
    # # # # # # #
          .
```

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.
.

Up to 15 hashes at the bottom

4. Using turtles concept draw a wheel of your choice
5. Write a program that draws Archimedean Spiral
6. The letters of the alphabet can be constructed from a moderate number of basic elements, like vertical and horizontal lines and a few curves. Design an alphabet that can be drawn with a minimal number of basic elements and then write functions that draw the letters. The alphabet can belong to any Natural language excluding English. You should consider at least Ten letters of the alphabet.
7. The time module provides a function, also named time that returns the current Greenwich Mean Time in "the epoch", which is an arbitrary time used as a reference point. On UNIX systems, the epoch is 1 January 1970.

   >>> import time
   >>> time.time()
   1437746094.5735958

   Write a script that reads the current time and converts it to a time of day in hours, minutes, and seconds, plus the number of days since the epoch.
8. Given n+r+1 <= 2^r . n is the input and r is to be determined. Write a program which computes minimum value of r that satisfies the above.
9. Write a program that evaluates Ackermann function
10. The mathematician Srinivasa Ramanujan found an infinite series that can be used to generate a numerical approximation of 1/ π :
    Write a function called estimate_pi that uses this formula to compute and return an estimate of π.

$$\frac{1}{\pi} = \frac{2\sqrt{2}}{9801} \sum_{k=0}^{\infty} \frac{(4k)!(1103 + 26390k)}{(k!)^4 396^{4k}}$$

    It should use a while loop to compute terms of the summation until the last term is smaller than 1e-15 (which is Python notation for 10^{-15}). You can check the result by comparing it to math.pi.
11. Choose any five built-in string functions of C language. Implement them on your own in

Python. You should not use string related Python built-in functions.

12. Given a text of characters, Write a program which counts number of vowels, consonants and special characters.
13. Given a word which is a string of characters. Given an integer say 'n', Rotate each character by 'n' positions and print it. Note that 'n' can be positive or negative.
14. Given rows of text, write it in the form of columns.
15. Given a page of text. Count the number of occurrences of each latter (Assume case insensitivity and don't consider special characters). Draw a histogram to represent the same
16. Write program which performs the following operations on list's. Don't use built-in functions
    a) Updating elements of a list
    b) Concatenation of list's
    c) Check for member in the list
    d) Insert into the list
    e) Sum the elements of the list
    f) Push and pop element of list
    g) Sorting of list
    h) Finding biggest and smallest elements in the list
    i) Finding common elements in the list

18. Write a program that reads a file, breaks each line into words, strips whitespace and punctuation from the words, and converts them to lowercase.
19. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Read the book you downloaded, skip over the header information at the beginning of the file, and process the rest of the words as before. Then modify the program to count the total number of words in the book, and the number of times each word is used. Print the number of different words used in the book. Compare different books by different authors, written in different eras.
20. Go to Project Gutenberg (http://gutenberg.org) and download your favorite out-of-copyright book in plain text format. Write a program that allows you to replace words, insert words and delete words from the file.
21. Consider all the files on your PC. Write a program which checks for duplicate files in your PC and displays their location. Hint: If two files have the same checksum, they probably have the same contents.
22. Consider turtle object. Write functions to draw triangle, rectangle, polygon, circle and sphere. Use object oriented approach.
23. Write a program illustrating the object oriented features supported by Python.

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24. Design a Python script using the Turtle graphics library to construct a turtle bar chart representing the grades obtained by N students read from a file categorising them into distinction, first class, second class, third class and failed. 25. Design a Python script to determine the difference in date for given two dates in YYYY:MM:DD format(0 <= YYYY <= 9999, 1 <= MM <= 12, 1 <= DD <= 31) following the leap year rules. 26. Design a Python Script to determine the time difference between two given times in HH:MM:SS format.(0 <= HH <= 23, 0 <= MM <= 59, 0 <= SS <= 59)
Reference Books:
1. Peter Wentworth, Jeffrey Elkner, Allen B. Downey and Chris Meyers, "How to Think Like a Computer Scientist: Learning with Python 3", 3rd edition, Available at http://www.ict.ru.ac.za/Resources/cspw/thinkcspy3/thinkcspy3.pdf 2. Paul Barry, "Head First Python a Brain Friendly Guide" 2nd Edition, O'Reilly, 2016 3. Dainel Y.Chen "Pandas for Everyone Python Data Analysis" Pearson Education, 2019

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Course Code	PROCESSING OF FRUIT AND VEGETABLES, SPICES AND PLANTATION CROPS LAB		L	T	P	C
20A27402P			0	0	3	1.5
Pre-requisite		Semester	IV			

Course Objectives:

- Estimation of preservatives like benzoic acid and SO_2, different processed products from fruit and vegetables and each operation importance.

Course Outcomes (CO):

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

- Know how to find out heat transfer coefficient, emissivity, conductivity, heat flux etc.
- Know how to find out steam economy in evaporators
- Students will understand the separation techniques, significance of water activity, working principle of various mass transfer equipment.

List of Experiments:

1. Estimation of benzoic acid & SO_2
2. Pectin determination in fruits and vegetable products.
3. Preparation fruit juices e.g. carambola, orange, pineapple, mango etc.
4. Canning of fruits and vegetables
5. Extraction of Pectin (identification pectin rich foods, chemistry and interaction of pectin with other components)
6. Preparation of jams and jellies, marmalade, crystallized & glazed fruit, preserves and candies (knowledge on selection of fruits)
7. Preparation of Syrup, Squash, Crush
8. Preparation of tutti-frutti
9. Preparation of pickles, chutneys
10. Preparation of tomato products
11. Extraction of Papain
12. Drying of fruit and vegetables (Soup powders, dried products)
13. Visit to a Canning Plant
14. Visit to Fruits and Vegetable processing industries; processing of Mushrooms.

Online Learning Resources/Virtual Labs:

1. http://vmt-iitg.vlabs.ac.in/Binary_vapour_liquid_equilibrum(theory).html
2. http://vmt-iitg.vlabs.ac.in/Rotary_dryer(theory).html
3. http://vmt-iitg.vlabs.ac.in/Forced_draft_tray_dryer(theory).html
4. http://ce-iitb.vlabs.ac.in/exp8/Aim.html?domain=Chemical%20Engineering&lab=Chemical%20Engineering%20Lab
5. https://vlab.amrita.edu/?sub=1&brch=194&sim=802&cnt=1

https://vlab.amrita.edu/?sub=1&brch=194&sim=354&cnt=1

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Food Technology

Course Code	HEAT AND MASS TRANSFER LAB		L	T	P	C
20A27403P			0	0	3	1.5
Pre-requisite		Semester	IV			

Course Objectives:

- This course enables the students to under the heat transfer operations that takes place in food industry in better way. It also helps to study the mass transfer operations and their principles in more realistic approach.

Course Outcomes (CO):

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

- Know how to find out heat transfer coefficient, emissivity, conductivity, heat flux etc.
- Know how to find out steam economy in evaporators
- Students will understand the separation techniques, significance of water activity, working principle of various mass transfer equipment.

List of Experiments:

1. To find the thermal conductivity of metallic rod at different temperature and draw the temperature profile for steady and unsteady state conduction.
2. To find out the thermal conductivity of insulating powder.
3. To find the emissivity of grey plate with respect to black plate
4. To find the heat transfer coefficient for parallel and counter current flow condition for a Double pipe heat exchanger
5. To study the shell & Tube heat exchanger and find the heat duty and over all heat transfer coefficient for parallel flow condition.
6. To study the shell & Tube heat exchanger and find the heat duty and over all heat transfer coefficient for counter flow condition.
7. Psychrometric chart and psychrometers.
8. Determination of depression of freezing point
9. Determination of Boiling point elevation and solute concentration
10. Determination of overall mass transfer coefficient based on continuous and dispersed phase
11. Studies on steam distillation
12. Separation factors of the experiments with liquid – liquid extraction.
13. Separation factors of the experiments with solid –liquid extraction.
14. Separation factors of the experiments with ion exchange.
15. Studies on Bubble cap/ tray/ fractional column

Online Learning Resources/Virtual Labs:

1. Binary vapor liquid equilibriumhttp://vmt-iitg.vlabs.ac.in/Binary_vapour_liquid_equilibrum(theory).html
2. Rotary Dryerhttp://vmt-iitg.vlabs.ac.in/Rotary_dryer(theory).html
3. Forced draft tray dryerhttp://vmt-iitg.vlabs.ac.in/Forced_draft_tray_dryer(theory).html
4. Heat transfer in a double pipe heat exchangerhttp://ce-iitb.vlabs.ac.in/exp8/Aim.html?domain=Chemical%20Engineering&lab=Chemical%20Engineering%20Lab
5. Heat Transfer by Radiationhttps://vlab.amrita.edu/?sub=1&brch=194&sim=802&cnt=1
6. Newton's Law of Coolinghttps://vlab.amrita.edu/?sub=1&brch=194&sim=354&cnt=1

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Course Code	BASIC MICROBIOLOGY		L	T	P	C
20A27404			1	0	2	2
Pre-requisite		Semester	IV			

Course Objectives:

- To learn the basic microbiological classification and microbial techniques.
- To enable students to gain knowledge on various microbial cultures and their growth factors.

Course Outcomes (CO):

By the end of the course, students will learn

- Significance and importance of microbiology
- Morphology of various microorganisms
- Methods used for Control of microorganisms and preservation of pure cultures

UNIT - I		8 Hrs

Evolution and scope of microbiology; History of microbiology; Classification of microorganisms, Applied areas of microbiology; Microscopy – Optical & Electron- Optical: Bright field, dark field, ultraviolet, phase contrast, fluorescent; Electron- Scanning electron microscopy, Transmission electron microscopy; Morphology, general characteristics & Reproduction of algae; Morphology general characteristics and reproduction of fungi and molds.

UNIT - II		12 Hrs

Morphology general, characteristics, structure, classification, identification, reproduction, nutrition and growth of bacteria, bacteria genetics; bacteria recombination; Bacterial conjugation, transduction; Bacterial transformation.

UNIT - III		8 Hrs

Mutations: Types of mutations, mutagenesis; Mutation rate, repair of mutations; Phenotypes of bacterial mutants; Designation of bacterial mutants.

UNIT - IV		10 Hrs

Viruses – Structure, shape classification based on nucleic acid; replication and multiplication; food borne viruses.

UNIT - V		8 Hrs

Factors affecting growth of microorganism, Intrinsic factors and Extrinsic factors; Identification of bacteria- bacteria straining, estimating members cell counts, viable , plate counts; Pure culture: Definition, methods of isolation, preservation techniques; control of microorganisms by physical, chemical, antibiotic and other chemotherapeutic agents.

Textbooks:

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

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Reference Books:
1. RY Stainier, JL ML Ingraham, Wheelis&PR.Painter "General Microbiology". MacMillan, 2003. 2. George J Banwart, "Basic Food Microbiology". 2nd Edition, International Thomson Publishing, 1989. 3. S S Purohit "Microbiology Fundamentals and Applications". 7th Edition, Agro Botanical Publishers, 1998. 4. M R Adams & M O Moss "Food Microbiology". 2nd Edition, Athenaeum Press Ltd, 2006. 5. James M Jay "Modern Food Microbiology". 4th Edition, CBS Publishers and Distributors, 2005.
BASIC MICROBIOLOGY LAB:
1. Methods of Sterilization 2. Media Preparation-Broth, deep, slant and plate 3. Pure Culture techniques- introduction and Streaking (Continuous and quadrant) 4. Cultural Characteristics in broth and solid media 5. Microscopy- introduction 6. Motility determination-soft agar deeps and Hanging drop method 7. Staining techniques- Simple staining 8. Negative Staining 9. Gram staining 10. Endospore Staining
Online Learning Resources/Virtual Labs:
https://vlab.amrita.edu/?sub=3&brch=73&sim=213&cnt=1
https://vlab.amrita.edu/?sub=3&brch=73&sim=697&cnt=1
https://vlab.amrita.edu/?sub=3&brch=73&sim=1338&cnt=1
https://vlab.amrita.edu/?sub=3&brch=73&sim=208&cnt=1
https://vlab.amrita.edu/?sub=3&brch=73&sim=1105&cnt=1
https://vlab.amrita.edu/?sub=3&brch=73&sim=1338&cnt=1
https://vlab.amrita.edu/?sub=3&brch=73&sim=212&cnt=1
https://vlab.amrita.edu/?sub=3&brch=76&sim=1109&cnt=1

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Course Code	Design Thinking for Innovation (Common to All branches of Engineering)		L	T	P	C
20A99401			2	1	0	0
Pre-requisite	**NIL**	**Semester**	**IV**			

Course Objectives:

The objective of this course is to familiarize students with design thinking process as a tool for breakthrough innovation. It aims to equip students with design thinking skills and ignite the minds to create innovative ideas, develop solutions for real-time problems.

Course Outcomes (CO):

- Define the concepts related to design thinking.
- Explain the fundamentals of Design Thinking and innovation
- Apply the design thinking techniques for solving problems in various sectors.
- Analyse to work in a multidisciplinary environment
- Evaluate the value of creativity
- Formulate specific problem statements of real time issues

UNIT - I	Introduction to Design Thinking	10 Hrs

Introduction to elements and principles of Design, basics of design-dot, line, shape, form as fundamental design components. Principles of design. Introduction to design thinking, history of Design Thinking, New materials in Industry.

UNIT - II	Design Thinking Process	10 Hrs

Design thinking process (empathize, analyze, idea & prototype), implementing the process in driving inventions, design thinking in social innovations. Tools of design thinking - person, costumer, journey map, brain storming, product development

Activity: Every student presents their idea in three minutes, Every student can present design process in the form of flow diagram or flow chart etc. Every student should explain about product development.

UNIT - III	Innovation	8 Hrs

Art of innovation, Difference between innovation and creativity, role of creativity and innovation in organizations. Creativity to Innovation. Teams for innovation, Measuring the impact and value of creativity.

Activity: Debate on innovation and creativity, Flow and planning from idea to innovation, Debate on value-based innovation.

UNIT - IV	Product Design	8 Hrs

Problem formation, introduction to product design, Product strategies, Product value, Product planning, product specifications. Innovation towards product design Case studies.
Activity: Importance of modelling, how to set specifications, Explaining their own product design.

UNIT - V	Design Thinking in Business Processes	10 Hrs

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Design Thinking applied in Business & Strategic Innovation, Design Thinking principles that redefine business – Business challenges: Growth, Predictability, Change, Maintaining Relevance, Extreme competition, Standardization. Design thinking to meet corporate needs. Design thinking for Startups. Defining and testing Business Models and Business Cases. Developing & testing prototypes. **Activity:** How to market our own product, About maintenance, Reliability and plan for startup.
Textbooks:
1. Change by design, Tim Brown, Harper Bollins (2009) 2. Design Thinking for Strategic Innovation, Idris Mootee, 2013, John Wiley & Sons.
Reference Books: 1. Design Thinking in the Classroom by David Lee, Ulysses press 2. Design the Future, by Shrrutin N Shetty, Norton Press 3. Universal principles of design- William lidwell, kritinaholden, Jill butter. 4. The era of open innovation – chesbrough.H
Online Learning Resources:
https://nptel.ac.in/courses/110/106/110106124/ https://nptel.ac.in/courses/109/104/109104109/ https://swayam.gov.in/nd1_noc19_mg60/preview

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COMMUNITY SERVICE PROJECT

……Experiential learning through community engagement

Introduction

- Community Service Project is an experiential learning strategy that integrates meaningful community service with instruction, participation, learning and community development
- Community Service Project involves students in community development and service activities and applies the experience to personal and academic development.
- Community Service Project is meant to link the community with the college for mutual benefit. The community will be benefited with the focused contribution of the college students for the village/ local development. The college finds an opportunity to develop social sensibility and responsibility among students and also emerge as a socially responsible institution.

Objective

Community Service Project should be an integral part of the curriculum, as an alternative to the 2 months of Summer Internships / Apprenticeships / On the Job Training, whenever there is an exigency when students cannot pursue their summer internships. The specific objectives are;

- To sensitize the students to the living conditions of the people who are around them,
- To help students to realize the stark realities of the society.
- To bring about an attitudinal change in the students and help them to develop societal consciousness, sensibility, responsibility and accountability
- To make students aware of their inner strength and help them to find new /out of box solutions to the social problems.
- To make students socially responsible citizens who are sensitive to the needs of the disadvantaged sections.
- To help students to initiate developmental activities in the community in coordination with public and government authorities.
- To develop a holistic life perspective among the students by making them study culture, traditions, habits, lifestyles, resource utilization, wastages and its management, social problems, public administration system and the roles and responsibilities of different persons across different social systems.

Implementation of Community Service Project

- Every student should put in a 6 weeksfor the Community Service Project during the summer vacation.
- Each class/section should be assigned with a mentor.
- Specific Departments could concentrate on their major areas of concern. For example, Dept. of Computer Science can take up activities related to Computer Literacy to different sections of people like - youth, women, house-wives, etc
- A log book has to be maintained by each of the student, where the activities undertaken/involved to be recorded.

- The logbook has to be countersigned by the concerned mentor/faculty incharge.
- Evaluation to be done based on the active participation of the student and grade could be awarded by the mentor/faculty member.
- The final evaluation to be reflected in the grade memo of the student.
- The Community Service Project should be different from the regular programmes of NSS/NCC/Green Corps/Red Ribbon Club, etc.
- Minor project report should be submitted by each student. An internal Viva shall also be conducted by a committee constituted by the principal of the college.
- Award of marks shall be made as per the guidelines of Internship/apprentice/ on the job training

Procedure

- A group of students or even a single student could be assigned for a particular habitation or village or municipal ward, as far as possible, in the near vicinity of their place of stay, so as to enable them to commute from their residence and return back by evening or so.
- The Community Service Project is a twofold one –
    - First, the student/s could conduct a survey of the habitation, if necessary, in terms of their own domain or subject area. Or it can even be a general survey, incorporating all the different areas. A common survey format could be designed. This should not be viewed as a duplication of work by the Village or Ward volunteers, rather, it could be another primary source of data.
    - Secondly, the student/s could take up a social activity, concerning their domain or subject area. The different areas, could be like –
        - Agriculture
        - Health
        - Marketing and Cooperation
        - Animal Husbandry
        - Horticulture
        - Fisheries
        - Sericulture
        - Revenue and Survey
        - Natural Disaster Management
        - Irrigation
        - Law & Order
        - Excise and Prohibition
        - Mines and Geology
        - Energy
        - Internet
        - Free Electricity
        - Drinking Water

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EXPECTED OUTCOMES
BENEFITS OF COMMUNITY SERVICE PROJECT TO STUDENTS

Learning Outcomes

- Positive impact on students' academic learning
- Improves students' ability to apply what they have learned in "the real world"
- Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- Improved ability to understand complexity and ambiguity

Personal Outcomes

- Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- Reduced stereotypes and greater inter-cultural understanding
- Improved social responsibility and citizenship skills
- Greater involvement in community service after graduation

Career Development

- Connections with professionals and community members for learning and career opportunities
- Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- Stronger relationships with faculty
- Greater satisfaction with college
- Improved graduation rates

BENEFITS OF COMMUNITY SERVICE PROJECT TO FACULTY MEMBERS

- Satisfaction with the quality of student learning
- New avenues for research and publication via new relationships between faculty and community
- Providing networking opportunities with engaged faculty in other disciplines or institutions
- A stronger commitment to one's research

BENEFITS OF COMMUNITY SERVICE PROJECT TO COLLEGES AND UNIVERSITIES

- Improved institutional commitment
- Improved student retention
- Enhanced community relations

BENEFITS OF COMMUNITY SERVICE PROJECT TO COMMUNITY

- Satisfaction with student participation
- Valuable human resources needed to achieve community goals
- New energy, enthusiasm and perspectives applied to community work
- Enhanced community-university relations.

SUGGESTIVE LIST OF PROGRAMMES UNDER COMMUNITY SERVICE PROJECT

The following the recommended list of projects for Engineering students. The lists are not exhaustive and open for additions, deletions and modifications. Colleges are expected to focus on specific local issues for this kind of projects. The students are expected to carry out these projects with involvement, commitment, responsibility and accountability. The mentors of a group of students should take the responsibility of motivating, facilitating, and guiding the students. They have to interact with local leadership and people and appraise the objectives and benefits of this kind of projects. The project reports shall be placed in the college website for reference. Systematic, Factual, methodical and honest reporting shall be ensured.

For Engineering Students

1. **Water facilities and drinking water availability**
2. **Health and hygiene**
3. **Stress levels and coping mechanisms**
4. **Health intervention programmes**
5. **Horticulture**
6. **Herbal plants**
7. **Botanical survey**
8. **Zoological survey**
9. **Marine products**
10. **Aqua culture**
11. **Inland fisheries**
12. **Animals and species**
13. **Nutrition**
14. **Traditional health care methods**
15. **Food habits**
16. **Air pollution**
17. **Water pollution**
18. **Plantation**
19. **Soil protection**
20. **Renewable energy**
21. **Plant diseases**
22. **Yoga awareness and practice**
23. **Health care awareness programmes and their impact**
24. **Use of chemicals on fruits and vegetables**
25. **Organic farming**

26. **Crop rotation**
27. **Floury culture**
28. **Access to safe drinking water**
29. **Geographical survey**
30. **Geological survey**
31. **Sericulture**
32. **Study of species**
33. **Food adulteration**
34. **Incidence of Diabetes and other chronic diseases**
35. **Human genetics**
36. **Blood groups and blood levels**
37. **Internet Usage in Villages**
38. **Android Phone usage by different people**
39. **Utilisation of free electricity to farmers and related issues**
40. **Gender ration in schooling lvel- observation.**

Complimenting the community service project the students may be involved to take up some awareness campaigns on social issues/special groups. The suggested list of programmesare;

Programmes for School Children

1. Reading Skill Programme (Reading Competition)
2. Preparation of Study Materials for the next class.
3. Personality / Leadership Development
4. Career Guidance for X class students
5. Screening Documentary and other educational films
6. Awareness Programme on Good Touch and Bad Touch (Sexual abuse)
7. Awareness Programme on Socially relevant themes.

Programmes for Women Empowerment

1. Government Guidelines and Policy Guidelines
2. Womens' Rights
3. Domestic Violence
4. Prevention and Control of Cancer
5. Promotion of Social Entrepreneurship

General Camps

1. General Medical camps
2. Eye Camps
3. Dental Camps
4. Importance of protected drinking water
5. ODF awareness camp
6. Swatch Bharath
7. AIDS awareness camp
8. Anti Plastic Awareness

9. Programmes on Environment
10. Health and Hygiene
11. Hand wash programmes
12. Commemoration and Celebration of important days

Programmes for Youth Empowerment

1. Leadership
2. Anti-alcoholism and Drug addiction
3. Anti-tobacco
4. Awareness on Competitive Examinations
5. Personality Development

Common Programmes

1. Awareness on RTI
2. Health intervention programmes
3. Yoga
4. Tree plantation
5. Programmes in consonance with the Govt. Departments like –
    i. Agriculture
    ii. Health
    iii. Marketing and Cooperation
    iv. Animal Husbandry
    v. Horticulture
    vi. Fisheries
    vii. Sericulture
    viii. Revenue and Survey
    ix. Natural Disaster Management
    x. Irrigation
    xi. Law & Order
    xii. Excise and Prohibition
    xiii. Mines and Geology
    xiv. Energy

Role of Students:

- Students may not have the expertise to conduct all the programmes on their own. The students then can play a facilitator role.
- For conducting special camps like Health related, they will be coordinating with the Governmental agencies.
- As and when required the College faculty themselves act as Resource Persons.
- Students can work in close association with Non-Governmental Organizations like Lions Club, Rotary Club, etc or with any NGO actively working in that habitation.
- And also with the Governmental Departments. If the programme is rolled out, the District Administration could be roped in for the successful deployment of the programme.

- An in-house training and induction programme could be arranged for the faculty and participating students, to expose them to the methodology of Service Learning.

Timeline for the Community Service Project Activity

Duration: 8 weeks

1. **Preliminary Survey (One Week)**
   - A preliminary survey including the socio-economic conditions of the allotted habitation to be conducted.
   - A survey form based on the type of habitation to be prepared before visiting the habitation with the help of social sciences faculty. (However, a template could be designed for different habitations, rural/urban.
   - The Governmental agencies, like revenue administration, corporation and municipal authorities and village secreteriats could be aligned for the survey.

2. **Community Awareness Campaigns (One Week)**
   - Based on the survey and the specific requirements of the habitation, different awareness campaigns and programmes to be conducted, spread over two weeks of time. The list of activities suggested could be taken into consideration.

3. **Community Immersion Programme (Three Weeks)**

   Along with the Community Awareness Programmes, the student batch can also work with any one of the below listed governmental agencies and work in tandem with them. This community involvement programme will involve the students in exposing themselves to the experiential learning about the community and its dynamics. Programmes could be in consonance with the Govt. Departments.

4. **Community Exit Report (One Week)**
   - During the last week of the Community Service Project, a detailed report of the outcome of the 8 weeks work to be drafted and a copy shall be submitted to the local administration. This report will be a basis for the next batch of students visiting that particular habitation. The same report submitted to the teacher-mentor will be evaluated by the mentor and suitable marks are awarded for onward submission to the University.

   Throughout the Community Service Project, a daily log-book need to be maintained by the students batch, which should be countersigned by the governmental agency representative and the teacher-mentor, who is required to periodically visit the students and guide them.