

**School of Agro & Rural Technology  
Indian Institute of Technology, Guwahati**

**Revised Curriculum of M. Tech. (Rural Technology) Credit Distribution**

<b>Semesters</b>	<b>Credits</b>
<b>I</b>	<b>26</b>
<b>II</b>	<b>30</b>
<b>III</b>	<b>24</b>
<b>IV</b>	<b>24</b>
<b>TOTAL</b>	<b>104</b>

**Number of Courses and Structure**

- 1.** Core Course - 5
- 2.** Courses on Field Work and Laboratory Practices- 2
- 3.** Elective Courses - 4
- 4.** Project Work - 2 semesters

**SEMESTER-I**

<b>Course No.</b>	<b>Course Name</b>	<b>L</b>	<b>T</b>	<b>P</b>	<b>C</b>
<b>RT 523</b>	<b>Rural Technology and Development</b>	3	0	0	6
<b>RT 504</b>	<b>Rural Water Supply and Sanitation</b>	3	0	2	8
<b>RT 510</b>	<b>Research Methodology &amp; Quantitative Techniques for Rural Development</b>	2	0	2	6
<b>RT 5XX</b>	<b>Open elective</b>	3	0	0	6
Total credit					<b>26</b>

**SEMESTER-II**

Course No.	Course Name	L	T	P	C
<b>xx xxx</b>	Elective – I	3	0	0	6
<b>xx xxx</b>	Elective – II	3	0	0	6
<b>xx xxx</b>	Elective – III	3	0	0	6
<b>RT 512</b>	<b>Livelihood and Entrepreneurship</b>	3	0	0	6
<b>RT 520</b>	<b>Field Work and Communication</b>	1	0	4	6
Total credit					<b>30</b>

**SEMESTER-III**

Course No.	Course Name	L	T	P	C
<b>RT 691</b>	Project Phase - I	0	0	24	24

**SEMESTER-IV**

Course No.	Course Name	L	T	P	C
<b>RT 692</b>	Project Phase - II	0	0	24	24

## **List of Courses**

### **Core Courses**

1. Rural Technology and Development - RT 523
2. Livelihood and Entrepreneurship- RT 512
3. Research Methodology & Quantitative Techniques for Rural Development - RT 510
4. Rural Water Supply and Sanitation - RT 504
- 5. Field Work and Communication - RT 520**

### **Elective Course offered by CRT**

1. Water Resources Management – RT 514
2. Natural Resources Management (NRM) – RT 515
3. Product and Process Development in Food & Bioprocessing industries – RT 516
4. Agri-horticultural Produce Processing Technology – RT 517

## **Course Contents: Theory Core Courses**

### **RT 523: Rural Technology and Development (3 0 0=6)**

*Rural Development:* Rural development concepts; indicators of rural development; rural institutions and their administrative structure, functions; emerging issues and determinants; rural development experiences from the ground-developed vs developing countries; case studies on rural development facilitated by international agencies; Rural Marketing- concepts, organization and functions of marketing, modern and traditional system of marketing; rural credit system, role of rural credit in rural development; evolution and growth of rural credit system in India.

*Rural Technology:* Technology and development, Appropriate technology development and dissemination, Technology Rating Level, Case studies of different technologies enabling rural development- Information and Communication Technology (ICT), Agro biotechnology, Food and Forest Product Value addition, Mechanization, Waste Management, Rural Energy Solutions; Technology impact assessment, Life Cycle Analysis.

### **Learning outcome:**

1. Students would get a deeper and broader understanding of *Rural Development* especially in the context of India
2. Understand the structure, function, and integration of the rural society with a thrust on technology driven rural development.
3. Students will be aware of the technological delivery process to a rural society and its challenges. They would also learn the tools for assessment and dissemination of technologies.

**Text:**

1. Singh, K. (2009). Rural development: principles, policies and management. SAGE Publications India.
2. Shukla, J. P. (Ed.). (2014). Technologies for sustainable rural development: having potential of socio-economic upliftment (TSRD–2014) (Vol. 1).
3. R. Chambers (1983) Rural Development: Putting the last first, Routledge-Taylor and Francis group.

**Reference**

1. McCalla, A. F., & Ayres, W. S. (1997). Rural development: From vision to action. The World Bank.
2. Allied Publishers. Campbell, M. J., & Campbell, M. J. (Eds.). (1990). New technology and rural development: the social impact. Psychology Press.

**RT 510: Research Methodology & Quantitative Techniques for Rural Development (2 0 2=6)**

Introduction to research; Qualitative and quantitative research; research problem formulation; hypothesis, exploratory and field data collection and sampling techniques; analytical tools for Qualitative research, search engine optimization technique for internet based data search, basic statistics-it's use in social research; descriptive & inferential statistics- types of data, collection of data, tabulation of data, diagrammatic representation of data Summarization of data: frequency table, diagrammatic representation of a frequency distribution – column diagram, frequency polygon, histogram. Cumulative frequency diagram; Measures of central tendency; Measures of dispersion; Correlation. Application of regression analysis in trend fitting. Clustering of data & factorial analysis, Statistical Design of Experiment, Mathematical modelling & data fitting for empirical or statistical modelling. Concept of optimization; gradient based and evolutionary optimization techniques. Practical examples of statistical analysis and statistical modelling using a software platform.

Field visit and hands on experience of planning, execution, and analysis of a field based research problem. The students are required to visit nearby villages to identify a challenge of rural community appealing to them. The identified challenge may be from, but not limited to, the area of rural livelihood, rural entrepreneurship, education and healthcare, energy, water supply and sanitation, agriculture, etc. Upon identifying such a challenge, the students are required to interact with the rural community to document its history, its impact on their day-to-day life, application of traditional knowhow to tackle it, improvements/developments made in the past, identifying bottle-necks to define scope for further improvements/developments. Students have to design experimental models on such issues and have to carry out parametric analyses. The students have to submit reports and make periodical presentations as part of evaluation.

**Texts Books:**

1. S. Taylor, R. Bogdan, M. DeVault, Introduction to Qualitative Research Methods: A Guidebook and Resource, John Wiley & Sons, 2015.
2. Hanneman, R. A., Kposowa, A. J., & Riddle, M. D. (2012). Basic statistics for social research (Vol. 38). John Wiley & Sons.

**References:**

1. R. B. Burns, Introduction to Research Methods, SAGE Publications, 2000.
2. E. Perelman, S. R. Curran, A Handbook of social sciences field research, SEGA Publications, California, 2006.
3. R. K. Yin, Case Study Research: Design and Methods, SAGE Publications, 2009.

**RT 512      Livelihood and Entrepreneurship****(3-0-0-6)**

Context of poverty; meaning and definition of livelihood; rural livelihood approaches; sustainable livelihood principles and frameworks; sectoral approaches in livelihood; rural and urban linkages in livelihood; major livelihood programs in India; National Rural Livelihood Mission (NRLM); role of diversified agro-ecosystems in livelihood promotion; livelihood portfolio of rural poor; challenges in livelihood promotion; tools and techniques for livelihood mapping.

Rural Entrepreneurship-different forms; Significance of rural entrepreneurship; Steps of entrepreneurship, Business planning for a new venture: the concept of planning paradigm; Forms of business enterprises, Sole proprietorship, partnership and corporations; Market analysis and competitive analysis, strategies; Financial resources; debt financing, banks and financial institutions and other non-bank financial sources; Government programmes : direct loan assistance and subsidies; Industrial and legal issues for rural enterprises, Financial feasibility study of a business proposal, DPR writing

**Texts:**

1. S. Datta, V. Mahajan, G. Thakur (Eds.) A resource book for livelihood promotion 3rd edn., Hyderabad: The Livelihood School, 2009.

**References**

1. R. Baumgartner and R. Hogger, In Search of Sustainable Livelihood Systems-Managing Resources and Change. Federal Institute of Technology, Zurich, 2004
4. P. C. Joshi, and N. Joshi, Biodiversity and conservation. A.P.H. Pub., 2004

**RT 504      Rural Water Supply and Sanitation****(3-0-2-8)**

Basic principles of rural water supply and sanitation; Water sources, surface and ground water treatment; Specific problem in rural water supply and treatment e.g. iron, manganese, fluorides etc. Water supply through spot sources, hand pumps, open dugwell. Traditional/low cost methods of water treatment and practices; Storm water and sullage disposal, rain water harvesting and uses. Simple wastewater treatment system for rural areas and small communities such as stabilization ponds, Imhoff tank etc. Introduction to rural sanitation; On site sanitation system and community latrines, concept of Eco-sanitation, trenching and composting methods, two pit latrines, aqua privy, septic tank, soak pit. Disposal of Solid Wastes; Composting; land filling, incineration; Biogas plants; Rural health.

Laboratory: Water and Wastewater Quality Parameters: Physico-chemical analysis

**Texts**

1. V. M. Eulers and E. W. Steel, Municipal and Rural Sanitation, 6th Ed., McGraw Hill Book Company, 2009.
2. H. S. Peavy, D. R. Rowe and G. Tchobanoglous, Environmental Engineering, McGraw-Hill International Ed., 2013.
3. S. Gupta, Rural Water Supply and Sanitation, Vayu Education of India, New Delhi, 2013.

**References**

1. F. B. Wright, Rural Water Supply and Sanitation, E. Robert Krieger Publishing Company, Huntington, New York, 1977
2. K. Verma, Decentralised Governance in Water and Sanitation in Rural India, Academic Foundation, NEW DELHI, 2014.

3. Central Public Health and Environmental Engineering Organization, Manual on Water Supply and Treatment, 2nd Ed, Ministry of Urban Development, New Delhi December 1991.
4. Central Public Health and Environmental Engineering Organization, Manual on Sewerage and Sewage Treatment Systems – Part A: Engineering, 3rd Ed – Revised and Updated, Ministry of Urban Development, New Delhi, November 2013.
5. Central Public Health and Environmental Engineering Organization, Manual on Solid Waste Management, 2nd Ed, Ministry of Urban Development, New Delhi, December 1993.

**RT 520      Field Work and Communication      (0-1-4-6)**

Theory of communication; various communication models; coder & decoder; message transmission; forms of communication; scientific and non-scientific communication; different forms of prose for communication; characteristics of scientific communications; scientific writings; IMARD technique; essentials of scientific writing. Steps of survey designs; various forms of surveys their advantages and limitations.

Field Work: Field survey and data gathering: preparation of questionnaire, identification of problems and prospects, data compilation and analysis. Effective Communication: Importance of communication, introduction to basic ways of communication, Importance of presentation techniques and its methods, importance of visual elements to create effective communication, idea generation, brainstorming and mind mapping methods. Introduction to basics of design, layout designing, quick initial prototyping techniques.

**Texts:**

1. C. Akner-Koler, Three Dimensional Visual Analysis, Institutionen for Industridesign, Konftfack, Sweden, 1994.
2. R. Carter and P. B. Meggs, Typographic Design: Form and Communication, John Wiley & Sons, 2000.

**References:**

1. M. A. Muser and D. Macleon, Art and Visual Environments, MIT Press, 1996.
2. R. Beech, Origami: The complete guide to the art of paper folding, Lorenz Books, 2001.

**Elective courses**

**RT-514 WATER RESOURCES MANAGEMENT**

(3-0-0-6)

**Preamble:**

The main objective of the subject is to give an overview of the development of water resources, quantification of water requirement, surface and sub-surface water availability, conservation and its management. The main focus is on water (drinking and agriculture) and its availability. Topics on water scarcity, the factors leading to it and the importance of water harvesting and conservation will also be discussed. Lights will also be shed on watershed management. Some portion will also be covered on water requirement for irrigation. Relevant case studies will also be discussed.

**Syllabus:**

The nature and use of water: Basic properties and distribution. Hydrologic Cycle, Precipitation: Precipitation types and its measurement Evapo-transpiration, Infiltration,; Water Demand; Population forecasting; Surface water: Sources and its measurement; Groundwater: Introduction, importance and occurrence of groundwater; Aquifers and groundwater scenario in India; Surface and subsurface investigation of groundwater; Construction, development and maintenance of wells; Principles of Watershed

Management: Basics concepts, Management of water supply; Soil erosion and conservation; Water Harvesting: Rainwater management - conservation, storage and effective utilization of rainwater, Structures for rainwater harvesting, roof catchment system, check dams, aquifer storage Applications of Geographical Information System and Remote Sensing in Watershed Management, Principles of Integrated Water Resources Management.

**Texts:**

1. V.T. Chow, D.R. Maidment, and L.W. Mays, Applied Hydrology, McGraw Hill, 2003.
2. Vir Singh, R., Watershed Planning and Management, Yash Publishing House, Bikaner, 2000.
3. D.K.Todd, Groundwater Hydrology, Wiley India Pvt. Ltd, 2<sup>nd</sup> Edition, 2006.

**References:**

1. H.M. Raghunath, Hydrology – Principles, Analysis and Design, Wiley Eastern Ltd., 1986.
2. K. Linsley, Water Resources Engineering, McGraw Hill, 1995.
3. Murty, J.V.S., Watershed Management, New Age Intl., New Delhi 1998.
4. Allam, G.I.Y., Decision Support System for Integrated Watershed Management, Colorado State University, 1994.
5. V.P. Singh, Elementary Hydrology, Prentice Hall, 1993.
6. Murthy, J.V.S., Watershed Management in India, Wiley Eastern, New Delhi, 1994.

## RT-515 Natural Resources Management (NRM)

(3-0-0-6)

### Syllabus:

*Introduction to Natural Resource Bases:* Concept of resource, carrying capacity, ecological foot print and sustainability; Natural resources of different geographical regions of India; Factors influencing resource availability, distribution and uses; Interrelationships among different types of natural resources; Concern on productivity issues. *Resource Management Paradigms:* Evolution of resource management paradigms, resource extraction, access and control system. Basic management issues associated with key natural resources viz. Forest, Land, Water, Minerals. *Approaches in Resource Management:* Ecological approach; economic approach; ethnological approach; implications of the approaches; participatory rural appraisal (PRA); role of indigenous knowledge in Natural Resources Management (NRM); *Technologies for NRM:* Farmers' field based technologies and tools for NRM; Case studies from few agro-ecological zones of India; Various crop models, landuse models, nutrient models; Multi-criteria decision analysis (MCDA); Precision farming technologies (PFT); Information Communication Technologies (ICT) for NRM.

### Texts:

1. E.P. Odum, Fundamentals of Ecology, W.B. Saunders Co. USA, 574p (Indian edition), 2005.
2. D. R. Lynch, Sustainable Natural Resource Management: For Scientists and Engineers, Publisher: Cambridge University Press, 2009.

### References:

1. M.C. Dash, Concepts of Environmental Management for Sustainable Development Publisher: I K International Publishing House Pvt. Ltd., 2013.
2. G. Shivakoti, U. Pradhan, H. Helmi (editors), Redefining Diversity and Dynamics of Natural Resources Management in Asia, Volume 1st Edition, Sustainable Natural Resources Management in Dynamic Asia, Editors:, ISBN: 9780128054543, Elsevier, 2016.
3. P. Rogers, K. F. Jalal, J. A. Boyd, An Introduction to Sustainable Development. Publisher: Routledge; 1 edition, ISBN-10: 1844075206, 2007.

## RT 516 Product and Process Development in Food & Bioprocessing industries (3-0-0-6)

### Preamble:

This course is intended to provide specific knowledge and skills necessary for the establishment of a food or bioprocessing based entrepreneurship. Generally, the basic reason for failure of entrepreneurial ventures is inadequate knowledge and/or skills on either the technology side or the management side. Essential concept and tools associated with the new product/process development would be discussed in the course to make the participants confident in taking up entrepreneurship activity or in facilitating food/bio enterprises, particularly, in rural settings. The course has no prerequisite. The specific learning objectives of course are;

- Knowledge and skills about development of new food and bio products and their



processing technology.

- Skills in research on aspects of quality and commercial viability of innovative food/bio- products and processes.
- Techno-commercial foundation for would-be entrepreneurs.

**Syllabus:**

Classification of processed foods and bio-products and overview of both the industries; Concept of new product in food processing and bio-processing industries: innovation and incentives of new product development (NPD), four phases of NPD in industry; Strategic element of NPD: market survey and market data analysis, idea screening, product specification, product planning, safety and regulatory concerns; product design and process development: process specifications, packaging system development, product testing strategies including strategies for self-life analysis, process optimization, scale-up, quality management system and statistical quality control, labeling requirement; Product commercialization: marketing strategy including positioning and pricing of the product, test marketing, supply chain design, financial performance indicators; Product launch and evaluation: launching strategies, evaluation of the launched product, financial analysis; Case studies of process development in Industries.

**Text books:**

1. R. Earle, A. Anderson, *Food product development: Maximizing success*. CRC Press, 2001.
2. J.A. Wesselingh, K. Soren, V.E. Martin, *Design & development of biological, chemical, food and pharmaceutical products*. John Wiley & Sons, 2007.
3. E.B. Magrab, S.K. Gupta, F. P. McCluskey, and P. Sandborn. *Integrated product and process design and development: the product realization process*. CRC Press, 2009.

**Reference books:**

1. G.W. Fuller, *New food product development: from concept to marketplace*. CRC Press, 2016.
2. M. Sorli, S. Dragan, *Innovating in Product/Process Development: Gaining Pace in New Product Development*. Springer Science & Business Media, 2009.

**Preamble:**

The aim of the course is to make the participants aware of importance and scope of processing of agricultural and horticultural produces. Specific concept of unit-operations involved in processing of such produces would be imparted for enabling the participants in selecting and maintaining processing units. Also techno-management concept of supply chain of the agri- horti-produces would be delivered to not only train the participants to develop supply chains for such products but also to motivate them for developing appropriate technological solutions. The course has no prerequisite. The specific learning objectives are;

- Knowledge and understanding about the processing, storage, and supply chain of agricultural and horticultural produces.
- Skills in designing, implementing and evaluating supply chain and processing strategies for agricultural and horticultural produces.
- Skills in putting the marketing strategies in place and evaluating financial alternatives.

**Syllabus:**

Over view of Agri- and Horti- production in India and its associated problems including produce processing; Conventional food processing techniques and sustainability concerns; Engineering properties and Post-harvest technology of agricultural and horticultural produces; Unit operations used in processing of agri- horti-produces: size reduction and screening of solids, mixing, emulsification and forming, filtration and membrane separation, Solid-liquid extraction and expression, chilling, freezing, thermal processing, extrusion, dehydration, evaporation, fermentation, food storage and packaging technology; Process calculations; Management of by-products from processing of agri- horti-produces; Overview of food safety and quality system, HACCP, hygienic equipment design. Examples of processing of some agro-horticulture products for non-food usage.

Supply chain concepts for fresh and processed agricultural and horticultural produces; system dynamics, supply chain matrices, ICT in supply chain, and Indian scenario of supply chain of fresh and processed produces; Traceability in supply chain; Case studies of development of supply chain of some important food crops.

**Laboratory components:** Drying kinetics of some agricultural and horticultural products and quality analysis of the final product; Milling of agro products and characterization of the milled products; Beverage preparation from a fruit/vegetable produce and its quality testing; Shelf-life testing of perishable fresh produces with and without packaging; Extraction of functional components from agro-horticulture products.

**Text books:**

1. Fellows, Peter J. *Food processing technology: principles and practice*. Elsevier, 2009.
2. Earle, Richard Laurence. *Unit operations in food processing*. Elsevier, 2013.
3. Dani, Samir. *Food supply chain management and logistics: From farm to fork*. Kogan Page Publishers, 2015.

**Reference books:**

1. R.T. Toledo, *Fundamentals of food process engineering*. Springer Science & Business Media, 2007.
2. S.M. Rahman, *Handbook of food preservation*. CRC press, 2007.
3. N.I.I.R. Board, *Modern Technology of Agro Processing and Agricultural Waste Products*. National Institute of Industrial Research, 2000.
4. S.S. Nielsen, *Food analysis*. Springer, 2010.

### **List of Relevant Elective Courses from other Departments/ Centres**

CE 525:	Solid and Hazardous Waste Management	(3-0-0-6)
ME655:	Energy Conservation and Waste Heat Recovery	(3-0-0-6)
ME 654:	Wind Energy Conversion	(3-0-0-6)
EN661:	Renewable Energy Systems	(3-0-0-6)
CE 559:	Watershed Management and Remote Sensing Applications	(3-0-0-6)
CE 568:	Environmental Management of Water Resources	(3-0-0-6)
BT 606:	Food Biotechnology	(3-0-0-6)
BT 607:	Plant Biotechnology	(3-0-0-6)
BT 622:	Biofuels	(3-0-0-6)