

**DAYALBAGH EDUCATIONAL INSTITUTE
FACULTY OF ENGINEERING
B.TECH. (AGRICULTURAL ENGINEERING)**

EIGHTH SEMESTER

COURSE NUMBER	COURSE TITLE	Credits	End sem. Exam.	Theory/ Practical
AEM801	AGRICULTURAL ENGINEERING PROJECT II	8.0	Y	P
AEM802	AGRICULTURE EXTENSION	3.0	N	T
AEM803	AGRICULTURE EXTENSION PRACTICE	1.0	Y	P
AEM804	MINOR PROJECT-II	1.0	Y	P
CAC881	CO-CURRICULAR ACTIVITIES	3.0	N	P
#	STREAM WISE CORE COURSES	3.0	Y	T
*	STREAM WISE FIRST OPTIONAL COURSES	3.0	Y	T
**	STREAM WISE SECOND OPTIONAL COURSES	3.0	Y	T
***	STREAM WISE THIRD OPTIONAL COURSES	3.0	Y	T
TOTAL CREDITS		28.0		

STREAM-WISE CORE COURSES (#)

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM805	TRACTOR SYSTEMS AND CONTROLS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM806	FOOD PLANT DESIGN AND MANAGEMENT	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM807	CONSUMER BEHAVIOUR & ANALYSIS	3.0	Y	T

STREAM-WISE FIRST OPTIONAL COURSES (*) - any one of the following to be opted

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM806	FOOD PLANT DESIGN AND MANAGEMENT	3.0	Y	T
AEM808	PRECISION FARMING TECHNIQUES FOR FIELD AND PROTECTED CROP PRODUCTION	3.0	Y	T
AEM809	POSTHARVEST ENGINEERING OF HORTICULTURE CROPS	3.0	Y	T
AEM810	PLASTIC APPLICATION IN AGRICULTURE	3.0	Y	T
AEM811	MECHATRONICS	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM810	PLASTIC APPLICATION IN AGRICULTURE	3.0	Y	T
AEM811	MECHATRONICS	3.0	Y	T
AEM812	DEVELOPMENT OF PROCESSED PRODUCTS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM806	FOOD PLANT DESIGN AND MANAGEMENT	3.0	Y	T

AEM813	INTELLETUAL PROPERTY RIGHT	3.0	Y	T
AEM814	PREDICTIVE ANALYTICS IN AGRICULTURE	3.0	Y	T

STREAM-WISE SECOND OPTIONAL COURSES () - any one of the following to be opted**

MAINSTREAM AGRICULTURAL ENGINEERING				
AEM815	WASTELAND DEVELOPMENT	3.0	Y	T
AEM816	HYDRAULIC DRIVES AND CONTROLS	3.0	Y	T
AEM817	WASTE AND BYPRODUCT UTILIZATION	3.0	Y	T
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
AEM819	SPRINKLER AND MICRO IRRIGATION SYSTEM	3.0	Y	T
DAIRY ENGINEERING SPECIALIZATION				
AEM820	PROCESS EQUIPMENT DESIGN	3.0	Y	T
AEM821	PACKAGING TECHNOLOGY	3.0	Y	T
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
AGRITECH & ENTREPRENEURSHIP SPECIALIZATION				
AEM818	SOFT COMPUTING IN AGRICULTURE SYSTEMS	3.0	Y	T
MEM824	TOTAL QUALITY MANAGEMENT	3.0	Y	T

STREAM-WISE THIRD OPTIONAL COURSES (*) - any one of the following to be opted**

AEM822	PRECISION AGRICULTURE AND SYSTEM MANAGEMENT	3.0	Y	T
AEM823	PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS	3.0	Y	T
EEM811	ROBOTICS	3.0	Y	T
MEM809	NANO-TECHNOLOGY & NANO-COMPUTING	3.0	Y	T
MEM811	FUTURES STUDIES	3.0	Y	T
MEM814	MANAGEMENT INFORMATION SYSTEMS	3.0	Y	T
MEM827	OPERATIONS MANAGEMENT	3.0	Y	T

Course Number: AEM801, Course Title: AGRICULTURAL ENGINEERING PROJECT II

Class: B.Tech., Status of Course: MAJOR COURSE,, Approved since session:

Total Credits:3, Periods (55 mts. Each)/week:4(L:0+T:0+P:6+S:0), Min.pds./sem.: 52

In this project the students continue their work of Course No. AEM701. The project involves Design and development of Hardware and Software for a system of complexity level normally covered in the theory upto 8thsemester in B.Tech.

Course No: AEM802, Course Title: AGRICULTURE EXTENSION

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT1

Communication – meaning – definition - models – elements and their characteristics – types and barriers in communication. Programme planning – meaning, definition, principles, steps in programme development process, monitoring and evaluation of extension programs

UNIT2

Extension Teaching methods - Audio-visual aids – definition – classification – purpose, planning and selection, combination and use – individual, group and mass contact methods - merits and demerits

UNIT3

Modern communication sources – internet, video and teleconferencing, interactive multimedia, compact disc (IMCD), Village kiosks, kisan call centre (kcc), mobile phone

UNIT4

Diffusion – meaning and elements. Adoption – meaning – adoptor categories influencing adoption, stages of adoption, innovation decision process and attribution of innovations consequences of adoption

UNIT5

Capacity building of extension personnel and farmers – meaning – definition, types of training to farmers, farm women and rural youth, FTC & KVK

SUGGESTED READINGS:

Ray, G.L., 1999. Extension communication and management, Naya Prakash, Vidhan Sarani, Kolkata

Sandhu, A.S., 1996. Extension Programme Planning, Oxford and IBH PublishingCO. (P) Ltd., New Delhi

Rogers, E.M., 1995. Diffusion of Innovations, The free press, New York

Sandhu, A.S., 1996. Agricultural Communication: Process and Methods, Oxford and IBH PublishingCO. (P) Ltd., New Delhi

Course No.: AEM803, Title: AGRICULTURE EXTENSION PRACTICE

Class: B.Tech., Status of Course: Half Major Course, Approved since session:

Total Credits:1, Periods(55 mts. each)/week:2(L:0+T:0+P:2+S:0), Min.pds./sem.:26

Students will practice or exercise the agriculture extension by working in village medical camps, spreading awareness to farmers about the use of technology in agriculture.

Course Number: AEM804, Course Title: MINOR PROJECT-II

Class: B.Tech., Status of Course: CORE COURSE, Approved since session: 2000-01

Total Credits: 1, Periods (55 mts. each)/week: 2 (L:0+T:0+P:2+S:0), Min.pds./sem.: 26

In order to implement the knowledge gained through various courses, the students undertake project related to demonstration of agriculture technologies, development of prototypes, establishment of small scale industries etc.

2. Exposure to agritech startups, listing the startups and case studies
2. To increase the farm productivity that will increase the farms income
3. Make innovative farm equipments for small and medium farmer
4. To develop cost effective storage system for vegetables and fruits at small scale

5. Visit to IARI/ICAR/some reputed agricultural facilities

Course Number: CAC881, Course Title: CO-CURRICULAR ACTIVITIES

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2000-01

Total Credits: 3, Periods (55 mts. each)/week: 3 for 26 weeks, Min.pds./sem: 52

Participation by the students in sports and games, literary, social, cultural and professional activities is compulsory. The proficiency attained in them is evaluated every year and counted in the assessment of the overall performance of the student to encourage a balanced and all-round development of their personality.

Course Number: AEM805, Course Title: TRACTOR SYSTEMS AND CONTROLS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 2, Periods (55 mts. each)/week: 2(L:2+T:1+P:0+S:0), Min.pds./sem: 39

Unit1

Study of need for transmission system in a tractor. Transmission system – types, major functional systems. Study of clutch – need, types, functional requirements, construction and principle of operation. Familiarization with single plate, multi-plate, centrifugal and dual clutch systems.

Unit2

Study of Gear Box – Gearing theory, principle of operation, gear box types, functional requirements, and calculation for speed ratio. Study of differential system – need, functional components, construction, calculation for speed reduction. Study of need for a final drive. Study of Brake system – types, principle of operation, construction, calculation for braking torque.

Unit3

Study of steering system – requirements, steering geometry characteristics, functional components, calculation for turning radius. Familiarization with Ackerman steering. Steering systems in track type tractors. Study of Hydraulic system in a tractor – Principle of operation, types, main functional components, functional requirements. Familiarization with the Hydraulic system adjustments and ADDC.

Unit4

Study of tractor power outlets – PTO. PTO standards, types and functional requirements. Introduction to traction. Traction terminology. Theoretical calculation of shear force and rolling resistance on traction device. Study of wheels and tyres – Solid tyres and pneumatic tyres, tyre construction and tyre specifications. Study of traction aids.

Unit 5

Study of tractor mechanics – forces acting on the tractor. Determination of CG of a tractor. Determination and importance of moment of inertia of a tractor. Study of tractor static equilibrium, tractor stability especially at turns. Determination of maximum drawbar pull. Familiarization with tractor as a spring-mass system. Ergonomic considerations and operational safety. Introduction to tractor testing. Deciphering the engine test codes.

Suggested Readings

Liljedahl J B and Others. Tractors and Their Power Units.

Rodichev V and G Rodicheva. Tractors and Automobiles.

Singh Kirpal. Automobile Engineering – Vol I.

Heitner Joseph. Automotive Mechanics: Principles and Practices.

C.B.Richey. Agricultural Engineering Handbook.

John Deere. Fundamentals of Service Hydraulics.

Relevant BIS Test Codes for Tractors

Course No: AEM806, Course Title: FOOD PLANT DESIGN AND MANAGEMENT

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Food plant location, selection criteria, Selection of processes, plant capacity, Requirements of plant building and its components, Project design, flow diagrams, selection of equipment,

process and controls, Objectives and principles of food plant layout. Preparation of project report and feasibility report.

Unit2

Salient features of processing plants for cereals, pulses, oilseeds, horticultural and vegetable crops, poultry, fish and meat products, milk and milk products. Salient features and layout of pre processing house, Salient features and layout of Milk and Milk product plants, Salient features, design and layout of modern rice mill, Salient features, design and layout of Bakery and related product plant

Unit3

Introduction to Finance, Food Product Marketing, Food Business Analysis and Strategic Planning, Introduction to Marketing, Food Marketing Management, Supply chain management for retail food products, Study of different types of records relating to finance of a food plant

Unit4

Entrepreneurship development in food industry, SWOT analysis, generation, incubation and commercialization of ideas and innovations, New product development process, Government schemes and incentive for promotion of entrepreneurship, Brain storming and SWOT analysis to start a food processing business.

Unit5

Govt. policy on small and medium scale food processing enterprise, export and import policies relevant to food processing sector, procedure of obtaining license and registration under FSSAI, Cost analysis and preparation of feasibility report.

Suggested Readings

Hall, H.S. and Rosen, Y.S. Milk Plant Layout. FAO Publication, Rome.

López Antonio. Gómez. Food Plant Design.

Robbarts Theunis C. Food plant engineering systems by, CRC Press, Washington.

Maroulis Z B and Saravacos G D. Food plant economics. Taylor and Francis, LLC

Mahajan M. Operations Research. Dhanpat Rai and Company Private Limited, Delhi

Maroulis Z B. Food Process Design. Marcel Dekker, Inc ,Cimarron Road, Monticello, New York 12701, USA.

Course Number: AEM807, Course Title: CONSUMER BEHAVIOUR & ANALYSIS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Introduction and concept:-Introduction market strategy and consumer behaviour, Market Analysis, consumer decision process, Culture and consumer behaviour: - Meaning of culture, Characteristics of culture, function of culture. types of culture, Cross-cultural consumer analysis:- cross cultural marketing objectives, Basic areas for cross-cultural marketing, problem in cross cultural marketing.

UNIT 2

Motivation and consumer behaviour: - Introduction, motives and motivation, positive or negative motivation, Consumer motives:- personal ,social motives, Involvement:-types of involvement, measuring involvement, values , values and attitudes, means and end chain model

UNIT 3

Perception and consumer behavior:- Introduction, of groups , advantages and disadvantage of groups, reference group, types of reference group, social class and consumer behavior- Introduction social class categorization, social class life style and buying behavior, social class and market segmentation, social factors, social class and consumer behavior

UNIT 4

Perception and consumer behaviour: - Introduction, meaning, nature, Importance and limitation of perception, Barriers to accurate perception, Sensation, perception of values, perception of process. Determining consumer buying Behaviour:-Consumer purchase decision, types of decision, types of decision behaviour, buying stage and situational influence, models of consumer behaviour, Economic model, learning model, sociological model, Howard Sheth model of buying.

UNIT 5

Attitude and consumer behaviour:- Meaning of attitude, nature and characteristics of attitude, types of attitude, learning of attitude, sources of influence on attitude formation, Model of attitude- Tricomponent attitude model, multiattribute attitude model, Consumer decision making process:- Introduction, levels of consumer decision ,consumer information processing model ,Hierarchy of effects model.

SUGGESTED READINGS:

Andrew Smith, Consumer behaviour and analytics, Routledge publication

Leon Schiffman, Consumer behaviour, Pearson publication

Course No: AEM808, Course Title: PRECISION FARMING TECHNIQUES FOR FIELD AND PROTECTED CROP PRODUCTION

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Protected cultivation: Introduction, History, origin, development, National and International Scenario, components of green house, perspective, Types of green houses, polyhouses / shade nets, Cladding materials, Plant environment interactions -principles of limiting factors.

Unit2

Solarradiation and transpiration, greenhouse effect, light, temperature, relative humidity, carbondioxide enrichment, Design and construction of green houses - site selection, orientation,design, construction, design for ventilation requirement using exhaust fan system, selection ofequipment.

Unit3

Greenhouse cooling system - necessity, methods - ventilation with roof and sideventilators, evaporative cooling, different shading material fogging, combined fogging and fan-pad cooling system, design of cooling system, maintenance of cooling and ventilationsystems, pad care etc. Greenhouse heating - necessity, components, methods, design ofheating system. Root media - types - soil and soil less media, composition, estimation,preparation and disinfection, bed preparation. Planting techniques in green house cultivation.

Unit4

Irrigation in greenhouse and net house - Water quality, types of irrigation system,components, design, installation and material requirement. Fogging system for greenhouses and net houses - introduction, benefits, design, installation and material requirement. Maintenance of irrigation and fogging systems. Fertilization - nutrient deficiency symptoms and functions of essential nutrient elements, principles of selection of proper application of fertilizers, fertilizer scheduling, rate of application of fertilizers, methods, automated fertilizer application.

Unit5

Greenhouse climate measurement, control and management. Insect and disease management in greenhouse and net houses Selection of crops for greenhouse cultivation, major crops in greenhouse - irrigation requirement, fertilizer management, cultivation, harvesting and post harvest techniques; Economic analysis.

Suggested Readings

Singh Brahma and Balraj Singh. 2014. Advances in protected cultivation, New India Publishing Company.

Sharma P. 2007. Precision Farming. Daya Publishing House New Delhi.

Course Number: AEM809, Course Title: POSTHARVEST ENGINEERING OF HORTICULTURAL CROPS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Importance of processing of fruits and vegetables, spices, condiments and flowers. Characteristics and properties of horticultural crops important for processing, Peeling: Different peeling methods and devices (manual peeling, mechanical peeling, chemical peeling,

and thermal peeling), Slicing of horticultural crops: equipment for slicing, shredding, crushing, chopping, juice extraction, etc.

Unit2

Blanching: Importance and objectives; blanching methods, effects on food (nutrition, colour, pigment, texture); Chilling and freezing: Application of refrigeration in different perishable food products, Thermophilic, mesophilic & Psychrophilic micro-organisms, Chilling requirements of different fruits and vegetables, Freezing of food, freezing time calculations, slow and fast freezing, Equipment for chilling and freezing (mechanical & cryogenic).

Unit3

Effect on food during chilling and freezing, Cold storage heat load calculations and cold storage design, refrigerated vehicle and cold chain system, Dryers for fruits and vegetables, Osmo-dehydration. Packaging of horticultural commodities, Packaging requirements (in terms of light transmittance, heat, moisture and gas proof, micro organisms, mechanical strength), Different types of packaging materials commonly used for raw and processed fruits and vegetables products,

Unit4

bulk and retail packages and packaging machines, handling and transportation of fruits and vegetables, Pack house technology, Controlled atmospheric storage, Modified atmospheric packaging, Preservation Technology, General methods of preservation of fruits and vegetables, Brief description and advantages and disadvantages of different physical/chemical and other methods of preservation,

Unit5

Minimal processing, Common methods of storage, Low temperature storage, evaporative cooled storage, Flowcharts for preparation of different finished products, Important parameters and equipment used for different unit operations, Post harvest management and equipment for spices and flowers, Quality control in Fruit and vegetable processing industry. Food supply chain.

Suggested Readings

Arthey D. and Ashurst P. R. 1966. Fruit Processing. Chapman and Hall, New York.

Pantastico, E.C.B. 1975. Postharvest physiology, handling and utilization of tropical and subtropical fruits and vegetables, AVI Pub. Co., New Delhi.

Pandey R.H. 1997. Postharvest Technology of fruits and vegetables (Principles and practices). Saroj Prakashan, Allahabad.

Sudheer K P. and IndiraV. 2007. Post Harvest Engineering of horticultural crops. New india Publishing House.

Course No: AEM810, Course Title: PLASTIC APPLICATIONS IN AGRICULTURE

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Introduction of plasticulture - types and quality of plastics used in soil and water conservation, production agriculture and post harvest management. Quality control measures. Present status and future prospective of plasticulture in India. Water management - use of plastics in in-situ moisture conservation and rain water harvesting.

Unit2

Plastic film lining in canal, pond and reservoir. Plastic pipes for irrigation water management, bore-well casing and subsurface drainage. Drip and sprinkler irrigation systems. Use of polymers in control of percolation losses in fields. Soil conditioning - soil solarisation, effects of different colour plastic mulching in surface covered cultivation.

Unit3

Nursery management - Use of plastics in nursery raising, nursery bags, trays etc. Controlled environmental cultivation - plastics as cladding material, green / poly / shade net houses, wind breaks, poly tunnels and crop covers. Plastic nets for crop protection - anti insect nets, bird protection nets.

Unit4

Plastic fencing. Plastics in drying, preservation, handling and storage of agricultural produce, innovative plastic packaging solutions for processed food products. Plastic cap

covers for storage of food grains in open. Use of plastics as alternate material for manufacturing farm equipment and machinery.

Unit 5

Plastics for aquacultural engineering and animal husbandry - animal shelters, vermi-beds and inland fisheries. Silage film technique for fodder preservation. Agencies involved in the promotion of plasticulture in agriculture at national and state level. Human resource development in plasticulture applications.

Suggested Readings

- Brahma Singh, Balraj Singh, Naved Sabir and Murtaza Hasan. 2014. Advances in Protected Cultivation. New India Publishing Agency, New Delhi.
- Brown, R.P. 2004. Polymers in Agriculture and Horticulture. RAPRA Review Reports : Vol. 15, No. 2, RAPRA Technology Limited, U.K.
- Central Pollution Control Board. 2012. Material on Plastic Waste Management. Parivesh Bhawan, East Arjun Nagar, Delhi-110032.
- Charles A. Harper. 2006. Handbook of Plastics Technologies. The Complete Guide to Properties and Performance. McGraw-Hill, New Delhi.
- Dubois. 1978. Plastics in Agriculture. Applied Science Publishers Limited, Essex, England.
- Manas Chanda, Salil K. Roy. 2008. Plastics Fundamentals, Properties, and Testing. CRC Press.
- Ojha, T.P. and Michael, A.M., 2012, Principles of Agricultural Engineering - I. Jain Brothers, Karol Bagh, New Delhi.
- Pandey, P.H. 2014. Principles and Practices of Agricultural Structures and Environmental Control. Kalyani Publishers, Ludhiana, India.
- Shankar, A.N. 2014. Integrated Horticulture Development in Eastern Himalayas, Plasticulture in Agri-Horticulture Systems, 241-247.
- Srivastava, R.K., R.C. Maheswari, T.P. Ojha, and A. Alam. 1988. Plastics in Agriculture. Jain Brothers, Karol Bagh, New Delhi.

Course No: AEM811, Course Title: MECHATRONICS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Definition of mechatronics, measurement system, control systems, microprocessor based controllers, mechatronics approach. Sensors and transducers, performance terminology, Displacement, Position & Proximity Sensors, photo-electric transducers, flow transducers, optical sensors and transducers.

Unit 2

Actuators, Mechanical Actuation Systems, Hydraulic & Pneumatic Actuation Systems, Electrical Actuation Systems, A.C. Motor, D.C. Motor, Stepper Motor. Signal conditioning process, filtering digital signal, multiplexers, data acquisition, digital signal processing, measurement system, pulse modulation, data presentation systems.

Unit 3

System modelling & control, Mathematical Models, Engineering Systems, Electro-mechanical & Hydraulic-mechanical Systems, Modelling Dynamic Systems, Transfer Functions, Control Modes, PID Controller.

Unit 4

Micro-processor & computer, Computer and Interfacing, Micro-computer Structure, Micro-controllers, Application of Microcontrollers, PLC. Robotics, Robot components, robot classification and specification, Work envelopes, other basic parameters of robots.

Unit 5

Robot applications, Robot applications in manufacturing, Material transfer and machine loading/unloading, Processing operations like Welding & painting, Assembly operations, Inspection automation, Future applications.

Suggested Readings

- Bolton, W. Mechatronics. Pearson Education Asia.
- Wolfram, Stadler. Analytical Robotics and Mechatronics. Mc-Graw Hill.
- Doebelin E.O. Measurement Systems. Mc-Graw Hill.
- Mahind, A.P. Introduction to Digital Computer Electronics. TMH.
- Niku, S.Y. Introduction to Robotics: Analysis, systems and applications, Pearson Education Asia.
- Craig, J.J. Introduction to Robotics. Pearson Education Asia.

Course No: AEM812, Course Title: DEVELOPMENT OF PROCESSED PRODUCTS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Process design, Process flow chart with mass and energy balance, Unit operations and equipment for processing, New product development,

Unit2

Technology for value added products from cereal, pulses and oil seeds, Milling, puffing, flaking, Roasting, Bakery products, snackfood.

Unit3

Extruded products, oil extraction and refining, Technology for value added products from fruits, vegetables and spices,

Unit4

Canned foods, Frozen foods, dried and fried foods, Fruit juices, Sauce, Sugar based confection, Candy, Fermented food product, spice extracts,

Unit5

Technology for animal produce processing, meat, poultry, fish, egg products, Health food, Nutra-ceuticals and functional food, Organic food. Visit to roller wheat flour milling

Suggested Readings

Geankoplis C. J. Transport processes and unit operations, Prentice-Hall.

Rao, D. G. Fundamentals of Food Engineering PHI Learning Pvt. Ltd, New Delhi.

Norman N. Potter and Joseph H. Hotchkiss. Food Science. Chapman and Hall Pub.

Acharya, K T Everyday Indian Processed foods. National Book Trust.

Mudambi Sumati R., Shalini M. Rao and M V Rajgopal. Food Science. New Age International Publishers.

Negi H.P.S., Savita Sharma, K. S. Sekhon. Hand book of Cereal technology. Kalyani Pub.

Course Number: AEM813, Course Title: INTELLECTUAL PROPERTY RIGHT

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 39

UNIT 1

Introduction and the need for intellectual property right (IPR) - Kinds of Intellectual Property Rights: Patent, Copyright, Trade Mark, Design, Geographical Indication, Plant Varieties and Layout Design – Genetic Resources and Traditional Knowledge – Trade Secret - IPR in India : Genesis and development – IPR in abroad - Major International Instruments concerning Intellectual Property Rights: Paris Convention, 1883, the Berne Convention, 1886, the Universal Copyright Convention, 1952, the WIPO Convention, 1967, the Patent Co-operation Treaty, 1970, the TRIPS Agreement, 1994

UNIT 2

Patents - Elements of Patentability: Novelty, Non Obviousness (Inventive Steps), Industrial Application - Non - Patentable Subject Matter - Registration Procedure, Rights and Duties of Patentee, Assignment and licence, Restoration of lapsed Patents, Surrender and Revocation of Patents, Infringement, Remedies & Penalties - Patent office and Appellate Board

UNIT 3

Nature of Copyright - Subject matter of copyright: original literary, dramatic, musical, artistic works; cinematograph films and sound recordings - Registration Procedure, Term of protection, Ownership of copyright, Assignment and licence of copyright - Infringement, Remedies & Penalties – Related Rights - Distinction between related rights and copyrights

UNIT 4

Concept of Trademarks - Different kinds of marks (brand names, logos, signatures, symbols, well known marks, certification marks and service marks) - Non Registrable Trademarks - Registration of Trademarks - Rights of holder and assignment and licensing of marks - Infringement, Remedies & Penalties - Trademarks registry and appellate board

UNIT 5

Design: meaning and concept of novel and original - Procedure for registration, effect of registration and term of protection, Geographical indication: meaning, and difference between

GI and trademarks - Procedure for registration, effect of registration and term of protection, Plant variety protection: meaning and benefit sharing and farmers' rights – Procedure for registration, effect of registration and term of protection, Layout Design protection: meaning – Procedure for registration, effect of registration and term of protection

SUGGESTED READING

1. Nithyananda, K V. (2019). Intellectual Property Rights: Protection and Management. India, IN: Cengage Learning India Private Limited.
2. Neeraj, P., & Khusdeep, D. (2014). Intellectual Property Rights. India, IN: PHI learning Private Limited.
3. Subramanian, N., & Sundararaman, M. (2018). Intellectual Property Rights – An Overview. Retrieved from <http://www.bdu.ac.in/cells/ipr/docs/ipr-eng-ebook.pdf>
4. World Intellectual Property Organisation. (2004). WIPO Intellectual property Handbook. Retrieved from https://www.wipo.int/edocs/pubdocs/en/intproperty/489/wipo_pub_489.pdf

Course Number: AEM814, Course Title: PREDICTIVE ANALYTICS IN AGRICULTURE

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT 1

Introduction to Regression Model, model development & Validation, multiple linear regression, estimation of regression parameters, model diagnostics, dummy, derived & interaction variables, multi-collinearity, model deployment

UNIT 2

Discrete choice models, logistics regression, estimation of parameters, logistic model interpretation, logistic model diagnostics, deployment

UNIT 3

Introduction to decision trees, chi-square automatic interaction detectors, classification and regression tree (CART), Analysis of unstructured data, naive bayes algorithm,

UNIT 4

Forecasting, time series analysis, additive and multiplicative models, exponential smoothing techniques, forecasting accuracy, auto-regressive and moving average models

UNIT 5

Application of predictive analytics techniques in agriculture: case studies

SUGGESTED READING

1. Trevor Hastie, Robert Tibshirani, Jerome Friedman, The Elements of Statistical Learning-Data Mining, Inference, and Prediction, Second Edition, Springer Verlag, 2009.

Course No: AEM815, Course Title: WASTELAND DEVELOPMENT

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Land degradation - concept, classification - arid, semiarid, humid and sub-humid regions, denuded range land and marginal lands. Wastelands - factors causing, classification and mapping of wastelands, planning of wastelands development - constraints, agro-climatic conditions, development options, contingency plans.

Unit2

Conservation structures - gully stabilization, ravine rehabilitation, sand dune stabilization, water harvesting and recycling methods. Afforestation - agro-horti-forestry-silvipasture methods, forage and fuel crops -socioeconomic constraints.

Unit3

Shifting cultivation, optimal land use options. Wasteland development - hills, semi-arid, coastal areas, water scarce areas, reclamation of waterlogged and salt-affected lands.

Unit4

Mine spoils- impact, land degradation and reclamation and rehabilitation, slope stabilization and mine environment management. Micro-irrigation in wastelands development.

Unit5

Sustainable wasteland development - drought situations, socioeconomic perspectives. Government policies. Participatory approach. Preparation of proposal for wasteland development and benefit-cost analysis.

Suggested Readings

Abrol, IP, and V.V., Dhruvanarayana. 1998. Technologies for Wasteland Development. ICAR, New Delhi.
Ambast, S.K., S.K. Gupta and Gurcharan Singh (Eds.) 2007. Agricultural Land Drainage -Reclamation of Waterlogged Saline Lands. Central Soil Salinity Research Institute, Karnal, Haryana.
Hridai Ram Yadav. 2013. Management of Wastelands. Concept Publishing Company. New Delhi.
Karthikeyan, C., K. Thangaraja, C. Cinthia Fernandez and K. Chandrakandon. 2009. Dryland Agriculture and Wasteland Management. Atlantic Publishers and Distributors Pvt. Ltd., New Delhi.
Rattan Lal and B.A. Stewart (Ed.). 2015. Soil Management of Smallholder Agriculture. Volume 21 of Advances in Soil Science. CRC Press, Taylor and Francis Group, Florida, USA.
Robert Malliva and Thomas Missimer. 2012. Arid Lands Water Evaluation and Management. Springer Heidelberg, New York.
Swaminathan, M.S. 2010. Science and Integrated Rural Development. Concept Publishing Company (P) Ltd., Delhi.
The Energy and Resources Institute. 2003. Looking Back to Think Ahead-Green India 2047. Growth with Resource Enhancement of Environment and Nature. New Delhi.
Virmani, S.M. (Ed.). 2010. Degraded and Wastelands of India: Status and Spatial Distribution. ICAR, New Delhi.

Course No: AEM816, Course Title: HYDRAULIC DRIVES AND CONTROLS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Hydraulics Basics: Pascal's Law, Flow, Energy, Work, and Power. Hydraulic Systems, Colour Coding, Reservoirs, Strainers and Filters, Filtering Material and Elements. Accumulators, Pressure Gauges and Volume Meters, Hydraulic Circuit, Fittings and Connectors.

Unit2

Pumps, Pump Classifications, operation, performance, Displacement, Design of Gear Pumps, Vane Pumps, Piston Pumps. Hydraulic Actuators, Cylinders, Construction and Applications, Maintenance, Hydraulic Motors.

Unit3

Valves, Pressure-Control Valves, Directional- Control Valves, Flow-Control Valves, Valve Installation, Valve Failures and Remedies, Valve Assembly, Troubleshooting of Valves Hydraulic Circuit Diagrams and Troubleshooting,

Unit4

United States of American Standards Institute USASI Graphical Symbols Tractor hydraulics, nudging system, ADDC. Pneumatics: Air services, logic units, Fail safe and safety systems

unit5

Robotics: Application of Hydraulics and Pneumatics drives in agricultural systems, Programmable Logic Controls (PLCs). Use of hydraulics and pneumatics for robotics.

Suggested Readings

Kepner RA, Roy Barger & EL Barger. Principles of Farm Machinery.
Anthony E. Fluid Power and Applications.
Majumdar. Oil Hydraulic System.
Merit. Hydraulic Control Systems.
John Deere. Fundamentals of Service Hydraulics.

Course No: AEM817, Course Title: WASTE AND BYPRODUCT UTILIZATION

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT1

Types and formation of by-products and waste; Magnitude of waste generation in different food processing industries; Uses of different agricultural by-products from rice mill, sugarcane industry, oil mill etc., Visit to various industries using waste and food by-products.

UNIT2

Concept, scope and maintenance of waste management and effluent treatment, Temperature, pH, Oxygen demands (BOD, COD), fat, oil and grease content, metal content, forms of

phosphorous and sulphur in waste waters, microbiology of waste, other ingredients like insecticide, pesticides and fungicides residues,

UNIT3

Waste utilization in various industries, furnaces and boilers run on agricultural wastes and byproducts, briquetting of biomass as fuel, production of charcoal briquette, generation of electricity using surplus biomass, producer gas generation and utilization, Waste treatment and disposal, design, construction, operation and management of institutional community and family size biogas plants, concept of vermin-composting,

UNIT4

Pre-treatment of waste: sedimentation, coagulation, flocculation and floatation, Secondary treatments: Biological and chemical oxygen demand for different food plant waste- trickling filters, oxidation ditches, activated sludge process, rotating biological contractors, lagoons,

UNIT5

Tertiary treatments: Advanced wastewater treatment process-sand, coal and activated carbon filters, phosphorous, sulphur, nitrogen and heavy metals removal, Assessment, treatment and disposal of solid waste; and biogas generation, Effluent treatment plants, Environmental performance of food industry to comply with ISO-14001 standards.

Suggested Readings

- Markel, I.A. 1981. Managing Livestock Waste, AVI Publishing Co.
Pantastico, ECB. 1975. Post Harvest Physiology, Handling and utilization of Tropical and Sub-tropical fruits and vegetables, AVI Pub. Co.
Shewfelt, R.L. and Prussi, S.E. 1992. Post-Harvest Handling - A Systems approach, Academic Press Inc.
USDA. 1992. Agricultural Waste Management Field Hand book. USDA, Washington DC.
Weichmann J. 1987. Post Harvest Physiology of vegetables, Marcel and Dekker Verlag.
V.K. Joshi & S.K. Sharma. Food Processing Waste Management: Treatment & Utilization. New India Pub. Agency.
Vasso Oreopoulou and Winfried Russ (Edited). 2007. Utilization of By-products and Treatment of waste in the Food Industry. Springer Science & Business media, LLC 233 New York.
Prashar, Anupama and Bansal, Pratibha. 2007-08. Industrial Safety and Environment. S.K. Kataria & sons, N. Delhi
Garg, S K. 1998. Environmental Engineering (Vol. II) - Sewage Disposal and Air Pollution Engineering. Khanna Publishers, New Delhi
Bhatia, S.C. 2001. Environmental Pollution and Control in Chemical Process Industries. Khanna Pub., New Delhi.

Course No: AEM818, Course Title: SOFT COMPUTING IN AGRICULTURE SYSTEMS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Definition, classification, and characteristics of systems- Scope and steps in systems engineering-Need for systems approach to water resources and irrigation.

Unit2

Introduction to Operations Research-Linear programming, problem formulation, graphical solution, solution by simplex method-sensitivity analysis-application-Bellman's optimality criteria, problem formulation and solutions-application.

Unit3

Basic principles and concepts-random variance and random process-Monte Carlo techniques-Model development-inputs and outputs-Deterministic and stochastic simulation-irrigation scheduling and application.

Unit4

Neuron, Nerve structure and synapse, Artificial Neuron and its model, Neural network architecture: networks, Various learning techniques; perception and convergence rule, Auto associative and hetro-associative memory-Architecture: model, solution, single layer and multilayer perception model, back propagation learning methods, applications.

Unit5

Basic concepts of fuzzy logic, Fuzzy set theory and operations, properties of fuzzy sets, membership functions, interface in fuzzy logic, fuzzy implications and fuzzy algorithms, fuzzy controller, industrial applications. Genetic algorithm (GA) – basic concepts, working principles, procedures, flow chart, genetic representations, encoding, initialization and selection, genetic operators, mutation-applications.

Suggested Readings

Vedula, S., and Majumdar, P.P. Water resource systems – Modelling Techniques and Analysis, Tata Mc Graw Hill New Delhi
Robert M Peart and W David Shoup, Agricultural Systems Management – Optimizing efficiency and performance, CRC Press 2013
Gupta PK and Man Mohan, Problems in Operations Research (Methods and Solutions), Sultan Chand and Sons, New Delhi

Course Number: AEM819, Course Title: SPRINKLER AND MICRO IRRIGATION SYSTEMS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Sprinkler irrigation: adaptability, problems and prospects, types of sprinkler irrigation systems; design of sprinkler irrigation system: layout selection, hydraulic design of lateral, sub-main and main pipe line, design steps; cost economics of sprinkler irrigation system

Unit2

Selection of pump and power unit for sprinkler irrigation system; performance evaluation of sprinkler irrigation system: uniformity coefficient and pattern efficiency; Micro Irrigation Systems: types-drip, spray, & bubbler systems, merits and demerits, different components; unit3

Design of drip irrigation system: general considerations, wetting patterns, irrigation requirement, emitter selection, hydraulics of drip irrigation system, design steps;

Unit4

necessary steps for proper operation of a drip irrigation system; maintenance of micro irrigation system: clogging problems, filter cleaning, flushing and chemical treatment; cost economics of drip irrigation system

Unit5

Fertigation: advantages and limitations of fertigation, fertilizers solubility and their compatibility, precautions for successful fertigation system, fertigation frequency, duration and injection rate, methods of fertigation.

Suggested Readings

Keller Jack and Bliesner Ron D. 2001. Sprinkle and Trickle Irrigation. Springer Science+ business Media, New York
Mane M.S. and Ayare B.L.2007. Principles of Sprinkler Irrigation systems, Jain Brothers, New Delhi.
Mane M.S and Ayare B.L. and MagarS.S.2006.Principles of Drip Irrigation systems, Jain Brothers, New Delhi.
Michael AM, Shrimohan and KR Swaminathan. Design and evaluation of irrigation methods, (IARI Monograph No.1). Water Technology Centre, IARI New Delhi.
Michael A.M. 2012. Irrigation: Theory and Practice. Vikas Publishing Vikas Pub. House New Delhi.
Choudhary M.L and Kadam U.S 2006. Micro irrigation for cash crops Westville Publishing House.

Course No: AEM820, Course Title: PROCESS EQUIPMENT DESIGN

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit 1

Introduction on process equipment design, Application of design engineering for processing equipments,

Unit 2

Design parameters and general design procedure, Material specification, Types of material for process equipments, Design codes, Pressure vessel design, Design of cleaners.

Unit 3

Design of tubular heat exchanger, shell and tube heat exchanger and plate heat exchanger,

Unit 4

Design of belt conveyer, screw conveyer and bucket elevator, Design of dryers.

Unit 5

Design of milling equipments. Optimization of design with respect to process efficiency, energy and cost, Computer Aided Design.

Suggested Readings

Mahajani, V. V. and Umarji, S. B., Process equipment design, Macmillan.
Bhattacharyya, B. C., Introduction to Chemical Equipment design, CBS Publishers and Distributors.
Geankoplis C. J. Transport processes and unit operations, Prentice-Hall.
Rao, D. G. Fundamentals of Food Engineering PHI Learning Pvt. Ltd, New Delhi.

Course No: AEM821, Course Title: PACKAGING TECHNOLOGY

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

UNIT1

Factors affecting shelf life of food material during storage, Interactions of spoilage agents with environmental factors as water, oxygen, light, pH, etc. and general principles of control of the spoilage agents; Difference between food infection, food intoxication and allergy. Packaging of foods, requirement, importance and scope, frame work of packaging strategy, environmental considerations,

UNIT2

Packaging systems, types: flexible and rigid; retail and bulk; levels of packaging; special solutions and packaging machines, technical packaging systems and data management packaging systems, Different types of packaging materials, their key properties and applications, Metal cans, manufacture of two piece and three piece cans, Plastic packaging, different types of polymers used in food packaging and their barrier properties.

UNIT3

manufacture of plastic packaging materials, profile extrusion, blown film/ sheet extrusion, blow molding, extrusion blow molding, injection blow molding, stretch blow molding, injection molding. Glass containers, types of glass used in food packaging, manufacture of glass and glass containers, closures for glass containers. Paper and paper board packaging, paper and paper board manufacture process, modification of barrier properties and characteristics of paper/ boards.

UNIT4

Relative advantages and disadvantages of different packaging materials; effect of these materials on packed commodities. Nutritional labelling on packages, CAS and MAP, shrink and cling packaging, vacuum and gas packaging; Active packaging, Smart packaging, Packaging requirement for raw and processed foods, and their selection of packaging materials, Factors affecting the choice of packaging materials, Disposal and recycle of packaging waste, Printing and labelling, Lamination,

UNIT5

Package testing: Testing methods for flexible materials, rigid materials and semi rigid materials; Tests for paper (thickness, bursting strength, breaking length, stiffness, tear resistance, folding endurance, ply bond test, surface oil absorption test, etc.), plastic film and laminates (thickness, tensile strength, gloss, haze, burning test to identify polymer, etc.), aluminium foil (thickness, pin holes, etc.), glass containers (visual defects, colour, dimensions, impact strength, etc.), metal containers (pressure test, product compatibility, etc.).

Suggested Readings

Coles, R., McDowell, D., Kirwan, M .J. 2003. Food Packaging Technology. Blackwell Publishing Co.
Gosby, N.T. 2001. Food Packaging Materials. Applied Science Publication
John, P.J. 2008. A Handbook on Food Packaging Narendra Publishing House,
Mahadevia, M., Gowramma, R.V. 2007. Food Packaging Materials. Tata McGraw Hill
Robertson, G. L. 2001. Food Packaging and Shelf life: A Practical Guide. Narendra Publishing House.
Robertson, G. L. 2005. Food Packaging: Principles and Practice. Second Edition. Taylor and Francis Pub.

Course Number: MEM824, Course Title: TOTAL QUALITY MANAGEMENT

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2011-12

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 52

UNIT 1

Definition, historical review, basic concept of TQM, TQM framework, Principles of TQM, Leadership Role and Commitment in TQM, Strategic Quality Management, W.E. Deming's Philosophy, TQM Models, Barriers to TQM, Benefits of TQM.

UNIT 2

Customer Perception of Quality, Types of Customer, Employee Involvement, Input/ Output Process Model, Juran Trilogy, Improvement Strategies, PDSA Cycle, 5-S System, Kaizen, Six Sigma.

UNIT 3

Benchmarking concepts, Reason to Benchmark. Approaches to Benchmarking, Pitfalls of Benchmarking, Quality Function Deployment (QFD), QFD Matrix, Benefits of QFD, FMEA (Failure Mode Effect Analysis), Reliability, Failure Rate, FMEA Documentation, Total Productive Maintenance.

UNIT 4

ISO, ISO 9000 Series of Standards, ISO 9001 requirements, Implementation, Documentation, ISO 14001, Implementation, Documentation.

UNIT 5

Loss functions, Orthogonal Arrays, Signal to Noise Ratio, Parametric Design, Tolerance Design, Advantages/ Disadvantages of Taguchi's ideas.

SUGGESTED READING:

TOTAL QUALITY MANAGEMENT: DH Besterfield, C Besterfield-Michna, GH Besterfield, M Besterfield-Scare, Pearson Education, Prentice Hall

TOTAL QUALITY MANAGEMENT: W William, Dearborn

Course No: AEM822, Course Title: PRECISION AGRICULTURE AND SYSTEM MANAGEMENT

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Precision Agriculture – need and functional requirements. Familiarization with issues relating to natural resources. Familiarization with various machines for resource conservation

Unit2

Familiarization with equipment for precision agriculture including sowing and planting machines, power sprayers, land clearing machines, laser guided land levellers, straw-chopper, straw-balers, grain combines, etc., optimization of fertilizer application rate for cereals and horticulture crop, increase nutrient use efficiency

Unit3

Introduction to GIS based precision agriculture and its applications. Introduction to sensors and application of sensors for data generation. Problems related to cost analysis and inflation and problems related to selection of equipment, replacement,

Unit4

Database management. System concept. System approach in farm machinery management, problems on machinery selection, maintenance and scheduling of operations. Solving problems related to various capacities, pattern efficiency, system limitation

Unit5

Application to PERT and CPM for machinery system management, break-even analysis, time value of money

Suggested Readings

Kuhar J E. The Precision Farming Guide for Agriculturist.

Dutta SK. Soil Conservation and land management.

Sigma and Jagmohan. Earth Moving Machinery.

Wood and Stuart. Earth Moving Machinery.

DeMess MN. Fundamentals of Geographic Information System.

Hunt Donnell. Farm Power and Machinery Management.

Sharma DN and S Mukesh. Farm Power and Machinery Management Vol I.

Course No: AEM823, Course Title: PHOTOVOLTAIC TECHNOLOGY AND SYSTEMS

Class: B.Tech., Status of Course: Major Course, Approved since session:

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:1+P:0+S:0), Min.pds./sem: 52

Unit1

Solar PV Technology: Advantages, Limitations, Current Status of PV technology, SWOT analysis of PV technology. Types of Solar Cell, Wafer based Silicon Cell, Thin film amorphous silicon cell Thin Cadmium Telluride (CdTe) Cell, Copper Indium Gallium Selenide (CiGS) Cell, Thin film crystalline silicon solar cell.

Unit2

Solar Photo Voltaic Module: Solar cell, solar module, solar array, series & parallel connections of cell, mismatch in cell, fill factor, effect of solar radiation and temperature on power output of module, I-V and power curve of module. V-I characteristics of solar PV system

Unit3

Balance of Solar PV system: Introduction to batteries, battery classification, lead acid battery, Nicked Cadmium battery, comparison of batteries, battery parameters,

Unit4

Charge controller: types of charge controller, function of charge controller, PWM type, MPPT type charge controller,
Converters: DC to DC converter and DC to AC type converter. smart grid technology and application, manufacturing technique of solar array

Unit5

Application of Solar PV system. Solar home lighting system, solar lantern, solar fencing, solar street light, solar water pumping system, Roof top solar photovoltaic power plant and smart grid. Electrical characteristics and Commissioning of complete solar PV system.

Suggested Readings

Rai GD. 1998. Non-conventional Sources of Energy. Khanna Pub.

Rathore N.S., Kurchania A.K., Panwar N.L. 2006. Renewable Energy: Theory & Practice, Himanshu Publications.

Solanki C.S. 2011. Solar Photovoltaic: Fundamentals, Technologies and Applications, PHI Learning Private Ltd.

Meinel & Meinel. Applied Solar Energy.

Derrick, Francis and Bokalders, Solar Photo-voltaic Products.

Course Number: EEM811, Course Title: ROBOTICS

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2015-16

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 39

UNIT 1

Definitions & Laws of Robots, Evolution of Robots & Robotics, Robots & Robotics, Robot classification, Robot anatomy, Types of joints, Degrees of Freedom, Robot configurations, Workspace, Applications of Robots etc.

UNIT 2

Actuators- pneumatic, hydraulic & electric actuators, dc servomotors & stepper motors
Sensors- status sensors viz. potentiometer, tachometer, optical encoders, limit switches etc.
- Environment sensors viz., pressure, force, torque, vision, optical, acoustic, infrared, proximity etc. End-effectors- grippers & tools.

UNIT 3

Co-ordinate Frames, Mapping & Transformation between frames, Fundamental Rotation Matrices, Direct Kinematics problem. Inverse Kinematics problem. Representation.

UNIT 4

Newton- Euler's formulation. Lagrange's formulation.

UNIT 5

(a) CONTROL: Various control techniques used (b) TASK LEVEL PLANNING OF ROBOTS: Motion planning with reference to path and trajectory planning (c) ROBOT PROGRAMMING: Various languages used for robot programming with hands on experience.

SUGGESTED READINGS:

Fu, KS Lee RCCSG: ROBOTICS SENSING, VISION AND INTELLIGENCE

Richard P Paul, Mikell Grover: ROBOT MATHEMATICS

Y Koren: ROBOTICS FOR ENGINEERS

Simon Noff: ENCYCLOPEDIA OF ROBOTICS

Course Number: MEM809, Course Title: NANO-TECHNOLOGY & NANO-COMPUTING

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2007-08

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem.: 52

UNIT 1

Nanosystems, Molecular machinery and Manufacturing, quantum mechanics mechanosynthesis, Ideas of Richard Feynman. Nanocomputing: Introduction, Nanocomputing Technologies, Carbon nanotubes, Nano information processing, Silicon Nanoelectronics, Prospects and Challenges.

UNIT 2

Properties, Molecular Structure, Chiral Vector, Carbon nanotube Electronics, Carbon Nanotube Field-effect Transistors.

UNIT 3

Nanocomputing with Imperfections: Nanocomputing in presence of Defects and Faults, Redundancy, Error Control Coding, Reconfiguration, Fault Simulation, Defect Tolerance, Reconfigurable Hardware, Overcoming Manufacturing Defects. Reliability of Nanocomputing: Markov Random Fields, Examples, Reliability Evaluation Strategies, Law of Large Numbers, NANOPRISM.

UNIT 4

Quantum Computers, Challenges to Physical Realization, Quantum-dot Cellular Automata (QCA), QCA Clocking, Design Rules, Placement, Basic QCA Circuits using QCA Designer Software and their implementation.

UNIT 5

Molecular Computing: Background of molecular electronics, Adleman's Experiment, DNA Computation, Bacteriorhodopsin, Challenges before Molecular Computing. Optical Computing: Introduction, use of Optics for Computing, Optical Computing Paradigms, Ultrafast Pulse Shaping, Photonic Switches.

SUGGESTED READING:

NANO, QUANTUM AND MOLECULAR COMPUTING- IMPLICATIONS TO HIGH LEVEL DESIGN AND VALIDATION: SK Shukla & RI Bahar(Eds.), *Kluwer Academic Publishers*

NANOCOMPUTING- AN INTRODUCTION: V Sahni and D Goswami, *Tata McGraw Hill Publishers*

QUANTUM COMPUTING: V Sahni, *Tata McGraw Hill Publishers*

NATIONAL SCIENCE AND TECHNOLOGY INITIATIVE (NSTI), DST (INDIA), <<http://dst.gov.in/scientific-programme/ser-nsti.htm>

NATIONAL NANOTECHNOLOGY INITIATIVE, NSF (USA), <http://www.nsf.gov/home/crssprgm/nano/nni.htm>

Course Number: MEM811, Course Title: FUTURES STUDIES

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem.: 52

UNIT 1

Future scan: A tool for management decision; the decision making process: from need to objectives; search for alternatives, precision, assumptions; Conceptualization of decision making, some illustrations.

UNIT 2

Technology forecasting and assessment, Quantitative methods, Regression analysis: time series and Fuzzy time series analysis.

UNIT 3

The morality of systems, A science of values, Consumerism and consumer protection, Social indicator of Quality of life, Measures of Consensus and Agreement, SWOT Analysis, Creative idea engineering: Descriptive and Normative elements; Delphi scenario building methodology: Seth-Harva method, Fuzzy Delphi Method.

UNIT 4

Planning and decision making; Hierarchical modeling, Option Field and Option Profile Methodology, Conflict Resolution: Meta game theory.

UNIT 5

Neural networks, System Dynamics and Quantum computing as a tool for future studies, Preliminary concepts and applications to sample problem, Blue Ocean Strategy, White Mountain strategy: for futuristic Planning.

SUGGESTED READING:

Roberts: MANAGERIAL APPLICATION OF SYSTEM DYNAMICS RG Coyle: MANAGEMENT SYSTEM DYNAMIC

PS Satsangi & V S Gautam: MANAGEMENT OF RURAL ENERGY SYSTEM

AE Thompson: UNDERSTANDING FUTUROLOGY AND INTRODUCTION TO FUTURES STUDY

SC Seth: INDIA THE NEXT 7000 DAYS VNK Reddy: PROBLEMS OF FUTUROLOGY STERLING

Michael R Goodman: STUDY NOTES ON SYSTEM DYNAMICS

Course Number: MEM814, Course Title: MANAGEMENT INFORMATION SYSTEMS

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits: 3, Periods (55 mts. each)/week: 3(L:3+T:0+P:0+S:0), Min.pds./sem: 52

UNIT 1

Information Systems (IS) in Global Business Today: Characteristics of the digital world, Role of IS, IS defined, Purpose of IS, Dimensions of IS, Components of IS, types of IS, Dimensions of IS, Ethical and Social Issues in IS, Managing Knowledge, Dimensions of Knowledge, Use of IS.

UNIT 2

Gaining competitive advantage through IS: IS for automating, IS for organizational learning, IS for supporting strategy, freeconomics.

UNIT 3

IT infrastructure and emerging technologies : IT infrastructure, Contemporary Hardware & Software Platform Trends, Convergence of Computing & Telecommunications, RFID & Wireless Sensor Networks, e-business, e-commerce and e-government.

UNIT 4

Achieving Operational Excellence and Customer Intimacy: Enterprise Applications: Enhancing communication / cooperation / collaboration / connection / business intelligence using IS.Database approach to IS: Entry and Querying Data, Data Warehouses, Data Mining, Decision Support Systems, Online Transaction Processing, Online Analytic Processing, Intelligent Systems, Knowledge Management Systems.

UNIT 5

Developing and Acquiring Information Systems and Outsourcing. Enterprise Information Systems.

SUGGESTED READING:

Kenneth C Laudon & Jane P Laudon: MANAGEMENT INFORMATION SYSTEMS, 12e, Pearson Education

Joseph Valacich & Christoph Schneider: INFORMATION SYSTEMS TODAY, 5e, Pearson Education

GB Davis, MH Olson: MANAGEMENT INFORMATION SYSTEM, McGraw Hill

Course Number: MEM827, Course Title: OPERATIONS MANAGEMENT

Class: B.Tech., Status of Course: MAJOR COURSE, Approved since session: 2013-14

Total Credits: 3, Periods (55 mts. each)/week: 3(L-3+T-0+P/S-0), Min.pds./sem.: 52

UNIT 1

Introduction to operations management; competitiveness; strategy; factors affecting productivity; Measurement of Productivity, Product / Service design; Design for Manufacture. Growing importance of Quality, QFD and TQM.

UNIT 2

Location Planning: Need for Location Decisions, Location Decision Factors, Trends in Locations, qualitative and quantitative methods for evaluating Locations. Process Selection and Facility

Layout: Process types and selection. Classification of production systems and types of layouts. Line balancing. Designing process layouts.

UNIT 3

Forecasting requirements, importance and basic categories. Qualitative methods: Delphi method, Market research, Expert judgment. Quantitative methods: Moving Average, Exponential Smoothing, Seasonal Method, Causal Methods: Regression and Multiple Regression. Accuracy and control of forecasts.

UNIT 4

Inventory: Types, requirements, scope, and functions. Independent vs. Dependent Demand. Inventory Costs. Economic Order Quantity. Quantity Discounts. Material Requirements Planning (MRP): MRP inputs, MRP processing, MRP outputs. Manufacturing Resource Planning (MRP II). Logistics and Supply Chain Management.

UNIT 5

Job Shop Scheduling: Gantt charts. Static and Dynamic Scheduling. Optimal Approaches - Johnson's and Jackson's Algorithms; Heuristic Approaches: Priority Dispatching Rules. Project Scheduling: Precedence diagrams. Critical Path Method (CPM). Program Evaluation and Review Technique (PERT). Project Crashing.

SUGGESTED READINGS:

OPERATIONS MANAGEMENT by Gaither and Frazier, Thomson Learning

OPERATIONS MANAGEMENT by L. J. Krajewski and L. P. Ritzman, Pearson Education

OPERATIONS MANAGEMENT by William J. Stevenson, McGraw-Hill

OPERATIONS MANAGEMENT by Chase, Aquilano, Jacobs, TMH OPERATIONS MANAGEMENT by Martinich, J W &Co.