Programme Specification

RAMAIAH UNIVERSITY OF APPLIED SCIENCES

Programme: Bachelor of Vocation(B.Voc)

in Post Harvest Technology

Faculty of Engineering and Technology

Directorate of Training & Lifelong Learning

Ramaiah University of Applied Sciences

University House, New BEL Road, MSR Nagar, Bangalore – 560 054

www.msruas.ac.in

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Ramaiah University of Applied Sciences

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Bangalore - 560 054

Registrar
M.S.Ramaiah University of Applied Sciences
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Course Specifications and Syllabus for awards

Vocational Diploma, Vocational Advanced Diploma, Bachelor of Vocational Degree in Post-Harvest Technology

1. Title of the Awards

Vocational Diploma in Post-Harvest Technology

Vocational Advanced Diploma in Post-Harvest Technology

Bachelor of Vocational Degree in Post-Harvest Technology

2. Modes of Study

Full-Time

3. Awarding Institution /Body

Ramaiah University Of Applied Sciences – Bangalore, India

4. Joint Award

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5. Teaching Institution

Faculty of Engineering and Technology

Ramaiah University of Applied Sciences - Bangalore, India

6. Date of Programme Specifications

Feb 2019

7. Date of Programme Approval

8. Programme Benchmark

UGC Guidelines

9. Rationale for the Course

India is among one of the fastest growing economies in the world and is the second largest country in terms of population. Feeding the growing population by optimizing the natural resources with sustainability is the new challenge. Producing the food on a very large scale to the growing population is a major challenge. And changing eating habits and life style calls for

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adapting creative and modern engineering technologies and solutions to produce the food on a large scale.

Trend is changing from conventional way of processing food to a modern and sophisticated way of processing. Changing eating habits of the people calls for adapting new methodologies in developing sustainable solutions to meet the growing needs. Food processing plants, machineries and equipments have to be ultra-modern and sophisticated enough to handle the present requirements.

To make the modern food production systems customer friendly, robust and to ensure ease of operation it calls for employment of skilled labor, built in automation and mistake proof technologies. Machines, equipment have to be manufactured with high precision that guarantee 100% quality food and customer and consumer satisfaction.

On the other hand, though food processing industry is a huge market, there is a big need for skilled and trained manpower to operate and maintain the plants, machines and equipments. Another objective of this course is to impart adequate knowledge develop hands on skills of the young talents to operate and maintain the machines and equipments.

Keeping the above needs in mind, B VOC in Post-Harvest Technology is designed in association with MSRUAS which would through sufficient light on the food / grain processing aspects and developing adequate knowledge and skills to operate and maintain the food / grain processing machines

10. **Programme Aim**

The aim of the course is to develop skilled professionals who can operate and maintain machines, tools and equipment's used for food / grain processing in the domestic market

11. **Programme Objectives**

The objectives of the course are:

1. To impart knowledge on general education including physics, mathematics, electrical, electronics and computer applications
2. To impart knowledge on fundamentals and advancements in food/grain processing technologies, machines and equipment's.
3. To repair and maintain various types of machines used in food / grain processing industry

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4. To impart knowledge on working in dynamic situations in project sites, interaction with stake holders, managing people and projects, servicing aspects of the food / grain processing plants / machines

5. To create awareness on new technologies and trends in food/grain processing industry

12. Programme Specific Outcomes

The Programme Specific Outcomes (PSO) are listed under three headings:

1. Knowledge and Understanding 2. Practical Skills and 3. Capability/Transferable Skills.

12.1 Knowledge and understanding

After undergoing this course students will be able to:

1. To understand various mechanical, electronics and electrical systems present in food processing machines.
2. To understand the concepts of food processing.
3. Read and interpret various safety regulations, labor laws connected with industries.

12.2 Practical Skills

1. Identify various machines, tools and their applications connected with food / grain processing
2. Read and interpret complex drawings related to machines, plants and equipments
3. Independently operate and maintain the machines
4. Visit the sites, gather information and translate into business needs

12.3 Capability/Transferable Skills

After undergoing this course, the student will be able to :

1. Identify and develop an academic project on food / grain processing
2. Plan, organize and execute the activities by keeping in mind the safety, cost and productivity aspects within the team
3. Communicate effectively with stake holders
4. Identify and develop the provisions for continuous improvements

13. Course Structure

A student is required to successfully complete the following modules for the award of the degree. The course is delivered as per the Time-Table for every batch.

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Vocational Diploma

Semester-1

General Education: 12 Credits, 180 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VGE057	Physics	4	60
2	VGE071	Mathematics & Statistics	4	60
3	VGE074	Bio - Chemistry	4	60
Vocational Education: 18 Credits, 270 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VPT001	Basic Workshop Practices	6	90
2	VPT002	Computer Application	6	90
3	VPT003	Engineering Drawing	6	90

Semester-2

General Education: 12 Credits, 180 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VGE008	Basic Electrical Systems	4	60
2	VGE039	General Communication - English	4	60
3	VGE030	Engineering Materials	4	60
Vocational Education: 18 Credits, 270 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VPT004	Introduction to Food & Grain Technology	6	90
2	VPT005	Turning & Milling Operations	6	90
3	VPT006	Metrology, GD & T Measurements	6	90

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Vocational Advanced Diploma

Semester-1

General Education: 12 Credits, 180 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VGE075	Basic Electronic Circuits	4	60
2	VGE011	Basics of Hydraulics & Pneumatics	4	60
3	VGE072	Elements of Mechanical Design	4	60
Vocational Education: 18 Credits, 270 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VPT007	Fundamentals of Food Engineering	6	90
2	VPT008	Inspection & Quality Control	6	90
3	VPT009	Machine Drawing and 3D Modeling	6	90

Semester-2

General Education: 12 Credits, 180 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VGE028	Elements of Mechatronics	4	60
2	VGE063	Sensors & Signals	4	60
3	VGE059	Principles of Management	4	60
Vocational Education: 18 Credits, 270 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VPT010	Food Processing Engineering - 1	6	90
2	VPT011	Electrical & Electronics Systems Simulation & Analysis	6	90
3	VPT012	Project Work - 1	6	90

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Vocational Degree

Semester-1

General Education: 12 Credits, 180 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VGE023	Customer Relationship Management	4	60
2	VGE013	Business Communication English	4	60
3	VGE073	Industrial Automation	4	60
Vocational Education: 18 Credits, 270 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VPT013	Food Processing Engineering - 2	6	90
2	VPT014	PLC & Its Applications	6	90
3	VPT015	New Product Development	6	90

Semester-2

General Education: 12 Credits, 180 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VGE054	Operations Management	4	60
2	VGE041	Good Shop Floor Practices	4	60
3	VGE047	Labour laws, Occupational Health and Safety	4	60
Vocational Education: 18 Credits, 270 Hours				
S. No.	**Code**	**Module Title**	**Credit**	**Hours**
1	VPT016	Emerging Technologies in Food Processing	6	90
2	VPT017	Seminars & Presentations	2	30
3	VPT018	Project Work - 2	10	150

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14. Delivery Structure

The course is in a semester pattern with an average of 30 hours of interactions per week and 15 weeks per semester

15. Teaching and Learning Methods

The module delivery comprises of a combination of few or all of the following:

1. Face to Face Lectures using Audio-Visuals
2. Demonstrations
3. Laboratory/Field work/Workshop
4. Industry Visit
5. Group Exercises
6. Project Exhibitions
7. Technical Festivals

16. Assessment and Grading

Each module is assessed for a total of 100 marks with two tests each of 25 marks and a final examination of 50 marks for general education modules and similar pattern is followed for vocational based modules with emphasis on skills. A candidate is required to score a minimum of 40% overall in each of the modules.

17. Failure

If a student fails in a module, he/she is required to take up the make-up examination.

18. Attendance

A student is required to have a minimum attendance of 75% in each of the modules.

19. Award of Class

As per the Academic Regulations for Vocational Programme.

20. Student Support for Learning

Student are given the following support:

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1. Module notes
2. Reference books in the library
3. Magazines and Journals
4. Internet facility
5. Computing facility
6. Laboratory facility
7. Workshop facility
8. Staff support
9. Lounges for discussions
10. Any other support that enhances their learning

21. Quality Control Measures

Following are the Quality Control Measures:

1. Review of module notes
2. Review of question papers
3. Student feedback
4. Opportunities for the students to see their assessed work
5. Staff student consultative committee meetings
6. Student exit feedback
7. Subject Assessment Board
8. Programme Assessment Board

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Diploma

Semester 1

Module Title	Physics
Module Code	VGE057
Department	Department of Physics
Faculty	Faculty of Mathematical and Physical Sciences (FMPS)

Course Summary

The aim of this course is to enable the students to understand and apply the concepts of Fundamentals of Physics.

Course Outcomes

After undergoing this course students will be able to:

CO1: Explain the basic concepts in units and dimensions, Vectors
CO2: Explain the concepts of materials and its properties
CO3: Explain the concepts of thermal properties, Fluid and its properties
CO4: Explain the basic concepts of sources of energy, light sources and geometric optics
CO5: Solve problems in Units and Dimensions, Vectors, Thermal properties.

Course Contents

Unit 1: Unit of measurement - System of units - SI units - Fundamental and derived units, mass, velocity, length, area, volume in SI and FPS systems, Errors in measurement: Significant figures, Scalars and vectors – Position and displacement vectors, Equality of vectors -Multiplication of a vector by real number, Motion in a plane velocity and acceleration.

Unit 2: Materials - Metals, polymers, composites, temperature measurement, various types of thermometers, thermostats, thermal properties of materials-Thermal expansion, Specific heat, latent heat, thermal conductivity, Demonstration of the determination of latent heat of steam and ice, Demonstration of the determination of thermal conductivity of copper and steel, Air conditioners and refrigerators,

Unit 3: Mechanical properties of materials-Various moduli of elasticity, Knives and steel (Stress, strain, toughness, hardness and tempering), Demonstration of the elastic constants. Timber, Porcelain, Glass, enamel, rubber. Physics of simple machines, Demonstration of typical machines,

Unit 4: Fluids and its Properties – Fluid pressure, Bernoulli's principle and its applications, Viscosity, Surface tension.

Unit 5: Physics of waves - sound waves, Vibration, noise and insulation, Physics of Radio (AM and FM), TV, Mobile phone,

Unit 6: Nuclear energy, Solar energy, Wind energy, Tidal energy. Light sources- light bulbs, fluorescent lamps, LEDs, Lasers, Light intensity measurements, Light detectors, Geometrical optics – Reflection, Total internal reflection

Course Resources

a. Essential Reading

1. Class Notes.

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2. Fundamentals of Physics David Halliday.Robert Resnick(2004).
3. Berkeley Physics Course (5 Volumes) McGraw Hill(1965).

b. Recommended Reading

1. Fundamentals of Physics David Halliday.Robert Resnick(2004).
2. Berkeley Physics Course (5 Volumes) McGraw Hill(1965).

c. Other Electronic Resources

1. Physics Laboratory.

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Module Title	Engineering Mathematics and Statistics
Module Code	VGE071
Department	Department of Mathematics and Statistics
Faculty	Faculty of Mathematics and Physical sciences

Course Summary

The course trains the students to use basic concepts in mathematics and statistics and apply them to Post-harvest and Technology. The course introduces students to the basic concepts and techniques in trigonometry and analytical geometry. Students are taught the concepts of simple calculations and quantitative techniques and statistics for decision making. This course also introduces the concepts of algebra, statistics and probability. An introduction to statistical techniques is also provided.

Course Outcomes

After undergoing this course students will be able to:

CO1- Explain the principles of trigonometry, algebra, analytical geometry and statistics
CO2- Solve simple problems associated with trigonometry, analytical geometry and Statistics
CO3- Explain descriptive techniques for arranging and analyzing data
CO4- Apply the appropriate methods from trigonometry, analytical geometry and Statistics in Post-Harvest Technology

Course Contents

UNIT –1 Arithmetic: Review of Arithmetic operations. Highest common factor and least common multiple. Order of operations. Arithmetic operations on fractions. Decimals, Rounding and Scientific notation. Powers, Roots, Laws of Indices and Logarithms. Percentages, Ratios, Proportions and their applications. Simple and Compound interest. Arithmetic, Geometric, Harmonic progression.

UNIT–2 Algebra: Variables, Expressions and Evaluating expressions. Properties of equalities and inequalities. Linear Equation, Quadratic Equation and formulas. Solving simultaneous equations. Matrices and Determinants: Introduction and properties, Application of matrices to solve the simultaneous equation.

UNIT –3 Statistics: Permutation and combination. Mean, mode, median and standard deviation. Graphical representation of statistical data (Pie chart, Bar chart and Histogram). Introduction to probability and laws of Probability.

UNIT –4 Geometry: Lines and Angles. Triangles: Area and perimeter of a triangle, angles in a triangle, types of triangles and similar triangles. Quadrilaterals: Squares, rectangles and rhombus. Area and perimeter of a rectangle and applications. Circles: Area and perimeter of a circle, angles in a circle and

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construction of circles. Volume and surface areas of objects like sphere, cylinder, cone and prisms. Coordinate geometry: Axes and coordinates and Gradients, intercepts and graphs of equations. Practical problems involving straight-line graphs.

UNIT –5 Trigonometry:

Introduction. The theorem of Pythagoras. Sines, cosines and tangents. Evaluating trigonometric ratios of acute angles. Solving right-angled triangles. Angles of elevation and depression. Graphs of trigonometric functions. The sine and cosine rules. Area of any triangle.

Course Resources

a. Essential Reading

1. Class Notes
2. Bird, John, Basic Engineering Mathematics, 2014, Routledge.
3. Kreyszig, Erwin, Advanced Engineering Mathematics, 10th edition, Wiley.

b. Recommended Reading

Grewal, B.S., Higher Engineering Mathematics, 2014, Khanna

c. Other Electronic Resources

1. Laboratory
2. Hardware: PCs
3. Software

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Module Title	Bio - Chemistry
Module Code	VGE - 074
Department	Buhler India / Food Technology
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

The course provides students with a solid foundation in understanding the chemical composition of food & the enzymatic processes involved in its production. These graduates are prepared to enhance food manufacturing industry, focusing on precision & efficiency to maintain product quality & safety.

Course Outcomes

After undergoing this course students will be able to:

CO1- Explain physico-chemical properties of water, cell structure & function.
CO2- Explain classification, digestion, absorption & metabolism of carbohydrates, lipids & protein.
CO3- Summarize biological functions of enzymes, vitamins, minerals, nucleic acids & their application in food processing.
CO4- Describe chemical nature, mechanism of action & factors affecting enzyme activities.
C05- Discuss the significance of biochemistry & its relationship with food processing.

Course Contents

UNIT –1 Biochemistry, Water, Cell: Importance of Biochemistry in food & nutrition. Physical & chemical properties of water. Prokaryotic & Eukaryotic cell.

UNIT–2 Carbohydrates, Protein & Lipids: Definition, classification, digestion, absorption & metabolism. Functional properties in food & processing.

UNIT –3 Enzymes: Chemical nature, classification, mechanism of action, specificity of enzymes, factors affecting for enzymatic activities.

UNIT –4 Nucleic acids: RNA & DNA; their biological functions, nucleosides & nucleotides, structure & functions.

UNIT –5 Minerals & Vitamins: Definition, classification, function, sources, deficiency symptoms.

Course Resources

a. Essential Reading

1. Class Notes
2. 2. David L. Nelson and Michael M. Cox. 2012. Lehninger Principles of Biochemistry, 6th Ed. Macmillan Learning, NY, USA.
3. Donald Voet and Judith G. Voet. 2011. Biochemistry, 4th Ed. John Wiley and Sons, Inc., NY, USA.

b. Recommended Reading

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Owen R, Fennema. 1996. Food Chemistry, 3rd Ed. Marcel Dekker, Inc., New York, USA.

c. Other Electronic Resources

1. Laboratory

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Module Title	Basic Workshop Practices
Module Code	VPT001
Department	Central Workshop
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to impart knowledge on Basic tools and Equipments used in workshop and develop the models as per the given exercise.

Course Outcomes

After undergoing this course students will be able to:

CO1: Identify the basic tools used in workshop.
CO2: Work with tools and develop the fitting, sheet metal and carpentry models as per the given drawing.
CO3: Understand different types of welding concepts and develop the models with different types of welding machines.

Course Contents

Unit 1 (Introduction to Fitting): Introduction to Fitting tools, measuring equipment's and Demo of a model. Fitting Exercise-1 V-joint, Fitting Exercise-2 Half round joint, Fitting Exercise-3 Dovetail joint and Fitting Exercise-4 Diagonal joint

Unit 2 (Introduction to Welding): Introduction to Welding tools and techniques, Types and Demo of a model. Welding Exercise-1 – 4 Lap joint, Butt joint, T-joint and Corner joint (Arc welding), Welding Exercise- 4 – 6 (Spot welding, TIG welding). Introduction & Demonstration of Gas welding concepts.

Unit 3 (Introduction to Carpentry): Introduction to Carpentry tools and techniques and Demo of a model. Carpentry Exercise 1-3 Dowel joint, Grooved joint and Lap joint, Exercise 3-6 Mitre joint, Dovetail joint.

Unit 4 (Introduction to Sheet metal forming): Introduction to Sheet metal forming, Bending, and Rolling. Sheet Metal Forming Exercise

Course Resources

a. Essential Reading

1. Workshop Manual
2. Class Notes, PPTs and Slides
3. Elements Of Workshop Technology (Volume - 1), A. K. Hajra Choudhury , amir Kumar Hajra Choudhury, and Nirjhar Roy , Media Publishers & Promoters, India, 2007

b. Recommended Reading

1. A text book of workshop technology, R.S. Khurmi, J.K Gupta, Publishers: S Chand & Co Ltd, 2008

c. Other Resources

1. Laboratory: Workshop
2. Hardware: PCs

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Module Title	Computer Applications
Module Code	VPT002
Department	Department of Computer Science and Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to introduce the students to fundamental knowledge pertaining to computer hardware, software and Microsoft office applications. It also aims to develop the skills to perform basic computer operations in the industry. It provides value added skills to make the students job ready.

Course Outcomes

After undergoing these course students will be able to:
CO1: Describe types of computer hardware, software, network, search engines and browsers
CO2: Explain email etiquette and ethics for business communication
CO3: Perform fundamental tasks of Microsoft Office Word application
CO4: Perform fundamental tasks of Microsoft Office Excel application
CO5: Perform fundamental tasks of Microsoft Word Power Point application

Course Contents

Unit 1(Computer Hardware and Software): Introduction, Applications, Multimedia, Control Panel, Network and Tools

Unit 2(E-mail): Introduction, Creation of an e-mail ID, Structure, Manage e-mail, Carbon and Blind Carbon Copies, Print e-mail

Unit 3 (MS Office Word): Introduction, File, Home, Insert, Design, Page Layout, Reference, View

Unit 4 (MS Office Power Point): Introduction, File, Home, Insert, Design, Transition, Animations, Slide show, View

Unit5 (MS Office Excel): Introduction, File, Home, Insert, Page layout, Formulas, View

Course Resources

a. Essential Reading
1 Class Notes
2 Tutorials point

b. Recommended Reading
2. S. S. Shrivastava., MS Office, Laxmi Publications, 2015.

c. Other Electronic Resources
1. Laboratory
2. Hardware: PCs
3. Software

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Module Title	Engineering Drawing
Module Code	VPT003
Department	Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the module is to impart knowledge on graphical representation of geometrical entities in various views for visualization and communication. Students will be taught orthographic projection of points, lines, planes, solids and isometric projection of solids. Students will also be trained to use CAD tool to carry out these geometric projections.

Course Outcomes

After undergoing this course students will be able to:

CO1: Describe the conventions used in projections of geometric entities and interpret the same.
CO2: Sketch and draw orthographic and isometric projections for the geometric entities in specified positions.
CO3: Prepare drawings of sections of solids for representation of cross section details.
CO4: Demonstrate competency in using CAD tool for drawing geometric projections.

Course Contents

Unit 1 (Introduction to Engineering Graphics and CAD Tool): Drawing Instruments and their uses, BIS conventions, Lettering, Dimensioning and free hand practicing.

Unit 2 (Introduction to CAD Tool): Co-ordinate system and reference planes. Definitions of HP, VP, RPP & LPP. Creation of 2D/3D environment. Selection of drawing size and scale. Creation of geometric entities and text. Applying constraints and editing of geometric entities. Dimensioning and line conventions.

Unit 3 (Orthographic Projections): Planes of projection, reference line and conventions employed. Projections of points in all the four quadrants, Projections of straight lines (located in First quadrant/first angle only), True and apparent lengths, True and apparent inclinations to reference planes (simple problems only). Planes (First Angle Projection Only) projections of plane surfaces–triangle, square, rectangle, pentagon, hexagon and circle. Solids (First Angle Projection Only). Projections of solids such as – cube, prisms, cylinder, pyramids, cones and tetrahedron in different positions.

Unit 4 (Sections of Solids): Introduction, Section planes, Sections, Section views, Apparent shapes and True shapes of Sections of right regular prisms, pyramids, cylinders and cones resting in simple positions. Development of surfaces: cylinder, cones, frustum of a cone, pyramid, frustum of a pyramid and rectangular tray. Isometric Projection (Using Isometric Scale Only) Introduction, Isometric scale, Isometric projection of simple solids and truncated solids – prisms, pyramid, cylinders, cones and simple combinations of solids

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Course Resources

a. Essential Reading

3 Class Notes

4 N.D. Bhatt and V.M. Panchal, (2006) Engineering Drawing, 49th Edn, Charotar Publishing House, Gujarat.

5 K R Gopalakrishna, (2005) Engineering Graphics, 32nd Edn, Shubhash Publishers, Bangalore.

b. Recommended Reading

1. Luzadder W.J., (2006) Fundamentals of Engineering Drawing, 11th Edn, Prentice Hall India.
3. CAD Tool Users Manuals

c. Other Resources

1. Laboratory:
2. Hardware: PCs

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Diploma

Semester 2

Module Title	Basic Electrical Systems
Module Code	VGE008
Department	Department of Electrical Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is deals with basic principles and concepts of Elements of Electrical Engineering. Students are taught the fundamentals of circuit analysis, magnetic circuits. Construction, principle of operation. Classification and working principle of measuring instruments. Domestic wiring and earthing techniques. Applications of circuit theorems, DC machines, AC machines and measuring instruments.

Course Outcomes

After undergoing this course students will be able to:

CO1: State and explain various laws of electric circuits, magnetic circuits and their significance, phasor diagrams for electrical elements
CO2: Derive equations for electrical circuits, magnetic circuits and calculate the performance of various AC and DC machines
CO3: Solve simple numerical problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines Interpret, compare with standard results and draw conclusion
CO4: Solve complex numerical problems on electric circuits, magnetic circuits, DC machines, transformers and AC rotating machines

Course Contents

Unit 1(Analysis of D.C Circuits): Introduction, Concept of E.M.F, potential difference, current, ohm's law, resistance, Resistivity, effect of temperature on resistance, Kirchhoff 's laws, Problems on ohm's law , KCL and KVL, Voltage division and current division principles, Ideal and practical voltage and current sources, Mesh analysis, Problems on mesh analysis, Nodal analysis and problems, Star-delta transformation, Problems on Star/delta transformation

Unit 2(D C Circuits Theorems): Superposition Theorem in the context of dc voltage and current sources acting in a resistive network, Problems on Superposition Theorem, Thevenin's theorem in the context of dc voltage and current sources acting in a resistive network, Problems, Norton's theorem in the context of dc voltage and current sources acting in a resistive network, Problems, Maximum power transfer theorem, Problems, Source transformation, Problems

Unit 3(A C Fundamentals): Single-phase AC Circuits: Generation of Sinusoidal Voltage Waveform (AC) and Fundamental Concepts RMS and Average value, form factor , crest factor, Phasor relationship of pure R,L and C, Power and power factor for R,L and C circuits, Problems on pure R,L and C, Analysis of Simple series RL, RC and RLC circuits, Phasor relationship of series RL, RC and RLC circuits, Problems on series RL, RC and RLC circuits

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Unit 4(Magnetic Circuits): Fundamental concepts of magnetic circuit, Magnetic Flux, magnetic flux density, MMF, Reluctance, Permeability and magnetizing force, leakage and fringing flux, Analogy between magnetic and electric circuits, Ohm's law and Kirchhoff 's laws in magnetic circuits, Oersted experiment, Magnetic effect of electric current, series magnetic circuits with and without airgap, composite magnetic circuit, Problems on series magnetic circuits, Parallel magnetic circuits with and without airgap, Problems on parallel magnetic circuits, Classification of magnetic materials.

Unit 5(Electromagnetic Induction)

Introduction, Faraday's laws of electromagnetic Induction, Classification of Induced E.M.F, Direction of induced E.M.F, Problems on induced E.M.F, Self inductance and expression for self inductance, Mutual inductance and expression for mutual inductance, coupling co-efficient, inductance in series and parallel (Dot Convention), Energy stored in a magnetic field, Problems.

Unit 6(Domestic Wiring)

Introduction, Wiring materials and accessories, Types of wiring systems, Important lighting accessories, Circuit to control one lamp with one switch, Circuit to control one lamp with two 2-way switch, Necessity and types of earthing.

Course Resources

a. Essential Reading

Course Notes

Edward Hughes, (2002), Electrical and Electronics Technology, ELBS, 6th edition

Del Toro V., (2008) Electrical Engineering Fundamentals, PHI

b. Recommended Reading

Mittle, V.N., (2007) Basic Electrical and Electronics Engineering, Tata McGraw Hill Edition, New Delhi, 1st edition

Delton Horn T., (1993) Abraham Pallas, Basic Electricity and Electronics, Europe, McGraw-Hill Limited

Magazines and Journals

c. Websites

Basic Electrical Technology (2013) http://freevideolectures.com/Course/2335/Basic-Electrical-Technology/23

IITM Lectures (2013) http://www.nptel.iitm.ac.in/courses/108105017/

d. Other Electronic Resources

Electronic resources on the course area are available on RUAS library

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Module Title	General Communication - English
Module Code	VGE 039
Department	Human Resources
Faculty	Buhler Academy

Course Summary

The aim of the course is to impart knowledge on language, requirement, grammar, etiquette and basics of communication that are required for day to day life

Course Outcomes

After undergoing this course students will be able to:
CO1: Understand the need for language and its importance
CO2: Understand basics of English language, grammar, sentences, tenses, voices etc.
CO3: Learn and demonstrate etiquette followed in a business environment

Course Contents

Unit 1 (Introduction): Definition of language, need for language, components of a language, widely spoken languages in the world

Unit 2 (Introduction to English & Grammar): Evolution of English, old English, middle age English, modern English, letters, vowels & consonants, genders, plural & singular, sentences, idiom, phrases, subject, predicate, active & passive voice etc. , activities

Unit 3 (Parts of speech): Noun, pronoun, verb, adverb, adjective, preposition, conjunction, interjection, types of noun, types of adverbs, difference between adverb & adjective, comparison of adverbs, activities

Unit 4 (Basics of communication): definition, need for communication, types of communication, advantages and disadvantages & barriers to communication, activities

Unit 5 (Etiquette): Definition, need for etiquette, types of etiquette, benefits of practicing etiquette, office etiquette, email etiquette, social etiquette, telephone etiquette, meeting etiquette, eating etiquette, activities

Course Resources

a. Essential Reading

1. Class Notes
2. High school grammar & composition – Wren & martin
3. Modern etiquette made easy – Myka Meier

b. Recommended Reading

News papers, journals, listen to lectures

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c. Other Electronic Resources

Buhler internal portal, Diagram, Varaha, Technical Publications, you tube lectures, news channels.

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Module Title	Engineering Materials
Module Code	VGE030
Department	Department of Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to introduce engineering materials, their properties and applications. Physical and mechanical properties of engineering materials will be discussed. Students will be exposed to phase diagrams, TTT diagrams and heat treatment methods.

Course Outcomes

After undergoing this course students will be able to:

CO1: Explain different types of crystalline structures in solids, engineering materials and its properties
CO2: Describe phase diagrams, heat treatment processes of metals
CO3: Classify metals and alloys based on crystal structure, compositions and phases
CO4: Identify different methods for improving the properties of materials for specific requirements and applications

Course Contents

Unit 1(Introduction): Classification of materials, Advanced Materials, Future materials

Unit 2(Crystalline structure): Atomic Structure, Interatomic Bonding and Structure of Crystalline Solids

Unit 3 (Metals and Alloys): Types of metals and alloys, Ferrous alloys – low carbon steels, medium carbon steels, high carbon steels, stainless steels, Gray cast iron, ductile iron, white and malleable cast iron. Nonferrous alloys – aluminium alloys, copper alloys, magnesium alloys, zinc alloys, titanium; Super alloys

Unit 4 (Phase Diagrams): Iron-carbon system, Phase transformations, Transformation rate effects and TTT diagrams, Microstructure and property changes in iron-carbon system.

Unit5 (Heat Treatment): Annealing Processes–Process annealing, stress relief, normalising, hardening, tempering, austempering, surface hardening like case hardening, carburising, cyaniding, nitriding, induction hardening. Demonstration on material identification, material selection, application of ferrous and non-ferrous metals. Demonstration on Heat treatment.

Unit 6 (Non-metallic materials): Ceramics - Ceramic Structures. Mechanical properties. Types and applications (optical and electrical) of ceramics
Polymers- Polymer types, Mechanical behaviour of polymers, Polymer applications and processing (injection moulding, extrusion, compression moulding). Composites - Classification and Types of composites. Properties, Processing and their Applications. Demonstration on identification of ceramics, polymers and composites, application examples. Demonstrations on polymer and PMC processing

Unit 7 (Mechanical Properties of Metals): Elastic deformation, Plastic deformation, Interpretation of tensile stress-strain curves. Demonstration of tensile test, plotting the stress strain curve and discussion

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on parameters. Demonstration of compression and shear test, plotting the stress strain curve and discussion on parameters. Hardness test – Brinell, Rockwell and Vickers hardness tests. Impact test - concept, scope and measurement of impact toughness. Torsion test and measurement of modulus. Metallographic examination – specimen preparation and metallography, microscopic examination, identification and analysis of microstructure. Corrosion test, determination of corrosion behavior. Fatigue in metals, concept, fatigue test and interpretation of S-N curve. Demonstration on NDT methods- Magnetic particle, dye penetrant, ultrasonic tests.

Course Resources

a. Essential Reading

6 Class Notes
7 W. D. Callister, 2010, Materials Science and Engineering: An Introduction, 8th Edition, Wiley Publications

b. Recommended Reading

4. H. Van Vlack, 2002, Elements of Materials Science and Engineering, 6th Edition, Addison-Wesley
5. V. Raghavan, 2004, Materials Science and Engineering: A First Course, 5th Edition, PHI

c. Magazines and Journals

1. Materials Science and Engineering: A
2. Materials Science and Engineering: B
3. Materials Science and Engineering: C
4. Materials Science and Engineering: R: Reports
5. Materials Research Bulletin
6. Journal of Materials Science
7. Materials Today Magazine
8. Journal of Testing and Evaluation, ASTM International
9. Characterization and Evaluation of Materials, Springer

d. Websites

1. http://www.mrs.org
2. http://www.mrsi.org.in
3. http://www.asminternational.org
4. www.nptel.ac.in

e. Other Electronic Resources

1. RUAS Laboratory Videos
2. Electronic resources on the course area are available on RUAS library

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Module Title	Introduction to food and grain technology
Module Code	VPT004
Department	Department of Food Technology
Faculty	Faculty of life and Allied Health Sciences

Course Summary

The aim of the course is to study Grain Science, which helps in understanding the composition, structure, and characteristics of cereals, pulses, and oil seeds as well as the reactions or transformations that occur as a result of these qualities.The foundation of the world's food supply, such as wheat, rice, corn, millet, etc , their processing and chemistry behind is educated

Course Outcomes

After undergoing this course students will be able to:
CO1: Explain the morphology of grains and their composition (Starch, protein and fat, micronutrients) .
CO2: Understand dry and wet milling Processing of grains.
CO3: End product, by product handling & waste management in Mills
CO4: Food and feed technology and their applications

Course Contents

Unit 1 - Technology of Cereals: Wheat- milling, flour grade, flour treatments (bleaching, maturing), flour for various purposes, technology of dough development.: Classification of materials, Advanced Materials, Future materials.

Unit 2 :(Rice) Physicochemical properties, milling (mechanical & solvent extraction), parboiling, ageing of rice, utilization of byproducts. Corn - Milling (wet & dry), cornflakes.

Unit 3: (Barley) Milling (pearl barley, barley flakes & flour), beer preparation. Oats - Milling (oat-meal, oat-flour & oat- flakes).

Unit 4: (Sorghum and millets) Traditional & commercia l milling (dry &wet) Rye and triticale-milling (flour), uses.

Unit 5 : (Technology of Pulses) Milling of pulses i.e. Dry milling, Wet milling, Improved milling method. Technology of Oilseeds-Introduction, Extraction of oil and refining, Sources of protein (defatted flour, protein concentrates and isolates}, properties and uses, protein texturization, fiber spinning.

Unit 6 :Oil extraction: principles, traditional and modern methods. Solvent extraction process: Principles, pretreatment - breaking, cracking, flaking. Extraction: principles, factors affecting extraction process. De solventization . Refining of oils - Degumming, neutralization, bleaching, filtration, deodorization, their principles and process controls.New technologies in oil seed processing, utilization of oil seed meals and different food uses{Including animal feed).

Course Resources

a. Essential Reading

8 Class Notes

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9 Heinis, J. J. (2010). Review of Principles of Cereal Science and Technology, by Jan A. Delcour and R. Carl Hoseney. St. Paul, MN: AACC International, 2010. Reviewed by James J. Heinis, Florida A&M University, Tallahassee, Florida.

b. Recommended Reading

6. Board, N. (2013). *Modern Technology Of Oils, Fats & Its Derivatives: Extraction of fats and oils, Extraction of Olive Oil, Extraction of Palm Oil, Fat and oil processing*
7. Drincha, V. M., & Tsench, Y. S. (2020). Fundamentals and Prospects for the Technologies Development for Post-Harvest Grain Processing and Seed Preparation. *Agricultural Machinery and Technologies*, *14*(4), 17-25

c. Magazines and Journals

1. Milling magazine #1
2. milling magazine #2.
3. milling magazine #3
4. milling magazine #4
5. Milling - Springer

d. Websites

1. http://www.mrs.org
2. http://www.mrsi.org.in
3. http://www.asminternational.org
4. www.nptel.ac.in

e. Other Electronic Resources

1. RUAS Laboratory Videos
2. Electronic resources on the course area are available on RUAS library

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Module Title	Turning and Milling Operations
Module Code	VPT005
Department	Central Workshop
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

Aim of the course is to provide in depth knowledge on lathe, milling and drilling machine operating, programming, setting and maintenance and also develop skilled machine operators and CNC programmers to operate the machineries independently.

Course Outcomes

After undergoing this course students will be able to:

CO1: Operate and Maintain Conventional turning machines independently
CO2: Operate and Maintain Conventional milling machines independently
CO3: Understand CNC machining & CNC turning process and concepts
CO4: Develop the turning & milling components as per the given drawings

Course Contents

Unit 1(Introduction to Lathe and Turning Operations): Introduction to Lathes, Drilling machines and tools used for turning and drilling operations. Demonstrations of lathe operations – Facing, Step turning, Boring.
Exercise-1 Chuck loading & Centering, Exercise-2 Slitting, Facing and Plain turning, Exercise-3 Parting , Step turning and Boring.
Demo – Drilling, Grooving, Taper turning, Thread cutting, Knurling and Chamfering. Exercise-4 Grooving ,Taper turning , Thread cutting, Knurling and Chamfering, Exercise -5 Grooving ,Taper turning , Thread cutting, Knurling and Chamfering, Exercise -6 Grooving ,Taper turning , Thread cutting, Knurling and Chamfering

Unit 2(Introduction to Milling Machines and Milling Operations): Introduction to Milling machines and tools used for milling operations. Demonstrations of milling operations (Face, Size, Step, Slotting and key milling). Exercise – (1-3) Face, Size, Step, Slotting and Keyway milling.
Demo – (Angular milling, Form milling, Profile milling, Gear cutting, Helical milling and T-slot cutting). Exercise – (4 -6) Angular milling, Form milling, Profile milling, Gear cutting, Helical milling and T-slot cutting.

Unit 3(Introduction to Drilling and Tapping): Demo- Drilling, Reaming and Tapping . Exercise -11 Drilling, Reaming & Tapping

Unit 4(Introduction to CNC): Introduction to CNC machineries, types, uses, advantages, limitations, functions, features etc.
CNC machines Demonstration - Control panel specification, Machine starting, Machine shut down, operating in reference point, Operation modes (JOG , MDI, Auto, Edit), Machine Over Travel Limits, Cycle start, Chip conveyor, Emergency stop, Coolant control etc.
CNC Turning - Work and Tool setting, Tool Offset Measurement, Jaws fixing and centralizing, Wear offset, Geometry offset and Clamping, De-clamping etc.

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CNC Milling - Work and Tool setting, fixing tools in ATC, Dialing, and Work offset measurement, Tool Offset Measurement. Hands on Session on all above mentioned concepts.

Course Resources

a. Essential Reading

1. Course Notes
2. Manufacturing Engineering and Technology, Serope Kalpakjian & Steven R. Schmid, publications: Pearson Education India, 2002

b. Recommended Reading

1. CNC Machine Tool Technology with Programming and Operating, Mahesh Dhotre and D. Rao, Marathi Edition, NC Machines, M. Adithan & B.S. Pable, New Age International Publishers, 2018

c. Other Resources

1. Laboratory: Workshop
2. Electronic resources on the course area are available on RUAS library

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Module Title	Metrology, GD&T & Measurements
Module Code	VPT006
Department	Department Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering & Technology (FMC)

Course Summary

The aim of the course is to provide practical exposure to Metrology, GD&T & Measurements. The students will be given hands on exercises on calibration process, measurements, GD&T interpretation. Measurement using CMM will taught with real case examples. Hands on training will be provided to measure both geometric and dimensional tolerance with real case examples.

Course Outcomes

After undergoing this course students will be able to:
CO1: Understand the role of Metrology, GD&T & Measurements
CO2: Calibrate the given instrument as per standard
CO3: Carry out measurement of given component dimensions
CO4: Use CMM for measurement of GD&T measurements

Course Contents

Unit 1: Engineering Metrology- Introduction, SI units, standards of measurements, selection of measuring instruments, general rules for measurements, Comparators- types, working principles, application examples and exercises
Unit 2: Calibration and its importance, calibration of measurement instruments.
Unit 3: Limits, fits and tolerances Limit gauging, Indian Standards, Geometric Dimensioning and Tolerance, Geometric Dimensioning and Tolerance, Measurement and gauging of gears, Measurement and gauging of screw threads,
Unit 4: Measurement of tapers, radius, Straightness, Flatness
Unit5: Measurement of Squareness, Circularity, Roundness, Surface Texture, Surface Texture application examples and exercises
Unit 6: GD&T measurements using CMM

Course Resources

a. Essential Reading

1. Class Notes
2. Geometric Dimensioning and Tolerance Handbook: Applications, Analysis & Measurement, Publisher ASME
3. BEWOOR, Vinay A. Kulkarni,(2017)Metrology & Measurement, McGraw Hill Education

b. Recommended Reading

c. Other Electronic Resources

1. Laboratory
2. Hardware: PCs
3. Software

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Advanced Diploma

Semester 1

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Module Title	Basic Electronics Circuits
Module Code	VGE075
Department	Electronics and Communication Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

This course deals with the concepts of basic electronics and their applications. The course provides students an understanding of the essential principles and terminology that are used in basic electronics. The course deals with semiconductor devices such as diodes, transistors, FETs and UJT. Students are also introduced to digital electronic circuit concepts.

Course Outcomes

After undergoing this course students will be able to:

CO1: Demonstrate the knowledge of the working principle of various semiconductor devices and circuits
CO2: Derive mathematical expressions for various parameters in electronic devices and circuits
CO3: Solve numerical problems related to analog circuits
CO4: Design simple analog circuits for a given applications

Course Contents

Unit 1 (Semiconductor diodes): Semiconductor: p-type, n-type; p-n junction diode- depletion region, VI characteristics. Diode model, DC load line and operation point. Rectifiers-half wave, full wave and bridge type, basic filter circuits, clipping and clamping circuit, Zener diode construction and characteristics-Zener diode as voltage regulator.

Unit 2 (Bipolar Junction Transistor (BJT)): BJT working- CB, CE and CC; BJT parameters: alpha, beta and gamma, Transistor biasing – Base, Collector- to-base and Voltage Divider Bias. Transistor as switch and Amplifier; construction and characteristics of JFET and MOSFET. Financial Accounting-definition and Scope, objectives of Financial Accounting, Accounting v/s Book Keeping Terms used in accounting, users of accounting information and limitations of Financial Accounting.

Unit 3 (Operational Amplifiers): Differential amplifiers and their transfer characteristics, IC Op-Amps, their ideal and practical characteristics, Op-Amp in different modes as inverting amplifier, non-inverting amplifier, summing amplifier etc

Course Resources

a. Essential Reading

1. Class Notes
2. Millman and Halkias, 2001, Integrated Electronics, Tata McGraw-Hill Education
3. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 7th Ed, Prentice Hall

b. Recommended Reading

1. Albert Malvino, 2006, Electronic Principles, Tata McGraw - Hill Education
2. Donald L. Shilling & Charles Belowl, 1968, Electronic Circuits, New York: McGraw-Hill

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3. Tocci R J and Widmer N S, 2001, Digital Systems – Principles and Applications, 8th Ed., Pearson Education India, New Delhi
4. Cooper and Helfrick, 1996, Modern Electronic Instrumentation and Measuring Techniques, 4th print Prentice Hall of India, New Delhi
5. H S Kalsi, 2007, Electronic Instrumentation, TMH, 2nd Edition
6. R A Gaikwad, 2001, Op-Amps and Linear Integrated Circuits, PHI, 4th edition
7. Millman and Grabel, 1999, Microelectronics, 2nd Ed. Tata McGraw-Hill

c. Magazines and Journals

1. Electronics for You
2. IEEE Transaction on Circuits and System I and II

d. Websites

1. http://www.electronics-lab.com
2. http://www.labmanager.com
3. http://electronicsforu.com
4. http://www.lifescienceleader.com

e. Other Electronic Resources

1. Laboratory
2. Hardware: PCs
3. Software

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Module Title	Basics of Hydraulics & Pneumatics
Module Code	VGE011
Department	Department of Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to impart knowledge about fluid statics related to fluid power systems including hydraulic and pneumatic actuators, pumps, reservoirs, and valves. Selection of key components, in the circuit based on their specification is taught. An understanding of the working of hydraulic circuits and common circuits such as meter-in, meter-out, regenerative circuits are taught. Hands on experiments to elucidate the working of these components are conducted.

Course Outcomes

After undergoing this course students will be able to:

CO1: Identify fluid power components and recognize their specification
CO2: Explain the working of various components of fluid power systems
CO3: Select the components for fluid power application
CO4: Draw and develop simple hydraulic and pneumatic circuit

Course Contents

Unit 1(Introduction to Fluid power systems) Concepts of Fluid Power, Properties of Fluids, Viscosity: Dynamic and Kinematic viscosity, Newton's law of viscosity, Vapour Pressure, perfect gas, universal gases, Isothermal & Adiabatic Process, Bulk Modulus of Elasticity and Surface tension, Pascal's Law: Steady flow equation, Components of fluid power systems (Hydraulic system), Pneumatic system, Advantages and disadvantages of hydraulic system & Pneumatic system, source of Hydraulic Power

Unit 2(Components of Fluid power systems): Pump Classification: Positive & Non-Positive Displacements, Gear Pumps: External and Internal, Vane pump of unbalanced Type & Balanced Type, Hydraulic actuators and motors: Linear hydraulic actuators, Mechanics of Hydraulic cylinder loads (lever system), Applications & symbolic representation, Hydraulic Motors: Gear motors, Vane motors, Piston motors: In-line and Axial, Control Component in Hydraulic system: Directional Control valve, Check Valve, Pilot check valve, 3-way and 4-Way Valve. Manual and Mechanical Check Valve, Pressure valve, Pressure control Valve, relief valve and reducing Valve, Flow Control valve, Needle Valve, Non-Pressure compensated valve, Pressure Compensated valve

Unit 3 (Fluid power circuits): Hydraulic circuit design and analysis: Introduction, symbolic representation, control of hydraulic cylinders: single and double cylinders, Regenerative Circuits, Pump unloaded, Speed control of hydraulic motor, Accumulator and its types and Accumulator circuits,

Unit 4 (Maintenance of Fluid power systems): Maintenance of Hydraulic systems: properties of Hydraulic fluids, Types of fluids and sealing devices, O-rings, Packing's ,Rings, Description of Reservoir system,

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Filters and Strainers, Locating filters in circuits, Causes of hydraulic flow, Temp control, Trouble shooting, Pressure measurement

Unit5 (Pneumatic systems): Pneumatic control System, Properties of air, perfect gas laws and description of Pneumatic actuators, Brief Description on End position cushioning, seals, Mounting arrangements, Rod less Cylinder, symbolic representation and circuit diagram, Rotary actuators and its types , Cylinder Performance characteristics, speed control of cylinders, Memory function

Unit 6 (Pneumatic Circuits) Introduction to Multi-cylinder application, Control diagram, symbolic representation, color coding for push buttons, signal suppression and signal elimination (valve symbols and Circuit diagram), Concept of CASCADE, Electro Pneumatic control and pilot operated valves and Air relays, Control circuit for single acting cylinders, Electrical relays, Contact sensing, Production of compressed air, Compressor analysis, preparation of compressed air, Air dryers, Filters, Lubricators, Pressure regulators

Course Resources

a. Essential Reading

10 Class Notes
11 Anthony Esposito, 2000, Fluid Power with Applications, Pearson Education
12 A. Parr, (2011), Hydraulics and Pneumatics, 3rd Edition, Elsevier

b. Recommended Reading

1. Johnson James L. (2002) Introduction to Fluid Power, Thomson Delmar Learning.
2. G. E. Totten (1999) Handbook of Hydraulic Fluid Technology, CRC Press.
3. Ilango Sivaraman, Introduction to Hydraulics and Pneumatics, PHI, 3rd Edition

c. Other Electronic Resources

1. Laboratory: Hydraulics and Pneumatics laboratory
2. Hardware: Hydraulic training kit
3. Software: Matlab

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Course Title	Elements of Mechanical Design
Course Code	VGE072
Department	Department of Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering and Technology

Course Summary

The aim of the course is to study about the basic elements of Mechanical System consists of Translation and Rotational Elements, Internal parts of the system such as Springs, Clutches, shafts, Couplings, Axle's bearings and flywheels. Power transmission elements like Belts, Chains, Gears and Power Screws, sealing elements such as O-Rings and Seals, damping elements to avoid shocks and vibrations along with Pipe fittings and Advanced Materials

Course Outcomes

After undergoing this course students will be able to:

CO1: Understand about the Translational and Rotational Elements
CO2: Identify the different elements of mechanical system
CO3: Basic designing aspects of elements based on its application
CO4: knowledge for building the complete product specification

Course Contents

Unit 1 (Introduction to Mechanical System): Introduction to Mechanical Systems: Translation and Rotational with Examples, Spring Elements Types: Compression, Extension, Torsion and Leaf Spring, Spring Elements Types: Constant Force Spring 1 and 2, Belleville Spring clip, Helical Spring and Spring Element Properties and Applications

Unit 2 (Belts and Chains): Belts: Types, Properties and applications, Chains: Kinematic Chains, link pair and Chain, Chains: Roller Chains and Silent Chains

Unit 3 (Clutches and Brakes): Brakes: Disc and Band Brakes, Block Brake with shoe, Air brakes, and Vacuum brakes, Hydraulic Brake, Electro-Magnetic Brake, single and Double acting Brakes, Clutches: Disc Clutch and Cone Clutch

Unit 4 (Gears and Keys): Gears: Terms and Functionality, Spur gear and Helical Gear, Bevel and Worm Gears, Rack & Pinion and Ratchet and Pawl, Keys: Sunk key and its types, Saddle keys and Tangent Keys Motoreta and Spline Keys

Unit 5 (Rivets and Joints and Screws): Joints: Knuckle Joint and Turnbuckle joint, Pin and Cotter Joint, Bolted and Screw Joint, Butt Joint and Fillet Joint, Rivets: Round Head and Semi Tubular Rivets, Blind, Oscar, Drive Rivets, Flush and Friction Lock Rivets, Screws, types and applications, Power Screws, Multiple Threaded Screw, Self-Locking Screws and Screw Jack, Cap Screws and Set Screws

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Unit 6 (Shafts, Couplings and Axles): Shafts: Machine Shafts and Transmission Shafts and Applications, Stub shaft and Line Shaft, Sector Shaft, Jack shaft, Flexible Shaft and Hollow Shaft, Drive shaft, Tail Shaft and Pinion Shaft, Couplings: Sleeve or Muff Coupling and Clamp Coupling, Rigid Flange Coupling, Flexible Coupling: Beam Coupling and Elastic Coupling, CV couplings and Bush Pin Type Flange Couplings, Diaphragm Coupling and Disc Coupling, Fluid and Gear Couplings, Grid and Oldham's Couplings, Magnetic and Twin Spring Couplings, Schmidt Coupling and Hydro dynamic Couplings, Axles and Cranks

Unit 7 (Bearings and Flywheels): Bearings: Radial Bearing-Ball Bearings and Roller bearings, Thrust Bearing: Ball and Roller Bearings, Self-Aligning Bearings, Shaft Bearings, Journal Bearing: Hydro-dynamic and Hydro-Static Journal Bearings, Fly wheel: Disc and Rim Type, High Velocity and Low Velocity Flywheels

Unit 8 (O-seals & Ropes, Dampers and Advanced Machine Elements): Oil Seals and Types, O-rings and Types, Wire Ropes and Types, Nails and Spikes, Damper and its Types, Hydraulic dampers and Electro-Rheological Fluid Dampers, Metallic Dampers: Steel Dampers and Friction Dampers, Advanced Machine Elements, Piping and Tubing, Pipe Fittings

Course Resources

a. Essential Reading

1. Class Notes
2. Bhandari V B,(1994), Design of Machine Elements, Tata McGraw Hill Education Private Ltd, Third Edition
3. JBK Das, Srinivasa Murthy P L,(2019), Design of Machine Elements-1,Sapna book House
4. JBK Das, Srinivasa Murthy P L,(2019), Design of Machine Elements-2,Sapna book House

b. Recommended Reading

1. Shigley's,(2015),Mechanical Engineering Design, Tata McGraw Hill Education Private Ltd,Tenth Edition

c. Other Electronic Resources

1. Laboratory
2. Hardware: PCs
3. Software

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Course Title	Fundamentals of Food Engineering
Course Code	VPT007
Department	Buhler India / Food Technology
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

The aim of the course is to study about the concept of SI system and its the conversion from one system to another, Mass and Energy Balance of Food Processing Plants, Size reduction and mixing principles, Construction requirements, process design of Food Processing Industry. To understand the fluid flow and its characteristics and Properties, measurement devices and equations involved. Understanding the engineering operations involved in the preservation of food materials by the application of heat, cooling, freezing operations and separation techniques. To understand engineering principles and practical applications of food processing techniques useful for increase shelf life of food products.

Course Outcomes

After undergoing this course students will be able to:

CO1: Apply the principles of mass and energy balance to food processing systems.
CO2: Use psychometric charts to analyze the thermodynamic properties of the atmospheric air and its applications in drying, humidification etc.
CO3: Describe the construction and operating principles of Refrigerators, Freezers, Evaporators, Membrane Separation devices, Boilers and Drying Systems.
CO4: Understand the hygienic design concepts for selection of location and designing of food processing plant

Course Contents

Unit 1 (Introduction to Unit Operations): Concept of Unit operation, Units and dimensions, Unit conversions, dimensional analysis, Mass and Energy Balance

Unit 2 (Design of food plant): Important considerations for designing of food plants, Construction and design, Types of layouts.

Grinding and Mixing - Principle and equipment used in food industry.

Unit 3 (Fluid Flow in food Processing): Liquid Transport systems, Properties of Liquids, Newton's Law of Viscosity, Principle of capillary tube and rotational viscometer, Properties of Non-Newtonian fluids, Flow characteristics, Reynolds Number, Bernoulli's Equation, Principles of Flow Measurement devices.

Unit 4 (Refrigeration and Freezing): Concept and selection of a refrigerant, Description of a Refrigeration cycle Pressure Enthalpy charts and Tables, Freon 12 and R-717, superheating and sub cooling Freezing time calculation using Plank's Equation Frozen food storage

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Unit 5 (Membrane separation systems): Electro dialysis system, Reverse Osmosis Membrane System, and Ultrafiltration Membrane System, Membrane devices used for RO and UF: Plate and Frame, Tubular, Spiral wound and hollow fiber devices.

Unit 6 (Psychometrics): Properties of Dry Air, Properties of Water Vapor, and Properties of air Vapour mixture, Psychrometric Chart

Unit 7 (Steam, Evaporation and Dehydration): Generation of steam, Boiling point elevation, Types of evaporations, Design of single effect evaporators, Basic Drying Process, Moisture content on wet basis and dry basis, Dehydration systems.

Course Resources

a. Essential Reading

1. Class Notes
2. Romeo T. Toledo, Rakesh K. Singh, Fanbin Kong., 2007, Fundamentals of Food Process Engineering, Springer., 4 th edition
3. C. Brennan, 2006, Food Processing Handbook, WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim. First edition
4. R Paul Singh and Dennis R. Heldman., 2009. Introduction to food engineering. Academic press, Fourth edition.

b. Recommended Reading

1. Albert Ibarz and Gustavo V. B. C., 2003 .Unit operation in food processing. CRC Press.

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Course Title	Inspection and Quality Control
Course Code	VPT008
Department	Buhler India
Faculty	Buhler India

Course Summary

The aim of the course is to provide importance of quality controls, reworks, rejections, identify and use of different types measuring instruments and gauges. The students will be given hands on exercises on inspection practices to understand variation in process output. Students will taught on 7 quality control tools, and problem-solving method by using real time examples. Hands on training related to six-sigma project for quality issues and experiments to optimize the process with real case examples.

Course Outcomes

After undergoing this course students will be able to:
CO1: Understand the importance of quality control.
CO2: Identifying the measuring instruments and gauges, carry out measurements.
CO3: Applications of problem-solving methods by using 7 QC tools and six sigma methods.
CO4: Knowledge of process optimization using designated experiments.

Course Contents

Unit 1 (Introduction to inspection and quality control): Objectives, types of inspection, differentiate between acceptable part, rework, and rejection part, importance of GD & T. Identification of measurement devices, gauges, and their least count. Hands on practice by using Vernier calipers, screw gauge, height gauge, depth gauge, bore gauge and CMM.

Unit 2 (Inspection practices and introduction to 7 QC tools): Gate inspection, set-up and first piece inspection and in process and postproduction. Measuring of parts and comparing standard deviation. Introduction to 7 QC tools and problem-solving methods like why-why analysis and their applications.

Unit 3 (Quality assurance, Introduction and using of six-sigma tool): Design and prototyping, programming and code, continuous integration/continuous delivery, configuration management, test planning and execution, deployment and integration, customer acceptance and feedback. Introduction to six-sigma, conducting a six-sigma project for given quality issues. Concept of developing road map for implementing quality standards, QFD, and cascade control plan. 8D, 8W, Process capability, Gage repeatability and reproducibility, Quality Function Deployment, A3, Quality standards

Unit 4 (Case study and project on quality improvements): Conducting designated experiments and optimize the selected process. Practice exercises using quality control software on real based data. Prepare a PPT on the quality improvement project or QC story and present the same.

Course Resources

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a. Essential Reading

1. Introduction to Statistical Quality Control - DOUGLAS C. MONTGOMERY Arizona State University (For Control chart)

b. Recommended Reading

1. https://asq.org/quality-resources/seven-basic-quality-tools (for 7 Quality control tools)
2. https://www.lean.org/lexicon-terms/a3-report/ (for A3 report)
3. Six-Sigma-A-Complete-Step-by-Step-Guide Templates for all kind of topics, refer google.

c. Other Electronic Resources

1. Laboratory
2. Hardware: PCs
3. Software

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Course Title	Machine Drawing and 3D Modelling
Course Code	VPT009
Department	Central Workshop
Faculty	Faculty of Engineering and Technology

Course Summary

The aim of the course is to study about the Orthographic views of Three-Dimensional Model, gaining hands on experience on the software tool, Modelling of Screw jack, Plummer block, Machine Vice, knuckle joint and Oldham's couplings by understanding the function and Mechanism of each Component, Interpret the Industrial drawing

Course Outcomes

After undergoing this course students will be able to:

CO1: Generate the Orthographic views manually from the given 3D model
CO2: Explore the commands on Software to build the Part model and drafting
CO3: Assemble all the parts to generate the complete Product and Generate BOM
CO4: Analyze and Interpret the Manufacturing Industry Drawing

Course Contents

Unit 1 (Introduction to Mechanical Drawing): Introduction to Drawing & CAD software, Manufacturing Drawing Analysis and Identifying Operations, Isometric Drawing to Orthographic Views (Manual Sketching), Practice Session on Isometric Drawing to Orthographic Views (Manual Sketching)

Unit 2 (Basic Sketches on CAD Software): Basic Commands of Software Tool-Demonstration and Practice, 2D Sketching on Software Tool- Practice Session, 3D Part model on Software Tool-Demonstration and Practice, 3D Part model on Software Tool- Practice session, Detailed Drawing of Isometric part model on Software Tool –Demonstration and Practice Session, Assembly Work bench – Demonstration and Practice Session

Unit 3 (Modelling of Screw Jack): Part modelling of Screw Jack- Demonstration and Practice Session, Part modelling of Screw Jack- Practice Session, Assembly Modelling and Drafting of Screw Jack-Demonstration and practice session

Unit 4 (Modelling of Plummer Block): Modelling of Plummer Block –Demonstration and Practice Session, Modelling of Plummer Block –Practice Session

Unit 5 (Modelling of Knuckle joint): Modelling of Knuckle Joint- Demonstration and Practice Session, Modelling of Knuckle joint- Practice Session

Unit 6 (Modelling of Machine Vice): Modelling of Machine Vice-Demonstration and Practice Session, Modelling of Machine Vice-Practice Session

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Unit 7 (Modelling of Oldham's Coupling): Modelling of Oldham's coupling-Demonstration and Practice session, Modelling of Oldham's coupling- Practice session

Unit 8 (Surface Modelling and Concepts): Overall View of Surface Modelling – Demonstration and Practice Session, Overall View of Surface Modelling – Practice Session

Unit 9(Case Study): Case Study on Manufacturing Industry Drawing Analysis and Presentation

Course Resources

a. Essential Reading

1. Class Notes
2. Gopala Krishna K R, (2017), Machine Drawing in 1st angle Projection, Subhas stores

b. Recommended Reading

1. Narayana K L, Kanniah P, Venkata Reddy K, (1994),Machine Drawing, New Age International Publishers, Third Edition

c. Other Electronic Resources

1. Laboratory: CAD Laboratory
2. Hardware: PCs
3. Software: Unigraphics (UG)

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Advanced Diploma

Semester 2

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Module Title	Elements of Mechatronics
Module Code	VGE028
Department	Department of Electronics and Communication Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to study the elements of mechatronics as mechatronics is the synergistic combination of mechanical and electrical engineering, computer science, and information technology, which includes the use of control systems as well as numerical methods to design products with built-in intelligence. It involves study of sensors, actuators, controlling mechanism/algorithm and common Mechatronics applications. The synergistic combination of all the aspects of Mechatronics which would be useful in developing a particular application.

Course Outcomes

After undergoing this course students will be learning about:

CO1: Key elements of mechatronics.
CO2: sensors and signal conditioning circuits.
CO3: Pneumatic and hydraulic systems.
CO4: Basics of embedded systems, modelling and design in mechatronics

Course Contents

UNIT 1(Introduction of Mechatronics): System: Definition and examples, Measurement system: Definition and examples, Measurement System Block Diagram, Control System: Definition and examples, Control System Block Diagram: open loop with examples, Control System Block Diagram: closed loop with examples, Differences between Open loop and Closed loop systems, Sequential Controllers with examples, Microprocessor Based Controllers, Engine Management System as an example, Water Level Controller: Mechatronics Approach.

UNIT 2(Sensors and Transducers): Introduction, Performance terminology of Transducers, Performance terminology of Transducers, Demonstration on Different Types of Sensors, Demonstration on Different Types of Sensors, Demonstration on Different Types of Sensors.

UNIT 3(Signal Conditioning Circuits): Introduction, Amplifiers: introduction with examples, Oscillators: introduction with examples, Signal Converters: introduction with examples, Demonstration on Different Types of Signal Conditioning Circuits using MULTISIM, Demonstration on Different Types of Signal Conditioning Circuits using MULTISIM, Demonstration on Different Types of Signal Conditioning Circuits using MULTISIM, Data Presentation Systems: introduction with examples, Analog Indicators and Recorders with examples, Digital Indicators with examples, Recorders-Printers with examples.

UNIT 4(Pneumatic systems and hydraulic actuation systems):Introduction to Pneumatic systems with examples, Introduction to hydraulic systems with examples, Introduction to Mechanical actuation systems with examples, Introduction to Electrical actuation systems with examples, Demonstration of

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Pneumatic Actuation Systems, Demonstration of hydraulic Actuation Systems, Demonstration of Mechanical actuation Systems, Demonstration of Electrical Actuation Systems.

UNIT 4(System Modelling): Introduction with examples, Basic Building Blocks of System Modelling, Basic Building Blocks of System Modelling, Digital Combinational logic: introduction with examples, Digital Combinational logic: introduction with examples, Sequential Logic Circuits: introduction with examples, Sequential Logic Circuits: introduction with examples, Demonstration on Digital Combinational Logic Circuits using MULTISIM, Demonstration on Digital Combinational Logic Circuits using MULTISIM

UNIT 5(Micro-Processor, Micro-Controllers and logic controllers) Micro-Processor: introduction with examples, Micro-Controllers: introduction with examples, Introduction to Logic Controllers, Input/output Systems: introduction with examples, Input/output Systems: introduction with examples, Introduction to Distributed Control Systems, Distributed Control Systems with examples

UNIT 5(Introduction to Mechatronic Design) Design steps, Mechatronic Design with examples, Case Studies of Mechatronic System.

Course Resources

a. Essential Reading

1. Class Notes
2. W. Bolton, "Mechatronics – Electronic control systems in Mechanical & Electrical Engineering", Pearson Education Ltd., 2015

b. Recommended Reading

1. Shetty and Kolk, "Mechatronics System Design', Cengage learning, India, second edition.
2. Frank D petruzella, "Programmable logic controllers", Fourth edition, McGraw Hill higher education, 2016
3. Richard C. Dorf, Robert H. Bishop, "Modern Control Systems" Twelfth Edition, Pearson Education, 2014.

c. Other Resources

1. https://onlinecourses.nptel.ac.in/noc21_me27/preview

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Module Title	Sensors and Signals
Module Code	VGE063
Department	Electronics and Communication Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

This course deals with the concepts of basic electronics and their applications. The course provides students an understanding of the essential principles and terminology that are used in basic electronics. The course deals with semiconductor devices such as sensors, Op-amp and measuring equipments. Students are also introduced to digital electronic circuit concepts.

Course Outcomes

After undergoing this course students will be able to:
CO1: Demonstrate the knowledge of the working principle of various semiconductor devices and circuits
CO2: Derive mathematical expressions for various parameters in electronic devices and circuits
CO3: Solve numerical problems related to analog circuits
CO4: Design simple analog circuits for a given applications

Course Contents

Unit 1: Introduction to Sensors and Transducers, Broad Classification , Mechanical and Electro-Mechanical Sensors: strain gauges, Resistive, Inductive Type of Sensors and Magnetic sensors, LVDT, RVDT and proximity sensors, Position sensors, crankshaft position sensor and Throttle angle sensors, Pneumatic Sensors, Capacitive Sensors and Pressure Sensors, Piezo-Electric Transducers and introduction to Temperature sensors, Thermistors, thermocouples, RTD, NTC and PTC, Piezo electric sensors in acceleration, velocity, displacement, vibration, measurement , Flow measuring sensors

Unit 2: Optical Sensors, IR Sensors, Gas Sensors, Gyro Sensors, Signals, Types of Signals, Signal Conditioning Circuits: Amplifiers, Transistor Amplifiers, OPAMP as Comparator and Wave-Shaping Circuit

Unit 3: Wave form generators and Filters: Oscillators, Signal Converters: ADC and its Types, DAC and its types, Signal Selectors: Multiplexes and De-Multiplexes, Signal Processors: Modulators and De-Modulators, DAQ Boards in Signal Acquisition

Course Resources

a. Essential Reading

1. Class Notes
2. Millman and Halkias, 2001, Integrated Electronics, Tata McGraw-Hill Education
3. Robert Boylestad and Louis Nashelsky, Electronic Devices and Circuit Theory, 7th Ed. Prentice Hall

b. Recommended Reading

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1. Albert Malvino, 2006, Electronic Principles, Tata McGraw - Hill Education
2. Donald L. Shilling & Charles Belowl, 1968, Electronic Circuits, New York: McGraw-Hill
3. Tocci R J and Widmer N S, 2001, Digital Systems – Principles and Applications, 8th Ed., Pearson Education India, New Delhi
4. Cooper and Helfrick, 1996, Modern Electronic Instrumentation and Measuring Techniques, 4th print Prentice Hall of India, New Delhi
5. H S Kalsi, 2007, Electronic Instrumentation, TMH, 2nd Edition
6. R A Gaikwad, 2001, Op-Amps and Linear Integrated Circuits, PHI, 4th edition
7. Millman and Grabel, 1999, Microelectronics, 2nd Ed. Tata McGraw-Hill

c. Magazines and Journals

1. Electronics for You
2. IEEE Transaction on Circuits and System I and II

d. Websites

1. http://www.electronics-lab.com
2. http://www.labmanager.com
3. http://electronicsforu.com
4. http://www.lifescienceleader.com

e. Other Electronic Resources

1. Laboratory
2. Hardware: PCs
3. Software

Course Title	Principles of Management
Course Code	VGE059
Department	Department of Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering and Technology (FET)

Course Summary

The aim of the course is to provide an overview of management and its evolution. It examines management functions of planning, organizing, staffing, leading, directing and controlling and its impact on the business organization. It discusses necessary skills and functions required for efficient manager in contemporary business environment.

Course Outcomes

After undergoing this course students will be able to:

CO1: Describe the primary functions of management and roles of managers
CO2: Explain how managers align the planning process with company vision and mission
CO3: Identify common organizational structures and describe staffing process
CO4: Explain the importance of directing and need for control within the organization

Course Contents

Unit 1(Introduction to Management): Management - Introduction, Concept, Meaning and Definition of Management, Characteristics and Importance of Management, Difference between Administration and Management, Process and significance of management, Functions of Management, Managerial roles (Mintzberg), Roles and Functions of a Manager, Levels of Management, Development of Scientific Management and other Schools of thought and approaches, Objectives of Management, Principles of Management.
Case study on Basics of Management and Analysis - I
Case study on Basics of Management and Analysis - II

Unit 2(Planning): Planning; Introduction, Meaning, Importance, Characteristics, Elements of good planning, Types of Planning – Objectives and policies, , Planning Process (steps), Benefits of Planning, Limitations of Planning, Requisites of making effective Planning, SWOT Analysis, Strategic planning and Operational planning, Introduction to Management by objective, Management by objectives; Corporate planning; Environment analysis and diagnosis; Strategy formulation
Case Study on Planning – I
Case Study on Planning – II

Unit 3 (Types of Decisions): Nature, type, importance, principles and techniques of Decision making, Problems involved in Decision making
Case study and Analysis on Decision-Making - I
Decision making and its process, Objectives and policies- Decision making
Case study and Analysis on Decision Making - II

Unit 4 (Organisation): Introduction, Meaning, Definition, Functions of Organization, Importance, Principles of Organisation, Organization design, Types of Organization (functional, project, matrix and network), Types of authority: Line, staff and functional authority Power - The sources of power - Difference between Authority and power, Delegation - Advantages of Delegation, Barriers to Delegation,

Guidelines for Effective Delegation , Decentralization v/s Centralization, Advantages and Disadvantages of Decentralisation, Responsibility, Organisation Structure - Span of Control, Committees, Departmentalisation, Formal and informal organization , Authority and Responsibility, Definition and Types of Responsibility and Accountability, Organization chart
Case Study and Analysis on Organisation – I
Case Study and Analysis on Organisation - II

Unit5 (Staffing): Introduction, Definition, Functions of staffing, Recruitment, Sources of recruitment, Stages of selection procedure, Training, Methods of training and performance appraisal, Factors affecting staffing, job design, Teamwork, Stages of Team Building
Case study and Analysis on Staffing - I
Case study and Analysis on Staffing – II

Unit 6 (Communication)
Significance, Channels of communication, types and process of communication
Communication - barriers and remedies, Effective communication
Case study and Analysis on Communication - I
Case study and Analysis on Communication - II

Unit 7 (Leadership):Functions, qualities, Leadership-Concept and leadership styles ,Leadership – Functions and Types – X, Y and Z Theories, Qualities and Traits of a good Leader, Coordination and Cooperation, concept, significance, principles of coordination, Techniques, obstacles in co-ordination
Case study and Analysis on Coordination - I
Case study and Analysis on Coordination – II

Unit 8 – (Direction):
Concept, nature, importance and principles of Direction
Written vs. Oral Directives. Techniques of Direction
Case study and Analysis on Direction - I
Case study and Analysis on Direction – II

Unit 9: (Control): Definition of Controlling - Meaning and Importance of controlling, Relationship between Planning and Controlling, Control Process - Characteristics of Good control System. Types of Control, Barriers to control making and how to overcome them, Control techniques, budget and non-budgetary control devices, Introduction to TQM Budgetary Control, Management Audit. Management Audit, Components of Management Audit
Case study and Analysis on Control
Case study and Analysis on Budgeting - I
Case study and Analysis on Budgeting - II

Course Resources

a. Essential Reading

4. Class Notes
5. Harold Koontz, O'Donnell and Heinz Weihrich, 2012. Essentials of Management. New Delhi, 9th edition, Tata McGraw Hill

b. Recommended Reading

1. Stephen P. Robbins, David A. Decenzo, 2016. Fundamentals of Management, Pearson Education, 9th Edition

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Course Title	Food Processing Engineering - 1
Course Code	VPT010
Department	Buhler India / Food Technology
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

The aim of the course is to provide a vision on the processing technologies involved in transforming raw materials into quality food products, it includes material handling equipment, pretreatment of raw materials, size reduction, processing to increase the shelf life of the products and the hygienic design of the food processing equipment. To understand the engineering properties of the food materials.

Course Outcomes

After undergoing this course students will be able to:

CO1: Acknowledge the importance of material handling operations and the Hygienic design of Food Processing Equipment
CO2: Understand the working and applicability of various unit operations such as size reduction, mixing and separation operations.
CO3: Describe the operation and design principles of evaporators and dryers.
CO4: Understand the rheological, textural properties of food and their analysis methods.

Course Contents

Unit 1 (Material handling): Material handling machines and conveyors.

Unit 2 (Pretreatment in unit operations): cleaning, shelling and dehusking, sorting & grading & peeling

Unit 3 (Size reduction and separation): Principles and equipment used.

Agitation and mixing: Principles and equipment used. Blending and pulverization equipment.

Unit 4 (Drying): Principles of drying, drying rate kinetics, classification, mass and energy balance. Different types of dryers and components – roller, spray, tray, fluidized bed etc.

Unit 5: Hygienic design of food processing equipment, sanitary requirement, sanitary pipes and fittings

Unit 6 (Evaporation): Principles of evaporation, types and selection of evaporators, mass and energy balance. Functioning of single and multiple effect evaporators, recompression heat and mass recovery and vacuum creating devices.

Unit 7 (Engineering properties of food materials): Rheology and texture of food materials - Concept of rheology, elastic, plastic and viscous. Newtonian methods of texture evaluation, subjective and objective measurements. Methods of texture evaluation, subjective and objective measurements.

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Course Resources

a. Essential Reading

1. Class Notes
2. K. M. Sahay and K. K. Singh, "Unit Operations of Agricultural Processing," Vikas Publishing House Pvt. Ltd., New Delhi, 1994.
3. Brennan, J.G. (2006) Food processing handbook. Wiley VCH, Germany, 215-220.
4. Bourne, M. C. (2002). Food texture and viscosity: concept and measurement. 2nd ed. San Diego: Academic Press.
5. Schmidt, Ronald & Erickson, Daniel. (2008). Sanitary Design and Construction of Food Processing and Handling Facilities1. EDIS. 2005. 10.32473/edis-fs120-2005.

b. Recommended Reading

1. Earle R. L. 2014. *Unit Operations in Food Processing*. 2nd ed. Kent: Elsevier Science.
2. Chakraverty, A. (1988) Post-Harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH Pub. Co., New Delhi.
3. Heldman, D.R., Lund, D.B., & Sabliov, C. (Eds.). (2006). Handbook of Food Engineering (2nd ed.). CRC Press. https://doi.org/10.1201/9781420014372

Module Title	Electrical & Electronics System Simulation and Analysis
Module Code	VPT 011
Department	Department of Electrical and Electronics Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to deals with the study of electronic devices and their applications for control and conversion of electric power. The course also emphasizes the principles and applications of power electronics for the control of electric drives. Students are taught simulation tools to study the characteristics of power electronic circuits and electric drive systems.

Course Outcomes

After undergoing this course students will be able to:

CO1: Formulate and conduct experiments as per the standard procedures
CO2: Calculate the required parameters, tabulate and plot the results wherever required
CO3: Interpret, compare with standard results and draw conclusions
CO4: Simulate electronic circuits for drive control and conversion of electric power using standard software

Course Contents

Unit 1 (Introduction to Electrical Systems)
Fundamentals of energy-handling electric circuits, power electronic circuits such as inverters, and electromechanical apparatus, modeling of magnetic field devices and description of their behavior using appropriate models, simplification of problems using transformation techniques, analysis of power electric circuits, magnetic circuits, and elements of linear and rotating electric machinery, use of lumped parameter electro-mechanics to understand power systems, models of synchronous, induction, and DC machinery, the interconnection of electric power apparatus and operation of power systems

Unit 2 (Introduction to MATLAB and SIMULINK)
Introduction, Basics of Programming in MATLAB: Variables, array, matrices, programming structure, Script files, Functions, Debugging programs, Loops, branches and control flow, Relational and logical operations MATLAB graphics: Two and three dimensional graphics, Multiple plots, Plot properties Numerical analysis: Non-linear equations and optimization, Differential equations Introduction to SIMULINK: models, blocks, Systems and sub-systems, Simulating Dynamic System, Solving a model, solvers, MATLAB SIMULINK integration.

Unit 3 (Modelling of DC motor)
MATLAB representation of motor equations, Time and frequency responses of motor i/o using MATLAB, Control design: proportional control, Integral control, derivative control and PID, Simulink model of DC motor, Simulink model of BLDC motor.

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Unit 4 (Introduction to Electronics Systems)

Different types of systems & networks: continuous & Discrete, Fixed and Time varying, Linear and Non-linear, Lumped and distributed, Passive & Active Networks & Systems Laplace transform of impulse and sinusoidal steps waveforms for RL, RC, LC and RLC Circuits. Transient analysis of different electrical circuits with and without initial conditions, Fourier Series and Fourier Transform Network theorems and their applications in circuit analysis, Formulation of network equations, Source transformations, Loop variable analysis and node variable analysis Graph of network, concept of tree branch, tree link. Incidence matrix, Tie-set matrix and loop currents, Cut set matrix and node pair potentials

Unit 5 (Introduction to MULTISIM)

MultiSIM UI, Project on MultiSIM - Drawing a Schematic, Working with Instruments in MultiSIM, Microprocessor Control Units (MCU) in MultiSIM, Project on MultiSIM - Working with Analysis, Rectifier and filters simulation using MULTISIM, Regulators simulation using MULTISIM, Protection systems simulation using MULTISIM, Power supply simulation using MULTISIM, Invertors simulation using MULTISIM.

Unit 6 (Introduction to digital logic)

Counters, shift registers, Display decoders, Signal generators, Signal conditioning circuits-introduction, Amplifiers, Signal convertors, Signal convertors, Introduction to motor driving circuits.

Course Resources

a. Essential Reading

1. Course Notes
2. Ned Mohan, Tore Undeland ,M., William Robbins, P., (2008),Power Electronics: Converters, Applications and Design ,John Wiley Publication

b. Recommended Reading

Muhammad Rashid ,H., (2010),Power Electronics Handbook: Devices, Circuits and Applications , Academic Press

Bhimbra, P.S.,(2007), Power Electronics, Khanna Publication

c. Magazines and Journals

"Discover Power Electronics" magazine

"International Journal on Power Electronics and Drive Systems"

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Module Title	Project 1
Module Code	VPT012
Department	Buhler India / Central Workshop
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

Aim of the course is to give students an experience of identifying problems related to food processing Industry and generate the virtual models or a prototype models of the identified problem. They also develop technical reports documenting the project work. Students in a team not exceeding four (4) members should be able to design and develop a working prototype as a project.

Course Outcomes

CO1: Identify the need for developing a new or improving an existing product or system through an organized survey of literature

CO2: Design and model the product or system to meet the design specifications

CO3: Evaluate and justify the performance of the modelled system

CO4: Demonstrate the working of the product or system and make a presentation

CO5: Write a technical report

Degree

Semester 1

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Module Title	Customer Relationship Management
Module Code	VGE023
Department	Department Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to provide practical exposure to Concepts of Customer Relationship Management. Students are exposed to role of CRM and importance of CRM in the service industry. Importance of emerging dimensions in the field of CRM is being taught as a part of the course. Students are exposed to customer care management and Cost Benefit Analysis of CRM. Students are then taught CRM and Multi-Channel Integration Process with some industry based case studies.

Course Outcomes

After undergoing this course students will be able to:
CO1: Understand the concept of Customer relationship Management
CO2: Discuss the concepts of emerging dimensions in CRM.
CO3: Implement Cost Benefit Analysis in CRM.
CO4: Apply the CRM and Multi-Channel Integration Process.

Course Contents

Unit 1 (Concepts of CRM Concepts) - Introduction to customer relationship management, meaning, definition, purpose and significance. Factors responsible for the growth of CRM, customers loyalty and optimizing customer relationships. Winning markets through effective CRM, benefits of CRM, value creation in business, acquiring customers. Case study analysis

Unit 2 (Emerging Dimensions of CRM) - Building Customer Relationship – Need for people to do business with you, ways to address human needs. Building relationships through valuing the customer, building rapport, emotional bank account. Case study analysis the value equation, reasons for customer switching, need for customer retention. Customer retention strategies, customer complaint management strategy. Service recovery strategy, managing customer waiting strategy, levels of retention strategy. Recall management through personalization strategies and differentiation strategies.

Unit 3 (Customer Care Management) - Customer service representative, customer care software, Customer service applications. Customer facilities, multimedia contact center. Electronic point of sale, winning strategies. Processes for effective CRM in different sectors.

Unit 4 (Cost Benefit Analysis of CRM) - CRM benefits to the organization and customer. CRM benefits to the customer. CRM costs incurred by the organization. CRM costs incurred by the customer. Building customer loyalty in business to business customer centric organizational structure through communal coordination. Building customer loyalty in business to business customer centric organizational structure through serial coordination. Building customer loyalty in business to business customer centric organizational structure through symbiotic.

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Unit 5: **(CRM and Multi-Channel Integration Process)** - Channel management. Sales force management. Managing Call-center, direct mail and internet websites. E-commerce, m-commerce, channel integration strategies importance of customer channel experience and channel categories. Managing e-commerce and m-commerce. Channel integration strategies. Importance of customer channel experience and channel categories. Case study analysis.

Course Resources

a. Essential Reading

1. Class Notes
2. Francis Buttle and Stan maklan (2021) : Customer Relationship Management: Concepts and Technologies, New York : McGraw Hill
3. Shamsher Singh. (2019), Customer Relationship Management: A Corporate Strategy Himalaya publication House
4. Peelan (2022) CUSTOMER RELATIONSHIP MANAGEMENT 1ST EDITION, Pearson's Publishers

b. Recommended Reading

1. Peelan (2022) Customer Relationship Management, Pearson's Publishers

c. Other Electronic Resources

1. Software

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Module Title	Business Communication - English
Module Code	VGE013
Department	Human Resources
Faculty	Buhler Academy

Course Summary

The aim of the course is to make the learners aware of basics of communication, types of communication and how they are practiced in the business environment such as companies, institutes and other business establishments.

Course Outcomes

After undergoing this course students will be able to:
CO1: Need of English grammar in communication and apply grammar in day today communication.
CO2: Understand the need of communication and use of different types of communication.
CO3: Use different forms of communications like discussion, negotiations, presentation and email etc.

Course Contents

Unit 1 (Introduction to Grammar): Need for grammar, sentence, types of sentences, genders, plural & singulars, active & passive voice, articles, parts of speech, comparison of adverbs, introduction to etiquette.

Unit 2 (Introduction to communication): Definition, need for communication, types of communication and their application, communication process, advantages & disadvantages, one way & two way communication, activities and games

Unit 3 (Business communication 1): difference between general and business communication, 7Cs of communication, tone, voice, body language, eye contact, filters, noise, feedback, selection of words etc., tools for communication, digital platforms, conventional ways of communicating, elements of communication, barriers to communication and how to overcome

Unit 4 (Business Communication 2):

Negotiation – Need for negotiation, negotiation with customers, peers etc., activities
Presentation – need for presentation, types of presentation, making slides, layout, animation, visuals and charts, presentation styles, activities

Email – writing email (to parents, supervisors, vendors, customers etc.), effective ways of writing an e-mail, types for writing, activities

Letters – writing letters to customers, government authorities, supervisor, peers / colleagues, job applications, writing reports and activities

Public speaking – preparations, contents, selection of words, activities

Course Resources

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a. Essential Reading

1. Class Notes
2. High school grammar & composition – Wren & martin
3. Business Communication – Dr. B S Bodla

b. Recommended Reading

News papers, journals, listen to lectures

c. Other Electronic Resources

Buhler internal portal, Diagram, Varaha, Technical Publications

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Module Title	INDUSTRIAL AUTOMATION
Module Code	VGE073
Department	Department of Electronics and Communication Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

This course provides an overall exposure to the technology of Industrial Automation as widely seen in factories of all types both for discrete and continuous manufacturing and drives related to automation.

Course Outcomes

After undergoing this course students will be able to:

CO1: analyze industrial automation configurations
CO2: simulate and build circuits related to industrial drives
CO3: understand pneumatic and hydraulic systems in automation
CO4: understand technology involved in present industrial automation

Course Contents

UNIT 1: (Introduction to automation): Introduction to automation, Functional elements of industrial automation, Industrial Sensing elements: Functional configuration of a typical sensor system, Industrial actuation elements: Functional configuration of a typical actuation system, Signal processing element with an example- Simulation example using MATLAB

UNIT 2 :(Power devices): Power devices, their applications in power amplification and conversion elements Thyristor: SCR construction and working, SCR rectifiers: half wave rectifier, 1-phase, Study of SCR characteristics using MultiSim1-phase Half Wave Rectifier simulation using MultiSim, SCR rectifiers: half wave rectifier- 3-phase, full wave rectifier-1-phase1-phase Full Wave Rectifier simulation using MultiSim, SCR rectifiers: full wave rectifier, 3-phase, SCR triggering methods: R and RCSCR triggering methods: UJT based-Triggering circuit simulation, Choppers as DC/DC convertors, Inverters as DC/AC convertors, Cyclo-convertors as AC/AC convertors:1 phase to 1 phase mid-point, resistive load ,DC motor drives-Simulation example using MultiSim, Breaking methods in servo drives, Stepper motor drive using MultiSim, Transistor PWM DC convertor

UNIT 3: (Industrial drives): Closed loop speed and position control of a separately excited DC motor (analysis and simulation) Induction motor drives with examples (analysis and simulation), BLDC drives, Non-electrical power convertors: hydraulic and pneumatic, hydraulic control system: Conduction of an experiment using Hydraulic trainer, pneumatic control system: Conduction of an experiment using Pneumatic trainer, Industrial control systems, Introduction to Automatic Guided Vehicles, FMS: Demonstration-using SMC kit

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Course Resources

a. Essential Reading

1. Class Notes
2. Industrial Drives and Applications by Prof.G.K DUBEY
3. Industrial Automation and Robotics by A K Gupta and Arora

b. Recommended Reading

1. Handbook of Industrial Automation by Richard L. Shell, E-book

c. Other Resources

1. Laboratory: Control systems and Robotics (assembly mini cell)
2. Hardware: PCs
3. Software: Multisim

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Module Title	Food Processing Engineering -2
Module Code	VPT013
Department	Buhler India / Food technology
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

The aim of the course is to familiarize students with the application of heat and mass transfer principles to analyze and design food processes. Enhance the knowledge on the different processing principles and equipment used to improve the quality of the food materials. To make student aware on application of novel processing techniques, current trends and innovations in Food Processing and Engineering operations. To share knowledge and understanding on the basic steps and operation in preparation of Bread, Biscuits, cakes and other confectionary products.

Course Outcomes

After undergoing this course students will be able to:

CO1: Solve the problems related to heat transfer and mass transfer, design of Heat Exchangers
CO2: . able to understand the principle and application of Leaching, Crystallization and Distillation process.
CO3: To acquire knowledge on process and principles for development of various bakery products and their quality determination and their operations
CO4: Student will acquire basic concept and idea of various novel food processing and preservation techniques.

Course Contents

Unit 1 (Mechanical Separation): Basic principles of Solid-solid, Solid-liquid and Liquid-liquid separation.

Unit 2 (Centrifugation): Liquid-liquid centrifugation, Liquid-solid centrifugation, Basket centrifuge, Bowl centrifuge, clarifiers, de-sludging, Nozzle and decanting centrifuges.

Unit 3 (Filtration): Principles involved in filtration, Pressure, Vacuum and Centrifugal filtration,

Expression: batch and continuous types

Unit 4 (Baking, Roasting and Frying operations): Principles and equipment.

Unit 5 (Extraction/ Leaching Crystallization and Distillation): Basic principles and equipment used, Membrane processes, ultra filtration, reverse osmosis, electro dialysis, pre-evaporation and micro filtration spray drying and Super critical fluid extraction.

Unit 6 (Heat and Mass Transfer): Systems for heating and cooling food products, Thermal Properties of Food Modes of heat transfer, Application of steady state heat transfer- estimation of conductive heat

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transfer coefficient, convective heat transfer coefficient, overall heat transfer coefficient and, design of tubular heat exchanger. Fick's Law of Diffusion, Mass transfer in packaging material.

Unit 7 (Irradiation): Principle and its equipment

Unit 8: Current trends in food processing and Engineering, Innovation and application.

Course Resources

a. Essential Reading

1. Class Notes
2. Brennan, J.G. (2006) Food processing handbook. Wiley VCH, Germany, 215-220.
3. Earle R. L. 2014. *Unit Operations in Food Processing*. 2nd ed. Kent: Elsevier Science.
4. Hameed, Fozia & Ayoub, Anjum & Gupta, Neeraj. (2018). Novel food processing technologies: An overview. 6.
5. Singh, R. & Heldman, D.R.. (2014). Introduction to food engineering: Fifth edition. Introduction to Food Engineering: Fifth Edition. 1-861.

b. Recommended Reading

1. Heldman, D.R., Lund, D.B., & Sabliov, C. (Eds.). (2006). Handbook of Food Engineering (2nd ed.). CRC Press. https://doi.org/10.1201/9781420014372
2. Barbosa-Cánovas, G.V. & Tapia, M.S. & Cano, M. Pilar & Martin-Belloso, Olga & Martínez, Antonio. (2004). Novel food processing technologies.

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Module Title	PLC and its applications
Module Code	VMS013
Department	Department of Electronics and Communication Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

Programmable Logic Controller (PLC) is a very important device to control any system and is widely used in industries now a day. Therefore the person who wants to work in control and automation industries must have enhance knowledge of PLC. This course gives a detailed knowledge and practice of PLC programming for different applications.

Course Outcomes

After undergoing this course students will be able to:

CO1: Compare conventional sequential control with programmable logic control system
CO2: Develop programs using different PLC programming languages for sequential and continuous process
CO3: Interface analog and digital input/ output devices with PLC using different communication protocol
CO4: Test the PLC based system and troubleshoot the errors associated with it with examples.

Course Contents

UNIT 1: (Introduction to programmable logic controllers): PLC History, Ladder Logic and Relays: introduction, PLC Programming, PLC Operation, PLC architecture and hardware configurations.

UNIT 2: (Input and outputs-PLC): Input and outputs types, Electrical wiring for inputs and outputs, Relays, Logical sensors Logical actuators.

UNIT 3: (PLC programming): Logic design, Event based logic, Sequential logic, Latches with examples, Timers with examples, Counters.

UNIT 4: (Program design methods): Program design methods, SFC with examples, FBD with examples,

Ladder logic with examples

UNIT 5: (Advanced ladder logic): Advanced ladder logic with examples, Ladder logic comparison for different PLCS, Traffic light ladder programming, Water level controller ladder programming, Conveyor ladder programming, Lift control ladder programming, Pick and place ladder programming, Component segregation ladder programming, FMS using SMC-Mitsubishi PLC

Course Resources

a. Essential Reading

1. Class Notes
2. Programmable Logic Controllers by W. Bolton, Elsevier Newnes publication, 4th edition

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b. Recommended Reading

1. Programmable logic controller by Frank D. Petrusella, Tata McGraw-Hill publication
2. Introduction to programmable logic controller by Gary dunning, Thomson Asia Pte Ltd. Publication, Singapore.
3. Programmable Logic Controllers: Principles and Applications by John W. Webb and Ronald A. Reis, Prentice – Hall India publication, 5th edition
4. Programmable Controllers An engineer's guide by E.A.Parr, Elsevier Newnes publication 3rd Edition
5. S7-200, PLC Manual of Siemens for Instructions
6. S7-300, PLC Manual of Siemens for Instructions
7. Programmable Controller by T. A. Huges, ISA publication, 2nd edition
8. Programmable Logic Controllers: Programming methods and applications by
9. John R. Hackworth and Frederick D. Hackworth Jr., Pearson publication

c. Other Resources

1. Laboratory: PLC Kits
2. Hardware: PCs
3. Software: Keyence simulation software

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Module Title	New Product Development
Module Code	VPT015
Department	Buhler India / Food Technology
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

The aim of this course is to enable students to understand the design process and different stages of product design cycle and life cycle of a product. The students are taught to prepare a design boards and gestalt principles and concept generation techniques using brainstorming, mind mapping, gallery method and other concept generation techniques. Students are taught with product case studies to make them understand the essential design and design features requirements in a product. Student are enable to develop a new concepts with manual sketching using hand tools and later on it will be converted in digital detail design and rendering real material for better visualization before to go for product development

Course Outcomes

After undergoing this course students will be able to:

CO1 Explain the design process and stages of product design cycle and product life cycle
CO2 Discus the concept generation techniques
CO3 Apply the gestalt principles and elements of design to develop digital design
CO4 Create product concepts using hand tools and digital tools

Course Contents

Unit 1(Introduction): Introduction to Design Process, Different stages of product design cycle, Life cycle of a product, Explanation and preparation of Image board, Lifestyle board, Mood board, theme board.

Unit 2(Gestalt Principles): Nine influential Principles of Gestalt (Application in design) -1, Nine influential Principles of Gestalt (Application in design) -2, Nine influential Principles of Gestalt (Application in design) -3 (Figure and Ground, Similarity, Proximity, Continuity, Closure, Focal point, Symmetry, Common Region and Common Fate)

Unit 3 (Concept Generation): Introduction a Concept generation techniques, Concept generation techniques with Gallery Method, mind-mapping and other available techniques. Design Case: Art Lebedev Studio, Russia

Unit 4 (Product Usability): Introduction to Product Usability, Product Usability – Exercise 1. a (Hand Tools), Product Usability – Exercise 1. b (Hand Tools), Product Usability – Exercise 2. a (Handheld Electronic products), Product Usability – Exercise 2. b (Handheld Electronic products), Product Usability – Exercise 3. a (Consumer electronic Goods), Product Usability – Exercise 3. b (Consumer electronic Goods), Design Case: Waalmakers, the Netherlands and Design Case: WAACS Design, the Netherlands.

Unit5 (Ideation and visualization of the product): Introduction to Ideation and visualization of the product, Creating Products from Basic shapes, Sketching Consumer Products 1, Sketching Consumer

Products 2, Sketching Consumer Products 3, Product concepts and detail design 1, Product concepts and detail design 2, Product Presentation 1 and Product Presentation 2.

Course Resource

a. Essential Reading

1. Class Notes
2. Laura Slack (2006), What is Product Design? Essential design handbook.
3. Rajesh Lal (2013), Digital Design Essentials, 100 ways to design better desktop, web, and mobile interfaces.
4. Wolfgang Kohler (1970), Gestalt Psychology, The Definitive Statement of the Gestalt Theory
5. Koos Eissen, Roselien Steur (2019), Sketching (paperback): Drawing Techniques for Product Designers

b. Recommended Reading

1. Bhagvanji Sonagra, Sushmita Rao and Bhavin Dabhi (2020), Nature of Form (For Designers), Metaphorical Forms.
2. Website: Sketch a Day

c. Other Electronic Resources

1. Laboratory
2. Hardware: PCs
3. Software

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Degree

Semester 2

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Course Title	Operations Management
Course Code	VGE054
Department	Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering technology

Course Summary

The aim of the course is to provide an overview of concepts, principles, problems, and practices of operations management and how these operations have strategic importance and can provide a competitive advantage in the workplace.

Course Outcomes

After undergoing this course students will be able to:

CO1: Identify the elements of operations management and organization
CO2: Summarize operations scheduling, management of quality, and facilities planning in operations management
CO3: Understand the importance of inventory management, forecasting and supply chain management
CO4: Analyze and evaluate various facility alternatives and their capacity decisions, develop a balanced line of production & scheduling and sequencing techniques in operation environments

Course Contents

Unit 1: Introduction to Operations Management, History of OM Development, Production Systems Current Issues in Operations management, Operations Strategy and its Dimensions, Developing a manufacturing/Service Strategy, Productivity measurements, Case Study on (Business Model Comparison) Viz: Compaq Computer Versus Dell Computer, Project Management - Pure Projects, Functional Projects and Matrix Projects, Project Control Charts

Unit 2: Job Design, Behavioral Considerations in Job Design, Physical Considerations in Job Design, Work Methods, Work Measurement and Standards, Incentive Planning, Product Design Process. Designing for Customer – Quality Function Deployment, Value Analysis / Engineering. Designing Products for Manufacturing and Assembly - DFMA, Example / Case study, Process Selection, Break Even Analysis-Specific Equipment Selection, DFMA Software Demo Facility layout, Process Layout, Product layout - Assembly Line

Unit 3: Product layout - Assembly Line Balancing, Flexible and Cellular Manufacturing Layout, Fixed Position layout & Office layout, Retail Service layout, Case Studies on different layouts, waiting line management, Introduction to Supply chain Management & History, Purchasing / Global sourcing

Unit 4: Resource planning, fore casting, Aggregate Planning, Inventory Control, Just in Time, Total Quality management, Quality Specifications, Cost of Quality, Quality control tools Kaizen / Continuous Improvement

Course Resources

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a. Essential Reading

1 Class Notes
2 Richard B. Chase, Ravi Shankar and F. Robert Jacobs (2014); Operations & Supply Chain Management; McGraw-Hill - 2014 (14th Edition).

b. Recommended Reading

1 Chary S. N. Theory and Problems in Production & Operations Mgt.; Tata McGraw Hill (14th Edition).
2 Krajewski Lee; Operations Mgt. Process for Value Chains; Prentice Hall (8th Edition).

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Module Title	Good Shop Floor Practice
Module Code	VGE041
Department	Department Mechanical and Manufacturing Engineering
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

The aim of the course is to provide practical exposure to good shop floor practices. Importance of productivity, quality, delivery, safety and morale will be taught. Development of standard charts for monitoring and improvement of shop floor activities will enable students to perform as good team members. Concepts and real life example of 5S, Kaizen, PDCA, POKA YOKA, Kanban, Root Cause Analysis. Significance of Lean operations and its role for operational excellence will explained, followed by both Indian and international case studies

Course Outcomes

After undergoing this course students will be able to:
CO1: Understand the role of shop floor (Gemba) for business success
CO2: Apply tools and techniques that helps to improve shop floor performance
CO3: Implement basic good shop floor practices
CO4: Conduct time and motions studies to reduce non value added time.

Course Contents

Unit 1. Introduction to Good Shop floor Practice & Kaizen concepts. Basic Understanding - PQCDSM, Daily Management and Improvement
Unit 2. Process Chart - Flow Process Chart, Outline Process Chart, and Two handed Process Chart, Flow Process Chart (Man Type) Flow Process Chart (Machine Type)
Unit 3 Work Place Layout Design, Stop Watch Procedure for Collecting Time Study Data, Performance rating
Unit 4 Lean manufacturing Tools – 5S Concepts, Kaizen, PDCA, POKA YOKA, Kanban, Root Cause Analysis, Six Big Losses
Unit5 SOP, QC tools, Basic of ISO, Safety, Man Management & Culture Building for Excellence in Shop Floor
Unit 6: Indian and International case studies related to implementation challenges of good shop floor practices

Course Resources

a. Essential Reading

4. Class Notes
5. Masaaki Imai (2012)Gemba kaizen : a commonsense approach to a continuous improvement strategy, New York : McGraw Hill
6. Taiichi Ohno. (2013), Taiichi Ohnos Workplace Management: Special 100th Birthday Edition McGraw Hill
7. Bryan McWhorter (2017)Introduction to Lean Manufacturing: The Road to Continuous Improvement, Create Space Independent Publishing Platform

b. Recommended Reading

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8. Yukihiro Ando / Pankaj Kumar.(2011) Daily Management The TQM Way, Productivity & Quality Publishing Pvt. Ltd.
9. Ralph M. Barnes. (2009) Motion and Time Study Design and Measurement of Work Seventh edition, Wiley

c. Other Electronic Resources

1. Laboratory 2. Hardware: PCs 3. Software

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Module Title	Labour Laws, Occupational health, and Safety
Module Code	VGE047
Department	
Faculty	Faculty of Engineering & Technology (FET)

Course Summary

India introduced the Minimum Wages Act in 1948, giving both the Central government and State government jurisdiction in fixing wages. The act is legally non-binding, but statutory. Payment of wages below the minimum wage rate amounts to forced labour. The main purpose of the Act is to protect workers from health and safety hazards on the job. It sets out duties for all workplace parties and rights for workers. It establishes procedures for dealing with workplace hazards and provides for enforcement of the law where compliance has not been achieved voluntarily.

Course Outcomes

After undergoing this course students will be able to:
CO1: Learning of labour laws, Occupational health and safety
CO2: Key principles and aim of occupational health and safety (OHS) Programmes
CO3: Governments enact labour laws on industrial relations and rights of labour.
CO4: Provide economic and social justice to workforce in any organization.

Course Contents

UNIT 1: Introduction to the Labour laws , occupational health and safety, Constitutional rights, Contract and rights, Scope of protection, Employment contracts, Wage regulation, Working time, Health and safety, Pensions and insurance, Workplace participation, Trade unions, Management participation, Collective action, Sex discrimination, Migrant workers, Vulnerable groups, Dismissal regulation, International comparison of Indian labour laws.

UNIT 2: Introduction to occupational Safety and Health, Safety Legislation, Workers Compensation and Recordkeeping, Safety Related Business Law, Accident Causation and Investigation, Introduction to Industrial Hygiene, Ergonomics and safety management, Fire Prevention and Protection, System Safety.

UNIT 3: Managing the safety function`, Psychology and safety, Workplace Violence, Terrorism Preparedness, Hazardous materials, Transportation Safety, Required written programs, Resources on safety and health, Working at different weather, Indian Scenario :Health and Safety Concerns across Sectors in India.

Course Resources

a. Essential Reading

1. Class Notes
2. Reference from "Kahn-Freund's LABOUR AND THE LAW by Paul Davies, M.A., LL.M Fellow of Balliol College, Oxford; Lecturer in Law at the University of Oxford Mark Freedland, LL.B., M.A., D. Phil., of Gray's Inn, Barrister; Fellow of St. John's College, Oxford. University Lecturer in Labour Law at the University of Oxford.

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3. The FUNDAMENTAL PRINCIPLES OF OCCUPATIONAL HEALTH AND SAFETY Second edition Benjamin O. ALLI O. ALLI, INTERNATIONAL LABOUR OFFICE -GENEVA.

b. Recommended Reading

1. https://labour.gov.in/sites/default/files/Last_Date_Extended_for_OSH_Code_0.pdf.
2. https://www.free-safety-training.com/product/occupational-health-and-safety-books-pdf/

c. Other Resources

1. http:// https://ecu.au.libguides.com/c.php?g=410557&p=6665306
2. https://labour.gov.in/e-book-1

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Module Title	Emerging Technologies in Food Processing
Module Code	VPT016
Department	Buhler India / Food Technology
Faculty	Faculty of Life and Allied Health Sciences

Course Summary

The aim of this course is to introduce students to latest and emerging technologies in food processing. Students are exposed to emerging food processing technologies like high pressure processing, pulsed electric fields processing, osmotic dehydration, ultrasound, and irradiation. Students are also introduced to alternative thermal processing like combined microwave vacuum drying, recent advances in hybrid drying technologies, infrared heating, concepts of minimal processing and innovations in food processing technologies.

Course Outcomes

After the successful completion of this course, the student will be able to:

CO-1. Explain non-thermal food processing techniques like osmotic dehydration, high-intensity pulsed light technology, high pressure processing and pulsed electric fields processing

CO-2. Apply alternative thermal food processing like combined microwave vacuum drying, Radio-Frequency Processing and hurdle technology

CO-3. Adopt latest innovation in food refrigeration and minimal processing

Course Contents

Unit-I: High Pressure Processing of-Fruits and Fruit Products, Salads and Ready Meals, Meats and Seafood, & Microbiological Aspects of High-Pressure Processing.

Unit-II: Pulsed Electric Fields Processing of Liquid and Solid foods, Effect of High-Intensity Electric Field Pulses on Solid Foods, Enzymatic Inactivation by Pulsed Electric Fields.

Unit-III: Other Non-thermal Processing Techniques-Recent Developments in Osmotic Dehydration, A thermal Membrane Processes for the Concentration of Liquid Foods and Natural Colors, High-intensity Pulsed Light Technology.

Unit-IV: Non thermal Processing By Radio Frequency Electric Fields- Application of Ultrasound, Irradiation, hurdle technology, Decontamination of Foods by Cold Plasma, Opportunities and Challenges in the Application of Ozone in Food Processing.

Unit-V: Alternative Thermal Processing- Recent Developments in Microwave Heating, Radio-Frequency Processing, Ohmic Heating, Combined Microwave Vacuum Drying, Recent Advances in Hybrid Drying Technologies, Infrared Heating.

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Unit-VI: Refrigeration and freezing, thermal processing- canning of meat, retort pouch, dehydration, irradiation, and RTE meat products, meat curing, Sausages- processing, types and defects.

Unit-VI: Innovations in Food Refrigeration- Vacuum Cooling of Foods, Ultrasonic Assistance for Food Freezing, High-Pressure Freezing, Controlling the Freezing Process with Anti-freeze Proteins, Freezing Combined with Electrical and Magnetic Disturbances.

Course Resources

a. Essential Reading

1. Course Notes
2. Da-Wen Sun, 2014, Emerging Technologies for Food Processing, USA, Academic Press
3. Megha R. Goyal and Mital J. Kaneria, Food Technology: Applied Research and production Apple Academic press

b. Recommended Reading

1. Amit K.Jaiswal, Food processing Technologies: Impact on product attributes, CRC press

c. Magazines and Journals

1. FOOD SCIENCE & TECHNOLOGY-Magazine

d. Websites

1. https://www.foodprocessing.com/

e. Other Electronic Resources

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Module Title	Seminars and Presentations
Module Code	VPT017
Department	Central Workshop
Faculty	Faculty of Engineering and Technology

Course Summary

Aim of the course is to establish motivation for any topic of interest and develop a thought process for technical presentation.

Course Outcomes

CO1: Organize a detailed literature survey and build a document
CO2: Analysis and comprehension of proof-of-concept and related data.
CO3: Effective presentation and improve soft skills.

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Module Title	Project - 2
Module Code	VPT018
Department	Buhler India / Central Workshop
Faculty	Faculty of Engineering and Technology

Course Summary

Aim of the course is to give students an experience of identifying problems related to food processing Industry and generate the virtual models or a prototype model of the identified problem. They also develop technical reports documenting the project work. Students in a team not exceeding four (4) members should be able to design and develop a working prototype as a project.

Course Outcomes

CO1: Identify the need for developing a new or improving an existing product or system through an organized survey of literature

CO2: Design, model and analyze the product or system to meet the design specifications

CO3: Evaluate and justify the performance of the modelled system

CO4: Demonstrate the working of the product or system and make a presentation

CO5: Write a technical report

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