SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR

An Autonomous College of Rashtrasant Tukadoji Maharaj
Nagpur University, Nagpur, Maharashtra, India

TEACHING SCHEME & SYLLABUS
2015-16

B. E. INDUSTRIAL ENGINEERING DEPARTMENT

Published by
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ISO 9001 : 2008 CERTIFIED ORGANISATION

Industrial Engineering Department

About the Department:

The Department was established in the year 1984 and has been accredited by National Board of Accreditation in the year 2001 and 2008 for three years.

The department is having well-equipped laboratories with advanced Equipments / Softwares / Experimental setups worth more than Rs. 1 Crore. Postgraduate program was established in the year 2004 with the intake of 18 seats.

The department received during last three years the following grants from A.I.C.T.E.

- EDC Entrepreneurship development Cell, Rs. 4 Lacs , Dec. 2012
- Coordinate Measuring Machine (CMM), Rs. 13 Lacs , Jan 2013
- CNC Milling Machine, (RPS) Rs. 22 Lacs , July 2013

Industrial Engineering Society is in place which provides a platform to the students and staff to reveal their talent through various technical, curricular and co-curricular activities.

Salient Features of The Department:

1. Alumni have achieved higher position in Multi-National Companies.
2. Highest placement amongst private institutes in the region.
3. Excellent academic results with numerous university rankers/ highest CGPA.
4. Students excel in Professional Examinations.
5. Students outshine in various sports activities of University / State level.
6. State-of-Art infrastructure.
7. Experienced, enthusiastic & dedicated staff with research aptitude.
   - No. of Ph.D.: 05
   - Ph.D. (Submitted): 03
   - Ph.D. (Pursuing): 03
8. Faculty members have to their credit more than 200 research publications.
9. Faculty is having thorough interactions with outside world.
10. Department carries out Industrial visits and industry based projects on regular basis.
11. Association with Indian Institution of Industrial Engineering Mumbai
12. Softwares available with the department
    Simul8, WITNESS, Techno-Matix, MOST Software (WM + PDMS), SPSS, Primevera

Industrial Engineering Program

Vision of the Department

To be a leader in imparting knowledge of creating efficient and effective systems for manufacturing and service organizations

Mission of the Department

- To nourish a learning environment conducive to foster **innovations in Industrial Engineering**
- Improvement in **Industrial productivity** by devising systems and **quality standards**

- Sintering the **engineering knowledge** by research support. Absorption of such knowledge in **teaching and learning process** and its reapplication to quasi-similar situations

Program Educational Objectives

1. The students of Industrial Engineering shall be **prepared to work in any Engineering organization, pursue higher studies or start their own entrepreneurial project.**
2. Industrial Engineering students shall have the expertise to **create the integrated systems** of man-machine-material for productivity improvement. Students shall have the ability to provide financially viable systems.
3. The students shall have the general understanding and competency of **designing and evaluating** the interfacing systems of Information and Technology, Mechanical and Production Engineering.
4. Exposure to management courses shall inculcate into the students a sense of **professionalism.** Involvement of the graduates with student bodies shall help them shape their personalities as it will hone their **communication skills**, build team-spirit and generate **social awareness**.
5. The students shall have the desire to **pursue higher studies** and engage themselves in life-long learning in the context of **technological changes.**

Industrial Engineering Program

Program Outcomes:

a. Program makes sure that students will apply the **knowledge of mathematics, science, engineering fundamentals** to the solution of Industrial engineering problems.

b. Program ensures that students are capable to identify, formulate and **analyze the problems** in manufacturing and service industry.

c. Students are capable to **design and develop** the system/components or process using industrial engineering tools to derive the solutions.

d. Students are proficient to **investigate complex problems** by using statistical tools/simulation techniques etc. to draw conclusion.

e. Program ensures that students gain ability to exercise **contemporary industrial engineering tools** with information technology support.

f. Program ascertains to inculcate the skill set in students to behave and become acceptable as an important **contributor to the society** in general.

g. Program make certain that students recognize long term effects of solutions provided by industrial engineering tools and techniques on **environment and sustainability of mankind**.

h. Students should understand the importance of **ethical behavior** and incorporate the same in their day to day working.

i. Program undertakes that students will work as an **individual and lead the team** effectively to achieve the set objectives.

j. Program composes that students are capable to **effectively communicate** with his peers, superiors and subordinates to enhance the productivities.

k. Students are able to **plan and execute engineering projects** with cost consideration.

l. Program reassures that students are satisfactorily motivated to **pursue a profession in Industrial engineering**.

Teaching Scheme for First Year (Semester I and II) Bachelor of Engineering

GROUP 1: SEMESTER I / GROUP 2: SEMESTER II

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks			Exam Duration
							Internal Assessment	End Sem Exam	Total	
1	MAT101/ MAT102	Engineering Mathematics-I/II	4	1	0	9	40	60	100	3 Hrs.
2	PHT101	Engineering Physics	4	1	0	9	40	60	100	3 Hrs.
3	PHP101	Engineering Physics lab	0	0	3	3	25	25	50	-
4	EET101	Electrical Engineering	3	1	0	7	40	60	100	3 Hrs.
5	EEP101	Electrical Engineering lab	0	0	2	2	25	25	50	-
6	CST101	Computer Programming	2	0	0	4	40	60	100	3 Hrs.
7	CSP101	Computer Programming lab	0	0	2	2	25	25	50	-
8	HUT101	Communication Skills	2	0	0	4	40	60	100	3 Hrs.
9	HUP101	Communication Skills lab	0	0	2	2	25	25	50	-
10	PEP101	Sports/Yoga	0	0	2	0	-	-	-	-
		TOTAL	**15**	**3**	**11**	**42**	**300**	**400**	**700**	

Teaching Scheme for First Year (Semester I and II) Bachelor of Engineering

GROUP 1 : SEMESTER II / GROUP 2 : SEMESTER I

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks			Exam Duration
							Internal Assessment	End Sem Exam	Total	
1	MAT102/ MAT101	Engineering Mathematics-II/I	4	1	0	9	40	60	100	3 Hrs.
2	CHT101	Engineering Chemistry	4	1	0	9	40	60	100	3 Hrs.
3	CHP101	Engineering Chemistry lab	0	0	3	3	25	25	50	-
4	CET101	Engineering Mechanics	3	1	0	7	40	60	100	3 Hrs.
5	CEP101	Engineering Mechanics lab	0	0	2	2	25	25	50	-
6	MET101	Engineering Drawing	3	0	0	6	40	60	100	4 Hrs.
7	MEP101	Engineering Drawing lab	0	0	3	3	25	25	50	-
8	HUT102	Social Skills	2	0	0	4	40	60	100	3 Hrs.
9	INP102	Workshop	0	0	2	2	25	25	50	-
		TOTAL	**16**	**3**	**10**	**45**	**300**	**400**		

Scheme of Examination of Bachelor of Engineering (Industrial Engineering)
Semester Pattern
III Semester, B.E. (Industrial Engineering)

Sr. No.	Subject Code	Subject Name	L	T	P	Credits	Maximum Marks		
							Internal Assessment	End Sem Exam	Total
1	MAT204	Quantitative Methods-I	3	1	0	7	40	60	100
2	INT201	Thermal Engineering	4	1	0	9	40	60	100
3	INT202	Principal of Management & Managerial Economics	4	0	0	8	40	60	100
4	INT203	Metal Working processes	4	1	0	9	40	60	100
5	INP203	Metal Working Processes Lab	0	0	2	2	25	25	50
6	CST210	Data Structures & File handling using C	3	0	0	6	40	60	100
7	CSP210	Data Structures &File handling using C Lab	0	0	2	2	25	25	50
8	INP204	M/c. Drawing & Computer Aided Drafting	0	0	2	2	25	25	50
9	INP205	Industrial Visit	0	0	2	2	Grade A to D (Marks)		
10	CHT201	Environmental Studies- I	2	0	0	0	-	-	-
		TOTAL	**20**	**3**	**8**	**47**			

Scheme of Examination of Bachelor of Engineering (Industrial Engineering)
Semester Pattern
IV Semester, B.E. (Industrial Engineering)

Sr. No.	Subject Code	Subject Name	L	T	P	Credits	Maximum Marks		
							Internal Assessment	End Sem Exam	Total
1	MAT244	Quantitative Methods- II	3	1	0	7	40	60	100
2	INT206	Theory of Machines	4	0	0	8	40	60	100
3	INT207	Methods Engineering	4	1	0	9	40	60	100
4	INP207	Methods Engineering Lab	0	0	2	2	25	25	50
5	INT208	Facilities Planning	4	1	0	9	40	60	100
6	INT209	Instrumentation & Metrology	4	1	0	9	40	60	100
7	INP209	Instrumentation & Metrology Lab	0	0	2	2	25	25	50
8	CHT202	Environmental Studies- II	2	0	0	0	-	-	-
		TOTAL	**21**	**4**	**4**	**46**			

Scheme of Examination of Bachelor of Engineering (Industrial Engineering)
Semester Pattern
V Semester, B.E. (Industrial Engineering)

Sr. No.	Subject Code	Subject Name	L	T	P	Credits	Maximum Marks		
							Internal Assessment	End Sem Exam	Total
1	INT301	Operations Research- I	4	1	0	9	40	60	100
2	INP301	Operations Research-I Lab	0	0	2	2	25	25	50
3	INT302	Fluid Power Engineering	3	1	0	7	40	60	100
4	INT303	Machine Design	4	0	0	8	40	60	100
5	INT304	Productivity Measurement and Improvement	4	1	0	9	40	60	100
6	INP304	Productivity Measurement and Improvement Lab	0	0	2	2	25	25	50
7	INT305	Elective-I*	3	1	0	7	40	60	100
8	INT306	Modeling and Simulation	2	0	0	0	-	-	-
		TOTAL	**20**	**4**	**4**	**44**			

Elective - I (List of Subjects)
1) System Dynamics
2) Human Resource Management
3) Object Oriented Programming
4) Energy Management

Course Code	Course Name
INT305-1	System Dynamics
INT305-2	Human Resource Management
INT305-3	Object Oriented Programming
INT305-4	Energy Management

Scheme of Examination of Bachelor of Engineering (Industrial Engineering)
Semester Pattern
VI Semester B.E. (Industrial Engineering)

Sr. No.	Subject Code	Subject Name	L	T	P	Credits	Maximum Marks		
							Internal Assessment	End Sem Exam	Total
1	INT307	Operations Research- II	3	1	0	7	40	60	100
2	INP307	Operations Research- II Lab	0	0	2	2	25	25	50
3	INT308	Metal Removal Processes	3	1	0	7	40	60	100
4	INP308	Metal Removal Processes Lab	0	0	2	2	25	25	50
5	INT309	Production Planning and Control	3	1	0	7	40	60	100
6	INT310	Supply Chain Management	3	1	0	7	40	60	100
7	INT311	Open Elective	3	1	0	7	40	60	100
8	INP312	Entrepreneurship Development	0	0	2	0	-	-	-
9	INP313	Project	0	0	4	8	50	-	-
		TOTAL	**15**	**5**	**10**	**47**			

Course Code	Course Name
INT311-1	Six Sigma
INT311-2	Decision Modeling
INT311-3	Organizational Behaviour and Development

Scheme of Examination of Bachelor of Engineering (Industrial Engineering)
Semester Pattern - VII Semester B.E. (Industrial Engineering)

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks		
							Internal Assessment	End Sem Exam	Total
1	INT401	Quality Engineering	4	1	0	9	40	60	100
2	INP401	Quality Engineering Lab	0	0	2	2	25	25	50
3	INT402	Database Management System	4	0	0	8	40	60	100
4	INP402	Database Management System Lab	0	0	2	2	25	25	50
5	INT403	Ergonomics	4	1	0	9	40	60	100
6	INP403	Ergonomics Lab	0	0	2	2	25	25	50
7	INT404	Engineering Economy & Cost Control	4	1	0	9	40	60	100
8	INP405	Project Seminar	0	0	4	4	25	25	50
9	INT406	Knowledge Management System	2	0	0	0	-	-	-
		Total	18	3	10	45			

Scheme of Examination of Bachelor of Engineering (Industrial Engineering)
Semester Pattern - VIII Semester B.E. (Industrial Engineering)

Sr. No.	Code	Course	L	T	P	Credits	Maximum Marks		
							Internal Assessment	End Sem Exam	Total
1	INT407	Industrial Automation	4	1	0	9	40	60	100
2	INT408	Management Information System	4	1	0	9	40	60	100
3	INP408	Management Information System Lab	0	0	2	2	25	25	50
4	INT409	Organizational Behavior	2	0	0	0	-	-	-
5	INT410	Elective II	3	1	0	7	40	60	100
6	INT411	Elective III	3	1	0	7	40	60	100
7	INP412	Project	0	0	6	12	75	75	150
		Total	**16**	**4**	**8**	**46**			

Course Code	Elective II
INT410-1	Creativity and Innovation
INT410-2	Research Methodology
INT410-3	Web Technologies
INT410-4	Non Linear Optimization Technique
INT410-5	Tool Design

Course Code	Elective III
INT411-1	Materials Management
INT411-2	Reliability and Maintenance Engg.
INT411-3	Enterprise Resource Planning
INT411-4	Value Engineering

Syllabus of Group 1 - Semester I and Group 2 - Semester I, Bachelor of Engineering

Course Code : MAT101 **Course : Engineering Mathematics-I**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 09**

Course Outcomes

Upon successful completion of the course, the student should be familiar with and be able to

1. Formulate and analyze mathematical problems, precisely define the key terms, and draw clear and reasonable conclusions.
2. Read, understand, and construct correct mathematical model for simple electrical circuits, mechanical systems and other related engineering problems.
3. Apply techniques of differential calculus to obtain the solution of mathematical models of physical systems and use optimization technique.
4. Continue to acquire mathematical knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematics

Syllabus

Unit - I:

Ordinary Differential Calculus: Successive differentiation, Taylor's and Maclaurin's series for function of one variable, indeterminate forms, curvature, radius of curvature and circle of curvature.

Unit - II:

Partial Differentiation: Functions of several variables, first and higher order derivative, Euler's Theorem, Chain rule and Total differential coefficient, Jacobians. Taylor's and Maclaurin's series for function of two variables, Maxima and minima for function of two variables, Lagrange's method of undetermined multipliers.

Unit - III:

Infinite Series: Convergence, divergence and oscillation of series, General properties, Tests of convergence, Alternating series.

Unit - IV:

First Order Differential Equation: First order first degree differential equations: Linear, reducible to linear, exact and reducible to exact differential equations; Non-linear differential equations.

Unit - V:

Higher Order Differential Equation: Higher order differential equations with constant coefficient, method of variation of parameters, Cauchy's and Legendre's homogeneous differential equations, simultaneous differential equations, differential equation of the type $d^2y/dx^2 = f(x)$ and $d^2y/dx^2 = f(y)$.

Unit - VI:

Applications of Differential Equation: Applications of first order first degree differential equations: Simple electrical circuits in series. Application of higher order differential equations: Mechanical and electrical Oscillatory circuits (free, damped, forced oscillations)

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, Delhi.
2. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India)
3. Advanced Engineering Mathematics, 2 ed , Jain ,Iynger , Narosa publication

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th edition, Neekunj print process, Delhi.
2. Schaum's Outline of Differential Equations, Richard Bronson , TMH, 3ed, New Delhi
3. Engineering Mathematics by Srimanta, Paul
4. A text book of Applied Mathematics I, T. Singh, K.L. Sarda, Professional Publishing House Pvt.Ltd., Nagpur.

Syllabus of Group 1 - Semester I and Group 2 – Semester II, Bachelor of Engineering

Course Code : PHT101 **Course : Engineering Physics**

L: 4 Hrs, T: 1 Hr, P : 0 Hr., Per week **Total Credits : 09**

Course Objectives :

1. To develop the ability to apply concepts in elementary physics to understanding of engineering applications;
2. To introduce more advanced physics concepts, which form the basis of modern engineering;
3. To provide a sound foundation in mathematical formulation of concepts learnt and their applications;
4. To elaborate the general nature of concepts learnt and of possibility of their cross-disciplinary application;
5. To develop skills for numerical problem solving in areas covered

Course Outcomes :

1. Develop a better understanding of physics as a fundamental discipline;
2. Gain understanding of the type of questions addressed by theories in and methods of physics in different fields of engineering;
3. Develop a deeper appreciation of the notion of applying knowledge of physical laws;
4. Deepen understanding of certain basic tools, such as state of a system, system response, resonance, coherence, superposition and interference, in thinking about and analyzing physical systems;
5. Gain an understanding of developing areas in physics and their possible engineering applications;
6. Develop ability to choose a physical approach to understanding of advanced areas in engineering;
7. Be comfortable with fundamental ideas in areas like semiconductor, electronic devices, fibre optic communication and quantum mechanics;
8. Gain familiarity with the language, fundamental concerns, techniques and applications of nanoscience and nanotechnology

Unit-I:

Optics:

Interference in thin films, division of amplitude and wavefront, wedge-shaped films, Newton's rings, antireflection coatings; Diffraction, single slit, double slit, grating; Bragg's law of crystal diffraction, Different types of polarization of light, Malus' law, Optically anisotropic materials, double refraction, wave-plates and compensators, production and analysis of polarized light.

Unit-II:

Quantum Physics:

Wave-particle duality, wave packets, Heisenberg uncertainty relations; Wave function, probability and probability current, Schrodinger's equation, time dependent equation and its separation; Infinite potential and finite potential wells, phenomenon of tunneling, application to tunneling diode.

Unit-III:

LASERs and Optical Fibres:

Interaction of matter and radiation, LASER, spontaneous and stimulated emission, population inversion; Common types of lasers and their applications; Optical fibres, structure, types, propagation in a fibre, modes of propagation, signal attenuation, signal distortion.

Unit-IV:

Elements of Crystal Structure, Mass Spectrograph and Particle Accelerators:

Lattice and basis, crystal systems, centering, Bravais lattices, cubic system, principles of electron optics, cathode ray oscilloscope, mass spectrographs, particle accelerators.

Unit-V:

Semiconductors:

Band structure of solids, band diagrams of insulators, semiconductors and conductors, Fermi level in conductors and semiconductors, carrier concentration, conductivity, effective mass; Junction diode and its band diagram, depletion region and barrier potential, bipolar junction transistor, band diagrams of pnp and npn transistors, transistor action.

Unit-VI:

Nanophysics:

What is Nanotechnology? Fullerenes and nanoparticles; Outline of methods of preparation; Elements of electron microscopy; Outline of properties – physical, thermal, optical, electrical, magnetic; Quantum size-effects; CNTs and molecular electronics; Applications.

Text Books:

1. Fundamentals of Physics: D. Halliday, R. Resnik and J. Walker, John Wiley.
2. Engineering Physics: S. Jain and G.G. Sahasrabudhe, Universities Press (2010).
3. Introduction to Nanoscience and Nanotechnology: K.K. Chattopadhyay and A.N. Banerjee, PHI Learning (2009)

Reference Books:

1. Electronic Engineering Materials and Devices: J. Allison, TMH.
2. Engineering Physics: P.K. Palaniswamy, Scietech (2005).
3. Engineering Physics: H. Malik and A.K. Singh, TMH (2010).
4. Engineering Physics: D.K. Bhattacharya and A.Bhaskaran, Oxford University Press (2010)
5. Materials Science and Engineering – A First Course, 5th Ed., V. Raghvan, PHI Learning.

Syllabus of Group 1 - Semester I and Group 2 – Semester II, Bachelor of Engineering

Course Code: PHP101 **Course: Engineering Physics Laboratory**

L: 0 Hrs., T: 0 Hrs., P: 3 Hrs., Per week **Total Credits: 03**

Course Outcomes :

1. Students should be able to perform tasks like leveling, alignment, reading vernier scales, do specific measurements, systematically record observations, do calculations from data collected and draw conclusions.
2. Students gain working familiarity with instruments like simple spectrometer, travelling microscope, lenses, prisms, ammeter, voltmeter, the CRO, power supplies etc.;
3. Students gain better understanding of concepts like interference, diffraction, polarization, energy band gap in semiconductor etc.
4. Students gain a working knowledge of estimating errors in an experiment for which background theory is known;
5. Students should be able to subject data collected to statistical and error analysis.

A minimum of 8 experiments to be performed from the following list of experiments.

List of Experiments :

1. Study of interference in thin films: Formation of Newton's rings
2. Study of diffraction: Transmission diffraction grating
3. Study of diode rectifier equation: Ordinary p-n junction and Zener diode characteristics
4. Study of transistor action: Transistor characteristics in common emitter configuration
5. Study of Hall effect: Determination of Hall coefficient of an extrinsic semiconductor
6. Study of energy bandgap in semiconductor: NTC thermistor bandgap determination
7. Study of rectifiers: Determination of ripple factor for half, full and bridge rectifiers
8. Linear least squares fit on a PC: Fitting a straight line to measured (x,y) sets
9. Study of double refraction: Quartz prism
10. Interference in wedge-shaped thin films: Refractive index of liquids, diameter of a wire
11. Use of CRO: Frequency and phase difference determination

Demo experiments: Laser kit to demonstrate diffraction, optical fibre to demonstrate signal attenuation, Interactive Mathematica demonstrations on polarization, wave packets, tunneling, charge particle dynamics and semiconductor devices.

Reference Books:

1. Physics Lab Manual written by the Teaching Faculty of Physics Department, RCOEM.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EET101 **Course : Electrical Engineering**

L:3 Hr., T:1 Hrs., P:0 Hrs., Per week **Total Credits : 07**

Course Outcomes :

Upon completion of this course, the students shall be able to,

1. Apply the basic laws of electric and magnetic circuits to obtain the unknown quantities.
2. Represent and interpret the sinusoidal electrical quantities mathematically as well as graphically in the form of waveforms/phasors and analyze the 1-phase/3-phase AC circuits to determine the unknown quantities.
3. Determine the power losses/efficiency and voltage drop/voltage regulation of a 1-phase transformer at full load condition and demonstrate the knowledge related with its need, construction, principle, types and applications.
4. Describe the construction, principle, applications and performance characteristics of DC machines and Induction motors.
5. Demonstrate the concept of electrical power generation, transmission, distribution and the understanding about conventional/renewable energy sources.
6. Demonstrate the understanding about necessity of electrical earthing, safety & protecting devices, electrical energy utilization, illumination sources and their selection.

Unit-I:

DC Electric Circuits: Definition of EMF, Current, Power, Energy Resistance, Variation of resistance with physical parameters viz. length, area, specific resistivity and temperature. Ohm's law, resistances in series and parallel, current and voltage division rules, KVL & KCL, star delta transformation and related numerical. Measurement of DC electrical quantities.

Magnetic Circuit: Concept of MMF, Flux, reluctance, analogy with electric circuits, B-H curve, simple numerical on series magnetic circuits.

Unit-II:

AC Circuits: Generation of single phase and three phase alternating EMF. Average and RMS values for sinusoidal waveform. Phasor representation of sinusoidal electrical quantities, Steady state behavior of RLC circuits with sinusoidal excitation. Reactance, impedance, Power & Energy in AC Circuits. Simple numerical on series and parallel AC circuits. Concept & importance of power factor & its improvement (with simple numerical).

Simple analysis of balanced three phase AC circuits, Star-delta resistive networks. Measurement of AC electrical quantities.

Unit-III:

Introduction to Electrical Power System :

Introduction to Power Generation (Thermal, Hydro, Nuclear, Wind and Solar) with block schematic representation only. Single line diagram for Generation, Transmission & Distribution through different voltage

levels; Low voltage radial distribution system (Over head & underground, single phase and three phase). Necessity of equipment earthings, Fuses (Rewirable and HRC), MCB, ELCB.Basic operation of UPS and Inverters (Block schematic representation).

Unit-IV:

Single phase Transformer :

Principle of operation, Construction Transformer ratings, No load and On load operation with leakage reluctance, losses, efficiency, Definition & formula for voltage regulation, OC/ SC test, equivalent circuit referred to primary side of transformer.

Unit-V:

Rotating Electric Machines :

DC Machines: DC Generator-Principle of working, construction (without details of armature winding), classification of DC generators. DC Motors-Back EMF, necessity of starters, speed and torque equations, characteristics of motors, speed control of DC motors (without numerical), Application of DC motors.

Three Phase Induction Motors: Working principles, types and construction of three phase Induction Motor, synchronous speed, torque, sleep, torque speed characteristics, applications of three phase Induction motor.

Single Phase Induction Motors: operating principle of capacitor start and run single phase induction motor and its applications.

Unit-VI:

Utilization of Electrical Energy :

Illumination: Definition of luminous flux, luminous intensity, Candle power, illumination, Luminance, Luminous efficiency (lumens/watt) of different types of lamps, working principle of Fluorescent/Sodium Vapour/ Mercury vapor & CFL Lamps. Simple numerical to determine number of lamps to attain a given average lux level in an area.

Electric Heating: Advantages of Electrically produced heat, types and applications of Electric heating equipment, transfer of heat (conduction, convection, radiation); Resistance ovens, Induction heating (Core & coreless type), Dielectric heating. (Note. Numerical excluded)

Tariff: One part (KWH based) tariff with simple numerical; to calculate the domestic electricity charges.

Text Books :

1. Elements of Electrical sciences: P. Mukhopadhyay, N. Chand & Bros Roorkee (1989).
2. Electrical Technology: B. L. Thareja, S. Chand Publications.
3. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Reference Books :

1. Basic Electrical Engineering: T.K. Nagasarkar& M. S. Sukhija, Oxford Univ. Press.
2. Utilization of Electrical Energy: H. Pratab, Dhanpatrai& Sons.
3. Utilization of Electrical Energy: E. Openshaw Taylor, Orient Longman.
4. Websites: www.powermin.nic.in, www.mnes.nic.in, www.mahaurja.com.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EEP101 **Course: Electrical Engineering Lab**

L:0 Hr., T:0Hrs., P:2 Hrs., Per week **Total Credits : 02**

Course Outcomes :

Upon completion of this course, the students shall be able to,

1. Connect the electric circuits based on the syllabus of theory subject EET101 and test the performance by way of observation, calculations and conclusion.
2. Demonstrate the concept and significance of power factor and how it can be improved.
3. Conduct an electrical energy survey of connected load at residential premises and demonstrate the understanding of energy tariff by calculating the energy bill in accordance with the norms of State Electricity Distribution Company.

List of Experiments :

1. To verify Kirchoff's voltage and current law using D.C. source.
2. To study the R-L-C series circuit with AC source
3. To study R-L-C parallel circuit with AC source
4. To perform direct load test on 1-phase transformer for finding regulation and efficiency
5. To perform open circuit and short circuit tests on 1-phase transformer
6. To study 3-phase star delta connections and verify different relations of voltage ,current and power
7. To study the speed control techniques for DC shunt motor
8. To study the importance of power factor and improvement of power factor.
9. To analyze energy bill of residential category and prepare energy sheet.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CST101 **Courses: Computer Programming**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 4**

Course Outcomes

On successful completion of the course, students will be able to

1. Design and code well-structured C programs, flowcharts, algorithms etc.
2. Write program on the basis of decision control structures and loop control structures.
3. Perform sorting and various other operations on 1-D and 2-D array.
4. Perform operations on structures, functions and pointers.

Syllabus

Unit-I:

Computer Fundamentals: Basic Structure of a computer, Input/output devices and memories and types of computer. Introduction to DOS and Windows OS, Number Systems: Decimal, Binary, Octal, Hexadecimal and conversion from one to another. Algorithm – Conventions used in writing algorithm, Software Life Cycle, Program and Programming Language System Software- Translator, Compiler, Interpreter, Linker, Loader. Languages – Procedural, Object oriented, High level, assembly, Machine Language and Flowchart

Unit-II:

C Programming Language: Keyword, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case.

Unit-III:

Loop Control Structure: go to, while, for, do while, break, continue Storage class, Enumerated Data types, Renaming Data types with typedef(), Type Casting, Bitwise Operators.

Unit-IV:

Array: Introduction, array Declaration, Single and multidimensional array Pointers: Introduction, Definition and use of pointer, Pointer arithmetic, pointer operators, pointer and array, pointer to pointer

Unit-V:

Structures and Union: Declaring and using structure, Structure initialization, Structure within structure, array of structure, pointer to structure.

Unit-VI:

Function Programming: Introduction, User Defined and Library Function, Parameter passing, Return value, Recursion, pointer and function

Text Books:

1. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill
2. Programming in ANSI C,5th ed. : E. Balguruswami McGraw Hill

Reference Books:

1. Let Us C.9thed: Yashwant Kanetkar, BPB Publication
2. Programming with C: Byron Gottfried, Schaums Outline Series.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CSP 101 **Course: Computer Programming Lab**

L: 0 Hrs., T: 0 Hrs., P:2 Hrs. Per week **Total Credits: 2**

Course Outcomes :

On successful completion of the course, students will be able to

1. Implement programs based on if-else, switch and loop structure.
2. Implement programs based on 1-D and 2-D numeric and character arrays.
3. Perform operation on structure and pointer.
4. Design programs based on functions.

CSP101practicals based on above CST 101 syllabus

Syllabus of Group 1- Semester I and Group 2-Semester II, Bachelor of Engineering

Course Code : HUT101 **Course:-Communication Skills**

L:2 Hrs.,T:0Hrs.,P:0Hrs.,Per week **Total Credits:4**

Course Objectives:

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place. The sub-objectives are:

1. To develop students' reading skills and pronunciation.
2. To develop technical communication skills through drafting, letter writing, and précis writing.
3. To develop literary skills through essay writing.
4. To develop public speaking skills of the students.
5. To expose the students to the ethics of English language by teaching grammar

Course Outcomes :

1. Students have better reading comprehension, pronunciation, and functional English grammar.
2. Students are able to write letters and resumes
3. Students are able to organize their thoughts for effective presentation and writing.
4. Students are able to learn skills to present themselves well in an interview, and handle a Group Discussion

Syllabus

Unit-I :

Communication:

What is Communication, the Media of Communication, Channels of Communication, Barriers to Effective Communication, Role of Communication Skills in Society.

Unit-II :

Reading Comprehension :

The Process of Reading, Reading Strategies Central idea, Tone and Intention, Comprehension Passages for practice.

Unit-III :

Professional Speaking:

Components of an effective talk, Idea of space and time in public speaking, Tone of voice, Body language, Timing and duration of speech, Audio-Visual Aids in speech. Presentation Skills, Group Discussion and Job Interviews

Unit IV :

Orientation to Literary and Scholarly Articles:

Preferably two fictional and two non-fictional texts (Selected by the teachers and the Head). The art of writing articles on social, cultural, scientific and technical issues (Paragraph Writing), Exercises.

Unit V :

Business Correspondence:

Types and Formats of Business letters, Routine Business Letters (Inquiry, Order, Instruction, Complaint, Adjustment), Sales Letters, Resumes and Job applications, Business Memos, Emails.

Unit VI:

Grammar:

Synonym and Antonym, Give one word for, Voice, Narration and Comparison of Adjectives and Adverbs, Transformation of sentences and Common Errors, Idioms and Phrases, Note Making, Précis writing.

Text Book :

1. M. Ashraf. Rizvi. Effective Technical Communication. Tata Mc Graw-Hill Publishing Company Limited.2009

Reference Books :

1. Sanjay Kumar and Pushp Lata. Communication Skills. Oxford Publication
2. Meenakshi Raman and Sangeeta Sharma. Technical Communication. Second Edition Oxford Publication.2011
3. Anne Nicholls. Mastering Public Speaking. Jaico Publishing House.2003
4. Dr Asudani .V. H An easy approach to English. Astha Publication Nagpur. 2009 , 3rd Edition.

Syllabus of Group 1- Semester I and Group 2-Semester II, Bachelor of Engineering

Course Code :-HUP101 **Course:-Communication Skills Practical**

L:0Hrs.,T:0Hrs.,P:2Hrs.,Per week **Total Credits:2**

Course Outcomes

On successful completion of the course, students will be able to

1. Learn presentation skills
2. Understand effective strategies for Personal Interview and Group Discussions
3. Learn and apply effective language skills – listening, speaking, reading and writing

Sr. No	Name of the Practical	Activities Taken	Medium of Practical
1	Speaking Skills	1. Introduction to effective ways of speaking 2. Oral presentations Extempore / Debate / JAM/Self-introduction	PPT Based, Activity Based
2	Presentation Skills	1. Preparing visual aids/PPTs on given topics	PPT Based, Activity Based, English Edge software
3	Group Discussion-Orientation	1. GD types 2. GD techniques/rules - videos 3. General/familiar topics for discussion	English Edge software Oxford Publication CD, PPT based Activity based
4	Group Discussion-Practice session	1. Divide in group of 6 2. Classification of topics 3. Feedback	PPT Based, Activity Based
5	Group Discussion-Mock	1. Divide in group of 6 2. Mock GDs - types 3. Feedback	Activity Based
6	Interview Techniques-Orientation	1. Various types of interviews 2. Types of interviews 3. Self-analysis 4. KYC sheet 5. Self-introduction	English Edge software Oxford Publication CD Activity Based
7	Interview Techniques Practice Sessions	1. Video 2. Non-verbal communication 3. Types of interview questions	Oxford Publication CD, Activity Based
8	Interview Techniques-Mock Interviews	1. Mock Interviews (One to One)	Activity Based
	Optional Practicals	**Teacher can decide any other Practical apart from the ones mentioned below**	
9	Listening Skills	1. Listening Barriers	PPT Based, Activity Based
10	Non Verbal Communication	1. Kinesics in com/interviews 2. Activities/Role play	English Edge software based, PPT based
11	Use Figurative Language	1. Intro phrases/ Idioms/proverbs/ pronunciation	PPT Based, Activity Based

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code :PEP101 **Course: Sports/Yoga**

L:0 Hr., T:0Hrs., P:2 Hrs., Per week **Total Credits : 00**

Course Outcomes

On successful completion of the course, students will be able to

1. More number of students are participating in sports activities.
2. Students interest toward physical fitness has been increased.
3. Students are getting basic knowledge of yoga & sports.

BRIEF OBJECTIVES OF SPORTS/YOGA PRACTICAL CLASSES

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education department at RCOEM will conduct sports/yoga classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be todevelop team spirit, social skills as well as identify and develop leadership qualities in students through various sports group activities. Training of students to understand the rules of various national and international games would also be an important objective. Sport activities would also be conducted with the objective to provide recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate fitness of students so as to recommend and conduct specific Yoga and Sport activities.

PROGRAMME OUTLINE

1. Sports

1. Introduction to sports i.e. volleyball, cricket, football, basketball, badminton, T.T., Athletics.
2. Health and safety issues related to sports; Knowledge, recognition and ability to deal with injuries and illnesses associated with sports.
3. Awareness about sports skills, techniques and tactics.
4. Rules, regulations and scoring systems of different games (Indoor & Outdoor).
5. Trials of students to participate in inter-collegiate/University level games.

2. Yoga: Includes asanas like sitting, standing and lying, Surayanamaskar, Pranayam.

3. Physical fitness test: this would include speed, Cardiovascular Endurance, strength, skill & flexibility, body composition (fat weight & lean body weight).

Syllabus of Group 1 - Semester II and Group 2 – Semester II, Bachelor of Engineering

Course Code: MAT102 **Course: Engineering Mathematics-II**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes

On successful completion of the course, students will be able to

1. Identify, formulate and analyze statistical problems, precisely define the key terms, and draw clear and reasonable conclusions.
2. Read, understand and analyze problems in Fluid dynamics, Electromagnetic fields and related topics using techniques of vector algebra and calculus.
3. To use the knowledge of multiple integrals in finding the area and volume of any region bounded by the given curves.
4. Continue to acquire mathematical and statistical knowledge and skills appropriate to professional activities and demonstrate highest standards of ethical issues in mathematics.

Syllabus

Unit-I:

Integral Calculus I: Beta and Gamma functions, Differentiation of definite integrals, Mean value and root mean square values.

Unit-II:

Integral Calculus II: Tracing of curves (Cartesian, polar and parametric curves), rectification of simple curve, quadrature, volumes and surface of solids of revolutions(Cartesian, polar and parametric forms).Theorem of Pappus and Guldin.

Unit-III:

Multiple Integrals and their Applications: Elementary double integrals, change of variable (simple transformation), change of order of integration (Cartesian and polar), application to mass, area, volume and centre of gravity (Cartesian and polar forms), elementary triple integrals.

Unit-IV:

Vector Calculus I: Scalar point function, Vector point function, vector differentiation, gradient, divergence and curl, directional derivatives with their physical interpretations, solenoidal and irrotational motions, Scalar potential function.

Unit-V:

Vector Calculus II: Vector integration: Line integrals, work done, conservative fields, surface integrals and volume integrals, Stoke's theorem, Gauss divergence theorem, Green's theorem and their simple applications.

Unit VI:

Statistics: Fitting of straight line, $y = a + bx$, parabola $y = a + bx + cx^2$ and the exponential curves by method of least squares, Coefficient of linear correlation, lines of regression , rank correlation, multiple regression and regression plane of the type $z = a + bx + cy$, coefficient determination.

Text Books:

1. Higher Engineering Mathematics, B. S. Grewal, Khanna Publishers, Delhi
2. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India)
3. Advanced Engineering Mathematics, 2 ed , Jain ,Iynger , Narosa publication

Reference Books:

1. Advanced Engineering Mathematics by Erwin Kreyszig, 8th edition, Neekunj print process, Delhi.
2. Engineering Mathematics: Principal and Applications Srimanta, Paul, Oxford Univ Press,(2011)
3. Higher Engineering Mathematics: B.V. Ramana, TMH

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course No. CHT101 **Course : Engineering Chemistry**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 09**

Course Outcomes :

Upon successful completion of the course, the student should be familiar with and be able to gain:

1. Knowledge of water analysis, waste water analysis, boiler water chemistry and desalination of water enable the students to overcome the difficulties, to a larger extent; that often come across in the field of (i) Civil engineering, (ii) Public health and environmental engineering (iii) Ocean engineering (iv) Thermal and electrical power generation sectors and process engineering.
2. Better understanding to surmount over the difficulties faced in the selection of proper and economical constructional materials to be used; the impact of change in the physicochemical and mechanical properties of the concrete type composites due to variation in their chemical composition.
3. To apply the knowledge of 'Principles of Tribology' for reduction of friction and wear in the process engineering, manufacturing and production engineering and automotive engineering fields.
4. Knowledge for proper selection and design of engineering materials having better corrosion resistance and to implement effective measures to minimize corrosion.
5. Better insight in the selection of materials for modern technologies which demand with unusual combination of properties that cannot be met by any of the conventional metal alloys, ceramics and polymeric materials viz in aerospace applications, military warfare materials, nuclear installations, electrical electronic components devices, nano materials process engineering field etc.

Syllabus

Water Treatment :

Water Treatment for Industrial Applications: Brief introduction regarding sources, impurities in water, hardness of water and their types. Softening of water using lime-soda process: principles in hot and cold lime-soda process. Zeolite softener, demineralization by synthetic ion exchange resins. Boiler troubles: Carryover, Priming and Foaming, Scales and Sludges, Caustic Embrittlement, Boiler Corrosion-causes and effects on boiler operation and methods of prevention. External and Internal conditioning : Phosphate, Carbonate and Calgon conditioning.

Water Treatment for Domestic Water:

Domestic water treatment : Brief discussion and Chemistry involved in the process of sedimentation, coagulation, filtration and sterilization by UV, Ozone, Chlorination including Break point chlorination. Desalination of water using reverse osmosis and electro dialysis.

Numericals Based on Water Softening: Numericals based on (1) lime-soda (2) zeolite / ion-exchange water treatment processes.

Cement :

Process parameters involved in the manufacturing of portland cement, manufacture of portland cement, microscopic constituents of cement and their effects on strength; setting and hardening of cement.

Types and uses of cement : Pozzolonic; Rapid hardening, Low heat and High alumina cements. Additives and admixtures used in cement: Accelerators, Retarders, Air entrainment agents, Water repellants.

Chemical approach to Nanomaterials :

General introduction to nanotechnology, timeline and milestone, overview of different nanomaterials available, potential use of nanomaterials in electronics, sensors, medical applications, catalysis, environment and cosmetics.

Physical chemistry related to nanoparticles such as colloids and clusters: conductivity and enhanced catalytic activity compared to the same materials in the macroscopic state.

Synthesis of nanomaterials: ' Top-Down'- photolithography and 'Bottom-Up'- sol-gel method .

Carbon nanotubes: Single-walled and multi-walled carbon nanotubes, their structures, properties and applications.

Potential risks of nanomaterials- Health and environmental impact.

Fuels and combustion :

Introduction, Calorific value, Higher and Lower calorific value, flame temperature and flame intensity , determination of calorific value by Bomb calorimeter and Boy's calorimeter, numericals based on the determination of calorific value by Bomb and Boy's Calorimater.

Solid Fuels:

Types of coals, proximate and ultimate analysis of coal, its significance, Carbonization of Coal.

Liquid and Gaseous Fuels:

Liquid fuels: mining & fractional distillation of crude petroleum, use of gasoline in internal combustion engine, octane number, cetane number, flash point of combustible liquid fuel, knocking. Fisher-Tropsch's process for manufacture of synthetic gasoline, thermal and catalytic cracking: fixed bed and fluid bed catalytic cracking, aviation gasoline.

Gaseous fuels:

CNG and Significance of flue gas analysis by Orsat apparatus.

Numericals based on Combustion Calculations:

Numericals based on combustion calculations for solid fuels. Numericals based on combustion calculations for liquid and gaseous fuels.

Friction, Wear and Lubricants :

Introduction, lubrication mechanism : Hydrodynamic, Boundary and Extreme pressure lubrication. Classification of lubricants- Solid, Semisolid and Liquid lubricants, Blended oils using different additives viz.:-

Anti-oxidants, E. P. additive, corrosion inhibitor, viscosity index improver, etc. synthetic lubricants viz.:- Dibasic acid esters, Polyglycol ethers and Silicones, Lubricating Emulsions. Properties of Greases: Drop point and consistency test, Properties of liquid lubricants: Viscosity and Viscosity Index, Aniline point, Cloud & Pour point and Decomposition stability. Criteria for selection of lubricants under different conditions of load and speeds.

Corrosion :

Electrochemistry and Theories of Corrosion :

Introduction to corrosion, Cause and Consequences of corrosion, Measurement of corrosion rate, Galvanic series, Dry and Wet corrosion, Pilling-Bedworth rule, factors affecting the rate of corrosion.

Types of corrosion and Preventive Methods; Different types of corrosion (Pitting, Stress, Intergranular and

Galvanic), protection against corrosion, design and selection of engineering materials, cathodic and anodic protection, Brief discussion about Protective Coatings: Metallic, Inorganic, Organic coatings, Corrosion inhibitors.

Text Books :

1. Text Book of Engineering Chemistry, S. S. Dara, S. Chand and Company Ltd., New Delhi.
2. Textbook of Engineering Chemistry, P. C. Jain and Monica Jain, Dhanpat Rai and Sons, New Delhi.
3. Text Book of Environmental Chemistry and Pollution Control, S. S. Dara; S. Chand and Company Ltd., New Delhi.
4. Textbook of Engineering Chemistry, S. N. Narkhede, R. T. Jadhav, A. B. Bhake, A. U. Zadgaonkar, Das Ganu Prakashan, Nagpur.
5. Applied Chemistry, A. V. Bharati and Walekar, Tech Max Publications, Pune.
6. Engineering Chemistry, Arty Dixit, Dr. Kirtiwardhan Dixit, Harivansh Prakashan, Chandrapur.

Reference Books :

1. Engineering Chemistry by Gyngell, McGraw Hill Publishing Company, New Delhi.
2. Engineering Chemistry (Vol I), Rajaram and Curiacose, Tata McGraw Hill Publishing Company, New Delhi.
3. Engineering Chemistry (Vol II), Rajaram and Curiacose, Tata McGraw Hill Publishing Company, New Delhi.
4. Engineering Chemistry, Saraswat and Thakur, Vikas Publication, New Delhi.
5. Engineering Chemistry, B. S. Sivasankar, Tata Mcgraw Hill Publishing Company, New Delhi.
6. Engineering Chemistry, O. G. Palan, Tata Mcgraw Hill Publishing Company, New Delhi.
7. Engineering Chemistry, R. Shivakumar, Tata Mcgraw Hill Publishing Company, New Delhi.
8. Chemistry of Cement, J. D. Lee, Mcgraw Hill Publishing Company, New Delhi.
9. Nanomaterials Chemistry, C. N. R. Rao, A. Muller, A. K. Cheetam, Wiley VCH verlag GmbH and Company, Weinheim.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : CHP101 | **Course: Engineering Chemistry Lab**

L:0 Hr., T:0Hrs., P:3 Hrs., Per week | **Total Credits : 03**

Minimum of **Eight** practicals will be performed based on the theory.

Text Books :

1. Text Book on Experiments and Calculations in Engineering Chemistry: S. S. Dara; S. Chand and Company Ltd., New Delhi.
2. Practical Engineering Chemistry: S. N. Narkhede, R. T. Jadhav, A. B. Bhake, A. U. Zadgaonkar, Das Ganu Prakashan, Nagpur.

Reference Books :

1. Concise Laboratory Manual in Engineering Chemistry: R. Shivakumarand J. Prakasan, Tata McGraw Hill Publishing Company, New Delhi.

Syllabus of Group 1 - Semester II and Group 2 - Semester I, Bachelor of Engineering

Course Code: CET101 **Course: Engineering Mechanics**

L:3 Hr., T:1 Hrs., P:0 Hrs., Per week **Total Credits : 07**

Course Outcomes

After Completion of the course in Engineering Mechanics, the student should be able to

1. Define and Describe the various parameter related to statics and dynamics behaviour of the rigid bodies.
2. Understand and describe physical phenomenon with the help of various theories.
3. Explain and analyse various physical phenomenon with the help of diagrams.
4. Describe and analyse the engineering problems with the acquired knowledge of engineering mechanics

Syllabus

Unit-I:

Fundamental of Engineering Mechanics:

Fundamentals of Engineering Mechanics, axiom's of mechanics, resultant of concurrent force system. Moment of a force, couples, resultant of non-concurrent force system

Unit-II:

Equilibrium of Force System :

Equilibrium of concurrent force system, Equilibrium of non-concurrent force system Friction: Law's of friction, simple application, wedge friction, belt friction.

Unit-III:

3-D Force system & Analysis of trusses :

Moment of a force about a point and about an axis, resultant of spatial concurrent & Non concurrent force system, wrench, equilibrium of concurrent and non-concurrent force system. Analysis of simple trusses (Joint & Section Method)

Unit-IV:

Centroids and moment of inertia :

Centroids locating by first principle, centroid of composite areas, Second moment and product of inertia of plane areas. Moment of Inertia of composite areas. Transfer theorems for moment of Inertia and Product of Inertia.

Virtual work method

Virtual work principle, application of virtual work principle.

Unit-V

Kinematics & Kinetics of Particles :

Rectilinear motion of a particle with variable acceleration, Projectile motion, normal and tangential components of acceleration, kinetics of particle and several interconnected particles. D'Alembert's principle, problems on connected system of particles.

Unit-VI:

Collision of elastic bodies:

Principle of conservation of momentum, Impulse momentum equation, work energy equation, coefficient of restitution, impact of elastic bodies.

Text Books:

1. Engineering Mechanics: F. L. Singer Harper & Row Publications.
2. Fundamentals of Engineering Mechanics : A.K. Sharma, Sai Publications.
3. Engineering Mechanics :A.K.Tayal, Umesh Publications, New Delhi.
4. Engineering Mechanics : P.B. Kulkarni, Professional Publications.

Reference Books:

1. Engineering Mechanics: Timoshenko & Young, Tata McGraw Hill Publications, New Delhi.
2. Engineering Mechanics: Bear and Johnston, Tata McGraw Hill Publications, New Delhi.
3. Engineering Mechanics: I. H. Shames, Phi Pvt. Ltd., India.

Syllabus of Group 1 - Semester II and Group 2 - Semester I, Bachelor of Engineering

Course Code : CEP101 | **Course : Engineering Mechanics Lab**

L:0 Hr., T:0Hrs., P:2 Hrs., Per week | **Total Credits : 02**

Course Outcome

After Completion of the course in Engineering Mechanics Practical, the student should be able to

1. Define and explain different terminologies of simple lifting machines.
2. Understand and perform practicals on equilibrium of concurrent and non-concurrent force systems.
3. Describe various terminologies related to friction and mass moment of inertia.
4. Explain graphical solutions of equilibrium conditions in engineering mechanics.
5. Analyse the experimental data collected based on practicals and discuss the results.

Minimum of Eight Practical will be performed based on the theory

List of Experiment

Experiments On"Simple Lifting Machines"

1. Law of machine for Differential Axle and Wheel
2. Law of machine for Single Purchase Crab
3. Law of machine for Double Purchse Crab

Experiments On"Equilibrium of force systems"

4. Jib Crane (Equilibrium of concurrent Forces)
5. Simple Beam (Equilibrium of Non-concurrent Forces)
6. Shear Leg Apparatus(Equilibrium of 3-D concurrent forces)

Experiments On"Friction & Inertia"

7. Inclined Plane (Coefficient of friction using Inclined Plane)
8. Belt Friction(Coefficient of friction using coil friction set-up)
9. Fly-Wheel (Mass moment of Inertia of fly-wheel)

Graphical Methods in Engineering Mechanics

10. Resultant of concurrent force systems
11. Resultant of Non-concurrent force system
12. Reactions for simply supported beams
13. Forces in members of simple Trusses
14. Moment of Inertia (Mohr's Circle)

Syllabus of Group 1- Semester II & Group 2- Semester I, Bachelor of Engineering

Course Code: MET101 | **Course : Engineering Drawing**

L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week | **Total Credits: 06**

Course Outcomes

1. Ability to draw & interpret technical drawings.
2. Ability to plan the sheet layout for the given drawing.
3. Ability to convert 2-D drawing to 3-D drawing & vice-versa.
4. Ability to represent the various positions of planes & solids in different orientations.
5. Ability to develop the solid surface for sheet metal working.

Syllabus (Only First Angle Method of Projection)

UNIT 1

Introduction: Lines, Lettering & Dimensioning, Preparation of Sheet Layout.

Scales - Plain Scale, Diagonal Scale, Vernier Scale.

Engineering Curves; Ellipse: Directrix Focus, Concentric Circles & Rectangle Method.

Parabola: Directrix Focus, Rectangle Method, Tangent Method.

Hyperbola: Directrix Focus & Asymptote Method.

UNIT 2

Theory of Projections - Concept of Projection, First & Third angle projection methods.

Orthographic Projections: Conversion of given 3 dimensional View to 2 dimensional representation.

UNIT 3

Projections of Lines: Oblique Lines, Traces. Applications of lines.

UNIT 4

Projections of Planes - Polygonal Lamina, Circular Lamina.

Projections of Solids- Cube, Prism, Pyramid, Tetrahedron, Cylinder, Cone.

UNIT 5

Sections of Solids & Development of Lateral Surfaces- Cube, Prism, Pyramid, Tetrahedron, Cylinder, Cone.

UNIT 6

Isometric Projections: Isometric Scale, Conversion of given 2 dimensional views to Isometric Projection/View.

Books:

1. Engineering Drawing by N.D. Bhatt, Charotar Publishing House Pvt. Ltd.
2. Engineering Drawing by D. A. Jolhe, Tata McGraw Hill Publications
3. Engineering Graphics by H. G. Phakatkar, Nirali Publication.
4. Engineering Graphics by A. R. Bapat, Allied Publishers

References:

1. Engineering Drawing by R.K. Dhawan, S. Chand Publications
2. Engineering Drawing by K.L. Narayana & P. Kannaiah, SciTech Publication.

Syllabus of Group 1- Semester II & Group 2- Semester I, Bachelor of Engineering

Course Code: MEP101 **Course: Engineering Drawing Lab**

L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits: 03**

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1. Ability to draw & interpret technical drawings.
2. Ability to plan the sheet layout for the given drawing.
3. Ability to convert 2-D drawing to 3-D drawing & vice-versa.
4. Ability to represent the various positions of planes & solids in different orientations.
5. Ability to develop the solid surface for sheet metal working.
6. Ability to use & demonstrate drafting package.

List of Sheets:

Sheet No.1: Engineering Scales & Curves

Sheet No.2: Orthographic Projections

Sheet No.3: Projection of Lines

Sheet No.4: Application of Lines

Sheet No.5: Projection of Planes

Sheet No.6: Projection of Solids

Sheet No.7: Section & Development of Solids

Sheet No.8: Isometric Projections

Books:

1. Engineering Drawing by N.D. Bhatt, Charotar Publishing House Pvt. Ltd.
2. Engineering Drawing by D. A. Jolhe, Tata McGraw Hill Publications
3. Engineering Graphics by H. G. Phakatkar, Nirali Publication.
4. Engineering Graphics by A. R. Bapat, Allied Publishers

References:

1. Engineering Drawing by R.K. Dhawan, S. Chand Publications
2. Engineering Drawing by K.L. Narayana & P. Kannaiah, SciTech Publication.
3. AutoCAD 14 for Engineering Drawing by P. Nageshwara Rao, Tata McGraw Hill Publications

Syllabus of Group 1- Semester II and Group 2-Semester I, Bachelor of Engineering

Course Code:-HUT102 **Course:-Social Skills**

L:2 Hrs.,T:0Hrs.,P:0Hrs.,Per week **Total Credits:4**

Course Outcomes

On successful completion of the course, students will be able to

1. Learn the basic concepts of personnel management or manpower planning and the process of recruitment and selection that they will go through as engineers.
2. Learn leadership skills, industrial relations, work organizations, and impact of industry on society.
3. Learn about the political systems and institutions working in India, laws and legislations affecting industry and the application of political principles like democracy in industry.
4. Learn the importance and application of Economics in Engineering.
5. Learn about culture/civilization and develop cross cultural capacity.
6. Learn about Personal, Professional and social ethics.

Syllabus

Unit-I:

Industrial Sociology:-

- Meaning and scope of Industrial Sociology
- Work Organization and its types.
- Concept of Leadership: Meaning, changing roles and its types.
- Concept of Power and Authority: Meaning, Importance, sources and Delegation
- Industrial Culture in India: Effects of Industrialization and Urbanization on Indian Society.

Unit-II:

Industrial Psychology:-

- Meaning and scope of Industrial Psychology
- Recruitment, Selection and Training
- Industrial fatigue
- Motivation, Theories of motivation: Maslow's Need Priority Theory, Macgregor's X And Y Theory, McClelland's Needs Theory
- Dealing with Self: Stress, health, and coping; interpersonal relationships; gender roles; environmental adjustments.

Unit-III:

Political Orientation:-

- Indian Constitution, features and federal structure.
- Fundamental rights
- Directive principles of state policy
- Industrial Democracy.
- Role of Bureaucracy in Modern Democratic states.

Unit-IV:
Economics:-
- Development of Indian Economy
- Infrastructure in the Indian Economy: Energy, power, transport system, road transport system, Rail-Road co ordination, water transport, Civil aviation, communication system, urban infrastructure, science and technology, private investment in infrastructure.
- Role of Public and Private sector in Indian Economy.
- Challenges before Indian Economy in 21st Century.
  Poverty, Unemployment, Corruption, Regional Imbalance, Growth of educational sector.

Unit-V:
Culture and Civilization:-
- Concept of Culture and Civilization.
- Study of engineering skills with special reference to Egyptian and Indus Valley Civilization.
- Role of Engineers as agent of change with specific reference to change in Indian Society during 20th and 21st century.
- Multiculturalism: Meaning, scope and significance especially in Indian context.

Unit-VI:
Ethics and social responsibility:-
- Personal and professional ethics
- Corporate social responsibility
- Social capital, social audit.
- Role of entrepreneurship in nation building.
- Developing scientific and humanitarian outlook for the welfare of nation and society.

Text Books :

1. S. Shabbir, A.M. Sheikh, and J. Dwadashiwar (2010 reprint) A New Look Into Social Sciences, (5th edition, 2008), S. Chand and Co. Ltd., New Delhi
2. RuddarDatt and K.P.M.Sundharam, (67th Revised edition-2013), Indian Economy, S .Chand and Company Ltd, New Delhi.
3. Edmund G. Seebauer and Robert L Barry (2010 reprint) Fundamental of Ethics for Scientists and Engineers, Oxford University Press,

Reference Books:

1. P.C. Tripathi and P.N. Reddy, Principles of Management, (4th edition, 2008), Tata MacGraw Hill Publishing Co. Ltd., New Delhi
2. Martand.T. Telsang, Industrial and Business Management, (2001), S.Chand and Co. Ltd. New Delhi
3. Dr. V.H. Asudani: An Easy Approach To Social Science, (3rd edition, 2008), Aastha Publications, Nagpur
4. Tariq Modood, Multiculturalism (Themes for 21st Century Series)(1st Publication 2007), Polity Press, Cambridge, U.K. ISBN-13:97807456-3288-9.

Syllabus of Groups 1- Semester II and Group 2 – Semester I, Bachelor of Engineering

Course Code : INP102 **Course: Workshop**
L: 0 Hr., T: 0 Hrs., Per week **Total Credits : 02**

List of Experiments

(A) Carpentry shop
1) Introduction of carpentry tools, equipments, machine, material & process.
2) Manufacturing of Carpentry joints.
3) Turning practice on wood working lathe.
4) Demonstration and practice on universal wood working machine.

(B) Fitting shop
1) Introduction of fitting tools, equipments, machine, material & process.
2) Manufacturing & fitting practice for various joints & assembly.
3) Drilling, tapping and pipe threading operations.

(C) Welding shop
1) Introduction of welding tools, equipments, machine, material & process.
2) Fabrication of joints like Lap, Butt, Corner, 'T' etc.
3) Fabrication of Lap joint by spot welding process.

(D) Smithy shop
1) Introduction of smithy tools, equipments, machine, material & process.
2) Forging of combined circular/square/hexagonal cross section.

Text Books:

1. Elements of Workshop Technology Vol -I by Hajra Choudhari
2. A course in Workshop Technology Vol -I by B. S. Raghuwanshi
3. Production Technology (Manufacturing process) by P.C Sharma

Reference Book:

1. Workshop Manuals
2. Manufacturing Technology by P.C Sharma
3. Workshop Manual by Kannaiah Narayanan

III Semester

III Semester B.E. (Industrial Engineering)

Course Code: MAT204 **Course: Quantitative Methods-I**

L: 3 Hrs. T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes :

1. To create competence in critically evaluating research results, and carrying out good quality empirical work.
2. They will also be able to demonstrate the principles of hypothesis testing and thorough knowledge of statistical distributions their properties and uses.
3. The students will be able to conduct a quantitative study on versatile research area

Syllabus :

UNIT I: Probability Distributions:

Introduction, Random variables; discrete and continuous, Probability function, Probability density function, probability distribution function, moment generating function, Binomial, Poisson and Normal Distribution, The Mean and the variance of a probability distribution.

UNITII : Sampling and sampling Distributions:

Introduction to sampling, random sampling, sampling with and without replacement, introduction to sampling distributions, sampling distribution of means, sampling distribution of proportion, an operational consideration in sampling: the relationship between sample size & standard errors.

UNIT III: Estimation:

Introduction, point estimates, interval estimates: basic concepts, interval estimates & confidence intervals, calculating interval estimates of the mean from large samples, calculating interval estimates of the proportions from large samples, interval estimates using the t distribution, determining the sample size in estimation.

UNIT IV: Testing Hypothesis: One sample

Introduction, concepts basic to the Hypothesis- Testing procedure, Testing Hypothesis, Hypothesis testing of means when the population standard deviation is known, measuring the power of Hypothesis tests, Hypothesis testing of means when the population standard deviation is not known.

UNIT V : Testing Hypothesis Two samples

Hypothesis testing for differences between means & proportions, tests for differences between means : large sample sizes & small sample sizes, testing differences between means with dependent sample, test for differences between proportions : large sample sizes,

UNIT VI : Inferences Concerning Variances:

The estimation of variances, Hypothesis concerning one variance, Hypothesis concerning two variances

Text Books :

1. Statistics for management 7th Edition- R. I. Levin & D. S. Rubin (P.H.I.)2.Theory & Problems of Probability & Statistics- M.R.Spiegal(Mc Graw Hill) Schau, Series3.Probability & Statistics for Engineers 6th Edition- Miller Freund & Johnson

Ref.Books :

1. Basic Statistics for Business & Economy - E.K. Bowen, M.K.Starr (Mc Graw Hill)

III Semester B.E. (Industrial Engineering)

Course Code : INT201 **Course : Thermal Engineering**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

Students shall be able to

1. Identify different subsystems; indicate where there is work, heat transfer and the importance of temperature, pressure and density.
2. Compute the work and heat transfer. Formulate the ideal approximation to the behavior and compute the corresponding work and heat transfer, given a physical device and process.
3. Find the correct phase and remaining properties for a substance, for a given a set of properties
4. Evaluate performance and power for simple heat engines/IC Engine/refrigerators.
5. Treat a problem that involves a mixture of gases also to have an understanding of how processes affect the environment, given a physical setup.

Syllabus: UNIT I

Properties & Systems :

Introduction, Basic concepts, Definitions & Units, Properties of thermodynamic system such as specific volume, density, temperature. pressure etc. Intensive & Extensive properties. Reversible & Irreversible process, flow & non flow process, path & point function, energy interactions, concept of heat & work, Zeroth law of thermodynamics. First Law of thermodynamics, Second law of Thermodynamics, PPM I & II, concept of enthalpy & entropy, Heat Engine, Heat pump & Refrigerator.

UNIT II

Ideal Gases & Thermodynamics processes :

Ideal gases, Avagadro's law, Universal Gas constant. Various thermodynamic processes like Isobaric, Isochoric, Isothermal, Adiabatic & Polytropic change in internal Energy, heat transferred, work done, Change in Enthalpy & Entropy during various thermodynamic processes, P-V and T-S diagrams.

UNIT III

Air Standard Cycles :

Air standard cycles, Carnot cycle, Otto cycle, Diesel cycle, Duel cycle, Joule cycle, cycle efficiencies, P-V & T-S diagrams, mean effective pressure.

UNIT IV

IC Engines:

Introduction, Classification of IC Engines, Working principle of Carburetor, Fuel Injection system, Cooling system, Fuel Ignition system, Combustion and Knocking. Testing of IC engine: Measurement of BHP, IHP, Mechanical & Thermal efficiency, Morse Test, Heat balance sheet.

UNIT V

Properties of Steam:

Critical state, Sensible Heat, Latent heat, Super heat & Total heat of steam, Dryness fraction, Internal latent heat & Eternal work of evaporation, Different vapor processes. Steam tables & their uses. Boilers, Cooling Towers, Condensers.

Application: Simple steam power cycle, carnot cycle, Rankine cycle, Modified Rankine cycle, reheat & Regeneration Cycle.

UNIT VI

Refrigeration cycle & Psychrometry:

Household refrigeration system, Vapor compression refrigeration cycle, Vapor absorption refrigeration system, T-S- & P-H- diagrams. Psychrometrics: Properties of moist air namely WBT, DBT, All, Specific humidity etc, Psychrometric chart, Psychometric processes, Brief introduction to comfort Air conditioning, Industrial Air Conditioning & Centralized Air Conditioning.

Text Books:

1. Engineering Thermodynamics (Tata McGraw Hill)- P.K.Nag2.A course in Thermal Engineering- Domkundwar3.Element of Heat Engines- R.C. Patel & C.J. Karamchandani

III Semester B.E. (Industrial Engineering)

Course Code: INT202 **Course: Principle of Management & Managerial Economics**

L: 4 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits: 08**

Course Outcomes :

Students shall be able to

1. Realize the role of planning, organizing, guiding and controlling in a modern management.
2. Realize the importance of effective leadership, motivation and communication for the success of the organization.
3. Develop awareness about the basic concept of Economics and micro- economics theory.
4. Familiarize with the various types of industrial establishment, factors of production, division of labor, and structure of market.
5. Practice the concept of banking, credit instruments, international trade and taxation.

Syllabus: UNIT I

Concept of business, Organization, Management & Administration, Nature & Importance of Management, Function of Management, Objective Management. Evolution and Development of Management. Meaning, Nature & Importance of Planning. Planning process. Decision making.

UNIT II

Concept of organization, Authority, Responsibility & Delegation, Centralization & Decentralization. Forms of organization, Group of organization, Leadership qualities, traits and types.

UNIT III

Principles of Direction and Supervision, Coordination, Communication in Management Motivation and Morals, Leadership.

UNIT IV

Use of Economics to Engineers. Engineering economics, Definition of economics, Nature and Scope, Basic term concept of economics like goods kind of goods, utility values, Wealth. B) Micro Economics Price Theory. C) Human wants comparing and standard of living, Consumer behavior, Consumers surplus, Demand, Law of demand Elasticity of demand.

UNIT V

A) Industrial Establishment: various types of industrial establishment, sole traders, private partnership, joint stock company, types of shares, finance public undertaking. Division of labour, small scale & large scales of production, Factors of production. localization of Industry, natural , economic, social, and political factors. B)

Structure of markets, Market forms - pure & perfect competition, Monopoly - monopolistic competition-oligopoly- combination and its various forms. Advantage - middle man - speculation Price determination under perfect and imperfect competition .

UNIT VI

Micro Economics : National income, its definition, national income of India, inequality of income - standard of living, function of money, credit & credit instruments, Banking & Central Banking, Index number, International trade, Balance of payments, Foreign exchange rate determination public finance & Taxation.

Text Books:

1.Business Administration & Management (Sahilya Bhavan)- Dr. SC Saxena2.Essentials of management (Tata McGraw Hill)- Harold Koontzz3.Economics for Engineers (Sole Distributors)- RR Ainin. 4. Elementary Economics I.D. Verma

III Semester B.E. (Industrial Engineering)

Course Code: INT203 **Course: Metal Working Processes**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

1. The students should be able to understand the types, structure, properties and applications of different engineering materials.
2. The students should be able to understand the need and methods of various heat treatment processes.
3. The students should be able to select and apply appropriate casting method for making particular component.
4. The students should be able to use advance casting methods for intricate castings.
5. The students should be able to select and apply appropriate hot and cold working methods for manufacturing metal components.
6. The students should be able to select and apply appropriate welding methods for fabrication of various components.

Syllabus: UNIT I

Engineering Materials: Classification, crystal patterns, BCC. FCC, HCP, Pig iron, classification of iron & steel. Use and application of mild, medium, high, carbon steels, Alloy steel : Stainless, Silicon, HSS, Spring & tool steel, Cast Iron: Gray, White, malleable Nodular, Bearing Materials, Thermoplastic, Resin, Rubber, Cement, Concrete, Ceramics, Heat Insulating Materials, Melting practice, Cupola.

UNIT II

Heat Treatment: Object & principles of heat treatment, Allotropic forms of iron, iron- carbon equilibrium diagram, Heat treatment of steels, transformation curves, Hardening, Tempering, Annealing and Normalizing, Carburising, Cyaniding, Nitriding, Flame Hardening, Induction hardening.

UNIT III

Metal Casting Process: History, advantages and limitations, applications, casting terms. Sand mould making procedure, pattern allowances, pattern materials, types of pattern, molding materials, Sand preparation, Properties, Carbon di-oxide molding, Types of cores, Chaplets, Gates & Risers, Rapid Prototyping.

UNIT IV

Special Casting Processes: Shell Molding, Precision Investment Casting, Permanent mould casting, Die Casting, Centrifugal Casting, Foundry Mechanization.

UNIT V

Hot & Cold Working of metals: Hot and cold working, rolling, forging, Extrusion, Sheet Metal working.

UNIT VI

Fabrication process:

Gas welding, Electric Arc, Thermit welding, Resistance, other Fusion welding processes, Brazing, Soldering.

Text Books:

1.Manufacturing Technology (Tata McGraw Hill)- P. N. Rao2.Workshop Technology - I (Tata McGraw Hill)- H.S. Bawa3.Workshop Technology Parts - I & II- B. S. Raghuvanshi; Hajra-Choudhary

III Semester B.E. (Industrial Engineering)

Course Code: INP203 **Course: Metal Working Processes Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes:

1. The students should be able to prepare the various sand moulds.
2. The students should be able to identify specific types of pattern required to make a mould for casting a particular component.
3. The students should be able to select the appropriate metal melting methods and equipments according to the requirement.
4. The students should be able to perform the casting operation.
5. The students should be able to identify the various products of rolling mills and understand its applications.
6. The students should be able to distinguish and apply appropriate welding methods for a specific application.

Syllabus:

Practicals are based on the syllabus given in the theory.

III Semester B.E. (Industrial Engineering)

Course Code: CST210 **Course: Data Structures & File handling using C L:**

3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits: 06**

Course Outcomes :

Students shall be able to

1. Realize the importance of data structure in application software development.
2. Organize raw data in the format of algorithm and flow charts.
3. Write application programs for the given task or situation.
4. Design file handling programs using C.
5. Understand the importance of search and sorting algorithm in data structure.
6. Understand the importance of link list, double link list and circular link list and to write application programs on it .

Syllabus: UNIT I

Arrays- concepts, declaration, definition, accessing elements, storing elements, arrays and functions, two-dimensional and multi-dimensional arrays, applications of arrays. Pointers - concepts, initialization of pointer variables, pointers and function arguments, address arithmetic, Character pointers and functions, pointers to pointers, pointers and multidimensional arrays, dynamic memory managements functions, command line arguments, c program examples.

UNIT II

Derived types- structures- declaration, definition and initialization of structures, accessing structures, nested structures, arrays of structures, structures and functions, pointers to structures, self referential structures, unions, typedef, bitfields, C program examples.

UNIT III

Input and output – concept of a file, text files and binary files, streams, standard I/o, Formatted I/o, file I/o operations, error handling, C program examples.

UNIT IV

Searching – Linear and binary search methods, sorting – Bubble sort, selection sort, Insertion sort, Quick sort, merge sort.

UNIT V

Introduction to data structures, singly linked lists, doubly linked lists, circular list, representing stacks and queues in C using arrays and linked lists, infix to post fix conversion, postfix expression evaluation.

UNIT VI

Trees- Binary tress, terminology, representation, traversals, graphs- terminology, representation, graph traversals (dfs & bfs)

Text Books:

1. Computer science, A structured programming approach using C, B.A. Forouzan and R.F. Gilberg, Third edition, Thomson.
2. DataStructures Using C – A.S.Tanenbaum, Y. Langsam, and M.J. Augenstein, PHI/Pearson education.

Reference Books:

1. C& Data structures – P. Padmanabham, B.S. Publications.
2. The C Programming Language, B.W. Kernighan, Dennis M.Ritchie, PHI/Pearson Education
3. C Programming with problem solving, J.A. Jones & K. Harrow, dreamtech Press
4. Programming in C – Stephen G. Kochan, III Edition, Pearson Eductaion.
5. Data Structures and Program Design in C, R.Kruse, C.L. Tondo, BP Leung, Shashi M, Second Edition, Pearson Education.

III Semester B.E. (Industrial Engineering)

Course Code: CSP210 **Course: Data Structures & File handling using C - Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes :

Students shall be able to

1. Write programs using file handling functions.
2. Design application software using link lists.
3. Design flow chart for the given situation.
4. Design and develop a case study on real time date.

Syllabus :

Practicals are based on the syllabus given in the theory.

III Semester B.E. (Industrial Engineering)

Course Code: INP204 **Course: M/c Drawing & Computer Aided Drafting**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes :

1. Students shall be able to read the professional drawing to understand the mechanical system in industry.
2. Students shall be able to communicate their ideas to the others to improve the productivity of man machine–material integrated system.
3. Students shall be able to see the entire mechanical system on drawing sheet to analyze it for modifying the system to enhance its performance.
4. Students shall be able to get the ability to select the precise system for the given purpose from the available sources.
5. Students shall be able to get the multi drawing of the same system for the various purposes & shall preserve the original drawing as it is. They shall modify the existing drawing without loss of time.
6. Students shall be able to get the knowledge to utilize the available space effectively while modifying the process for productivity improvement.

Syllabus: UNIT I

Principles of drawing, Orthographic projections, Interpretation of views & Sectioning, Classification of machine drawing.

UNIT II

Limits, Tolerances & Fits: Introduction, Selection of Tolerances, Limit systems, Allowances & Fits, its use in machine drawing.

UNIT III

Assembly drawing: Introduction, drawings of stuffing box, steam engine cross head, air valve, Fuel injector, square tool post, spring loaded safety valve, knuckle joint, protected flanged coupling, crane hook, screw jack, etc., Drawing exercise.

UNIT IV

Parts drawing: Introduction, milling machine tail stock, Machine vice, drill jig, non return valve, lever safety valve socket & spigot joint, universal coupling, pipe vice, spark plug, Tool post.

UNIT V

Blueprint reading: Introduction, Gear box cover, pump housing, steam stop valve, connector, adopter, square tool post, drill jig, chuck body, etc.

UNIT VI

Computer Aided Drafting (CAD): Introduction to drafting software like Auto CAD, basic commands and development of simple mechanical component in 2D & 3D drawings.

Text Books:

1. Machine Drawing by K. L. Narayan, et,al.
2. Machine Drawing by N. Sidheshswar, et,al.
3. AutoCAD 14 for Engineering Drawing by P. Nageshwara Rao, TMH

III Semester B.E. (Industrial Engineering)

Course Code: INP205 **Course: Industrial Visit**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes :

1. Students are able to correlate the theory with practical applications observed in their visit.
2. Develop in-depth knowledge of application of concepts in processes and systems in industry.
3. Exposure to live experimentation.
4. Able to build relationships and rapport with industry persons. Facilitate the work of case-studies, projects and consultancy.
5. Able to understand interaction between various subsystems in industry.3

III Semester B.E. (Industrial Engineering)

Course Code: CHT201 **Course: Environmental Studies-I L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week** **Total Credits: 0**

Course Objectives :

1) Main objective of the course is to make the students aware of environmental issues which often come across.
2) It is envisaged to provide the students' with basic scientific background which is needed to understand how the Earth works, how we, as human beings, fit into it, prerequisites to understand environmental issues.
3) To adopt multidisciplinary approach which encompasses chemical sciences, biological sciences, environmental engineering and sciences to protect the mother earth and environment.
4) Course is to develop concern for our own environment which will lead us to act at our own level to surmount over the environment problems we face.
5) One of the objectives of the course is to make the students aware about importance of natural resources, ecosystems, biodiversity and its conservation, environmental pollution, social issues and environment, human population and environment.

Course Outcomes :

a) Students will get the sufficient information that will clarify modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.
b) Students will realize the need to change their approach so as to perceive our own environmental issues correctly, using practical approach based on observation and self learning.
c) Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro- environmental action; including simple activities we can do in our daily life to protect it.
d) By studying environmental sciences, students is exposed to the environment that enables one to find out solution of various environmental problems encountered on and often.
e) At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted. This will enable every human being to live in a more sustainable manner.

Syllabus:

UNIT I

Introduction : Definition, scope and importance; Need for public awareness – institutions in environment, people in environment.

UNIT II

Natural Resources: Renewable le and non-renewable and associated problems; Role of an individual in conservation of natural resources; Equitable use of resources for sustainable lifestyles.

UNIT III

Ecosystems: Concept of an ecosystem – understanding ecosystems, ecosystem degradation, resource utilization. Structure and functions of an ecosystem – producers, consumers and decomposers. Energy flow in the ecosystem – water, carbon, oxygen, nitrogen and energy cycles, integration of cycles in nature. Ecological succession; Food chains, food webs and ecological pyramids; Ecosystem types – characteristic features, structure and functions of forest, grassland, desert and aquatic ecosystems.

UNIT IV

Pollution : Definition; Causes, effects and control measures of air, water, soil, marine, noise and thermal pollutions and nuclear hazards. Solid waste management – Causes, effects and control measures of urban and industrial waste.

Text Books:

1. Statistic for management 7th Edn R.I. Levin and D.S. Rubin (P.H.I.)
2. Theory and Problems of Probability and Statistics - M.R. Spiegal (Mc Graw Hill) Schaum Series
3. Probability and Statistics for Engineers 6th Ed. - Miller, Freund and Johnson. (P.H.I.)

Ref. Books:

1. Basic Statistics for Business and Economics E.K. Bowen, M.K. Starr (Mc Graw Hill).

IV SEMESTER

IV Semester B.E. (Industrial Engineering)

Course Code: MAT244 **Course: Quantitative Methods-II L: 3 Hrs., T: 1 Hrs., P: 0**
Hrs., Per week **Total Credits: 07**

Course Outcomes:

1. The students will have a reliable base for making decisions.
2. They will also be able to make decision for having appropriateness of a distribution in population.
3. They will also be able to make proper modeling techniques.

Syllabus: UNIT I

Chi-square and Analysis of variance:

Chi-square as a test of independence. Chi-square as a test of goodness of fit: testing the appropriateness of a distribution, Analysis of variance.

UNIT II

Nonparametric Methods:

Introduction to non parametric statistics, the sign test for paired data, rank sum test: the Mann –Whitney U test and the Kruskal-Wallis test. Tests of Randomness.

UNIT III

Regression Analysis:

Review of concepts of simple Regression and correlation with the help of simple examples the standard error estimate, shortcut method to calculate standard error estimate. Multiple Regression, checking the adequacy of the model, correlation analysis, finding the multiple Linear Regression equation, making inferences about population parameters

UNIT IV

Times Series Methods and Forecasting:

Introduction, variation in times series, trend analysis, cyclical variation, seasonal variation, irregular variation, a problem involving all four components of a time series, time series analysis in forecasting.

UNIT V

Index Numbers:

Defining an index no., unweighted aggregates index, weighted aggregates index, average of relatives methods, quantity and value indices, issues in constructing using index numbers.

UNIT VI

Decision Theory:

The decision environment, expected profit under uncertainly, assigning probability values, using continues distributions: marginal analysis, utility as a decision criterion, helping decision makers supply the right probabilities, decision- tree analysis. Simple concept and designing a questionnaire.

Text Books:

1. Statistic for management 7th Edn R.I. Levin and D.S. Rubin (P.H.I.)
2. Theory and Problems of Probability and Statistics - M.R. Spiegal (Mc Graw Hill) Schaum Series
3. Probability and Statistics for Engineers 6th Ed. - Miller, Freund and Johnson. (P.H.I.)

Ref. Books:

1. Basic Statistics for Business and Economics E.K. Bowen, M.K. Starr (Mc Graw Hill).
2. Statistics for Business & Economics : R.P.Hooda (Mc.Millan Publication)

IV Semester B.E. (Industrial Engineering)

Course Code: INT206 **Course: Theory of Machines**

L: 4 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits: 08**

Course Outcomes :

1. Students shall be able to obtain the desired motion and select suitable mechanism for the application with given constraint of motion, freedom of motion, space, strength, time, cost, etc.
2. Students shall get the knowledge to modify the machines/ systems to enhance the performance of it.
3. Students shall get expertise to select the speed & torque combination for enhancing the reliability of system.
4. Students shall be able to analyze the machine problem to minimize the maintenance cost of mechanical system.
5. Students shall capable to identify the power loss in transmission system & the use of generated power for the application without interruption of energy & speed
6. Students shall develop capability to create integrated system of man- machine- material for productivity improvement.

Syllabus: UNIT I Basics:

Introduction to the study of mechanism & machine, Kinematic link, Types of link, kinematic pair, types of kinematic pairs, classification of kinematic pairs, kinematic chain, Difference between machines, mechanism& structure, superstructure, Degrees of freedom of mechanisms, Kutzback's & Grubler's criterion, Equivalent linkage concept, Inversions of mechanisms.

UNIT II

Kinematic Analysis of Mechanisms: (Velocity & acceleration analysis)

Concept of position, displacement and velocity of a point and link of a given mechanism, Kinematic analysis of mechanisms (Velocity Analysis), Concept of acceleration of a point and link of a given mechanism, Kinematic analysis of mechanisms(acceleration analysis), Coriolis Component of Acceleration.

UNIT III Cams :

Introduction to cams and followers, Classification and Application of cams and Followers, Motions of the follower, displacement, Velocity and Acceleration diagram for the cam, Graphical layout for cams profile, Geometry of Radial cams, Maximum velocity and acceleration.

UNIT IV Balancing:

Balancing Rotary masses, Single mass and Several masses in single planes and Different planes, Static and Dynamic balancing, Balancing or Reciprocating masses.

Flywheel:

Principles of Flywheel, Turning moment diagram for flywheel.

UNIT V Vibrations :

Types of vibration, free damped, undamped, Forced with single degree of freedom Vibration isolation & transmissibility, Critical speeds of shafts.

UNIT VI

Mechanical Drives :

Types of Mechanical drives, Gear drives, Belt drive, Chain drive, Rope drive, PIV drive. Friction & Clutches:- Single plate & multiple plates.

Text Books:

1. Theory of Machines and Mechanisms : J. E. Shigley et.al.2.Theory of Machines :S. S. Rattan3.Theory of Machines : R. S. Khurmi et. al.

IV Semester B.E. (Industrial Engineering)

Course Code: INT207 **Course: Methods Engineering**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

Students shall be able to

1. Do systematic investigation of existing way of doing work to effect improvement.
2. Do selection of appropriate recording technique for a given activity.
3. Design and develop the workplace layout using principles of motion economy and fundamental hand motions.
4. Establish standard time for a specific activity using time study.

Syllabus: UNIT I

(a) Work Study

Definition and objectives, Basic Procedures, human factor in the application of work study, history of motion and time study, Taylors use of time study and motion study, general problem solving procedure.

(b) Method Study

Introduction, Definition and objectives, basic procedure of method study.

UNIT II

Recording Techniques

Recording Techniques, process Chart symbols, outlines process chart, flow process charts, multiple activity chart, Quantitative Techniques for man machine relationship, two handed process chart, SIMO chart, travel chart, Flow diagram, string diagram. Critical evaluation Phase, Develop, Define and Install step of method study.

UNIT III

Micro motion Study

Introduction, micro motion study equipments, making motion pictures, Film analysis, the use of fundamental hand motions, principles of motion economy.

UNIT IV

Work Measurement

Objective of work measurement, work measurement techniques, time study, time study equipment, Principle steps in conducting time study. Selecting the Job for time study, choosing the operator, breaking the job into elements, determination of sample size.

UNIT V

Rating & Allowances

Concept of performance rating, definition, the concept of normal performance, characteristics of sound rating system, learning curve, Systems of rating -Westinghouse system- synthetic rating- speed rating- objectives rating, Factors affecting the rate of working.

Allowances: calculation of allowances, Types of allowances, standard time and numerical problems.

UNIT VI

Wage Payment

Direct and Indirect financial plans: piecework, the standard hour plan. the Taylor's, differential piece rate, the Merrick multiple piece rate, measured day work, the Halsey plan, the Bedaux point system, the Rowan plan, the Emerson plan, cost saving sharing plans, profit sharing, prerequisites of sound wage incentive plans, reasons for incentive plan failure.

Text Books:

1. International Labour organization, "Introduction to work-study", Universal Publishing Company. ISBN 81-850270
2. Barnes Ralph M., "Motion & Time study: Design and Measurement of Work", Wiley Text Books, 2001.
3. Marvin E, Mundel & David L, "Motion & Time Study: Improving Productivity", Pearson Education, 2000.

Reference Book:

1. Maynard H. B., "Industrial Engineering Handbook", 3rd edition, McGraw Hill Book Company. ISBN 0-07-041084-4.

IV Semester B.E. (Industrial Engineering)

Course Code : INP207 | **Course : Methods Engineering Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week | **Total Credits : 02**

Course Outcomes :

1. The students should be able to use the suitable recording technique to record information in a systematic way of a given activity.
2. The students should be able to identify the fundamental hand motions involved in the process in order to eliminate unnecessary motions.
3. The students should be able to apply the principles of motion economy for workstation design.
4. The students should be able to determine the standard time of a job using time study.
5. The students should be able to apply the concept of method study & time study for a given situation.

Syllabus :

Practicals are based on the syllabus given in the theory.

IV Semester B.E. (Industrial Engineering)

Course Code: INT208 **Course : Facilities Planning**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 09**

Course Outcomes:

Students shall be able to

1. Describe the steps involved in designing a new manufacturing facility.
2. Specify the equipment requirements for a manufacturing facility.
3. Specify the space requirements for a manufacturing facility.
4. Select the appropriate material handling equipment for a facility.
5. Design alternate layouts for the departments within a facility.
6. Use facility design software to generate and analyze layouts

Syllabus: UNIT I

The Facilities Management Function. Organization and Administration. Facilities Manager - Role and Responsibility. Facilities Planning & Design Management. Facility Planner, Planning for New Facilities & Modification of Existing Facilities. Facilities Design, Construction of New Facilities.

UNIT II

Plant Location: Factors affecting site selection, concepts, location Economics, Rural V/s urban Plant site Factory building, Types of factory building, Building construction. Plant Layout : - Layout Problems, objective of plant layout, symptoms of Bad plant layout. Types of layout systematic layout planning, Techniques for Quantitative Analysis of Layouts, computerized layout, safety requirement, steps in plant layout. Flow pattern. types of flow pattern.

UNIT III

Elements of materials Handling, Importance, principles of material handling, analysis of materials handling problems. Selection of Mechanical Handling Equipment. Selection of Handling system. Cost data & economic analysis, classification of drives, specifications for selection.

UNIT IV

Bulk handling Devices; conveyers : Belt, Chain, Pneumatic, Hydraulic, screw. Unit handling Devices ; Hoist, conveying materials, Elevator, conveyer cable ways , ropeways, draggling roller conveyers, escalators, tractors .Robotic handling.

UNIT V

Occupational Health and Safety Management System. Principles of safety Management, OHS Legislation and Obligations, Risk, Hazard. Risk Identification And Risk Assessment, Overview of OHSAS 18001.

UNIT VI

Environmental Management System. Introduction to Concept of Environment Aspect, Impact, Identification of Environmental Impact and Impact Assessment.

Text Books:

1. OH.SAS 18001: 1999 Standard
2. ISO 14001 1996 Standard.
3. Plant layout & Material Handling - Apple. Ronald press

IV Semester B.E. (Industrial Engineering)

Course Code: INT209 **Course: Instrumentation & Metrology**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

Students shall be able to

1. Make use of various linear and angular measuring instruments and design the gauges based on type of fit required.
2. Identify the elements and prepare block diagram of measurement system & Evaluate the response of measurement systems for various test inputs.
3. Make the use of process planning sheet & tolerence chart preparation.
4. Make use of principles of transducers for measuring linear and angular dimensions.
5. Understand the standard of measurement, tolerance system, direct and indirect methods and other techniques in measurement.

Syllabus: UNIT I

Measurement and measurement systems, Significance of measurement, Methods of measurement, elements of generalized measurement system, error in measurement, types of errors. Uncertainty in measurement of combination of component error.

UNIT II

Static and dynamic characteristics of instrument. Order of measurement system, Transfer Function, system response for standard test inputs.

UNIT III

Detector Transducer: Mechanical, Electrical, Electronic. Piezoelectric and Photoelectric transducers. Measurement of Force, Pressure, flow, temperature, and speed

UNIT IV

Metrology : Standards of Measurement, Simple Gauging Instruments For Linear And Angular Measurements. Mechanical, Electrical & Pneumatic Comparators.

UNIT V

Tolerance Analysis : Limits & Fits, Types of Fits, Shaft Basis System, Hole Basis System, Selective Assembly, Allowances, IS Specifications. Design of Limit Gauges, Process Planning Sheet and Tolerance Chart Preparation.

UNIT VI

Measurement of Straightness and Flatness. Use of Optical Flat. Measurement of Thread, Measurements of gear Tooth Profile. Measurement of Screw thread parameters using Floating Carriage Micro Meter.

Text Books :

1. Mechanical Measurement & Control- D.S. KUMAR (Metropolitan Book Co)
2. Instrument Measurement & Analysis- B.C.NAKRA & K.K.Chaoudhary (Tata McGraw Hill)
3. Engineering Metrology- R.K. Jain (Khana Publishers)

IV Semester B.E. (Industrial Engineering)

Course Code: INP209 **Course: Instrumentation & Metrology Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes :

1. Make use of various linear and angular measuring instruments.
2. Identify the elements and prepare block diagram of measurement system & Evaluate the response of measurement systems for various test inputs.
3. Desing the gueges based on type of fit required & make the use of process planning sheet & tolerance stack analysis.
4. Make use of principles of transducers for measuring linear and angular dimensions.
5. Develop understanding of the standard of measurement, tolerance system, direct and indirect methods and other techniques in measurement.

Syllabus :

Practicals are based on the syllabus given in the theory.

IV Semester B.E. (Industrial Engineering)

Course Code: CHT202 **Course: Environmental Studies-II**

L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits: 0**

Course Objectives :

1) Main objective of the course is to make the students aware of environmental issues which often come across.
2) It is envisaged to provide the students' with basic scientific background which is needed to understand how the Earth works, how we, as human beings, fit into it, prerequisites to understand environmental issues.
3) To adopt multidisciplinary approach which encompasses chemical sciences, biological sciences, environmental engineering and sciences to protect the mother earth and environment.
4) Course is to develop concern for our own environment which will lead us to act at our own level to surmount over the environment problems we face.
5) One of the objectives of the course is to make the students aware about importance of natural resources, ecosystems, biodiversity and its conservation, environmental pollution, social issues and environment, human population and environment.

Course Outcomes:

a) Students will get the sufficient information that will clarify modern environmental concepts like equitable use of natural resources, more sustainable life styles etc.
b) Students will realize the need to change their approach so as to perceive our own environmental issues correctly, using practical approach based on observation and self learning.
c) Students become conversant with the fact that there is a need to create a concern for our environment that will trigger pro-environmental action; including simple activities we can do in our daily life to protect it.
d) By studying environmental sciences, students is exposed to the environment that enables one to find out solution of various environmental problems encountered on and often.
e) At the end of the course, it is expected that students will be able to identify and analyze environmental problems as well as the risks associated with these problems and efforts to be taken to protect the environment from getting polluted. This will enable every human being to live in a more sustainable manner.

Syllabus: UNIT I

Bio-diversity:

Introduction – biodiversity at genetic, species and ecosystem levels Bio-geographic classification of India Value of biodiversity – Consumptive use value, productive use value, social, ethical, moral, aesthetic and optional vlue of biodiversity.

India as a mega-diversity nation; hotospots of biodiversity.

Threats to bio-diversity – habitat loss, poaching of wildlife, man-wild life conflicts. Common endangered and endemic plant and animal species of India.

Insitu and Exsitu conservation of biodiversity.

Role of individual and institutions in prevention of pollution. Disaster management – Floods, earthquake, cyclone, landslides

UNIT II

Social Issues and the Environment:

Unsustainable to sustainable development; Urban problems related to energy; Water conservation, rainwater harvesting, watershed management; Problems and concerns of resettlement and rehabilitation of affected people.

Environmental ethics – issues and possible solutions – Resource consumption patterns and need for equitable utilization; Equity disparity in Western and Eastern countries; Urban and rural equity issues; need for gender equity.

Preserving resources for future generations. Te rights of animals; Ethical basis of environment education and awareness; Conservation ethics and traditional value systems of India.

Climate change, global warming, acid rain, Ozone layer depletion, nuclear accidents and holocasts. Wasteland Reclamation; Consumerism and Waste products.

Environment legislations – The Environment (Protection) Act; The water (Prevention and Control of Pollution) Act; The Wildlife Protection Act; Forest Conservation Act; Issues involved in enforcement of environmental legislations – environment impact assessment (EIA), Citizens actions and action groups.

Public awareness – Using an environmental calendar of activities, self initiation.

UNIT III

Human Population and the Environment :

Global population growth, variation among nations. Population explosion; Family Welfare Programmes – methods of sterilization; Urbanization.

Environment and human health – Climate and health, infectious diseases, water-related diseases, risk due to chemicals in food, Cancer and environment.

Human rights – equity, Nutrition and health rights, Intellectual property rights (IPRS), Community Biodiverstity registers (CBRs).

Value education – environmental values, valuing nature, valuing cultures, social justice, human heritage, equitable use of resources, common property resources, ecological degradation.

HIV / AIDS; Women and Child Welfare; Information technology in environment and human health.

Text Books :

1. Envionmental Chemistry and Pollution Control:N. W. Ingole , D. M. Dharmadhikari, S. S. Patil, Das Ganu Prakashan, Nagpur
2. Environmental Chemistry:K. Bhute, A. Dhamani, A. Lonkar, S. Bakare, Celebration Infomedid, India.

Reference Books :

1. Text Book of Environmental Chemistry and Pollution Control: S. S. Dara; S.Chand and company Ltd., New Delhi.
2. Environmental Studies-From Crisis to Cure, Second Edition: R. Rajagopalan, Oxford University Press , New Delhi.
3. Text Book of Environmental Studies:E. Bharycha, University Press (India) Private Ltd., Hyderabad, India.

V SEMESTER

V Semester B.E. (Industrial Engineering)

Course Code: INT301 — **Course: Operations Research-I**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week — **Total Credits: 09**

Course Outcomes :

Student shall be able to :

1. Formulate given situation as LLP and solve the LLP by graphical & simplex method.
2. Understand the problem through counterparts and competitors perspective & solve problem by dual simplex method, also enhance capabilities for carrying out sensitivity analysis.
3. Understand application of LLP for solving transportation problem and also in using transportation problem for solving transshipment and cater problem.
4. Form and solve assignment (optional pairing) problem, also student should be able to sequence the operations activities for completing the tasks in least possible time.
5. Understand competitive situation competition and find strategies of playing in such circumstances.

Syllabus:

UNIT I : Nature and development of operation research, Decision making, general methodology of O.R. application of O.R. in industrial problems. Formulation of situation as LPP, Solution by graphical method, simplex, alternate optima, infeasible solution, unbounded solution, indications in simplex method , Degeneracy and techniques to resolve degeneracy in simplex method.

UNIT II : Forming the dual. Duality concept, complementary slackness condition, dual simplex methods, Sensitivity Analysis.

UNIT III : Transportation Models. Initial solution by N.W. Comer rule. least cost method. Vogel's approximation method. Penalty calculations, Optimization by MODI method. Water value, improvement potential, Degeneracy transportation problems. Caterer problem, Transshipment Model.

UNIT IV : Assignment Models : Hungarian method. Traveling salesman Problem, Sequencing Models.

UNIT V : Introduction to game theory, two person zero sum games. Dominance principle, saddle point, nx2, 2xm games. Solution of game by Algebraic method, arithmetic method., method of sub game, Graphical method, Oddment method. Simplex method, iterative method.

UNIT VI : Queuing system and concepts, classification of queuing situations, solution of queuing problems, Single channel, single stale, finite and infinite queues with Poissions arrival and exponential service, application to industrial problems. Emphasis only on (M/M/l): (FCFS/infinity /infinity) and (M/M/l) : (FCFS/N/infinity). Optimum service rate.

Text Books :

1. Operations Research - Prof- Askhedkar & Prof- R.V.Kulkarni
2. Principles of Operation Research - Wagner- Prentice Hall
3. Operations Research - Liberman, Hiller

V Semester B.E. (Industrial Engineering)

Course Code : INP301 — **Course : Operations Research-I Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week — **Total Credits : 02**

Course Outcomes :

Students shall be able to

1. Formulate any real-world problem into a linear problem with suitable assumption, objective functions and constraints. Solve this problem graphically or using the Simplex or Dual Simplex method.
2. Solve problems related to Sensitivity Analysis of a linear problem.
3. Solve Transportation problems by using the N-W Corner method, least cost and Vogel's approximation method for the initial solution and the optimal solution through the MODI method.
4. Solve Assignment problems through the Hungarian algorithm.
5. Solve problems of Game theory.
6. Solve problems related to waiting line models.

Syllabus :

Practicals are based on the syllabus given in the theory.

V Semester B.E. (Industrial Engineering)

Course Code: INT302 **Course : Fluid Power Engineering**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 07**

Course Outcomes :

Students shall be able to

1. Understand the concept of properties of fluids and their measurement, Using manometer .
2. Understand the kinematics and dynamics of fluid flow & Understand the relationship between a model and a prototype
3. To gain the knowledge about the working of turbomachinery .
4. Solve problems in Fluid power systems and apply the concepts in the real world
5. Understand the working principle of hydraulic machines and their application.

Syllabus:

UNIT I

Properties of Fluids :

Density, Specific weight, Specific volume, Specific gravity, Surface tension. Compressibility & Bulk modulus. Viscosity , Kinematic viscosity & Newton's law of viscosity. Classification of fluid based on Rheological chart.Total pressure & Centre of pressure on plane, vertical, horizontal & inclined surface submerged in liquid. Pressure at a point & Pressure head measurement using U-tube manometers.

UNIT II

Kinematics of flow:

Types of flow & Continuity equation in three dimensions.

Velocity and Acceleration. Velocity potential function & Stream function.

Dynamics of flow : Force influencing motion. Euler's equation of motion, Bernoulli's equation & its assumptions. Measurement of flow rate. Practical applications of Bernoulli's equation - Venturimeter, Orifice meter and Pitot tube.

UNIT III

Dimensional & Model Analysis:

Dimensional homogeneity, Rayleigh's method & Buckingham's theorem of dimensional analysis. Reynolds's apparatus and Dimensionless numbers (introductory treatment).

UNIT IV

Hydraulic Turbines & Pumps :

Elements of hydro electric Power plants, General principles of working & velocity triangles and work done for Pelton Wheel. Introduction to Reaction turbines.Centrifugal pump- Components, General principles of

working & velocity triangles and work done by the CP on water & Introduction to Reciprocating pump

UNIT V

Industrial Hydraulics I Hydraulic Press:

Mechanical advantages and leverage. Heavy Press, Hydraulic Accumulator and Hydraulic Intensifier.

UNIT VI

Industrial Hydraulics II Hydraulic Ram, Hydraulic lift :

Direct acting and suspended type. Hydraulic Crane, Hydraulic Coupling, Air lift Pump and Gear Wheel Pump

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Text Books:

1. Fluid Mechanics - Modi & Seth
2. Fluid Mechanics and Hydraulic Machines- Dr.R.K. Bansal
3. Fluid Mechanics and Hydraulic Machines- Sukumar Pati
4. Engineering Fluid Mechanics- P. A. Aswatha Narayana5.Fluid Mechanics- Rajput

V Semester B.E. (Industrial Engineering)

Course Code : INT303 **Course : Machine Design**
L: 4 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 08**

Course Outcomes:

1. Students shall be able to understand the concept of strength of materials, their properties and use of design data book.
2. Students should be capable of designing the various machine elements.
3. Should be able to understand the concept of design procedure and practice in design.
4. Should be able to understand various software in machine design..

Syllabus : UNIT I

Strength of Materials : Types of stresses in machine member , Factor of safety. Materials: Stress- strain diagram, Shear force & bending moments in beams, Design of Shafts. Significance of material properties, Material coding & standards, Selection of material.

Introduction to Design process , Use of Design Data Book.

UNIT II

Design of Helical & leaf spring, Design of threaded fasteners.

UNIT III

Design of Power transmission system : Design of Flat belt drive, Design of V- belt drive, Design of Chain drive.

UNIT IV

Design of Power transmission system: Design of Power Screw, Design and selection Ball, roller & journal bearings.

UNIT V

Design of Power transmission system : Design of Spur Gear..

UNIT VI

Introduction to Finite element analysis & Computer aided design, Optimization of design, Product cycle, Software's in design.

Text Books :

1.Design of Machine element - B.D. Shiwalkar
2.Design of Machine element - Bhandari
3.Design of Machine element - Khurmi and Gupta.

Reference Book:

Mechanical Engineering Design - J.E.Shegley , et. al

V Semester B.E. (Industrial Engineering)

Course Code: INT304 **Course: Productivity Measurement and Improvement**
L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

Students shall be able to

1. Identify the factors affecting productivity.
2. Apply different models of productivity measurements.
3. Evaluate performance of service industry using objective matrix.
4. Determine standard time of a job or process using predetermined time systems.

Syllabus: UNIT I Productivity:

Productivity concept and definition, Techniques of productivity improvement- Work content and ineffective time, improving productivity by reducing work content and ineffective time, Benefits of higher productivity.

UNIT II : Productivity Measurement:

Need for productivity measurement, total productivity index, partial productivity indices. Productivity models, Viz (1) Craig & Harris (2) Total productivity Model (3) American Productivity Centre model and Numerical Problems.

UNIT III Objective matrix : Format and Functions of the objective matrix, productivity criteria, performance scores, weights, values and Indicators. OMAX applications. Computer applications in work study.

UNIT IV : Work Sampling:

Theory of sampling and the law of averages, the normal and Binomial distribution as applied to work sampling. Accuracy of work sampling measurement, procedure for making a work sampling measurement, procedure for making a work sampling study, use of control chart in work sampling, Advantages and disadvantages of work sampling.

UNIT V : Predetermined Time Systems. Methods time measurement techniques, work factor system.

UNIT VI : Determining time standards from standard data, Concept of MOST, Basic MOST system and The Sequence Model. Multifactor wage incentive plan.

Text Books:

1. Sumanth D J, "Productivity Engineering & Management", McGraw Hill (1995).
2. Ralph M-Barnes, "Motion & Time Study - Design & Measurement of work "John Wiley & sons.
3. International Labour organization, "Introduction to work-study", Universal Publishing Company. ISBN 81-850270

Reference Book:

Maynard H. B., "Industrial Engineering Handbook", 3rd edition, McGraw Hill Book Company. ISBN 0-07-041084-4.

V Semester B.E. (Industrial Engineering)

Course Code: INP304 **Course: Productivity Measurement and Improvement**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes :

Students are able

1. To demonstrate the application of productivity models.
2. To evaluate the performance of service industry.
3. To demonstrate the application of work sampling technique for standard time determination.
4. To establish standard time using predetermined time systems.

Syllabus :

Practicals are based on the syllabus given in the theory.

V Semester B.E. (Industrial Engineering)

Course Code: INT305-1 (Elective-I) **Course: System Dynamics**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes:

Students shall be able to

1. Understand the concept of system thinking and dynamics involved in the system behavior.
2. Understand the cause and effect relationship between the system variables and drawing of casual loop diagram.
3. Understand and draw stock and flow diagram.
4. Use the system dynamics software.
5. Understand the application of system dynamics in manufacturing and service system.

Syllabus

UNIT I :

Introduction, Complex systems and system dynamics, System behavior, Need for system dynamics, historical developments, Systems thinking, feedback structure, Application areas of system dynamics, Basic definitions.

UNIT II

Building blocks of system dynamics, diagramming aids in system dynamics. Introduction to casual loop diagram; casual relations, feedback system, casual loops, fundamentals of drawing casual lop diagram, developing casual loop diagrams for systems.

UNIT III

Introduction to stock and flow diagram, steps to develop system dynamics model. Equations underlying the modeling, Positive and negative feedback loops. Dynamics of growth, modeling delays, Capturing nonlinear relationships, instability and oscillation.

UNIT IV

Introduction to system dynamics software, Model construction and formulation using system dynamic methodology.

UNIT V

Application of Vensim in dynamic modeling of manufacturing systems.

UNIT VI

Application of Vensim in dynamic modeling of service systems.

Refernce Books:

1. John Sterman , Business Dynamics: Systems Thinking and Modeling for a Complex World, Irwin/McGraw\ Hill (2000).
2. Sushil,System Dynamics : A Practical Approach for Managerial Problems,Wiley Eastern (1993)
3. J.W. Forrester, Industrial Dynamics, Cambridge MA : Producticity Press (1961)
4. Michael R. Goodman, Study Notes in System Dynamics, Pegasus Communications (1989)
5. R.G Coyle , System Dynamics Modelling : A Practical Approach Chapman and Hall/ CRC (1996)
6. Craig W. Kirkwood, System Dynamics : A Quick Introduction, Arizona State University (1998)

V Semester B.E. (Industrial Engineering)

Course Code : INT305-2 (Elective-II) **Course : Human Resources Management**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 07**

Course Outcomes :

Students shall be able to

1. Help the organization reach its goals.
2. Ensure effective utilization and maximum development of human resources.
3. Ensure reconciliation of individual goals with those of the organization.
4. Achieve and maintain high morale among employees.
5. Provide the organization with well-trained and well-motivated employees.
6. Increase to the fullest the employee's job satisfaction and self-actualization.

Syllabus: UNIT I Introduction:

The nature and challenge of Personnel Management, Definition of personnel management. The role of the personnel manager, challenges of modern personnel management From Mechanics to Social Responsibility, Mechanical approach towards personnel. Paternalism. Social system approach toward the social role of the business firm. Managing the personnel unit, Organizing the personnel unit, planning the personnel program, controlling personnel unit. Procurement of Personnel, Fair Employment Practices, Labor legislation and factory act-1948, Different considerations for minority races; female employees, pregnant employees, the older employees, religions, nationalities, handicapped personnel. Provisions against sexual harassment, Affirmative action programs, Provisions for culturally and socially disadvantaged personnel.

UNIT II

Organizational and Job Design:

Organizational objectives, functions, relationships, organization type, formal & informal organization, job design. Human Resources Planning-quality of personnel, human resources requirements. Recruitment & Hiring- Recruitment laws, recruitment evaluation, nature of the hiring process, hiring procedure. Psychological Tests and Identification of Management Talent-Psychological tests, basic concepts of testing, testing and the law, Types of tests. To test or not to test. Identification of management talent.

UNIT III

Personnel Development:

Individual and Organization Development-Operative Training, Management Development, Manager Needs and Developmental Programs, Evaluation of Management Development Programs, Organization Development, Performance Appraisal and Management by Objectives, Performance Appraisal and the Law, Systematic Appraisal by Superiors, Traditional Performance Appraisal System, The Appraisal Program, Career Development, Nature of Careers, Career Anchors, An Integrated Life, The Career Development Program, Two Modern Career Problems, Low -Ceiling Careers.

UNIT IV Compensation:

Base Compensation- Job, Significant Factors affecting Compensation Policy, Equity and Compensation, Comparable Value, Job Evaluation, Job Evaluation systems, Simple Ranking, Job Grading, Point System, Factor-Comparison System, Human Relation effects of job Evaluation, Variable compensation (individual and Group), Expectancy Theory and Compensation, variable Compensation - Individual, Variable Compensation - Group, Supplementary compensation-fringe benefits, Nature of supplementary compensation, A philosophy of employee benefits. Principles of Employee Benefit Programs, Payment for Time Not Worked, Economic Protection against Hazards, Facilitative Employee Services.

UNIT V

Integration and Motivation:

Integration-nature of the human resource, Importance of human relation. Nature of Human needs. The Need to Understand why Human Mode's Proposed by organization Psychologists. Maslow's Need Hierarchy, McGregor's Theory Y, Nature Human Being. Herberg's Motivated Employee, Human Model of Ethology, Human Models and Behaviorism, Human being and culture. Employee Wants, Motivation, 0rganizational Behavior Modification, Styles of leadership. Quality of work life and quality circles, Nature of. Labour Union, Types of Union , Current Status of Labor Union, Labor Legislation, Traditional Union Security. A Point of View, Collective bargaining. Traditional and Non-traditional Bargaining. The Process of collective Bargaining, Union Bargaining Pressures. Third Party Resolutions. Current Issues in Bargaining, A Philosophy of Labor - Management Peace, The management of conflict, The Discovery of Conflicts of Interest, The Processing of Grievances, Disciplinary Action, Conflict Resolution.

UNIT VI

Maintenance of Personnel:

Communication and Counseling, Nature and Importance of Communication, Channels and Structure, Communication Filters, Johari's Window, The Communication Process, Counseling, Safety and Health, Background of safety and health programs. Occupational safety and health act, workers compensation laws, the safety program, the health program, absenteeism. Separation Processes, Labour Turnover, Retirement, Layoff, Out- Placement, Discharge, Personnel Research, Change, and the future. Nature of Personnel Research, The Personnel Manager as Change Agent, Challenges of the Future.

Text Books :

1. Personnel Management by Edwin B. Flippo, McGraw Hill International Edition, New York, Sixth Edition,1984.
2. Business Administration and Management by Dr. S.CSaxena, Sahitya Bhavan, Agra, 1989 edition.
3. Human Resource Development and Managementj by Dr. A.M. Sheikh, S.Chand and Company Ltd Publishers, 1999

V Semester B.E. (Industrial Engineering)

Course Code: INT305-3 (Elective-III) **Course: Object Oriented Programming**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes:

Students shall be able to

1. Define objects and classes in C++.
2. Use arithmetic operators and its application in programming.
3. Define operator overloading.
4. Use principles of inheritance, friend function, assignment operator in programming.
5. Design programs using file handling concepts for small manufacturing / service unit.

Syllabus

UNIT I

Different paradigms for problem solving, need for OOP, differences between OOP and Procedure oriented programming, Abstraction, Overview of OOP principles, Encapsulation, Inheritance and Polymorphism.

UNIT II

C++ Basics: Structure of a C++ program, Data types, Declaration of variables, Expressions, Operators, Operator Precedence, Evaluation of expressions, Type conversions, Pointers, Arrays, Pointers and Arrays, Strings, Structures, References. Flow control statement- if, switch, while, for, do, break, continue, goto statements. Functions-Scope of variables, Parameter passing, Default arguments, inline functions, Recursive functions, Pointers to functions. Dynamic memory allocation and de-allocation operators-new and delete, Preprocessor directives.

UNIT III

C++ Classes And Data Abstraction: Class definition, Class structure, Class objects, Class scope, this pointer, Friends to a class, Static class members, Constant member functions, Constructors and Destructors, Dynamic creation and destruction of objects, Data abstraction, ADT and information hiding.

UNIT IV

Polymorphism : Function overloading, Operator overloading, Generic programming necessity of templates, Function templates and class templates,

Inheritance : Defining a class hierarchy, Different forms of inheritance, Defining the Base and Derived classes, Access to the base class members, Base and Derived class construction, Destructors, Virtual base class.

UNIT V

Virtual Functions And Polymorphism : Static and Dynamic bindings, Base and Derived class virtual functions, Dynamic binding through virtual functions, Virtual function call mechanism, Pure virtual functions, Abstract classes, Implications of polymorphic use of classes, Virtual destructors.

UNIT VI

C++ I/O: I/O using C functions, Stream classes hierarchy, Stream I/O, File streams and String streams, Overloading << and >> operators, Error handling during file operations, Formatted I/O, Exception Handling: Benefits of exception handling, Throwing an exception, The try block, Catching an exception, Exception objects, Exception specifications, Stack unwinding, Re-throwing an exception, Catching all exceptions, Design issues in exception handling.

Text Books :

1. Programming in C++ - E. Balgurusainy
2. Programming in C - E. Baigliruswamy , Tata Megraw Hills
3. Object Orientation through C++. - Parimala N. MAGMILLA

V Semester B.E. (Industrial Engineering)

Course Code : INT305-4 (Elective-IV) — **Course : Energy Management**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week — **Total Credits : 07**

Course Outcomes :

1. Students should be able to understand present & future energy scenario, importance of energy conservation & energy efficiency.
2. Student should be able to study various energy conversion processes & their use to generate energy..
3. Student should convince energy management as a separate function in plant management hierarchy.
4. Student should be able to conduct energy audit in an organization.
5. Student shall have understanding of efficient energy management approaches.

Syllabus

UNIT I

Introduction, Global Primary Energy Reserves, Indian Energy Scenario, Renewable and Non Renewable Energy, Energy and Environment, Energy Conservation and its Importance, The Energy Conservation Act, 2001 and its Features, Captive power units, demand and supply .

UNIT II

Physical aspects of energy - Classification of energy- Hydel, Thermal, Nuclear, Solar, Wind, Biomass, efficiency and effectiveness of energy utilization in industry. Energy and Energy analysis (Sankey diagram).

UNIT III

Energy Management definition and objective, Energy management skill, strategy Energy action planning: Energy Management as a separate function and its place in plant management hierarchy. Energy Managers responsibilities and duties.

UNIT IV

Energy Demand Management-Scope, methodology and modes of Energy Saving, Plant energy and utility system, efficient energy management steps, Financial Management.

UNIT V

Energy Audit - Introduction& important of energy audit, uses of energy audit, basic terms of energy audit, types of energy audit, procedure for carrying energy audit, Instrumentation and data analysis, Energy load measurement, system evaluation and simulation, energy saving techniques and guidelines, administrative control, proper measurement and monitoring system.

UNIT VI

Energy efficiency and energy conservation opportunities in different utilities. Fuels and combustion, Boilers, FBC boilers, Steam system, Furnaces, Insulation and Refractory's, Cogeneration, Waste heat recovery.

Text Books:

1. Thermal Engineering - P.L.Ballaney
2. A course in Thermal Engineering - Domkundwar
3. Element of Heat Engines - R.C. Patel & C.J.Karamchandani.

V Semester B.E. (Industrial Engineering)

Course Code : INT306 **Course : Modeling and Simulation**

L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 0**

Course Outcomes :

Students shall be able to

1. Define basic concepts in modeling and simulation (M&S)
2. Classify various simulation models and give practical examples for each category
3. Construct a model for a given set of data
4. Generate and test simulation models
5. Analyze output data produced by a model and test validity of the model

Syllabus

UNIT I :

Introduction to System Modeling Concepts : System Specification Formalisms, Levels of System Knowledge, Introduction of Hierarchy of Systems Specification, The Specification Levels Informally Presented, System Specification Morphisms.

UNIT II :

Framework for Modeling and Simulation : The Entities of the Framework, Primary Relations Among Entities, Other Important Relations, Time.

UNIT III :

Modeling Formalisms and their Simulators : Introduction, Discrete Time Models and their Simulators, Differential Equations Models and their Simulators, Discrete Event Models and their Simulators.

UNIT IV :

Introduction to Discrete Event System Specifications (DEVS) : Introduction, Classic DEVS System Specifications, Parallel DEVS System Specification, Hierarchical Models, Object- Oriented Implementations of DEVS.

UNIT V :

Parallel and Distributed Discrete Event Simulation : Problem Characterization of Parallel Discrete Event Simulation, Conservative Parallel Discrete Event Simulation.

UNIT VI :

Optimistic Parallel Discrete Event Simulation, Parallel DEVS Simulator.

Text Books :

1. Theory of Modeling and Simulation: Integrating Discrete Event and Continuous Dynamic Systems by Bernard P. Zeigler, Herbert Praehofer and Tag Gon Kim
2. Modeling and Simulation by Hartmut Bossel
3. Principles of Modeling and Simulation: A Multi-disciplinary Approach by John A. Sokolowski and Catherine M. Banks

VI SEMESTER

VI Semester B.E. (Industrial Engineering)

Course Code: INT307 **Course: Operations Research-II**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

Students shall be able to

1. Represent any project through a network and understand its critical activities.
2. Apply the concepts covered in Markov Chain Analysis.
3. Determine the optimal replacement period of failed items in course optimizing the resources.
4. Apply the concept of dynamic programming to solve problems of discreet and continuous variables.
5. Model any real-world problem into a simulation model
6. Apply the concept of multi-objective optimization, non-linear programming, compromise programming and goal programming.

Syllabus: UNIT I

Project Management:

Introduction to management project s. Introduction to the concept of EPO Slack EFT. LST. LFT Total float free Float and Independent Float Fulkerson's Rule number Events. Forward Tracking Backward Tracking Tracing the critical path CPM and PERT analysis of projects Concept of crashing Resources and leveling Optimization of projects for minimum cost and for minimum using option Resources

UNIT II

Markov Chains and their applications:

Concept of Brand Switching Mechanism Markov Process Transition matrix regular Transition matrix, steady state condition, absorbing state and decaying state appearing a: Markov chains

UNIT III

Replacement Analysis:

Rate of Return, Time value of Money Initial investment running costs, Salvage value, pay of period. Capital assets Single and Multiple Assets. Present worth Concept Comparison of alter:

natives. Replacement of items that deteriorate time Replacement of those which suddenly fail Replacement models

(i) Replacement of item A with item A
(ii) Replacement of item A with similar item B
(iii) Replacement of items in anticipation of failure
(iv) Group replacement

UNIT IV

Dynamic programming:

Concept of Multistage Programming Recursive relation approach, forward and Backward recursions Structure and Characteristics of Dynamic Programming. Analogous and Digital variations of variables Calculus method of solution, Tabular method of solution, solution- of LPP by dynamic programming Solution of Wagner's Stage Coach Problem (Shortest: Route Problem) by Dynamic Programming Applications of Dynamic Programming.

UNIT V Simulation:

Concept of simulation, simulation of values of variables following various distributions.

i. Step Distribution

ii. Normal Distribution

iii. Rectangular Distribution iv. Poisson Distribution

v. Exponential Distribution

Simulation of complex and dynamic situation in industry and business. Use of computers in Simulation.

UNIT VI

Optimization of conflicting objective and introduction to Nonlinear programming:

(i) Concept of Multi objective programming, Classification of different method for obtaining solution of multiple criteria decision making problem.

(ii) Introduction to nonlinear programming

(iii) Concept of compromise programming (iv) Concept of goal Programming

Text Books:

1. Operations Research - An Introduction By Handy A - Tata, PHI Publication - New Delhi - 2002, (Seventh Edition)
2. Introduction to 0.R - by Hillier & Lieberman-Tata Mc Graw Hill Publishers
3. Operation Research Principles & Practice, by -Ravindran. Philips & Solberg Sons. New. Delhi

VI Semester B.E. (Industrial Engineering)

Course Code: INP307 **Course : Operations Research-II Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits : 02**

Course Outcomes:

Students shall be able to

1. Solve problems related to CPM and PERT.
2. Solve problems on crashing of critical path and resource allocation.
3. Solve problems in Markov Chain Analysis.
4. Solve problems of individual and group replacement of items that fail gradually and suddenly.
5. Use dynamic programming to solve problems of discreet and continuous variables.
6. Model a linear and non-linear optimization problem and constraints into a simulation model using the Monte Carlo Simulation Technique.
7. Solve problems related of multi-objective optimization, non-linear programming, and goal programming.

Syllabus :

Practicals are based on the syllabus given in the theory.

VI Semester B.E. (Industrial Engineering)

Course Code: INT308 **Course: Metal Removal Processes-I**

I L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

1. The students should be able to understand different types of tools used in machining operations and the theory of metal cutting.
2. The students should be able to understand in detail the types, construction and working principle of various production machines.
3. The students should be able to understand the different types of operations to be performed on machines and its proper selection for product to manufacture.
4. The students should be able to understand, distinguish and select different machines for mass production, special purpose machines, CNC machines, etc.
5. The students should be able to understand, distinguish and select different unconventional machines for specific product.
6. The students should be able to understand different accessories, methods of holding and locating the tools and work piece on various machines.

Syllabus: UNIT I

Theory of metal cutting, chip formation. orthogonal and oblique cutting, tool nomenclature. Machinability, tool life; influence & effect of various parameters. Lathe, Centre Lathe: Construction and Operations, Introduction to capstan & turret, automatic. CNC and other special purpose machines.

UNIT II

Drilling Machine, General purpose, mass production and special purpose drilling machines, Planers, slotters and shapers, Boring Machine : Horizontal, vertical and jig .

UNIT III

Milling machine - Types, types of milling cutter, dividing & Indexing heads. Machines for gear production and screw thread production.

UNIT IV

Grinding machine - Centre type , surface, tool and cutter grinder, Centreless grinding machine., grinding wheel, machines for super finishing processes, Broaching machines.

UNIT V

Unconventional machining processes : Arc, anodic, electron beam, laser beam. Electric discharge electro-chemical, ultrasonic, electrolytic grinding, high energy rate forming processes.

UNIT VI

Jigs and fixtures:

Introduction, different elements, types, general design principles, drill jigs , milling fixtures. Principle of location, locating devices, clamping devices. Press Tools, Computer Integrated Manufacturing – NC, CNC, DNC, Simple CNC Programming

Text Books:

1. The machining of metals - E. J. A. Armarego & R.H Brown- Prentice Hall, Technology & Engineering
2. Manufacturing Technology - Metal Cutting and Machine Tools (Volume -II)-P. N. Rao-Tata M c G r a w - Hill Education
3. Production Technology -Jain-Gupta

VI Semester B.E. (Industrial Engineering)

Course Code: INP308 **Course: Metal Removal Processes-II Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes :

1. The students should be able to understand the working principles of different machines.
2. The students should be able to make different jobs on Lathe, Shaper, Milling and drilling machine.
3. The students should be able to understand the working principle of unconventional machine such as electric discharge machine.
4. The students should be able to work on CNC lathe and CNC milling machine.
5. The students should be able to use the various tools on various machines.

Syllabus :

Practicals are based on the syllabus given in the theory.

VI Semester B.E. (Industrial Engineering)

Course Code: INT309 **Course: Production Planning and Control**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes:

Students shall be able to

1. Understand need of various functions in production planning and control for better management of manufacturing and/or service systems.
2. Use qualitative and quantitative forecasting techniques for short, medium, and long range forecasting.
3. Develop material requirements plans (MRP) as part of resource requirements planning systems.
4. Use heuristic decision rules to make lot-sizing decisions.
5. Develop capacity requirements plans as part of resource requirements planning systems.
6. Develop quantitative models to manage independent demand inventory systems.

Syllabus: UNIT I

Production Planning : Introduction, Production Planning and Production Control, Functions and Objectives of PPC, Production procedure, Information requirement of PPC, Manufacturing Methods and PPC, Product Life Cycle, Product design.

UNIT II

Demand Forecasting : Forecasting and Prediction, Long-term and short-term forecasting, Time series analysis, least square method, exponential smoothing method, Moving Average forecasting.

UNIT III

Capacity And Process Planning : Introduction, Measurement and measures of capacity, factors influencing effective capacity, factors favouring over capacity and under capacity, aggregate planning, linear programming approach to aggregate planning, Master Production Schedule, Process Planning –Machine, Manpower Planning, line balancing.

UNIT IV

Inventory Control : Introduction, Types of inventories, reasons for keeping inventories, inventory control, benefits of inventory control, cost associated with inventory, inventory cost relationships, safety stock, inventory models, deterministic models.

UNIT V

MRP : Stochastic models, inventory control system. Introduction, Objectives of MRP, MRP-I System, MRP-II system, Lot sizing consideration,

UNIT VI

Production Control : Introduction, loading, sequencing, priority sequencing, scheduling, dispatching, and progressing.

Text Books :

1. Martand Telsang, "Industrial Engineering and Production Management", S. Chand, New Delhi (2009)
2. Buffa, "Modern Production operations Management", Wiley Eastern, New York (1999)
3. Panneer Selvan R, "Production and Operations Management", Prentice Hall India, New Delhi (2002)

VI Semester B.E. (Industrial Engineering)

Course Code: INT310 **Course: Supply Chain Management**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes :

Students shall be able to

1. Describe the basic concepts of supply chain management and its essential role in an organization.
2. Identify the key elements and processes of a supply chain and how they interact.
3. Explore the basics of Logistic Information systems.
4. Understanding the role of Warehousing, Inventory Management System and order processing system in SCM.

Syllabus : UNIT I : Introduction to Logistics: Producer - Consumer System, Logistics Communication, Costs & Role of modem Technology in Logistics Management. Marketing & Product Distribution - Interdependence & Interaction. Multilevel System & Sensitive Analysis.

UNIT II : Logistics Information system: Nature, Purpose & Scope of Information system. Customers Order Cycle & Order Processing. Neural Network. Bar Coding.

UNIT III : Transportations : Time Place Utility, Transportation - Logistics Marketing Interface. Different Model of Transportation - Merits, Demerits & Costs.

UNIT IV : Warehousing: Nature, purpose & Scope of Warehousing, Own Warehouse, Third party warehouse. Economics & warehousing.

UNIT V : Inventory Management, Material Handling. Storage & Packaging Issues. Organizing for Effective Logistics support strategies. Supply Chain Management in the Context Of Globalization.

UNIT VI : Order processing : Introduction, concept, functions, elements of order processing cost, significance.

Text Books:

1. Logistics and Supply Chain Management - By D.K.AGRAWAL.- MacMillan India Ltd.
2. Logistics and Supply Chain Management - By S.K BHATTACHARYYA-S CHAND

VI Semester B.E. (Industrial Engineering)

Course Code: INP311-1 (Open Elective) **Course: Six Sigma**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes :

Students shall

1. Develop understanding of Quality Management terminology
2. Develop conceptual understanding of different approaches of Quality Management given by Quality Gurus.
3. Have knowledge of methodology of implementation of Six Sigma in any industry
4. Be able to apply statistical quality control tools

Syllabus: UNIT-I

The history of quality management, from mere 'inspection' to Total Quality Management, and its modern 'branded interpretations such as 'Six Sigma', Processes, ideas, theories and tools : central to organizational development, change management, and the performance improvements.

UNIT-II

Quality Gurus and their theories: the American gurus: Joseph Juran, W Edwards Deming, and Armand Feigenbum; the Japanese quality gurus: Kaoru Ishikawa, Genichi Taguchi, and Shigeo Shingo; and the 1970-80's American Western gurus, Philip Crosby and Tom Peters, development and/or use of the Plan, Do, Check, Act (PDCA) cycle, Pareto analysis, cause and effect diagrams, stratification, check-sheets, histograms, scatter-charts, process control charts, system design, parameter design, tolerance design ('Taguchi methodology'), Quality Improvement Teams (QIT), Just In Time (JIT), Management By Walking About (MBWA), McKinsey 7-S Framework, etc.

UNIT-III

Fundamentals and structures of the TQM model customer-supplier interfaces (external and internal customers and suppliers) Processes - understanding processes and methods for process improvement.

UNIT-IV

Six Sigma central concepts, Teams and team leaders ,use of the measurement and improvement tools, Six Sigma terminology 'Black Belts' and 'Green Belts', levels of expertise and responsibilities, for implementing Six Sigma methods.

UNIT-V Quality Tools

The '5 Whys' - Flowcharts - brainstorming, business process modeling.

Fishbone/Ishikawa Diagrams - fishbone diagram and usage examples for project management.

Run Charts

Pareto Charts - Pareto theory.

Histograms - Checklists/Check sheets - Control/Shewhart Charts - Scatter Diagram/Scatter plot.

UNIT-VI

New 7 QC tools

1. Relationships diagram
2. Tree diagram
3. Arrow diagram
4. Affinity diagram
5. Matrix diagram 6. Matrix data analysis diagram 7. Process decision program chart. (PDPC)

Case Studies on: Quality Circles, ISO 9000, Quality Management Systems and Six Sigma Implementation.

Text Books :

1. Quality Planning and analysis - Juran Jata, McGraw Hill.
2. Statistical Quality- Control - Eugene L Grant, McGraw-Hill

VI Semester B.E. (Industrial Engineering)

Course Code: INP311-2 (Open Elective) **Course : Decision Modeling**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes :

Students shall be able to

1. Develop mathematical models that can be used to improve decision making within an organization.
2. Sharpen their ability to structure problems and to perform logical analyses.
3. Practice translating descriptions of decision problems into formal models, and investigate those models in an organized fashion.
4. Identify settings in which models can be used effectively and apply modeling concepts in practical situations.
5. Strengthen their computer skills, focusing on how to use the computer to support decision-making

Syllabus: UNIT I

Decision making, Formulation of situation as LPP, Solution of LPP by graphical, simplex, Degeneracy and techniques to resolve degeneracy in simplex method, forming the dual, Duality concepts, complementary slackness condition, dual simplex methods, Sensitivity Analysis.

UNIT II

Transportation Models, Caterer problem, Transshipment Model, Sequencing Models, Traveling salesman Problem

UNIT III

Assignment Models, Linear integer Programming, Zero-One (binary programming)

UNIT IV

Concept of simulation, simulation involving distributions like Step, Uniform, Normal , Poisson, Exponential Distribution, Simulation of complex and dynamic situation in industry and business. Use of computers in simulation.

UNIT V

Introduction to management project, CPM and PERT analysis of projects, Concept of crashing, Resources leveling and smoothing

UNIT VI

Dynamic programming, Concept of Multistage Programming Recursive relation approach, forward and backward recursions, Application of technique in discrete decision making problems

Text Books:

1. Principles of Operation Research- Wagner- Prentice Hall
2. Operation Research - An Introduction- Hamdy A Taha, PHI Publication - New Delhi
3. Introduction to Operations Research- Hillier, Lieberman-Tata McGraw Hill Publishers
4. Operation Research Principles & Practice- Ravindran. Philips, Solberg, John Wiley & Sons

VI Semester B.E. (Industrial Engineering)

Course Code: INP311-3 (Open Elective) **Course: Organizational Behavior Development**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes :

1. The students will conceptualize the components of individual and group behavior
2. Understand the practicability of communication
3. Understand the various work situations
4. Apply behavioral techniques in Organizations

Syllabus:

Unit 1: Introduction To Organizational Behavior - Psychology - Foundation Of Individual Behavior - Definition Need And Importance Of Organizational Behavior - Nature And Scope - Framework Of Organizational Behavior Models, theoretical perspectives

Unit 2 : Personality - Types - Factors Affecting Personality Theories - Perception - Importance - Factors Influencing Perception - Interpersonal Perception Types, Learning Types Of Learning Styles - The Learning Process - Learning Theories - Ob Modification; Motivation - Theories - Importance - Types - Motivation At Work - Designing Motivating Jobs.

Unit 3 : Group Dynamics - Group Behavior - Formation - Types Of Groups - Influence - Emergence Of Informal Leaders And Working Norms - Group Decision Making - Interpersonal Relations - Communication – Control

Unit 4: Leadership - Meaning - Importance Trait, Behavioral And Contingency Theories- Evolution Of Leaders - Leadership Styles - Leaders Vs Managers; Power And Politics - Sources Of Power - Power Centers - Trait And Behavioral Analysis (T.A) Work Stress.

Unit 5: Organizational Structure and Design - Organization Climate - Factors Affecting Organization Climate - Importance; Job Satisfaction - Determinants - Measurement - Influence On Behavior - Organizational Change.

Unit 6 : Organizational Development - Characteristics - Objectives - Team Building Organizational Effectiveness - Perspectives - Approaches- Organizational Conflict- Causes, Types, Management Of Conflict - Cases.

Text Books :

Stephen Robbins, Organizational Behavior, Prentice Hall Of India, 9th Edition, 2001. Fred Luthans, Organizational Behavior, Mcgraw Hill Book Co, 1998.

Aswathapa, Organizational Behavior, PHI Publications.

VI Semester B.E. (Industrial Engineering)

Course Code: INP312 | **Course: Entrepreneurship Development**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week | **Total Credits: 0**

Course Outcomes:

Students shall be able to

1. Analyze the feasibility of a new venture business concept Evaluate his or her own entrepreneurial tendency and ability.
2. Brainstorm ideas for new and innovative products or services.
3. Use a variety of feasibility tests, assess and select prospective new venture concepts for further study.
4. Conduct focus groups, surveys, and other methods for researching customer reaction to various new venture concepts.
5. Conduct a variety of secondary research activities to analyze competition, market trends, industry structures, and other issues relevant to specific new venture concepts.
6. Examine and analyze issues related to intellectual property protection for specific new product concepts, (e.g., patent and trade name searches).

Syllabus: UNIT I

Entrepreneurial traits types and significance. Definitions characteristics of Entrepreneur type's. Qualities and functions entrepreneurship. Role. and importance of entrepreneur economic growth .Competing theories entrepreneurship .Entrepreneurial Development Programmed in India History Programe in India History . Support. Objective stages of performances. Planning and EDP Objectives.

UNIT II

Target group selection of center pre-training work. Go\-t Policy towards SSI's. Entrepreneurial Behaviors entrepreneurial motivation. N - Achievement management success. Entrepreneunal success in rural area. Innovation and entrepreneur.

UNIT III

Establishing Entrepreneurs System. Search for business idea. sources of ideas, processing. input requirements. Sources and criteria of farcing ,fixed and working capital assessment Technical assistance, marketing assistance, sickness of units and remedial assistance Preparation of feasibility reports and legal formalities and documentation .

UNIT IV

Small Business in Indian Environment - Economic, Social. Political Cultural and Legal Policies Governing Small Scale Units. Industrial Policies and Strategies relating to smsil scale sector; Technological know-how and Appropriate Technology; Quality Circles and productivity, and linkage between Small and Big Business.

UNIT V

Organizational Structure and other Characteristics of Small -Firms .Special Problems m the Management of small Business in various Functional Areas like Finance. Marketing .Production and Personnel Sickness in the small Scale Sector. Modernization of Small and Village Industries; Training Programmes and consultancy Senders; Institution Assisting Export Promotion of Small Business m India; Export Promotion Councils Global perspective of Small Business in selected countries.

UNIT VI

Problems of Industrialization in underdeveloped countries with special reference to India .Industrial policy. Regulations and control of Industries in India , Mechanics of setting of new enterprises -size and location, optimum units-its meaning and determinants size of industrial units in India. Theory of industrial location factors determining the industrial location. Regional distribution of industrial activity in India; Recent trends in the localization of industrial activity in India, Regional planning of industrial activity in India; Feasibility studies technical . marketing and financial . Managerial problems of new Enterprises production purchasing. Financing labour and marketing problems . Facilities provided by different Institutions and Agencies in India .financing facilities for new enterprise . marketing and other facilities .

Text Books:

1. Dynamics of Entrepreneurial Development and Management – Vasant Desai, Himalaya Publishing House.

VII SEMESTER

VII Semester B.E. (Industrial Engineering)

Course Code: INT401 **Course: Quality Engineering**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

Students shall be able to

1. Make control charts for predicting loss of process control.
2. Make use of statistical tools for minimizing inspection in acceptance control.
3. Design quality management and assurance systems.
4. Predict and evaluate reliability of the products.
5. Develop skills to increase quality and reliability of manufactured product

Syllabus: UNIT I

Definition of Quality, Quality Planning, Quality Assurance Quality of Design and Manufacture . Grade and Quality; Quality Characteristics. Elements Definition of Inspection as liability. Inspection & Quality Control, TQM. Cost of Quality, Shewharts Experimentation with Normal Bowl. Probability Distributions, Types .Normal, Poisson and Binomial Distribution.

UNIT II

Variation, Causes of Variation in Manufacturing Processes, Histogram application in process control, Concepts of control chart/Attributes and variable control charts, X and R Chart Plotting. Data to be acquired. Patterns Observed in X and R chart. Interpretation of patterns, Processes Variability Calculations Procedures. Importance of process variability.

UNIT III

Attributes Control Charts, Plotting p & np chart .Plotting Procedure, Patterns observed Interpretation. plotting c and u chart, Patterns observed interpretation of c and u Chart, Application .Importance, Comparison with X and R Charts.

UNIT IV

Concepts of acceptance Sampling, Comparison with 100% Inspection, Cost of inspection. Sampling Inspection Types, Single Double Multiple and Sequential Sampling relative Merits and Demerits of each, probability' of Acceptance .Calculations in single sampling. Concepts of AQL and Producer's Risk Concepts of LTPD and consumers Risk, OC Curve, Concepts of AOQ & AOQL , Study of standard sampling plan LS-2500 and its Application,

UNIT V

Definition of Reliability. Quality and Reliability. Methods of Estimation of Reliability, Field Failure Data Analysis, Failure Rate. Failure Density, Life testing, MTBF.MTTF , Bath Tub Curve.

UNIT VI

Hazard Models Maintainability & Availability, Reliability Allocation Series Systems, Parallel Systems. Combined Series and parallel Systems. Block Diagrams. Standby System. Derating and Maintenance.

Text Books:

1. Quality Planning and analysis - Juran Tata, McGraw Hill.
2. Statistical Quality- Control - Eugene L Grant, McGraw-Hill

Reference Books:

1. Quality Engineering Handbook - Thomas Pyzdek, Paul A. Keller, CRC Press
2. Juran's Quality Handbook - Joseph M. Juran, A. Blanton Godfrey, McGraw Hill
3. Reliability Engineering Handbook - Dimitri Kececioglu, DEStech Publication

VII Semester B.E. (Industrial Engineering)

Course Code: INP401 **Course: Quality Engineering Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes:

Students shall be able to

1. Make control charts for predicting loss of process control.
2. Make use of sampling methods for inspection in acceptance control.
3. Predict and evaluate reliability of the products.
4. Make quality control plan and better decision making

Syllabus:

Practicals are based on the syllabus given in the theory.

VII Semester B.E. (Industrial Engineering)

Course Code : INT402 **Course : Database Management System**

L: 4 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 08**

Course Outcomes :

Students shall

1. Realize the importance of having relational database for a given information system.
2. Organize the raw data such that there is no loss of data from the system and yet the data of different entities is integrated.
3. Make the data entity set such that data does not become redundant over a period of time.
4. Design the SQL to retrieve the data from the system.
5. Use the RDBMS to capture the data from the various Business Processes and integrate it in a system.
6. Ensure the data integrity, robustness and error handling features in the software that will be designed for any Business system.

Syllabus: UNIT I

Introduction: Purpose of Database Systems, Views of data, Data Models, Database language, Transaction Management, Storage Management, Database Administrator, Database Users, Overall System Structure, Different types of Database Systems E-R Model: Basic Concepts, Design Issues, Mapping Constraints, Keys, E-R Diagram, Weak Entity set, Extended E-R features, Design Of an E-R Database Schema, Reduction of an E-R schema to Tables

UNIT II

Relational Model: Structure of Relational Database, The Relational Algebra, The tuple relational calculus, The Domain Relational Calculus, Views SQL- Background, Basic Structure, SET operations, Aggregate functions, Null Values, Nested Sub queries, Derived Relations, Views, Modification of Database, Joined Relations, DDL, Other SQL features

UNIT III

Transaction : Transaction Concepts, State, Implementations of Atomicity and durability, Concurrent Executions, Serializability, Recoverability, Transaction Definition in SQL.

UNIT IV

Concurrency Control: Lock based protocol, Timestamp based protocol, Validation based protocol, Multiple Granularity, Multi version Schemes, Deadlock Handing, Insert and Delete operations, Concurrency in index structure Query Optimization

UNIT V

Relational Database Design : Pitfalls in Relational-Database Design, Decomposition, Normalization Using Functional Dependencies, and Normalization Using Multi valued Dependencies, Normalization Using Join Dependencies, Domain-Key Normal Form and Alternative Approaches to Database Design Other Relevant Advance Topics and Applications

UNIT VI

Object Oriented Database: Decision-Support Systems, Data Analysis, Data Mining, Data Warehousing, Spatial and Geographic Databases, Multimedia Databases, Mobility and Personal Databases, Information-Retrieval Systems, Distributed Information Systems, The World Wide Web

Text Books:

1. Database System - Rob Comell Thomson learning
2. RDBMS - Korth'
3. RDBMS - Date

Reference Books:

1. Database Management Systems - Raghu Ramakrishnan, Johannes Gehrke, McGraw Hill
2. Database Management Concepts - S. Sudarshan, Henry F. Korth, McGraw Hill
3. Fundamentals of RDBMS - S. Sumathi, S. Esakkirajan, Springer

VII Semester B.E. (Industrial Engineering)

Course Code: INP402 **Course: Database Management System Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits: 02**

Course Outcomes:

1. Students should be able to make normalized Entity-Relation diagram of the data of a given system.
2. Should be able to create logical entity sets and manipulate (add/ retrieve etc.) the data w.r.t the entity sets.
3. Students should be able to add constraints in the entity sets to maintain the data integrity.
4. Students should be able to add index in the system for speedy retrieval of the data.
5. Students should be able to give a decision control feature to the designed database system.
6. Students should be able to add a robust error handling mechanism in the database system.

Syllabus:

Practicals are based on the syllabus given in the theory.

VII Semester B.E. (Industrial Engineering)

Course Code: INT403 **Course: Ergonomics & Value Engineering**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

1. Students will be able to put ergonomic assessments and solutions to practical use in the workplace.
2. Students will be able to identify injuries that occur in workplace due to improper design.
3. Students will be able to find and assure that the workplace fits the worker
4. Students will be able to reduce unwanted functions of a product and reduce production/ material cost.
5. Students will be able to apply the value engineering techniques of cost saving in industrial environment.
6. Students will be able to apply function-oriented thinking to any project or product.

Syllabus : UNIT I

The nature of Ergonomics: Scope, applications. Productivity correlation, System concepts, Human machine System. Characteristics, Capabilities limitations of man, system design. Metabolism & heat regulation. Human Perception.

UNIT II

Anthropometry : Structural and functional dimensions, collection of anthropometric principles in application of anthrop metrics data. Design of workplace, Seat design.

UNIT III

Information input and processing : concept of information, coding of information, human information processing model, memory, decision making, Attention, compatibility, mental workload. Design of displays, speech communication, Design of controls, hand tools and devices.

UNIT IV

Environmental Engineering : Heal exchange process. Methods of heat exchange, environmental factors influencing heat exchange. Zone of heat exchange. Measurements of thermal variables, heat stress, cold stress, thermal effects of clothing- Noise level measurement. Physiological effects of noise, effect of noise on performance & communication, noise reduction & exposure limit, illumination, measurement of light, concept of visibility, effect of light on performance, distribution of light, glare.

UNIT V

Organization Factors : Methods of investigating work, methods of measuring work and activity, fatigue. Physical workload, organization of work. Heavy work. Light work, repetitive and non repetitive work, light physical work. Work rest cycle, inspection, shift work. Effect of age and disability.

UNIT VI

Value Analysis & value Engineering : Concept, cost and value, project selection and scope, habits, Roadblocks & attitudes. The value Engg. Job plan, information phase, rules of function definition, FAST, function analysis, creative thinking, techniques, idea activators & stimulators, evaluation phase, investigation phase, Management of value analysis programme.

Text Books :

1. Human factors Engg. & Design - Mark S. Sanders. Ernest J. Me McCormick: McGraw Hill International Editors
2. Ergonomics: Man in his working Environment - Murrell, K. Chapman and Hall London.
3. Human Factors Design Handbook -Wooden Vs. McGraw Hill New York.

Reference Books :

1. Introduction to human factors Engineering - Christopher D. Wikkens, John D. Lee, Pearson
2. Value Engineering - Pergamon Press
3. Human factor Engg. & Ergonomics: A System Approach- Stephen J. Guastello, CRC Press

VII Semester B.E. (Industrial Engineering)

Course Code : INP403 **Course : Ergonomics & Value Engineering Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits : 02**

Course Outcomes :

1. Students will develop ability to solve ergonomics related problems in industry.
2. Students will develop ability to indentify occupational hazards related to improper design.
3. Students will develop ability to design workplace ergonomically
4. Students will develop ability of creative thinking.
5. Students will develop ability to design low cost and high value products
6. Students will develop ability to apply function-oriented thinking to any product

Syllabus :

Practicals are based on the syllabus given in the theory.

VII Semester B.E. (Industrial Engineering)

Course Code: INT404 **Course: Engineering Economy & Cost Control**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes:

Students shall be able to

1. Understand objectives and operations of enterprises with respect to its formation\
2. Develop skills for taking better decisions for selections amongst investment proposals from the enterprise.
3. Analyze and interpret the financial statements
4. Classify different types of costs and costing procedures and apply it for ascertainment of costs of a product or a process.
5. Better decision making power using proper technique for preparation of budgets and profit analysis.

Syllabus : UNIT I

Definition & Scope of Finance Function. Financing of Engineering Enterprises Ownership & Borrowed Capital, equity shares, preferential share, debentures, bonds etc. Individual ownership. Partnership. Joint stock company. Company formation, Introduction to Capital market. Stock Markets - Objectives & operations.

UNIT II

Engineering Economy, Principles of money -Time relationship, The nature & purpose of engineering economy, simple interest, compound interest. Discounted cash flow diagram, Present. Future & Annual worth nominal and effective interest rates. compounding more often than once per year. Gradient Series, Applications of money – time relationship.

UNIT III

Methods of making Engg. Economy Studies, Basic concepts, study period (Equal &. Unequal) Equivalent worth methods, rate of return methods. Payback period methods, mutually exclusive investment alternatives in terms of combination of projects. Depreciation, Methods of Depreciation, effect of selection of Depreciation method on Balance sheet of the company.

UNIT IV :

Elements of Accounting, Preparation and Interpretation of profit and loss accounts and balance sheet. Analysis of financial statements, use of ratios. Index analysis, common size analysis. Trend analysis, Du-pont chart. Exposure to one of the Standard Financial Accounting Software Package.

UNIT V :

Costing Systems, Job Costing, Batch Costing. Simple Process costing with normal & abnormal losses & Gains. Standard costing & variance analysis, (Analytical treatment expected on Process costing and Standard costing only)

UNIT VI :

Management Accounting, Marginal Costing, Break Even analysis - C.V.P. analysis. Application of costing to decision making like make or buy. Add or drop, operate or shut down etc.. Budget & Budgetary Controls. Concepts of budgeting, advantages & limitations of fixed & Flexible budget.

Text Books :

1. Financial Management (Theory & Practice) -Prasanna Chandra - Tata McGraw-Hill
2. Financial Management and Policy - . James C. N. Horne – Prentice Hall
3. Practice in Accountancy – Shankar liad Basil & Monilal Das –Amit Kumar Biswas

Reference Books :

1. Engg. Economics and Costing - Sasmita Mishra, Prentice Hall
2. Engineering Economics - R. Panneerselvam, Prentice Hall

VII Semester B.E. (Industrial Engineering)

Course Code: INP405 | **Course: Project Seminar**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week | **Total Credits: 04**

Course Outcomes :

The final year project is one of the primary the mechanisms used by the College to provide the students with an opportunity to gain experience in the practical, effective, efficient, and beneficial application of what you have been studying for the past several years.

Critical thinking in problem solving

Presentation and communication skills

Report organization and writing skills

Independent learning and information integration skills

Project management skill

Work as an individual, with support from a supervisor, formulating solutions to day-to-day problems by integrating knowledge and experience gained on the course and outside the course.

VII Semester B.E. (Industrial Engineering)

Course Code: INT406 **Course: Knowledge Management System**

L: 2 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits: 0**

Course Outcomes:

Students shall

CO1 : Understand concept of knowledge management. CO2 : Understand the impact of knowledge management. CO3 : Understand the knowledge management life cycle.

CO4 : Understand the activities undertaking in developing knowledge management.CO5: CO6:

Understand how organization requires knowledge management system. Understand how knowledge management could facilitate organization growth.

Syllabus:

Concept of Knowledge, Defining Knowledge Management, History of Knowledge Management, Elements of Knowledge Management, Knowledge Management Tools, Implementation of Knowledge Management. Knowledge generation, Knowledge coordination and codification, Knowledge transfer and reuse, Technologies and Knowledge management and Knowledge management strategies.

Text book:

1. Knowledge Management by Shelda Debowski, 2006, Milton, QLD: John Wiley & Sons Australia Ltd.
2. Introduction to Knowledge Management, ASEAN Foundation, Published (2008) by the ASEAN Foundation, Jakarta, Indonesia.

Reference Books:

1. Knowledge Management System for Business - Robert J. Thierauf, Greenwood Publishing Group
2. Knowledge Management System - Ronald Maier, Springer

VIII SEMESTER

VIII Semester B.E. (Industrial Engineering)

Course Code: INT407 **Course: Industrial Automation**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes:

Students shall be able to

1. Understand the concept of automation in manufacturing and differentiate the various automation processes. Evaluate the process and product requirements for an automated industry
2. Evaluate the automation proposals and compare the various alternatives.
3. Understand the various transfer mechanisms and evaluate the performance of automated transfer and assembly line. Estimate the cycle time in production and assembly line, evaluate the performance of line.
4. Differentiate the various robot configurations, links and anatomy, use of the specific sensor and robot for a given application.
5. Identify the elements of control system, Evaluate transfer function for control system for single and multiple inputs.

Syllabus:

UNIT I

Overview of automation, Types of automation, Mechanization and automation, Automation strategies, hard automaton devices. Automated factor

UNIT II

Manufacturing operations, Types of production, Production Concepts and Mathematical Models, Economics of automation, Evaluation of automation proposals, Break event analysis.

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UNIT III

Automated transfer lines, Fundamentals of Automated Production Lines, Storage Buffers, and Applications of Automated Production Lines. Analysis of transfer lines with internal Storage and without storage.

UNIT IV

Automated Assembly lines Automated Assembly Systems, Fundamentals of Automated Assembly Systems, Quantitative Analysis of Multi station assembly Systems, Parts Delivery System at Work Stations, Single Station Assembly Machines, Partial Automation.

UNIT V

Industrial robots, Robot elements, Robot Control-Fundamental principles, Joints and links, Configurations, Classification, Robot control systems , End effectors, Grippers, Accuracy and repeatability, Applications of industrial robots.

UNIT VI

Introduction to Control System, mathematical modeling of system component and complex system, block diagram algebra, analysis of control system and system stability, path and speed control systems, adaptive control.

TEXT BOOKS:

1. Automation, Production Systems and Computer Integrated Manufacturing , Groover M P, Prentice Hall
2. Yoram Koren, Robotics for Engineers- McGraw Hill
3. Robotics, K.S. Fu, R.C. Gonzalez, C.S.G. Lee , McGraw Hill
4. Pressman R.S, Numerical Control and CAM-. John Wiley 1993 Williams
5. Principles of Automation & Automated Production Process, Malov and Ivanov , Mir Publication

REFERENCE BOOKS:

1. Standard Handbook of Industrial Automation - CONSIDINE D M, and CONSIDINE G D, Chopman and Hall, London, 1986.
2. Performance Modeling of Automated Manufacturing Systems - Viswanatham N & Narahari Y, Prentice Hall of India (P) Ltd, 1992.
3. The design and Operation of FMS - Ranky P G, IFS Pub. Uk, 1988.

VIII Semester B.E. (Industrial Engineering)

Course Code: INT408 **Course: Management Information System**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes:

Students shall

1. Realize the importance of having a Management Information System in a given business enterprise.
2. Be able to leverage the IT infrastructure as a growth carrier for a given business model.
3. Be able to make the necessary changes in the organization to make the best use of IT growth. To empower the employee in the lower strata of the organization as they capture and process the valuable data.
4. Be able to evolve an effective decision support system (DSS) to guide the decision making and forecast the effect of those decisions.
5. Be able to devise and use the artificial intelligence to accomplish the complex task of their business process.
6. Be able to integrate and streamline the business processes of a business enterprise and add value to it.

Syllabus:

UNIT I : Basis of MIS, Different types of MIS, Web Engineering, Concepts related to Re- Engineering. Distribution System & System Documentation, System Integration & Testing Methodologies, Master Transaction Processing Mechanism.

UNIT II : Managing Data Resources: Data organization, database environment. Designing of database. Trends in database Management requirement for database system.

UNIT III : Decision support system. Group decision system. Executive support system, Telecommunication & networking

UNIT IV : Artificial Intelligence, Expert system. Fuzzy logic. Neural networks.

UNIT V : Development & Implementation of MIS, Quality assurance in MIS, Information System failure. Causes of Information system success & failure. Prototyping, Developing system with application software packages.

UNIT VI : Information system in various departments.

Text Books:

1. MIS By Kenneth C Landon & Jane Landon.
2. MIS by Sadagopalan (TMH)
3. Principles of information System by R.M. Stair & George W. Reynolds Thomson Learning

Reference Books:

1. Management Information System - Kenneth C. Lauden, Carol Guercio Traver, Prentice Hall
2. Management Information System - S. Sadagopalan, Prentice Hall
3. Management Information System - Eff. Oz, Cengage learning

VIII Semester B.E. (Industrial Engineering)

Course Code: INP408 | **Course: Management Information System Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week | **Total Credits: 02**

Course Outcomes:

1. Students should be able to capture and process all the information of a given system.
2. Should be able to revise/reengineer the business process by leveraging the benefits of IT growth.
3. The database design should be in consonance with the Information system of the organization.
4. Students should be able to do thorough testing of the developed software.
5. Students should be able to apply the knowledge of artificial intelligence to accomplish the complex task.
6. Students should be able to devise an effective Decision Support System for smooth functioning of the business.

Syllabus:

Practicals are based on the syllabus given in the theory.

VIII Semester B.E. (Industrial Engineering)

Course Code:INT409 | **Course: Organizational Behavior**

L: 2Hrs., T: 0 Hrs., P: 0 Hrs., Per week | **Total Credits:0**

Course Outcomes:

Students shall

1. Conceptualize the components of individual and group behavior
2. Understand the practicability of communication
3. Understand the various work situations
4. Apply behavioral techniques in Organizations

Syllabus:

Unit 1: Introduction To Organizational Behavior - Psychology - Foundation Of Individual Behavior - Definition Need And Importance Of Organizational Behavior - Nature And Scope - Framework Of Organizational Behavior Models, theoretical perspectives

Unit 2: Personality - Types - Factors Affecting Personality Theories - Perception - Importance - Factors Influencing Perception - Interpersonal Perception Types, Learning Types Of Learning Styles - The Learning Process - Learning Theories - Ob Modification; Motivation - Theories - Importance - Types - Motivation At Work - Designing Motivating Jobs.

Unit 3: Group Dynamics - Group Behavior - Formation - Types Of Groups - Influence - Emergence Of Informal Leaders And Working Norms - Group Decision Making - Interpersonal Relations - Communication – Control

Unit 4: Leadership - Meaning - Importance Trait, Behavioral And Contingency Theories- Evolution Of Leaders - Leadership Styles - Leaders Vs Managers; Power And Politics - Sources Of Power - Power Centers - Trait And Behavioral Analysis (T.A) Work Stress.

Unit 5: Organizational Structure and Design - Organization Climate - Factors Affecting Organization Climate - Importance; Job Satisfaction - Determinants - Measurement - Influence On Behavior - Organizational Change.

Unit 6 : Organizational Development - Characteristics - Objectives - Team Building Organizational Effectiveness - Perspectives - Approaches- Organizational Conflict- Causes, Types, Management Of Conflict - Cases.

Text Books :

Stephen Robbins, Organizational Behavior, Prentice Hall Of India, 9th Edition, 2001. Fred Luthans, Organizational Behavior, Mcgraw Hill Book Co, 1998.

Aswathapa, Organizational Behavior, PHI Publications.

Reference Books:

1. Management and Organizational Behavior - Laurie J. Mullins, Pearson
2. Organizational Behavior - David Buchanan, Andrzej Huczynski, Pearson
3. Organizational Behavior - Steven L. McShane, Mary Ven Glinow, McGraw Hill

VIII Semester B.E. (Industrial Engineering)

Course Code: INT410-1 **Course: Creativity and Innovation**

L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 7**

Course Outcomes:

Students shall have following traits. CO1: Self- Awareness.

CO2: Creative thinking and creative process. CO3: Challenging assumptions and boundaries. CO4: Critical thinking and evaluation.

CO5: Identifying what makes for a culture of innovation and creativity. CO6: Challenging myths about creativity.

CO7: Sustaining innovation in organizations and teams. CO8: Idea-generation facilitation skills.

CO9: Mastering relationships for innovation. CO10: Leadership behaviors for innovation.

Syllabus:

Thought and creative management; management thinking, rationality and the power of themetaphor.Creative processes; problem solving, brainstorming, mapping and networking ,intuition, judgement and imaging. Removing blocks to creativity. Exploiting the idea; scaling up, intellectual property, complementary assets, strategicarchitectures

Text book :

Out of our Minds: Learning to be Creative, Ben Robinson

Reference Books:

1. Creativity and Innovation - John W. Haefele, Chapman & Hall
2. Innovation and Creativity - Filip DeBeule, Ysabel Nauwelaerts, Edward eager Publication
3. Creativity and Entrepreneurship - Lynn Book, David Phillips, Edword eager Publication

VIII Semester B.E. (Industrial Engineering)

Course Code: INT410-2 (Elective-II) **Course: Research Methodology**

L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 7**

Course Outcomes:

Students shall be able

CO1: To systematise and summarise data of various research designs.

CO2: To present results of various research designs in written form and orally. CO3: To create and substantiate research methodology and design.

CO4: To prepare and present a report of theoretical research.

CO5: To prepare and present reports of quantitative and qualitative research.

Syllabus :

Data collection, analysis and systematization of various research designs, Characteristics of data summarizing of various research designs, Specificity of oral and written presentation of various research designs, Interpretation of results in various research designs, Methodological parameters of various research designs, Various types of research designs and their substantiation, Structure and methodological parameters of research project, Specificity of content and relationships between parameters in research project report, Methodological and technical designs of research project report, Differences and similarities of quantitative and qualitative research report.

Text book:

1) Anyon J., Dumas M.J., Linville, D. Nolan K., Perez M., Tuck E. and Weiss J. "Theory and Educational research towards Critical Social Explanation" (2009)
2) Oppenheim A.N. Questionnaire Design Interviewing and Attitude Measurement. (2006)
3) Thomas R.M. Blending Qualitative and Quantitative Research Methods in Theses and Dissertations. (2003)
4) Creswell, J.W. Educational research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research. (2005)
5) Gorard S., Taylor C. Combining Methods in Education and Social Research. (2004)

Reference Books:

1. Research Methodology - Ranjit Kumar, SAGE Publication
2. Research Methodology - R. Panneerselvam, Prentice Hall
3. Research Methodology - C.R. Kothari, Wiley Easten Limited

VIII Semester B.E. (Industrial Engineering)

Course Code: INT410-3 (Elective-II) **Course: Web Technologies**

L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 7**

Course Outcomes :

Students shall

CO1: Understand and apply the design principles of HTML and Java Script to create static and dynamic web pages. CO2: Understand the difference between HTML and XML scripting languages.

CO3: Be proficient in creating reusable web component using java bean.

CO4: Be able to use web server and data base servers using specific vendor related software's.

CO5: Be able to perform crude operations in data base servers, operations that are insertion, deletion, creation and updating.

Syllabus:

Introduction To Web Technology, Extensible Markup Language, Java Based Web Technologies- Java Servlets, Java Based Web Technologies - Java Server Pages(JSP, ASP) Design principles of HTML and Java Script to create static and dynamic web pages. Difference between HTML and XML scripting languages.Engineering structural design of XML and parse construction tree model.Client side validation procedure in web applications.Creating reusable web component using java bean.Web server and data base servers using specific vendor related software's. Crude operations in data base servers, operations that are insertion, deletion, creation and updating. Response generation process in web servers.

Text book:

1) Dietel and Nieto(2008), Internet and World wide Web How to Program, 4thedition, PHI/Pearson Education Asia, New Jersey.
2) H. Schild(2002), The Complete Reference JAVA 2, 5thedition, Tata McGraw Hill, New Delhi
3) B. Boiko(2005), Content Management Bible, USA
4) S. M. Grath(1998), XML by Example, 5thedition, Prentice Hall of India / Pearson Education, India
5) C. Bates(2002), Web Programming building Internet Applications, 2ndedition, WILLEY Dream Tech, New Delhi, India

Reference Books :

1. Web Technologies : A Computer Science Perspective - Jeffrey C. Jackson, Pearson
2. Internet & Web Technologies- Raj Kamal, Tata McGraw Hill3.Exploring Web Technologies for Designers- James Bennett, Cengage learning

VIII Semester B.E. (Industrial Engineering)

Course Code: INT410-4 (Elective-II) **Course: Non Linear Optimization Technique**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 07**

Course Outcomes:

Students shall be able to

1. Do optimal setting of variable to 0 or 1 in binary programming situation.
2. Get optimal solution using classical technique.
3. Get optimal solution to nonlinear optimization problem using digital techniques or geometric programming.
4. Determine optimal solution in uncertain situation and to predict future values of various states undergoing transition.
5. Determine optimal solution under various ranges of parameter and also find optimal solution in multiple objective environments.

Syllabus: UNIT I

Classical Optimization Techniques : Single and multi variable Optimization, Langrangean function, Kuhn–Tucker Conditions.

UNIT II

Nonlinear Programming I : One-Dimensional Minimization Methods: Unimodal Function, Unrestricted Search, Search with Fixed Step Size, Search with Accelerated Step Size, Exhaustive Search, Dichotomous Search, Interval ,Halving Method, Fibonacci Method, Golden Section Method, Comparison of Elimination Methods, Quadratic Interpolation Method, Cubic Interpolation Method, Direct Root Methods .

UNIT III

Nonlinear Programming II : Unconstrained Optimization Techniques: Random Search Methods, Grid Search Method, Univariate Method, Pattern Directions, Simplex, Steepest Descent (Cauchy) Method, Conjugate Gradient (Fletcher–Reeves) Method, Newton's Method, Quasi-Newton Methods, Davidon–Fletcher–Powell Method.

UNIT IV

Nonlinear Programming III : Constrained Optimization Techniques: Random Search Methods, Complex Method, Sequential Linear Programming, Basic Approach in the Methods of Feasible Directions, Zoutendijk's Method of Feasible, Rosen's Gradient Projection Method, Sequential Quadratic Programming, Interior Penalty Function Method, Exterior Penalty Function Method.

UNIT V

Geometric Programming :

Posynomial, Primal–Dual Relationship and Sufficiency Conditions, Degree of difficulty, orthogonality and normality conditions.

UNIT VI

Modern Methods of Optimization :

Genetic, Simulated Annealing, Particle Swarm Optimization, Ant Colony Optimization, Optimization of Fuzzy Systems, Neural-Network-Based Optimization

Text book:

1."Engineering Optimization Theory and Practice", Fourth Edition ,Singiresu S. Rao ,JOHN WILEY & SONS, INC.

Reference Books:

1. Optimization theory and Methods: Non linear Programming - Wenyu Sun, Ya-Xiang Yuan, Springer
2. Linear & Non linear Programming - David G. Luenberger, Yinyu Ye, Springer
3. Non linear Programming - Anthony V. Fiacco, Garth P. McCormick, SIAM

VIII Semester B.E. (Industrial Engineering)

Course Code : INT410-5 (Elective-II) **Course : Tool Design**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 07**

Course Outcomes :

1) Students should be able to understand basic principle of metal cutting theory.
2) Students should be able to describe design criterion for designing single point and multipoint cutting tools.
3) Students should be able to understand the selection of material for cutting tools; classify various cutting tools and identify their nomenclature
4) Students should be able explain principle of dynamometry and their types .
5) Students should be able to describe tool design methods for punch and die of various sheet metal operations like Punching, Bending & Drawing and equipments used in it.
6) Students should be able to explain the principles of clamping, jigs and designing fixtures and identify fixtures.

Syllabus :

Unit 1

Introduction to tool design: Cutting Tool and Machine tool, definition of Tool, Tool materials, Tool wear and machinability, economics of metal machining, types of chips, Requirement of Tool: Tool angles, Importance of each angle tool signature force & velocity relation at chip –tool –work piece interface, Mechanics of metal Cutting: Merchants force Circle diagram, single point cutting tool design

Unit 2

Hole making operations: drilling process. Drills, types of drills, nomenclature of twist drill elements, drill point geometry, chip control in drilling; Design of drill, axial thrust force calculations. Power requirements in drilling. Milling: types of milling cutter, important element s of milling cutter, steps in design of side and face miliing cutter.

Unit 3

Dynamometry: basic design principles, types of dynamometer, mechanical, electrical, pneumatic, strain rings and gauges, Jigs and fixtures: types and general design principles.

Unit 4

Press working: power press types, material handling equipments, introduction to die cutting operations, fundamentals of die cutting operations, press working materials, strip layout. Cutting action in punch and die, clearance, types of die construction, simple, inverted, progressive, compound and combination dies. Punch types, cutting forces in piercing, blanking, types of strippers.

Unit 5

Sheet metal bending: Calculation of blank size, types of bending dies, general design principles, spring back, bend allowance, bending pressure, Forming dies: Types, embossing, coining.

Unit 6

Drawing Operations, Metal flow during drawing, variables affecting metal flow during drawing, radius on punch and dies, percent reduction and depth of draw, drawing die clearance, design of draw die.

Books Recommended.

1. Tool Design – Donaldson Tata McGrew Hill
2. Introduction to Jig ad Tool design – M H Kempester
3. Jigs and Fixtures - Grant

VIII Semester B.E. (Industrial Engineering)

Course Code: INT411-1 (Elective-III) **Course: Materials Management**

L: 4 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 09**

Course Outcomes :

Students shall be able to

1. Increase the profitability of industry, so as to face the challenges arising out of present scenario of competitiveness due to globalization of economy.
2. Develop the sense for understanding high performance production and materials management practices.
3. Use various statistical and mathematical techniques to improve productivity.
4. Understand optimal utilization of resources and procurement of material of right quality, right quantity, right price at right time and right place.
5. Take make or buy decisions.
6. Maintain good supplier relations with the supplier.

Syllabus :

UNIT I

Production System:

Types of production system, Input-output Models, simplification & diversification Production Planning : Functions and objectives, forecasting, aggregate planning Determination of capacity required and available. Procedures and techniques of routing. Man machine interface. Types of machine in manufacturing, sequencing, line balancing. Computer in production management.

UNIT II

Production control :

Nature of production control in different types of production. Techniques of scheduling, dispatching, and expediting. Critical ratio, recording progress. Process pluming introduction, process planning: activities, documentation, various approaches to process Planning traditional manufacturing approach, generative approach, variant approach. Group Technology for process planning.

UNIT III

Modern concepts in Management :

Gernba Kalzen, SMED, Zero Defect, CAD, CAM, CAPP, CIM, MRP - Concepts, Lot sizing techniques , Bill of materials.

UNIT IV

Introduction to Materials Management:

Importance, objectives functions. Integrated Material approach Characteristics. Computers in materials management.

Purchasing : Importance of good purchasing system & Functions, Organization for purchasing. duties of purchase manager. Methods of purchasing, purchasing policy. Whether to purchase or Manufacture. Purchasing parameters. purchasing procedure: steps in purchasing, purchase requisition, Placement of purchase orders. Follow up. Receipt of materials. Vendor development evaluation.

UNIT V

Stores Management:

Function, Stores and storekeeping. Store Accounting.JIT & Kanban. Store accounting records. Valuation of materials issued from stores. Protection of stores. Interrelationship. Physical Verification (Stock - Taking) codification , Obsolete, Surplus and scrap Management.

UNTI VI

Inventory Management:

Inventory, importance Selective control .Classification: ABC, VED. FSN. FIFO, etc, analysis and systems approach for inventory management, inventory control, inventory Models: deterministic Models. Probabilistic (Stochastic) Inventory Models.EOO.

Text Books:

1. Production Planning & Control Management: R.K. Garg&V.Sharma.
2. Material Management & Material Handling: S.C. Sharma.
3. Material Management: Menon , Wheeler Publishing

Reference Books:

1. Hand Book of Materials Management - P. Gopalkrishnan, Prentice Hall
2. Materials Management: An Executives Supply chain Guide - Stan C. McDonald, Wiley
3. Materials Management: Procedures, texts & Cases - A. K. Datta, Prentice Hall

VIII Semester B.E. (Industrial Engineering)

Course Code: INT411-2 (Elective-II) **Course : Reliability and Maintenance Engg.**

L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 7**

Course Outcomes :

CO1 – Students shall able to understand concepts and terminology in reliability.

CO2 – Understand the applications of constant failure model and estimation of system reliability.

CO3 – Should be in position to perform failure analysis and construct fault tree diagram.

CO4 – Understand different maintenance strategies along with recent trends.

CO5 – Should understand planning and scheduling in maintenance and maintenance effectiveness measurement.

Syllabus :

UNIT I

Introduction to reliability, analysis of downtime, concept of availability, random versus deterministic failure phenomena, terms and definitions in reliability, application areas, reliability function, MTTF, Hazard rate function, bath tub curve, conditional reliability.

UNIT II

Constant Failure Rate (CFR) model- Failure modes with CFR model, two parameter exponential distribution, Poisson process, relevant applications.

Reliability of systems – Series configuration, parallel configuration, combined series parallel, redundancy, K out of N redundancy.

UNIT III

Design for reliability –Failure analysis, identification of failure mode, determination of cause, assessment of effect, classification of severity, system safety and fault tree analysis.

UNIT IV

Maintenance concept – Functions, objectives, purpose, system approach to maintenance function.

Maintenance planning and scheduling – Steps in job planning, planning technique, job manual, scheduling, Gantt chart and bar chart, PERT/CPM and CPA network.

UNIT V

Maintenance strategies – Basis of selecting maintenance strategies, types of maintenance, breakdown or emergency maintenance, corrective, opportunistic routine, preventive, predictive, condition based maintenance, risk based maintenance, design out maintenance, comparison of maintenance strategies, total maintenance management.

UNIT VI

Maintenance effectiveness – Overall equipment effectiveness, maintenance effectiveness assessment /survey, Key performance indicators (KPI), maintenance performance measuring indices, maintainability index.

Recent trends in maintenance - Reliability centered maintenance, Total productive maintenance.

Text Books :

1) Reliability and Maintainability Engineering – Charles E. Ebeling, Tata McGraw Hill
2) Maintenance Engineering – Er Sushilkumar Srivastava, S chand.

Reference Books :

1) Reliability Engineering- L. S. Srinath affiliated East- west Press Private Limited
2) Reliability Engineering – E. Balagurusamy Tata McGraw Hill
   Maintenance planning and control – Antony Kelly

VIII Semester B.E. (Industrial Engineering)

Course Code: INT411-3 **Course: Enterprise Resource Planning**

L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 7**

Course Outcomes :

Students shall be able to

CO1: Understand and gain insight into process views of organizations and tools and techniques used to model both as-is and to-be models.

CO2: Apply the process modeling techniques in one or more modeling environments.

CO3: Know and be able to apply key technical terminology in enterprise information systems as they apply in different ERP products and development methods

CO4: Understand key differences between the major ERP applications (such as SAP R/3, and Oracle / People Soft / Sibel) and issues specific to these applications their configuration and management.

CO5: Analyze a current architecture and perform an effective gap analysis before an ERP implementation

CO6: Understand and be able to articulate the life cycle stages of any ERP implementation.

Syllabus :

ERP legacy, ERP's element and sub-system, Impact of ERP on business, ERP implementation, ERP Pros and Cons. Process views of organizations and tools and techniques used to model both as-is and to-be models. Modeling technique in one or more modeling environments.

Key technical terminology in enterprise information systems as they apply in different ERP products and development methods. Key differences between the major ERP applications (such as SAP R/3, and Oracle/PeopleSoft/Sibel) and issues specific to these applications their configuration and management. Effective gap analysis before an ERP implementation.

Mapping of enterprise architectural resources to a contemporary Enterprise Architecture mapping tool Life cycle stages of any ERP implementation. ERP implementation projects. Evaluate the progress of an ongoing ERP implementation project.

Text book :

Enterprise Resource Planning – Jyotindra Zaveri

Reference Books :

1. Enterprise Resource Planning - Alexis Leon, Tata McGraw Hill
2. Enterprise Resource Planning: Concepts & Practice- Vinodkumar Garg, M.K. Venkitakrishnan, Prentice Hall

VIII Semester B.E. (Industrial Engineering)

Course Code: INT411-4 **Course: Mechatronics**

L: 3Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits: 7**

Course Outcomes :

Students shall be able

CO1: Describe the basic building blocks of mechatronic systems (e.g hardware, software, communication, interfacing, sensing, control and actuation)

CO2: Validate if a mechatronic design might be feasible as a solution to a given functional problem formulation.

CO3: Sketch such a technical solution and select component types.

CO4: Identify critical problems/design issues and suggest feasible methods and tools to solve those.

CO5: Summarize and on smaller problems apply a development model for mechatronic product development.

CO6: Model, simulate and synthesize (but not realize) smaller mechatronic systems and products. CO7: Assess implications of requirements on the product design.

Syllabus:

Introduction and Basic concepts, Robotics and Automation, Manipulator Control, Introduction to closed loop control, second order linear system, Introduction to Dynamics, Methods of Robot Programming, Computer integration of Electro-mechanical system, Optoelectronic encoding, System Modeling.

Text book:

1. John J. Craig, Introduction to Robotics (Mechanics and Control), Addison-Wesley, 2nd Edition, 2004
2. L. Sciavicco and B. Sicliano, Modelling and Control of robot Manipulators, The McGraw- Hill Co. Inc., 1996
3. R.J. Schiling, Fundamentals of Robotics: Analysis and Control, Prentice Hall, 1987

Reference Books:

1. Mechatronics: An Introduction - Robert H. Bishop, CRC Press
2. Mechatronics: Principles, Concepts & Applications - N.P. Mahalik, McGraw Hill
3. Mechatronics: Principles, & Applications - Godfrey Onwubolu, Elsevier Press

VIII Semester B.E. (Industrial Engineering)

Course Code: INP412 **Course: Project**

L: 0 Hrs., T: 0 Hrs., P: 6 Hrs., Per week **Total Credits: 12**

Course Outcomes :

The final year project is one of the primary the mechanisms used by the College to provide the students with an opportunity to gain experience in the practical, effective, efficient, and beneficial application of what you have been studying for the past several years.

Critical thinking in problem solving

Presentation and communication skills

Report organization and writing skills

Independent learning and information integration skills

Project management skill

Work as an individual, with support from a supervisor, formulating solutions to day-to-day problems by integrating knowledge and experience gained on the course and outside the course.