SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR - 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2019-20

B. E. (INDUSTRIAL ENGINEERING)

Published by
Dr. R.S. Pande
Principal
Shri Ramdeobaba College of Engineering & Management
Ramdeo Tekdi, Gittikhadan, Katol Road, Nagpur - 440 013
Ph. : 0712-2580011 Fax : 0712 - 2583237
ISO 9001 : 2015 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 2014 for six 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 is actively engaged in giving consultancy to several industries around Nagpur.

The department received following grants from A.I.C.T.E. in the past.

- 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.: 11
   - Ph.D. (Pursuing): 06
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. Software 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 replication 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:

Engineering Graduates will be able to :

1. **Engineering Knowledge :** Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis :** Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design / development of solutions :** Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal and environmental considerations.
4. **Conduct investigations of complex problems :** Use research - based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. **Modern tool usage :** Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society :** Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustain ability :** Understand the impact of the professional engineering solutions in societal & environmental contexts, and demonstrate the knowledge of & need for sustainable development.
8. **Ethics :** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work :** Function effectively as an individual, and as a member or leader in diverse teams, and in multi disciplinary settings.
10. **Communication :** Communicate effectively on complex engineering activities with the engineering community and with society at large such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance :** Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi disciplinary environments.
12. **Life-long learning :** Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Programme Specific Outcomes :

1. Understand the foundations of the linkage between the quality, productivity and cost.
2. Ability to add value to systems, process, products, services and people.

TEACHING SCHEME FOR FIRST YEAR (SEMESTER I & II) BACHALOR OF ENGG
GROUP 1: SEMESTER-I/ GROUP 2: SEMESTER-II

Sr. No.	Code	Course	Branches	Hours/week L	T	P	Credits	Maximum Marks Continual Assessment	End Sem Examination	Total	ESE Duration (Hours)
1.	PHT151	Mechanics	Civil; Industrial	3	1	0	4	40	60	100	03
	PHT152	Oscillations, waves & Optics	Electrical; Mechanical								
	PHT153	Semiconductor Physics	Electronics; EDT; Electronics & Comm; Computer Science Engg; Information Tech.								
2.	PHP151	Mechanics Lab	Civil; Industrial	0	0	3	1.5	25	25	50	–
	PHP152	Oscillations, Waves & Optics Lab	Electrical; Mechanical								
	PHP153	Semiconductor Physics Lab	Electronics; EDT; Electronics & Comm.; Computer Science Engg; Information Tech.								
3.	MAT152/ MAT151	Differential Equations, Linear Algebra, Statistics & Probability / Calculus	All Branches	3	0/1	0	3/4	40	60	100	03
4.	MAP151	Computational Mathematics Lab	All Branches	0	0	2	1	25	25	50	–
5.	EET151	Basic Electrical Engineering	All Branches	3	1	0	4	40	60	100	03
6.	EEP151	Basic Electrical Engineering Lab	All Branches	0	0	2	1	25	25	50	–
7.	MET151	Engineering Graphics & Design	All Branches	1	0	0	1	40	60	100	03
8.	MEP151	Engineering Graphics & Design Lab	All Branches	0	0	4	2	50	50	100	–
9.	HUT152	Constitution of India	All Branches	2	0	0	0	–	–	–	–
10.	PEP151	Yoga/Sports	All Branches	0	0	2	0	–	–	–	–
			Total	12	2/3	13	**17.5/18.5**			**650**	

GROUP 2: SEMESTER-I / GROUP 1: SEMESTER-II

Sr. No.	Code	Course	Branches	Hours/week L	T	P	Credits	Maximum Marks: Continual Assessment	End Sem Examination	Total	ESE Duration (Hours)
1.	CHT151	Chemistry	All Branches	3	1	0	4	40	60	100	03
2.	CHP151	Chemistry Lab	All Branches	0	0	3	1.5	25	25	50	–
3.	MAT151/ MAT152	Calculus / Differential Equations, Linear Algebra, Statistics & Probability	All Branches	3	1/0	0	4/3	40	60	100	03
4.	CST151	Programming for Problem Solving	All Branches	4	0	0	4	40	60	100	03
5.	CSP151	Programming for Problem Solving Lab	All Branches	0	0	2	1	25	25	50	–
6.	IDT151	Creativity, Innovation & Design Thinking	All Branches	1	0	0	1	20	30	50	1.5
7.	INT151	Workshop/Manufacturing Practices	All Branches	1	0	0	1	20	30	50	1.5
8.	INP151	Workshop/Manufacturing Practices Lab	All Branches	0	0	2	1	25	25	50	–
9.	HUT151	English	All Branches	2	0	0	2	40	60	100	03
10.	HUP151	English Lab	All Branches	0	0	2	1	25	25	50	–
			Total	14	2/1	9	**20.5/19.5**			**700**	

Scheme of Teaching & Examination of Bachelor of Engineering
III Semester B.E. (Industrial Engineering)

Sr. No.	Course Code	Course Title	Hours per week L	T	P	Credits	Maximum Marks: Continuous Evaluation	End Sem Exam	Total	ESE Duration (Hrs)
1	MAT258	Introduction to Statistics & Probability-I	3	0	0	3	40	60	100	3
2	INT251	Principles of Mechanical Engineering-1	3	0	0	3	20	30	50	2
3	INP251	Principles of Mechanical Engineering-1lab	0	0	2	1	25	25	50	–
4	INT252	Manufacturing Engineering-1	3	0	0	3	40	60	100	3
5	INP252	Manufacturing Engineering-1 Lab	0	0	2	1	25	25	50	–
6	INP253	Machine Drawing Laboratory	0	0	2	1	25	25	50	–
7	INT254	Facilities Planning	3	0	0	3	40	60	100	3
8	INT255	Object Oriented Programming Methods	2	0	0	2	40	60	100	3
9	INP255	Object Oriented Programming Methods Lab	0	0	2	1	25	25	50	–
10	IDT252	Biology	2	0	0	2	25	25	50	2
11	INP255	Industrial Visit	0	0	2	0	SF/USF Grade			–
12	HUP258	Personality Development	0	0	2	1	25	25	50	2

Scheme of Teaching & Examination of Bachelor of Engineering
IV Semester B.E. (Industrial Engineering)

Sr. No.	Course Code	Course Title	Hours per week L	T	P	Credits	Maximum Marks: Continuous Evaluation	End Sem Exam	Total	ESE Duration (Hrs)
1	MAT261	Introduction to Statistics & Probability - II	3	0	0	3	40	60	100	3
2	INT261	Principles of Mechanical Engineering - II	2	0	0	2	20	30	50	3
3	INP261	Principles of Mechanical Engineering - II Lab	0	0	2	1	25	25	50	–
4	INT262	Manufacturing Engineering-II	3	0	0	3	40	60	100	3
5	INP262	Manufacturing Engineering-II Lab	0	0	2	1	25	25	50	–
6	INT263	Work System Design	3	0	0	3	40	60	100	3
7	INP263	Work System Design Lab	0	0	2	1	25	25	50	1
8	INT264	**Open Elective - I**	3	0	0	3	40	60	100	3
9	INT265	Instrumentation & Metrology	3	0	0	3	40	60	100	3
10	INP265	Instrumentation & Metrology Lab	0	0	2	1	25	25	50	–
11	HUT259	Leadership Skills	2	0	0	2	40	60	100	2
12	CHT252	Environmental Science	2	0	0	0	SF/USF Grade			–

Scheme of Teaching & Examination of Bachelor of Engineering
V Semester B.E. (Industrial Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	INT351	Operations Research-I	3	0	0	3	40	60	100	3
2	INP351	Operations Research-I Lab	0	0	2	1	25	25	50	--
3	INT352	Production Planning & Control	3	0	0	3	40	60	100	3
4	INT353	Organizational Behavior	2	0	0	2	25	25	50	2
5	INP353	Organizational Behavior Lab	0	0	2	1	25	25	50	--
6	INT354	Relational DBMS	3	0	0	3	40	60	100	3
7	INP354	Relational DBMS Lab	0	0	2	1	25	25	50	--
8	INT354	Modeling and Simulation	3	0	0	3	40	60	100	3
9	INP355	Modeling and Simulation Lab	0	0	2	1	25	25	50	--
10		**Open Elective-II**	3	0	0	3	40	60	100	3
11	HUT353	Essence of Indian Traditional Knowledge	2	0	0	0	SF/USF Grade			

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

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	INT361	Operations Research - II	3	0	0	3	40	60	100	3
2	INP361	Operations Research-II Lab	0	0	2	1	25	25	50	--
3	INT362	Supply Chain Management	3	0	0	3	40	60	100	3
4	INT363	Quality Engineering	3	0	0	3	40	60	100	3
5	INP363	Quality Engineering Lab	0	0	2	1	25	25	50	--
6	INT364	Elective-I	3	0	0	3	40	60	100	3
7	INT365	Elective-II	3	0	0	3	40	60	100	3
8		**Open Elective-III**	3	0	0	3	40	60	100	3
9	INP367	Mini Project	0	0	4	2	25	25	50	--
10	INP368	Comprehensive Viva	0	0	2	1	25	25	50	--

Scheme of Teaching & Examination of Bachelor of Engineering
VII Semester B.E. (Industrial Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	INT451	Industrial Automation	3	0	0	3	40	60	100	3
2	INP451	Industrial Automation Lab	0	0	2	1	25	25	50	
3	INT452	Managerial Economics and Cost Management	3	0	0	3	40	60	100	3
4	INT453	Ergonomics	3	0	0	3	40	60	100	3
5	INP453	Ergonomics Lab	0	0	2	1	25	25	50	3
6	INT454	Elective - III	3	0	0	3	40	60	100	3
7	INT455	Elective - IV	3	0	0	3	40	60	100	3
8		**Open Elective - IV**	3	0	0	3	40	60	100	3
9	INP457	Major Project Seminar	0	0	4	2	25	25	50	--
10	INP458	Industry Internship (6-8 weeks) Evaluation	0	0	2	0	--	--	--	--

Scheme of Teaching & Examination of Bachelor of Engineering
VIII Semester B.E. (Industrial Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	INT461	Elective-V	3	0	0	3	40	60	100	3
2	INT462	Elective-VI	3	0	0	3	40	60	100	3
3	INP463	Project/ One Semester Industry Project / Incubation	0	0	12	6	100	100	200	

Total Credits	
Sem III	21
Sem IV	23
Sem V	21
Sem VI	23
Sem VII	22
Sem VIII	12
Total	**122**

Semester / Year	Course	Course Name
4th Sem	Open- Elective-1	INT264-1:- Organizational Behavior Development INT264-2:- Decision Modeling INT264-3:- Six sigma
5th Sem	Open- Elective-2	INT356-1:- Productivity Improvement Techniques
6th Sem	Open- Elective-3	INT366-1 :-Industrial Psychology INT366-2:- Industrial Engineering for IT
7th Sem	Open- Elective-4	INT456-1:- Total Quality Management INT456-2:- Maintenance Engineering INT456-2:- Design of Experiments

Scheme of Teaching & Examination of Bachelor of Engineering
Honors Specialization. (Industrial Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	INTH41	Industry 4.0	4	0	0	4	40	60	100	3
2	INTH51	Soft Computing Methods	4	0	0	4	40	60	100	3
3	INTH61	Taguchi Methods for Experimentation	4	0	0	4	40	60	100	3
4	INTH71	Supply Chain Optimization	4	0	0	4	40	60	100	3
5	INTH81-1	Business Analytics	4	0	0	4	40	60	100	3
6	INTH81-2	Strategic Information Management System	4	0	0	4	40	60	100	3

Scheme of Teaching & Examination of Bachelor of Engineering
Minors Specialization. (Industrial Engineering)

Sr. No.	Course Code	Course Title	Hours per week			Credits	Maximum Marks			ESE Duration (Hrs)
			L	T	P		Continuous Evaluation	End Sem Exam	Total	
1	INTM41	Methods Engineering	4	0	0	4	40	60	100	3
2	INTM51-1	Material Management	4	0	0	4	40	60	100	3
3	INTM51-2	Production Planning and Control	4	0	0	4	40	60	100	3
4	INTM61	Operations Research	4	0	0	4	40	60	100	3
5	INTM71	Quality Engineering and Management	4	0	0	4	40	60	100	3
6	INTM81	Project Engineering & Management	4	0	0	4	40	60	100	3

Syllabus for Semester I / II
(Civil Engineering, Industrial Engineering)

Course Code: PHT151 **Course : PHYSICS : Mechanics**
L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits: 4**

Course Objectives:

1. To develop working knowledge of methods to treat particle and rigid body motions;
2. To introduce kinematics and dynamics of general rigid body motions.

Course Outcomes:

After successful completion of the course students will

1. be able to understand and work with free, damped and forced oscillations;
2. be able to recognize and work problems with conservative as well as non-conservative forces ;
3. be able to use vector dierential operations in solving mechanics problems;
4. understand how to describe and solve simple general rigid body motions.

Module 1: Forces, Newton's Laws (8L)

Coordinate frames, change of frames as linear transformation, rotation matrix, Scalars and vectors - Denition based on their transformation under change of frames; Examples and problems; Newton's Laws of Motion, First law (law of inertia), inertial frame; Second law, concept of force; Third law; Forces in Nature, derived forces; friction, pressure in a fluid; Examples and problems including friction and constraints.

Module 2: One, and Two-dimensional Motion (7L)

One-dimensional harmonic oscillator, damped oscillator, over, critical and under damping; Forced oscillator, undamped and damped cases; Examples, resonance and Q factor; Projectile motion with drag; Two-dimensional oscillator; Charged particle in constant magnetic field.

Module 3: Conservative Forces (5L)

Work and kinetic energy: work-energy theorem, scalar and vector fields, Work done by a force field; Conservative and non-conservative forces, Potential energy function for conservative forces; Gradient of potential energy, F = - V; Curl of a vector field, test of conservation character of a force; Potential near equilibrium point.

Module 4: Angular Momentum, System of Particles (6L)

Angular momentum of a particle, torque of force; Radial-polar coordinates, Planetary orbits and Kepler's laws; elliptical, parabolic and hyperbolic trajectories; **' L'** of a system of particles, torque of external forces,

$$\frac{d\bar{L}}{dt} = \bar{N}_{ext}$$

Module 5: Rigid Body Dynamics-1 (5L)

Denition of a rigid body, rotation in a plane, angular momentum about a point of rigid body in planar motion about a fixed axis, Kinematics, concept of moment of inertia; The physical pendulum.

Module 6: Rigid Body Dynamics-2 (7L)

General rotation of a rigid body, Euler angles, angular velocity; Kinetic energy, moment of inertia tensor, examples, parallel axis theorem, angular momentum of a rigid body; Euler's equations of rigid body dynamics (statement and meaning without derivation), simple examples: rotating rod, torque-free precession.

Text Book(s):

1. Introduction to Mechanics (Second Edition), M. K. Verma, Universities Press 2016.

References:

1. An Introduction to Mechanics, Daniel Kleppner and Robert Kolenko, Cambridge University Press 2010.
2. Online course: Engineering Mechanics (Modules 1, 2,5, 6, 7, 8) by M K Harbola on NPTEL
3. Engineering Mechanics (Second Edition), M K Harbola, Cengage publications, New Delhi, 2013.

Syllabus for Semester BE I / II

Bachelor of Mechanical Engineering, Electrical Engineering

Course Code: PHT152 **Course: Oscillations, Waves, Optics**

L:3 Hrs.,T:1Hrs.,P:0Hrs.,Per week **Total Credits:4**

Course Objectives:

1. To train the student to work with oscillatory phenomena in electrical, mechanical and optical systems;
2. To introduce fundamental concepts and laws as relevant to electromagnetic waves and matter waves.

Course Outcomes:

After successful completion of the course students will understand and be able to work with

1. Free, damped and forced oscillations;
2. Fundamental properties of mechanical waves and their propagation across material boundaries;
3. Basics of electromagnetic waves and optical media, phenomena of interference, diffraction of optical waves
4. Elementary understanding of quantum behavior of electrons in solids.

Module 1: Oscillations (8L)

Quick review of simple harmonic motion, mechanical and electrical oscillators, vector and complex number (phasor) representation, superposition of many SHMs of equal amplitude and equal successive phase difference; Damped oscillations, under, critical and over-damping with stress on mechanical oscillators, problems; Forced oscillations with focus on electrical/mechanical oscillations, impedance of a electrical/mechanical circuit, forcing frequency dependence of velocity, displacement in a forced oscillator, two components of displacement, energy and power supplied by driving force, Q factor.

Module 2: Waves - 1 (5L)

Correlated harmonic oscillations in space and time, statement and meaning of the wave equation, general solution, concept of polarization of waves- transverse and longitudinal waves; Transverse wave on a string, characteristic impedance, reflection and transmission at a string-string boundary, impedance matching, insertion of quarter-wave element.

Module 3: Waves - 2 (5L)

Group of waves, group velocity, meaning of dispersion, causes of dispersion; Standing waves, normal modes of vibrating string, energy in modes, standing wave ratio; Longitudinal waves: sound waves in gases, statement and meaning of expressions for energy distribution and intensity.

Module 4: Wave Optics - 1 (6L)

Light as a transverse polarized electromagnetic wave in vacuum and in homogeneous isotropic dielectric, impedance $|\mathbf{E}|/|\mathbf{H}_{perp,E}|$, Poynting vector, energy; Reflection and refraction of em wave at dielectric-dielectric boundary, parallel and perpendicular polarizations, boundary conditions on E and H components, Fresnel equations, Brewster's angle.

Module 5: Wave Optics - 2 (6L)

Huygens' principle, superposition, interference by division of amplitude and wavefront, Young's double-slit, Newton's rings, Michelson interferometer; Single-slit Fraunhofer diffraction, Rayleigh criterion for resolution, grating and its resolving power.

Module 6: Matter Waves (8L)

Plank's energy packets, Wave-particle duality of de Broglie, Heisenberg uncertainty relations; Wave function for matter waves and its interpretation, position and momentum operators, Hamiltonian operator, Schrodinger's equation; One-dimensional single particle systems: Particle in a infinite square well potential (rigid box), Finite square well potential; Quantum tunneling.

Text Book(s):

1. The Physics of Vibrations and Waves (Sixth Edition), H J Pain John-Wiley 2005.
2. Optics, Ajoy Ghatak, Tata McGraw Hill Education 2005

References:

1. Online course: Oscillations and Waves by S Bharadwaj on NPTEL
2. Engineering Physics (Second Edition), Sanjay Jain and Girish Sahasrabudhe, Universities Press 2016.

Syllabus for Semester I / II

(Electronics Engineering, Electronics Design Technology, Electronics and Communication Engineering, Information Technology, Computer Science Engineering)

Course Code : PHT153 **Course: Semiconductor Physics**

L: 3 Hr., T: 1 Hrs., P : 0 Hrs., Per week **Total Credits : 4**

Course Objectives:

1. To introduce ideas of quantum mechanics necessary to begin understanding semiconductor devices;
2. To familiarize prospective engineers with fundamental concepts of semiconductors and their interaction with light and resulting devices

Course Outcomes:

After successful completion of the course students will

1. have an elementary understanding of quantum behavior of electrons in solids;
2. have a grasp of band structure and its consequences for semiconductors;
3. should be able to use band structure to explain effects of doping, properties of junctions between semiconductors and metals;
4. have an elementary understanding of working of optoelectronics devices

Module 1: Quantum Mechanics Introduction (6L)

Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Energies and wave functions of a single electron in one-dimensional infinite potentials: formulae, function graphs, number of bound states, tunneling

Module 2: Electronic Materials (8L)

Free electron theory, Extension of idea of energy level splitting in molecules to bonding in solids, Energy bands in solids, Kronig-Penny model (to better demonstrate origin of band gaps), Band gap based classification of electronic materials: metals, semiconductors, and insulators, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics: Occupation probability of states, Fermi level, Effective mass.

Module 3: Intrinsic and Extrinsic Semiconductors (10L)

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift, Carrier generation and recombination, Continuity equation, Ambipolar transport.

Module 4: Junction Physics (8L)

p-n junction, Zero applied bias, forward bias, reverse bias, Metal-semiconductor junction, Shottky barrier, Ideal junction properties, Ohmic contacts, ideal non-rectifying barrier, tunneling barrier, Heterojunctions, Materials, Energy band diagram.

Module 5: Light - Semiconductors Interaction (6L)

Optical transition in bulk semiconductors: absorption, spontaneous emission, and stimulated emission; Joint density of states in bulk semiconductors, density of states for photons, semiconductor materials for optoelectronic devices, electron hole pair generations, Photovoltaic effect, Solar cells, Light emitting diodes, population inversion, Optical loss and gain, Semiconductor Laser.

Module 6: Engineered Semiconductor Materials (6L)

Low-dimensional systems such as quantum wells, wires, and quantum dots: design, fabrication, and characterization techniques. Energies and wave functions in three dimensions with one, two, or all three dimensions of nano-sizes, Density of states for 2D, 1D and 0D electron gases, Heterojunctions and associated band-diagrams.

Text Book(s):

1. Semiconductor Physics and Devices (Fourth Edition), Donald A Neamen, McGraw-Hill 2012.

References:

1. Online course: Semiconductor Optoelectronics by M R Shenoy on NPTEL
2. Online course: Optoelectronic Materials and Devices by Monica Katiyar and Deepak Gupta on NPTEL
3. Principles of Electronic Materials and Devices (Third Edition), S. O. Kasap, McGraw-Hill 2006.
4. Engineering Physics (Second Edition), Sanjay Jain and Girish Sahasrabudhe, Universities Press 2016.

Syllabus of Physics Lab for Semester II, Bachelor of Industrial, Civil Engineering

Course Code : PHP151 **Course : Mechanics Lab**

L:0 Hr., T:0Hrs., P:3 Hrs., Per week **Total Credits : 1.5**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experiments based on the following list:

1. Error analysis and graph plotting
2. g by free fall
3. To determine acceleration due to gravity by compound pendulum
4. To determine the moment of inertia of a body using torsion pendulum
5. Young's modulus by bending of beam
6. Young's modulus by vibrational method
7. To study damping of a bar pendulum
8. Fixed pulley, loose pulley, and block and tackle as simple machine
9. Static friction, sliding friction, and rolling friction
10. Force oscillation and resonance
11. To study the oscillation of a mass in combinations of two springs and hence determination of force constant
12. Measurement of linear expansion of solid as a function of temperature
13. Determination of thermal conductivity of building materials using single plate model or heat flux plate principle
14. Thermal diffusivity Used for measuring the thermal diffusivity and thermal conductivity of brass.
15. Thermal conductivity of a bad conductor by Lee's disc method.
16. Data analysis using Mathematica.

Suggested References:

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

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

Syllabus of Physics Lab for Semester I/II,
(Semester-I: Electrical Engineering, Semester-II: Mechanical Engineering)

Course Code : PHP152 **Course : Oscillations, Waves , Optics lab**
L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program:

1. Error analysis and graph plotting
2. Wave length, frequency and phase velocity of travelling wave.
3. Wavelength of source of light using Newton's rings
4. To study the oscillation in bifilar suspension arrangement
5. Determination of velocity of sound in liquid–standing ultrasonic waves as optical grating
6. Kundt's tube – Determination of the wavelength of sound with the cork powder method
7. Determination of velocity of sound in solid
8. Beating of ultrasonic waves
9. Investigation of Doppler effect with ultrasonic waves
10. Refractive Index of prism
11. Frequency, amplitude and phase determination using C.R.O.
12. Study of surface flatness using interference phenomena
13. To determine the resolving power of grating
14. Study of Polarizers and Analyzers
15. Study of total internal reflection using Laser source
16. Data analysis using Mathematica

Suggested References:

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

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

Syllabus for Semester I/II, B.E. (2018-19)
(Semester I: Electronics, Electronics Design Technology, Electronics & Communication Engineering)
(Semester II: Computer Science Engineering and Information Technology)

Course Code : PHP153 **Course : Semiconductor Physics Lab**
L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

The Physics Laboratory course will consist of experiments illustrating the principles of physics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in physics laboratory and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the demo experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program

1. Error analysis and graph plotting
2. Energy gap of semiconductor/thermister
3. Study of Hall Effect
4. Parameter extraction from I-V characteristics of a PN junction diode
5. Parameter extraction from I-V characteristics of a zener diode
6. Study of diode rectification
7. Parameter extraction from I-V characteristics of a transistor in common-emitterconfiguration.
8. Determination of Planck's constant
9. Determination of time constant of RC circuit
10. V-I Characteristics of Light Emitting Diodes
11. Study of a photodiode
12. Solar Cell (Photovoltaic cell)
13. Resistivity measurement by Four Probe method
14. Van der Pau and conventional techniques for resistivity measurement (LCR meter)
15. Study of R-C filters using C.R.O.
16. Data analysis using Mathematica.

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

Syllabus for B.E. Semester I

Course Code: MAT151 | **Course: Mathematics-I: Calculus**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week | **Total Credits: 04**

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics & applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. To apply differential and integral calculus to notions of curvature and to improper integrals. Apart from some other applications they will have a basic understanding of Beta and Gamma functions and the fallouts of Rolle's Theorem that is fundamental to application of analysis to Engineering problems.
2. The tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. To deal with functions of several variables that are essential in most branches of engineering.

Syllabus

Module 1 Calculus: (6 hours)

Evolutes and involutes; Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Applications of definite integrals to evaluate surface areas and volumes of revolutions.

Module 2: Calculus: (6 hours)

Rolle's theorem, Mean value theorems, Taylor's and Maclaurin theorems with remainders; Indeterminate forms and L'Hospital's rule; Maxima and minima.

Module 3:Sequences and series: (10 hours)

Convergence of sequence and series, tests for convergence, power series, Taylor's series. Series for exponential, trigonometric and logarithmic functions; Fourier series: Half range sine and cosine series, Parseval's theorem.

Module 4:Multivariable Calculus (Differentiation) (10 hours)

Limit, continuity and partial derivatives, Jacobians, directional derivatives, total derivative; Tangent plane and normal line; Maxima, minima and saddle points; Method of Lagrange multipliers; Gradient, curl & divergence.

Module 5: Multivariable Calculus (Integration) (10 hours)

Multiple Integration: double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: areas and volumes by (double integration) Center of mass and Gravity (constant and variable densities). Theorems of Green, Gauss and Stokes.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. N.P. Bali and Manish Goyal, A text book of Engineering Mathematics, Laxmi Publications, Reprint, 2010.
4. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
5. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint, 2010.
6. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune - 411030 (India).

Syllabus for B.E. Semester II

Course No. MAT152 | **Course : Mathematics-II: Differential Equations, Linear Algebra, Statistics & Probability**

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

Course Objective:

The objective of this course is to familiarize the prospective engineers with techniques in ordinary differential equation, statistics, probability and Matrices. It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Syllabus

Module 1:First order ordinary differential equations(7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree: equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 2:Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

Module 3: Basic Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation.

Module 4: Basic Probability: (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigenvalues and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Textbooks/References:

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. Di Prima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B. S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory & Problems of probability and statistics : 2nd ed :J. R. Spiegal, Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune - 411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus of Mathematics Computational Lab for Semester I/II, B.E. (2018-19)

Course Code : MAP151 **Course : Computational Mathematics Lab**

L:0 Hr., T:0Hrs., P:2 Hrs., Per week **Total Credits : 1**

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Suggested References:

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

A minimum of 8 experiments to be performed based on the above list.

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

Course Code : EET151 **Course : Basic Electrical Engineering**

Course Outcomes:

At the end of this course, students will demonstrate the ability

CO1: To understand and analyze basic electric and magnetic circuits.

CO2: To study the working principles of electrical machines and power converters.

CO3: To study the working principles of power converters.

CO4: To introduce the components of power systems and low-voltage electrical installations.

Module 1: Introduction to Power system (2 hours)– CO4:

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

Module 2 : DC Circuits & Magnetic Circuits(8 hours) - CO1:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation, Time-domain analysis of first order RL and RC circuits, Magnetic materials, BH characteristics, Basics of Magnetic circuits.

Module 3: Single Phase AC Circuits (6 hours) - CO1:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Module 4: Three Phase AC Circuits (4 hours) - CO1:

Three phase Ac generation, Three phase balanced circuits, voltage, and current relations in star and delta connections. Power factor improvement.

Module 5: Transformers (6 hours) - CO2:

Ideal and practical transformer, Equivalent circuit, losses in transformers, regulation, and efficiency. Auto transformer and three-phase transformer connections.

Module 6: Electrical Machines (8 hours) - CO2:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components, efficiency, starting of induction motor. Single-phase induction motor. Construction, working, torque-speed characteristic, and speed control of separately excited dc motor.

Module 7: Power Converters (4 hours) - CO3:

Block schematic introduction to power converters and its practical applications (DC-DC, DC-AC, AC-DC, AC-AC), Types of Batteries, Important Characteristics for Batteries and battery backup.

Module 8: Electrical Installations (4 hours) - CO4:

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption, energy tariff.

Text / References:

1. D. P. Kothari and I. J. Nagrath, "Basic Electrical Engineering", Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, "Basic Electrical Engineering", McGraw Hill, 2009.
3. L. S. Bobrow, "Fundamentals of Electrical Engineering", Oxford University Press, 2011.
4. E. Hughes, "Electrical and Electronics Technology", Pearson, 2010.
5. V. D. Toro, "Electrical Engineering Fundamentals", Prentice Hall India, 1989.
6. Electrical Technology: B. L. Thereja, S. Chand Publications.
7. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

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

Course Code : EEP151 **Course: Basic Electrical Engineering Lab.**

Laboratory Outcomes: The students are expected to

CO1: Get an exposure to common electrical components and their ratings.

CO2: Make electrical connections by wires of appropriate ratings.

CO3: Understand the usage of common electrical measuring instruments.

CO4: Understand the basic characteristics of transformers and electrical machines.

CO5: Get an exposure to the working of power electronic converters.

List of Laboratory Experiments/Demonstrations:

1. Basic safety precautions. Introduction & use of measuring instruments – voltmeter, ammeter, multi-meter, oscilloscope. Real-life resistors, capacitors and inductors.
2. Measuring the steady-state and transient time-response of R-L, R-C, and R-L-C circuits to a step change in voltage (transient may be observed on a storage oscilloscope).Sinusoidal steady state response of R-L, and R-C circuits – impedance calculation and verification.
   Observation of phase differences between current and voltage.
3. Transformers : Observation of the no-load current waveform on an oscilloscope (non sinusoidal wave-shape due to B-H curve nonlinearity should be shown along with a discussion about harmonics). Loading of a transformer: measurement of primary and secondary voltages and currents, and power.
4. Star and Delta connections. Voltage and Current relationships (line-line voltage, phase-toneutral voltage, line and phase currents). Cumulative three-phase power in balanced three-phase circuits.
5. Demonstration of cut-out sections of machines: dc machine (commutator-brush arrangement), induction machine (squirrel cage rotor), synchronous machine (field winding - slip ring arrangement) and single-phase induction machine.
6. Torque Speed Characteristic of dc shunt motor.
7. Synchronous speed of two and four-pole, three-phase induction motors. Direction reversal by change of phase-sequence of connections.
8. Demonstration of (a) dc-dc converters (b) dc-ac converters – PWM waveform (c) the use of dc-ac converter for speed control of an induction motor and (d) Components of LT switchgear.

Syllabus of Department of Mechanical Engineering

Course Code : MET151 **Course: Engineering Graphics and Design**

L:1 Hr., T:0Hrs., P:0 Hrs., Per week **Total Credits : 01**

Course Outcomes

The expected learning outcome is that, the students shall be able to

1. Draw and interpret technical drawing
2. Convert 2-D to 3-D drawing and vice versa.
3. Represent the various positions of planes and solids in different orientations.
4 Develop the solid surface for sheet metal working.

UNIT 1 : Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of drawing instruments, Lettering and dimensioning.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions : Projections of Points and lines (line inclined to both planes) Projections of planes (inclined to both the planes), Introduction to Auxiliary Planes;

UNIT 3 : Projections of Solids

Inclined to both the Planes - Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include : windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid Cone-Auxiliary Views; Development of surface of Right Regular solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; Conversion of Orthographic views to Isometric Views / Projection.

Suggested Text / Reference Books :

i) Bhatt N. D. Panchal V.M. & Ingle P.R., (2014) Engineering Drawing, Charotar Publishing House.

ii) Jolhe D. A. (2016) Engineering Drawing with an Introduction to Auto CAD", Tata McGraw- Hill Publishing Co. Ltd., New Delhi.

iii) Narayan K. L. & P. Kannalah (2008), Text book on Engineering Drawing, Scitech Publishers.

iv) Shah, M. B. & Rana B. C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

v) Agrawal B & Agrawal C. M. (2012), Engineering Graphic, TMH Publication.

vi) Corresponding set of CAD Software Theory and User Manuals.

Syllabus of Department of Mechanical Engineering

Course Code : MEP151 **Course: Engineering Graphics & Design Lab**

L:0 Hr., T:0Hrs., P:4 Hrs., Per week **Total Credits : 02**

Course Outcomes

Students are prepared for actual work situations through practical training in a new state of the art computer designed CAD laboratory using engineering software. The student will learn to :

1. Draw and interpret technical drawing
2. Plan the sheet layout for the given drawing
3. Convert 2-D to 3-D drawing and vice versa
4. Represent the various positions of planes and solids in different orientations.
5. Develop the solid surface for sheet metal working
6. Use & demonstrate drafting package.

Unit I : Introduction to Engineering Drawing

Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloids, Hypocycloid and involutes; Introduction to Scales.

Unit II : Orthographic Projections

Principles of Orthographic Projections -Conventions - Projections of Points and lines inclined to both planes; Projections of planes - Auxiliary Planes.

Unit III : Projections of Solids

Inclined to both the Planes Auxiliary Views; Draw simple annotation, dimensioning and scale, Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

Unit IV : Sections and Sectional Views of Right Angular Solids

Prism Cylinder, Pyramid, Cone - Auxilary Views; Development of surfaces of Right Regular Solids Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

Unit V : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; conversion of Orthographic views to Isometric views / Projection

Unit VI: Overview of Computer Graphics

Demonstrating knowledge of the theory of CAD software such as (the Menu System Toolbars Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, crosshairs, Coordinate Systems), Dialog boxes and windows, Shortcut menus (Button Bars), The command Line (wherever applicable), The Status Bar, Different methods of zoom as used in CAD, select and erase objects; Isometric Views of lines, Planes, Simple and compound solids);

Unit VII : Customization & CAD Drawing

Setting up drawing page and the printer, including scale settings, Setting up of units and Drawing limits; ISO and ANSI standards for coordinate dimensioning; Orthographic constraints, map to objects, manually and automatically, Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles;

Unit VIII : Annotations Layering & Other Functions

Applying dimensions to objects, applying annotations to drawings; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

Unit IX : Demonstration of a simple team design project that illustrates

Geometry And Topology Of Engineered Components Creation Of Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed toplogies for engineering, Introduction to Building Information Modeling (BIM)

List of sheets

1. Curves (ellipse, Parabola, hyperbola, Cycloid, involute)
2. Line, Planes, Solids
3. Application of Section and development of solids
4. Orthgraphic Projection
5. Isometric
6. Auto CAD practic sheet 1
7. Auto CAD practice sheet 2
8. Blueprint sheet

Suggested Text/ Reference Books :

i) Bhatt N.D. Panchal V.M. & Ingle P.R., (2014), Engineering drawing, Charotar Publiishing house

ii) Jolhe D.A., (2016) Engineering drawing with an Introduction to Auto CAD", Tata McGraw-Hill Publishing Co. Ltd., New Delhi.

iii) Shah M.B. & Rana B.C. (2008), Engineering drawing and Computer Graphic, Pearson Education.

iv) Agarwal B & Agarwal C.M. (2012), Engineering Graphics, TMH PUBLICATION

v) Narayana, K.L & P Kannaiah (2008), Text Book on Engineering Drawing, Scitech Publishers.

vi) (Concesponding set of) CAD Software Theory and USER Manuals.

Syllabus for B.E. Semester I Department of Humanities

Course Code : HUT152 **Course : Constitution of India**

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

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Book

1. Durga Das Basu "An Introduction to Constitution of India" 22nd Edition, LexisNexis

Syllabus for B.E. Semester I Department of Humanities

Course Code : PEP151 **Course : Yoga / Sports**

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

Course outcome

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

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

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 to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline:

Sports :

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

Yoga : Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.

Physical Efficiency Tests : This includes 6 health related physical fitness tests.

Components	Name of Tests
Speed	50 mts Dash
Agility	Shuttle run
Cardiovascular Endurance	8 mins Run/Walk
Test Flexibility	Sit and Reach Test
Abdominal Strength (M) / shoulder strength (F)	Bent Knee Sit-ups (M)/ Modified Pull-ups (F)
Yogic exercises	Suryanamaskars

Syllabus for B.E. Semester I / II

Course Code : CHT151 **Course : Chemistry**

L: 3 Hrs, T: 1 Hr, P : 0 Hr., Per week **Total Credits : 4**

Course Outcomes

The concepts developed in this course will aid in quantification of several concepts in chemistry that have been introduced at the 10 + 2 levels in schools. Technology is being increasingly based on the electronic, atomic and molecular level modifications. Quantum theory is more than 100 years old and to understand phenomena at nano meter levels, one has to base the description of all chemical processes at molecular levels. The course will enable the student to:

- Analyse microscopic chemistry in terms of atomic and molecular orbitals and intermolecular forces.
- Rationalise bulk properties and processes using thermodynamic considerations.
- Distinguish the ranges of the electromagnetic spectrum used for exciting different molecular energy levels in various spectroscopic techniques
- Rationalise periodic properties such as ionization potential, electro negativity, oxidation states and electro negativity.
- List major chemical reactions that are used in the synthesis of molecules.

(i) Chemistry-I (Concepts in Chemistry for Engineering)

(i) Atomic and molecular structure (12 lectures)

Schroedinger equation. Particle in box solutions and their applications for conjugated molecules and nanoparticles. Forms of the hydrogen atom wave functions and the plots of these functions to explore their spatial variations. Molecular orbitals of diatomic molecules and plots of the multicentre orbitals. Equations for atomic and molecular orbitals. Energy level diagrams of diatomics. Pi-molecular orbitals of butadiene and benzene and aromaticity. Crystal field theory and the energy level diagrams for transition metal ions and their magnetic properties. Band structure of solids and the role of doping on band structures.

(ii) Spectroscopic techniques and applications (8 lectures)

Principles of spectroscopy and selection rules. Electronic spectroscopy. Fluorescence and its applications in medicine. Vibrational and rotational spectroscopy of diatomic molecules. Applications. Nuclear magnetic resonance and magnetic resonance imaging, surface characterisation techniques. Diffraction and scattering.

(iii) Intermolecular forces and potential energy surfaces (4 lectures)

Ionic, dipolar and van Der Waals interactions. Equations of state of real gases and critical phenomena. Potential energy surfaces of H3, H2F and HCN and trajectories on these surfaces.

(iv) Use of free energy in chemical equilibria (6 lectures)

Thermodynamic functions: energy, entropy and free energy. Estimations of entropy and free energies. Free energy and emf. Cell potentials, the Nernst equation and applications. Acid base, oxidation reduction and solubility equilibria. Water chemistry. Corrosion. Use of free energy considerations in metallurgy through Ellingham diagrams.

(v) Periodic properties (4 Lectures)

Effective nuclear charge, penetration of orbitals, variations of s, p, d and f orbital energies of atoms in the periodic table, electronic configurations, atomic and ionic sizes, ionization energies, electron affinity and electronegativity, polarizability, oxidation states, coordination numbers and geometries, hard soft acids and bases, molecular geometries

(vi) Stereochemistry (4 lectures)

Representations of 3 dimensional structures, structural isomers and stereoisomers, configurations and symmetry & chirality, enantiomers, diastereomers, optical activity, absolute configurations & conformational analysis. Isomerism in transitional metal compounds.

(vii) Organic reactions and synthesis of a drug molecule (4 lectures)

Introduction to reactions involving substitution, addition, elimination, oxidation, reduction, cyclization and ring openings. Synthesis of a commonly used drug molecule.

Suggested Text Books

(i) University chemistry, by B. H. Mahan
(ii) Chemistry: Principles and Applications, by M. J. Sienko and R. A. Plane
(iii) Fundamentals of Molecular Spectroscopy, by C. N. Banwell
(iv) Engineering Chemistry (NPTEL Web-book), by B. L. Tembe, Kamaluddin and M. S. Krishnan
(v) Physical Chemistry, by P. W. Atkins
(vi) Organic Chemistry: Structure & Function by K. P. C. Volhardt & N. E. Schore, 5th Edition http://bcs.whfreeman.com/vollhardtschore5e/default.asp
(vii) Selected topics in Inorganic Chemistry by Malik, Madan & Tuli.

Syllabus for B.E. Semester I / II

Course Code : CHP151 **Course : Chemistry Lab**

L: 0 Hrs., T: 0 Hrs., P: 3 Hrs., Per week **Total Credits : 1.5**

Laboratory Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering. The students will learn to:

- Estimate rate constants of reactions from concentration of reactants/products as a function of time
- Measure molecular/system properties such as surface tension, viscosity, conductance of solutions, redox potentials and impurities in water etc.
- Synthesize a polymer or drug molecule or nano-material.

List of Experiments for Chemistry Lab

1. Determination of Surface tension and Viscosity of a given liquid.
2. Determination of total hardness and alkalinity of a given water sample.
3. Synthesis of a polymer.
4. Determination of Cu and Zn in a brass sample.
5. Determination of partition coefficient of a substance between two immiscible liquids.
6. Study of chemical oscillations or iodine clock reaction.
7. Estimation of acid value and saponification value of oil.
8. Determination of cell constant and conductometric titration of strong acid vs. strong base.
9. Colligative properties using melting point.
10. Determination of rate constant of a reaction.
11. Ion Exchange column for removal of hardness.
12. Synthesis of nanoparticles.
13. Adsorption of acetic acid by charcoal.
14. Demonstration of UV-Visible spectrophotometer and FTIR

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

Course Code: CST151 **Course : Programming for Problem Solving**

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

Course Outcomes :

On successful completion of course student will learn:

1. To formulate simple algorithms for arithmetic and logical problems, translate the algorithms to programs (in C language), test and execute the programs and correct syntax and logical errors.
2. To implement conditional branching, iteration and recursion, to decompose a problem into functions and synthesize a complete program using divide and conquer approach.
3. To use arrays, pointers, structures and I/O operations for the formulation of algorithms and programs.
4. To apply programming to solve matrix addition, multiplication problems and searching & sorting problems.

Unit-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

Unit-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

Unit-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings.

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

Unit-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

Unit-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation)

Unit-VI: File handling

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush.

Text Books:

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

Reference Books:

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

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

Course Code: CSP151 **Course : Programming for Problem Solving Lab**

L: 0 Hrs., T: 0 Hrs., P: 2 Hrs., Per week **Total Credits : 1**

Course Outcomes :

On successful completion of course student will be able to:

1. Understand the fundamentals of C programming and choose the loops and decision making statements to solve and execute the given problem.
2. Implement different Operations on arrays also design functions to solve the given problem using C programming.
3. Understand pointers, structures, unions and apply them to develop programs.
4. Implement file Operations in C programming for a given application.

Syllabus Department of Industrial Engineering

COURSE SYLLABUS

Course Code : IDT151 **Course : Creativity Innovation And Design Thinking**

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

Course Outcomes

C1: Be familiar with processes and methods of creative problem solving

C2: Enhance their creative and innovative thinking skills

C3: Practice thinking creatively and innovative design and development

Detailed Topics

Unit I: Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

Unit II: Pattern Breaking: Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking , Mapping thoughts, Other (new approaches)

Unit III : Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

Unit IV: Systematic Inventive Thinking: Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats , Ethical considerations

Unit V : Design for Innovation: Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

Unit VI : Intellectual Property: Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, Trade Secret, Unfair Competition.

Reference Books and Text Books :

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

Syllabus Department of Industrial Engineering

Course Code : INT151 **Course : Workshop / Manufacturing Practices (Theory)**

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

Course Outcomes

1. Identify the different manufacturing process commonly employed in Industry along with prevailing safety practices.
2. Identify the various tools and equipments to carry out different manufacturing processes accompanied by the inspection of the work part.

Syllabus

Unit - I : Fundamentals of metal cutting, single point cutting tool, fundamental mechanics of metal cutting, fitting operations, and associated measuring and marking tools

Unit - II : Introduction to pattern making for metal casting, different types of carpentry tools, measuring tools and marking tools, holding devices, different types of carpentry joints.

Unit - III : Smithy and Forging, Forging tools like chisels, hammers, types of furnaces, types of coal, Forming operations, Hot working and Cold working of metals.

Unit - IV : Metal joining Process, mechanics of welding, types of welding, soldering and brazing, types of joints

Unit - V : Introduction to foundries, Metal Casting, types of sand, Introduction to Molding tools & casting process.

Unit - VI : Introduction to Plastic Injection Molding

Suggested Text Book

1. "Elements of Workshop Technology" Hajra S.K, Choudhury A. K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd. Mumbai.

Reference Books

1. Kalpakjian S. and Schmid S. "Manufacturing Engineering and Technology"4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, "Process and Materials of Manufacture"4th Edition, Prentice Hall India 1998.

Syllabus Department of Industrial Engineering

Course Code : INP151 **Course : Workshop/Manufacturing Practices Lab (Practical)**

L:0Hrs.,T:0Hrs.,P:2Hrs.,Per week **Total Credits:1**

Laboratory Outcomes

On the completion of the course the students shall be able to;

1. Recognize the different manufacturing process commonly employed in the Industry
2. Make the components using required manufacturing process, inspection methods while practicing the requisite safety precautions

Contents

1. Fitting Practice
2. Welding and Soldering Practice
3. Pattern Making Practice
4. Metal Casting Practice
5. Smithy and Forging Practice
6. Machining Practice
7. Plastic Molding Process
8. Glass Cutting Process

Suggested Text Book

1. "Elements of Workshop Technology'" Hajra S.K, Choudhury A.K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd Mumbai.

Reference Books

1. Kalpak Jain S. and Schmid S. "Manufacturing Engineering and Technology"4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, "Process and Materials of Manufacture", Prentice hall India 1998.

Syllabus for B.E. Semester I / II Dept of Humanities
Humanities and Social Sciences

Course Code: HUT151 **Course : English**

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

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 vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

SYLLABUS

1. Vocabulary Building
- 1.1. The concept of Word Formation
- 1.2. Root words from foreign languages and their use in English
- 1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives
- 1.4. Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills
- 2.1 Sentence Structures
- 2.2 Use of phrases and clauses in sentences
- 2.3 Importance of proper punctuation
- 2.4 Creating coherence
- 2.5 Organizing principles of paragraphs in documents
- 2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing
- 3.1 Subject-verb agreement
- 3.2 Noun-pronoun agreement
- 3.3 Misplaced modifiers
- 3.4 Articles
- 3.5 Redundancies
- 3.6 Cliches

4. Nature and Style of sensible Writing

4.1 Describing
4.2 Defining
4.3 Classifying
4.4 Providing examples or evidence

5. Writing Practices

5.1 Comprehension
5.2 Precis Writing
5.3 Essay Writing
5.4 Letter Writing
5.5 Email Writing

6. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations : Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for B.E. Semester I

Course Code: HUP151 | **Humanities and Social Sciences including Management courses** | **Course : English Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week | **Total Credits: 1**

Course objective :

1. To enhance competency of communication in English among learners.

Course outcomes:

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

List of Practical (2 hours each for each batch) based on unit 6 (oral communication).

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation , Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

Syllabus for B.E. Semester III

Course Code: MAT 258 **Course : Introduction to Statistics and Probability-I**

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

Course objective :

The objective of this course is to expose student to understand the basic concepts of Probability Distribution, Sampling Distributions and Testing of Hypothesis. It also focuses on Inferences Concerning Variances.

Course outcomes:

On Successful completion of the course, Student shall be able to

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

Syllabus :

Unit I :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.
Practice and Analysis with data analytic tools/software

Unit II : 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.
Practice and Analysis with data analytic tools/software

Unit III : Testing Hypothesis :

One sampleIntroduction, 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.
Practice and Analysis with data analytic tools/software

Unit IV : 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.
Practice and Analysis with data analytic tools/software

Unit V :Inferences Concerning Variances:

The estimation of variances, Hypothesis concerning one variance, Hypothesis concerning two variances Practice and Analysis with data analytic tools/software

Text Books :

1. Statistics for management 7Edition : R. I. Levin & D. S. Rubin (P.H.I.)
2. Theory & Problems of Probability & Statistics : M. R. Spiegal (McGraw Hill) Schau, Seriesth
3. Probability & Statistics for Engineers 6Edition : Miller Freund & Johnson

Reference Books :

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

Tools/Software – R, Scilab, Python, Matlab

Syllabus for B.E. Semester III

Course Code: INT 251 **Course : Principles of Mechanical Engineering-I**

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

Course outcomes:

The students shall able to: -

1. Understand basic laws of thermodynamic and their relation to various processes.
2. Apply the thermodynamic concepts to various thermal applications.
3. Understand basic properties of fluid and measurement of flow and pressure.
4. Know the principle of operation and working of various hydraulic machines.

Introduction to thermodynamics :

Basic laws of thermodynamics, property, state, process, cycles, thermodynamics equilibrium, temperature, concept of enthalpy and entropy, heat engine, heat pump and refrigerator (analytical treatment is expected).

Applications of thermodynamics: Introduction to boilers, cooling towers, condensers and Internal Combustion engines. Thermodynamics process pertaining to refrigeration and air conditioning. Different methods of refrigeration, classification and environmental impact of refrigerants, household refrigeration system, vapor compression refrigeration cycle, vapor absorption refrigeration system. Introduction to comfort industrial air conditioning (analytical treatment on refrigeration system is expected). Brief introduction to non-conventional power generation: wind, tidal, solar, and geothermal power plant.

Introduction to fluid power: Properties of fluid, Newton's law of viscosity, classification of fluid based on rheological chart. Pressure at a point and pressure head measurement using manometer. Application of Bernoulli's theorem. Dimensional analysis: dimensional homogeneity Rayleigh and Buckingham's method of dimensional analysis. Dimensionless number, laminar flow, turbulent flow and use of Reynold's apparatus.

Applications of fluid power: Elements of hydroelectric power plant, Impulse and reaction turbines, pumps and draft tube. Industrial hydraulics- hydraulic press, hydraulic accumulator, hydraulic intensifiers, hydraulic ram, hydraulic lift and hydraulic crane.

Text books

1. Engineering Thermodynamics, P. K. Nag, Tata McGraw-Hill Publication.
2. Thermal Engineering, P. L. Ballani, Khanna Publication.
3. Refrigeration and Air conditioning, C.P. Arora, Tata McGraw Hill Publication.
4. Fluid Mechanics and Hydraulic Machines, R.K. Rajput, S Chand Publication.

Reference books

1. Thermodynamics and Engineering approach, Yunus A. Cengel and Michael A. Boles, Tata McGraw-Hill Publication.
2. Modern Engineering Thermodynamics, Robert Balmer, Publisher- Academic Press.
3. Engineering Thermodynamics, Gordon Rogers, Pearson Publication.
4. Refrigeration and Air conditioning, Wilbert F. Stocker, McGraw Hill Publication.
5. Fluid Mechanics, John F. Douglas, Pearson publication.
6. Hydraulic and Compressible Flow Turbo-machines, A. T. Sayers, Mc-Graw Hill Publication.

Syllabus for B.E. Semester III

Course Code: INP 251 **Course : Principles of Mechanical Engineering-I-Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes:

The students shall able to: -

1. Analyze the performance characteristics of IC engine.
2. Understand the various elements of refrigeration and air conditioning systems.
3. Apply the concept of thermodynamics and fluid power to various applications.
4. Study and performance evaluation of hydraulic machines.

List of Experiments

1. Study of boilers, cooling towers, condensers and Internal Combustion (IC) engine.
2. To study and demonstrate the performance of computerized single cylinder petrol engine test rig.
3. To study and demonstrate the performance of computerized single cylinder diesel engine test rig.
4. To determine coefficient of performance (COP) of computerized vapor compression refrigeration test rig.
5. To study various types of air conditioning systems.
6. Study of non-conventional power generation plant with visit report.
7. Study of dimensional analysis and its applications.
8. Study and performance evaluation of hydraulic pumps (Centrifugal and Reciprocating pumps)
9. Study and performance evaluation of hydraulic turbines (Pelton wheel turbine and Francis turbine)
10. Study of hydraulic systems like accumulator, intensifier, press, lift and crane.

Note: 8 experiments are mandatory

Syllabus for B.E. Semester III

Course Code: INT 252 **Course : Manufacturing Engineering-I**
L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes:

The students shall able to: -

1. The students should be able to understand the types, structure, properties andapplications of different engineering materials.
2. The students should be able to understand the need and methods of various melting and heat treatment processes.
3. The students should be able to select & apply appropriate methodology for designing and producing component by casting processes.
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 metal working methods for designing and manufacturing metal components.
6. The students should be able to select and apply appropriate welding methods for fabrication of various components.

Unit I :

Engineering Materials: Classification, Crystal Structures, Properties of Engineering materials. Classification of Engineering materials: Ferrous and Non-Ferrous materials. Use and application. Classification Steels & Cast Irons, their processing and application. Bearing Materials, Thermoplastic & Thermosetting plastics, Rubber, Ceramics, Heat Insulating Materials.

Unit II:

Melting Practices of Ferrous & Non-Ferrous Metals: Types of Metal Melting Furnaces, Melt treatment, Degassing,Ladles,

Heat Treatment of Ferrous & Nonferrous Alloys: Iron- carbon equilibrium diagram Objective & principles of heat treatment, TTT curve, Allotropic forms of iron, Heat treatment of steels, transformation curves, Classification of Heat Treatment Processes, Process Parameters & Application. Heat Treatment Furnaces,

Unit III:

Metal Casting Process: Advantages, limitations & applicability, Product Design for Sand Casting, Pattern Design & Types of Pattern, Meth ding of Casting: Gating and Risering Design, Solidification of casting. Core, Chills & Chaplets. Casting terms: Process requirements of Sand mould Properties molding materials, Sand preparation, Methods for Mold & Mold Material analysis. Casting Defects. Foundry Mechanization.

Unit IV:

Special Casting Processes: Carbon di-oxide molding, Shell Molding, Precision Investment Casting, Permanent mould casting, Die Casting, Centrifugal Casting, Continuous Casting. Squeeze Casting, Slush Casting. Introduction of Rapid Prototyping in Casting.

UnitV:

Nature of Plastic Deformation, Product Design for Metal Working. Hot & Cold Working of metals: Rolling, Forging, Extrusion. Wire, Rod &Tube Drawing, Swaging. Introduction to Sheet Metal working, Press tool operations, shearing, drawing.UNIT VI:

Fabrication process: Classification of Metal Joining Processes, Gas welding, Electric Arc: MMA, TIG & MIG Welding, Resistance Welding, Thermit welding, Other Fusion welding processes, Brazing, Soldering.

Text Books:

1. Production Engineering by Dr. R.K. Jain (Khanna Publications)
2. Manufacturing Technology Vol-1 by Dr. P. N. Rao (TataMc Graw Hill Publication)
3. Manufacturing Science by A. Ghosh and J. Mallik (East West Publications)
4. Workshop Technology - I (Tata McGraw Hill)- H.S. Bawa
5. Workshop Technology Parts - I & II - B. S. Raghuvanshi; Hajra-Choudhary

Reference Books

1. Manufacturing Engineering by SeropeKalpakjainTataMcgraw Hill Publication
2. ASME Handbook of Metal Casting
3. ASME Handbook of Welding

Syllabus for B.E. Semester III

Course Code: INP 252 **Course : Manufacturing Engineering-I- Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes:

The students shall able to: -

1. The students should be able to identify specific types of pattern required to make a mould for casting a particular component.
2. The students should be able to select the appropriate metal melting methods and equipment according to the requirement.
3. The students should be able to identify the various products manufactured by hot and cold working methods and understand their applications.
4. The students should be able to distinguish and apply appropriate welding methods for a specific application.

The list of experiments shall be based on the theory course INT 252

Syllabus for B.E. Semester III

Course Code: INP 253 **Course : Machine Drawing Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes:

The expected learning outcome is that the students shall be able to:

1. Understand the significance and its use of standard machine components.
2. Convert 3D object to its 2D representation.
3. Read the Industrial drawing to understand the mechanical system.
4. Use of drafting package i.e. AutoCAD.

Unit I

Introduction to machine drawing, Classification of machine drawing, Principles of drawing, Orthographic projections, Interpretation of views & Sectioning, Conventional representation of machine components, Thread terminology, Types of threads, Thread designation, types of screws, bolts and nuts, Nut locking arrangements using pins, washers & screws.

Unit II

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, Feed check valve, Hartnell governor, Porter governor & Compound slide.

Unit III

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, Feed check valve, Hartnell governor, Porter governor & Compound slide.

Unit IV

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

Unit V

AutoCAD Drawing: use of various AutoCAD commands, preparation of 2-D drawings using AutoCAD.

Text Books:

1. Machine Drawing (4th Edition) by K. L. Narayan, R Kannaiah, K.V. Reddy- New Age Int. Publications.
2. Machine Drawing by N. Sidheshswar, P. Kannaiah, VVS Sastry- Tata Mc graw Hill Publications.

Reference Books:

1. Machine drawing (48th Edition) by N.D. Bhat- Charotar Publications.
2. Machine drawing by R.K.Dhawan- S. Chand Publications

Syllabus for B.E. Semester III

Course Code: INT 254 **Course : Facilities Planning**
L: 3 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 03**

Course outcomes:

The students shall able to: -

1. Design a new manufacturing facility.
2. Specify the equipment required 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

Unit-I

Plant Location: Factors affecting site selection, concepts, location Economics, Rural V/s urban Plant site Factory building, Types of factory building, Building construction. The Facilities Management Function. Organization and Administration. Facilities Manager - Role and Responsibility. Facilities Planning & Design Management.

Unit II :

Types of layout, layout procedures, systematic layout planning, Flow Analysis approaches and Activity relationship analysis, relationship diagram, purpose, premise and proximity, graph based process, relationship diagramming process. Space requirements and availability, production rate determination, equipment requirements, employee requirements, space determination. Designing the space relationship diagram, the BLOCPLAN, flexible layouts, designing material handling system, presenting the layout design.

Unit III :

Techniques for Quantitative Analysis of Layouts, computerized layout evaluation, adjacency-based scoring, distance based scoring, and distance weighted adjacency based scoring, more complex scoring models. Computerized Layout generations: Construction algorithms and improvement algorithms CRAFT, COFAD, PLANET, CORELAP and ALDEP.

Unit IV :

Storage systems layout, dedicated storage location policy, space requirements, sizing on the basis service levels and costs, comparison with dedicated storage, class based dedicated storage location policy, shared storage location policy, space requirements, throughput performance, continuous warehouse layout, storage region configuration, computing the expected distance traveled.

Unit V :

Elements of materials Handling, Importance, principles of material handling, and 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 VI :

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.

Text Books:

1. James A. Tompkins, John A. White, Facilities Planning, J. Wiley & Sons, Inc., 3rd Edition, New York.
2. Francis, R. L. and J. A. White, Facility Layout and Location: an Analytical Approach, Prentice-Hall, 2nd Edition.
3. James M Apple, Plant Layout and Material handling, 2nd Edition, John Wiley and Sail.
4. Production and Operations Management, Panneerselvam R, Publisher: PHI
5. Buffa, Modern Production/Operations Management, Wiley Eastern Ltd.
6. Plant layout & Material Handling – by Prof. G.K. Agrawal

Reference Books:

1. Sunderesh S.Heragu, Facilities Design, PWS Publishing Company.
2. James M. Moore, Plant Layout Design, Mc Millan Publishing Company.
3. Lee J Karjewski and larry P Ritzman, Operations management Strategy and Analysis, Pearson Education Asia.

Syllabus for B.E. Semester III

Course Code: INT 255 **Course : Object Oriented Programming Methods**
L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 02**

Course outcomes:

The students shall able to: -

1. Understand the principles of object-oriented programming, create classes, invoke methods and access data.
2. Understand C++ classes and data abstraction.
3. Use principles of inheritance and polymorphism in programming.
4. Implement different templates, Exception handling techniques in programming.

Unit I:

Concept of a class, Object, Features of Object Oriented Programming viz. data encapsulation, inheritance and polymorphism, Need for OOP, Access control of members of a class, constructors, Destructor, Friend Function.

Unit II:

C++ Classes And Data Abstraction: Static class members, Constant member functions, Dynamic creation and destruction of objects, Dynamic memory allocation and de-allocation operators-new and delete

Unit III:

Polymorphism: Static and Dynamic bindings, Function overloading, Operator overloading, Virtual functions, Concept of Inheritance, forms of inheritance.

Unit IV:

Function templates and class templates. Exception Handling: types of exception, throwing an exception, use of try catch block, user defined exceptions, Re-throwing an exception, Design issues in exception handling, Benefits of exception handling.

Text Books:

1. Object Oriented Programming Using C++: E. Balaguruswamy, 4th edition. Tata Mcgraw Hill Companies
2. The C++ Programming Language: B. Stroustrup, 4th edition, Addison Wesley. Reading Mass. USA. May 2013
3. Mastering C++: K Venugopal, Raj Buyya, T ravishankar, 2nd edition, McGraw Hill Education

Reference Books:

1. The Complete Reference: Herbert Schildt, 4th Edition, Tata McGraw Hill
2. Object oriented Programming in C++, 4th Edition, Robert Lafore by Sams Publishing

Syllabus for B.E. Semester III

Course Code: INP 255 **Course : Object Oriented Prog Method-Lab**
L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes:

The students shall able to: -

1. Create classes, invoke methods and access data using OOP principles.
2. Dynamically create objects, allocate and de-allocate memory.
3. Use principles of inheritance and polymorphism in programming.
4. Implement different templates, Exception handling techniques in programming.

The experiments shall be based on the syllabus of theory course

Syllabus for B.E. Semester III

Course Code: IDT 252 **Course : Biology**
L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 02**

Course outcomes:
The students shall able to: -

1) Differentiate between science and engineering with help of some surrounding examples.
2) Realize the universality of basic building blocks in the living world.
3) Develop an ability to use current techniques, skills and tools necessary for computational Biology practice.
4) Explore the immense variability possible due to genetic alterations.
5) Able to appreciate Physics of living being vis-à-vis mechanisms and machines.
6) Develop deeper insight for role of man in a Man-Machine system

Unit 1:
Why Study **Biology in Industrial Engineering**. Distinction between Science and Engineering, eye and camera, bird and flight, Hand and Manipulator. Terminology, "Standard Human" and Scaling.

Unit 2:
Cell Biology and Genetics. Universality of living things, Cell as the basic building block of all living beings.Mendel's laws, Concept of segregation and independent assortment. Genemapping, Gene interaction, Epistasis. Meiosis and Mitosis be taught as a part of genetics. Passing of genetic material to next generation. Concepts of recessiveness and dominance. Conceptof mapping of phenotype to genes.

Unit 3:
Bio-informatics: Mathematical Biology, Biostatistics, Computational Biology, Databases, types of databases, Neural Networks, Artificial Intelligence.

Unit 4:
Sequence Alignments: Introduction to sequences, alignment and dynamic programming, Local alignment and Global alignment, Pair wise alignment and examples of each, Genetic Algorithm.

Unit 5:
Mechanical Properties of Human Body. Statics of body, standing, walking, running and swimming. Effect on body elements like bones, muscles and tendons. Biology of safety devices in work place. Fluid pressure and Fluid flow in the body, Biological comfort zone for Humans.

Unit 6:
Metabolism Energy cost considerations for human activities during work. Energy, Heat, work and Power of the body. Cause of fatigue and recovery by resting.

Text Books

1. Physics of Human Body, Irwing P. Herman, First ed. (2007), Springer
2. Bioinformatics: Theory and Practice, N. J. Chikhale, V. S. Gomase, First ed., 2007, Himalaya Publishing House

Syllabus for B.E. Semester III

Course Code: HUP258 **Course : Personality Development**
L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course outcomes:
CO1: Students will learn to interact effectively in society and work efficiently in groups.
CO2: Students will learn strategies to communicate effectively
CO3: Students will learn generic skills for a better personality.
CO4: Students will learn the basics of motivation and attitude.

Syllabus (List of Practical)

1. Swot analysis (pre and post) and RBS Technique
2. Interpersonal relations and group dynamics
3. Time management
4. Negotiation skills
5. Critical thinking and Problem Solving
6. Role of motivation and attitude formation
7. Verbal Communication and barriers
8. Body language

Syllabus for B.E. Semester IV

Course Code: MAT 261 **Course : Introduction to Statistics & Prob -II**

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

Course Objectives :

The Objective of this course is to expose student to understand the important concepts of Probability Distributions, Regression Analysis and Nonparametric methods. It also focuses on Time series and Forecasting, Index numbers and Decision theory.

Course Outcomes :

On successful completion of the course, student shall be able to

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.

Practice and Analysis with data analytic tools/software

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.

Practice and Analysis with data analytic tools/software

Unit III :

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

Practice and Analysis with data analytic tools/software

Unit IV :

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.

Practice and Analysis with data analytic tools/software

Unit V :

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.

Practice and Analysis with data analytic tools/software

Text Books :

1. Statistic for management 7th ed : R.I. Levin and D.S. Rubin (P.H.I.)
2. Theory and Problems of Probability and Statistics - M.R. Spiegal (McGraw 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 (McGraw Hill).
2. Statistics for Business &Economics :R.P.Hooda (Mc.Millan Publication)

Tools/Software – R, Scilab, Python, Matlab

Syllabus for B.E. Semester IV

Course Code: INT 261 **Course : Principles of Mechanical Engineering-II**

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

Course Outcomes :

The students shall able to: -

1. Understand the basics of synthesizing the mechanisms and to determine the velocities of linkages.
2. Synthesis the cam for different motions of follower and to understand the problems of balancing and vibrations to avoid the failure of machine elements.
3. Understand the fundamentals of designing the machine elements and its optimization.
4. Select the fasteners, flat belts, V-belts, bearings, etc.

[A] Theory of Machines

Unit I :- Introduction to Mechanisms

Introduction to mechanism, machine and structure, Kinematic Link, Kinematic pair, Types of Pairs and its Classification, Kinematic Chain, Degree of freedom, Kutzback's criterion. , Inversion of four bar chain. Determination of velocities of links of mechanisms. Relative motion method (simple mechanisms are expected).

Unit II: Cam, Balancing and Vibrations

Introduction, Types of Cams and follower and its applications, Displacement, velocity and acceleration of follower and construction of cam profiles for – uniform acceleration and retardation and simple harmonic motion of followers. Balancing of rotary masses- static balancing and concept of dynamic balancing. Vibrations – Mechanism of vibration, terminology, types of vibrations, determination of frequency of vibration (only by equilibrium method).

[B] Machine Design

Unit III: Introduction to Machine Design

Introduction to machine design and its features, Basic procedure of machine design, Stress-strain diagram, Classification and Selection of engineering material, Types of stresses in machine member, Factor of safety, Use of data book, Design of shaft . Optimization in design (Single method is expected).

Unit IV: Design of elements

Design of threaded fasteners, Types of drives, selection of V-belt, Selection of rolling contact bearings.

Text Books:

1. S.S. Ratan; Theory of Machines, Tata McGraw Hill Publication.
2. B.D. Shiwalkar; Design of Machine Elements, Denett& Co.
3. P. Kannaiah; Machine Design, Scitech Publications.

Reference Books:

1. Thomas Bevan; Theory of Machines, Pearson Education Ltd.
2. Sadhu Singh; Theory of Machines, Khanna Publisher
3. Joseph Shigley; Design of Machine Elements,Tata McGraw Hill Publication.
4. R.S. Khurami, J. K. Gupta; Machine Design, S. Chand Co.
5. Design Data; B. D. Shiwalkar, Denett & Co.
6. V. B. Bhandari : Design of Machine Elements, Tata McGraw Hill.

Syllabus for B.E. Semester IV

Course Code: INP 261 **Course : Principles of Mechanical Engineering-II-Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Outcomes :

The students shall able:-

1. To get practical knowledge of configuring the mechanisms and cams.
2. To obtain hands on experience of balancing and vibrations.
3. To understand the design process of mechanical system.

List of Practicals:

1. Draw configuration of mechanisms (Any two) and determine number of links and its type, types of pairs, degree of freedom and find out the change in type of system by adding or removing one link.
2. Graphical solution of problems on velocity and acceleration in mechanisms by relative velocity and acceleration method.
3. To draw displacement diagram of cam profile.
4. Demonstration of balancing of rotary masses.
5. Demonstration of whirling of shaft.
6. Determine the natural frequency of spring mass system.
7. To verify the effect of factor of safety on sizes of mechanical component with the help of stress-strain diagram.
8. Design of basic mechanical system.

Syllabus for B.E. Semester IV

Course Code: INT 262 **Course : Manufacturing Engineering-II**

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

Course Outcomes :

The students shall able to: -

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

Unit I:

Theory of metal cutting, Orthogonal and Oblique Cutting, Tool Materials, Nomenclature & Signature. Chip formation & its Types, Chip control & Chip Breakers, Force and Velocity relationship, Influence & effect of various parameters on Tool Life & Machinability. Cutting fluids.

Lathe, Centre Lathe: Construction and Operations, Introduction to Capstan & Turret Lathe, Automatic Lathe. CNC and other special purpose machines.

Unit II :

Hole Making Machines & Operations: Introduction, Drilling, Reaming, Boring, Tapping & Others Hole Making Operations. General purpose, mass production and special purpose hole making machines,

Reciprocating Machine Tools: Introduction, Shapers, Planning Machine (Planers), Slotting Machine (Slotters), Broaching, Sawing and Comparison of Reciprocating Machine Tools.

Unit III :

Milling machine – Introduction to Milling Machine &Types, Operations performed on Milling Machine, Types of milling cutter, dividing & Indexing heads. Milling Mechanics, Machines for gear production and screw thread production.

Unit IV :

Abrasive Processes: Introduction, Grinding Wheel: Designation and Selection, Types of Grinding Machines, Grinding Process, Grinding-Process Parameters, Creep-Feed Grinding, Honing, Lapping, Other Finishing Processes. Machines for Super Finishing Processes.

Unit V :

Jigs and fixtures: Introduction, different elements, types, general design principles, drill jigs, milling fixtures. Principle of location, locating devices, clamping devices.

Designing for Machining: Introduction, General Guidelines for Design for Machining (DFM), Design for Turning, Design for Hole-Making Operations.

Computer Integrated Manufacturing – NC, CNC, DNC, Simple CNC Programming.

Unit VI :

Unconventional machining processes: Need For Unconventional Processes, Electric-Discharge Machining, Electro-chemical Machining, Ultrasonic Machining, Laser-Beam Machining, Electron-Beam Machining, Plasma-Arc Machining, Abrasive Jet Machining, Abrasive Water-Jet Machining. Introduction to High Energy Rate Forming Processes, Types and Application

Text Books:

1. Production Engineering by Dr. R.K. Jain (Khanna Publications)
2. Manufacturing Technology Vol-1 by Dr. P. N. Rao (TataMc Graw Hill Publication)
3. Manufacturing Science by A. Ghosh and J. Mallik (East West Publications)
4. Workshop Technology - I (Tata McGraw Hill) - H.S. Bawa
5. Workshop Technology Parts - I & II - B. S. Raghuvanshi; Hajra-Choudhary

Syllabus for B.E. Semester IV

Course Code: INP 262 **Course : Manufacturing Engg- II- Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Outcomes :

The students shall be able to: -

1. Understand the working principles of different machines.
2. Make different jobs on Lathe, Shaper, Milling and drilling machine.
3. Understand the working principle of unconventional machine such as electric discharge machine.
4. Work on CNC lathe and CNC milling machine.

The list of experiments will be based on the theory course INT 262

Syllabus for B.E. Semester IV

Course Code: INT 263 **Course : Work System Design**

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

Course Outcomes :

The students shall able to: -

1. Study and identify the factors affecting productivity
2. Carry out systematic investigation and improvement of existing way of doing work using appropriate recording technique.
3. Study principles of motion economy and fundamental hand motions
4. Establish standard time for a specific activity using time study

Unit I

Productivity:

Introduction and Concept of Productivity, Concept of work content, excess work content and ineffective time, Techniques for productivity improvement, Productivity Measures.

Unit II

Work study:

Introduction and definition of work study, Basic procedure, human factor in the application of work study, the influence of working conditions on work study. Concept and definition of Method Study, objectives of method study, basic Procedure of methods study.

Unit III:

Recording Techniques:

Recording Techniques, process Charts symbols, outlines process chart, flow process charts, multiple activity chart, Quantitative Techniques for man machine relationships, two hand process chart, travel chart, Flow diagram, string diagram, Critical evaluation Phase, Develop, Define and install the improved method.

Unit IV:

Micro motion Study

Introduction, micro motion study equipment, making motion pictures, Film analysis, the use of fundamental hand motions, SIMO Chart, principles of motion economy-related to the use of human body, work place and the design of tools and equipment.

Unit V:

Work Measurement time Study

Objective of work measurement, work measurement techniques, objectives and uses of Time study, time study equipment, Basic steps in time study. Selecting the Job for time study, choosing the operator, breaking the job into elements, determination of sample size.

Unit VI:

Time Study- Rating & Allowances

Definition of rating, performance rating, the concept of normal performance, Factors affecting the rate of

working, systems of rating, rating scale. Concept of allowance, Types of allowances, Calculation of standard time, Concept of Wage incentive plan.

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.

Syllabus for B.E. Semester IV

Course Code: INP 263 **Course : Work System Design Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Outcomes :

The students shall able to: -

1. Use the suitable recording technique to record information in a systematic way of a given activity.
2. Identify the fundamental hand motions involved in the process in order to eliminate unnecessary motions.
3. Identify the principles of motion economy for given workstation.
4. Understand the concept of performance rating.
5. Determine the standard time of a job using time study.

List of Experiments will be based on the syllabus in theory course INT 263

Syllabus for B.E. Semester IV

Course Code: INT 265 **Course : Instrumentation and Metrology**

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

Course Outcomes :

The students shall able to: -

1. Understand the various elements of generalized measurement system and identify functional elements of instruments.
2. Make the industrial use of various transducers and sensors.
3. Understand linear and angular measuring instruments. Design the gauges based on type of fit required.
4. Understand the conventional and advanced techniques in measurement.

Unit I

Introduction to measurement systems, significance of measurement, methods of measurement, elements of generalized measurement system and errors in measurement. Performance characteristics of measuring devices.

Unit II

Different types of transducers and their applications in measurement of force, pressure, flow, temperature, speed and sound. Industrial use of sensors.

Unit III

Introduction to metrology, standards of measurement, simple gauging instruments for linear and angular measurements. Mechanical, electrical and pneumatic comparators. Limits, fits and tolerances. Design of limit gauges, process planning sheet and tolerance chart preparation.

Unit IV

Measurement of straightness and flatness. Use of optical flat. Measurement of screw thread parameters. Measurement of surface roughness. Introduction to advanced measurements

Text Books:

1. Mechanical Measurement and Control, D. S. Kumar, Metropolitan Book Company.
2. Instrument Measurement and Analysis, Nakra and Chaoudhary, McGraw Hill Education.
3. Mechanical Measurements and Instrumentation (Including Metrology and Control Systems), R. K. Rajput, Publisher- S. K. Kataria and Sons.

Reference Books:

1. Handbook of Optical Metrology: Principles and Applications, Toru Yoshizawa, Publisher- CRC Press.
2. Mechanical Measurements, S.P. Venkateshan, Publisher- CRC Press.
3. Design Data for Machine Elements, B. D. Shiwalkar, Denett and company.
4. A Textbook of Engineering Metrology, I. C. Gupta, Dhanpat Rai Publications.

Syllabus for B.E. Semester IV

Course Code: INP 265 **Course : Instrumentation and Metrology-Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 01**

Course Outcomes :

The students shall be able to: -

1. Identify functional elements of measuring instruments.
2. Analyze the industrial use of linear and angular dimensions measuring instruments.
3. Design the gauges based on type of fit required.
4. Make the industrial use of various transducers.

List of Experiments

1. Study of generalized measurement system and identify functional elements of the measuring devices.
2. To perform measurement of linear and angular dimensions using precision instruments.
3. To determine taper angle of a conical shape work-piece using sine centre.
4. To perform measurement of straightness and flatness using auto-collimator and optical flat.
5. Study and measurement of screw parameters using Tool maker's microscope and Profile projector.
6. Design of limit gauges (GO and NOGO): a report on the study of limit, fits and design of gauges.
7. To perform measurement of effective diameter using floating carriage micrometer.
8. Study and demonstration of coordinate measuring machine.
9. Measurement of speed of motor shaft using magnetic and photoelectric pick up.
10. Study and measurement of temperature using contact and non - contact type transducers.

Note: 8 experiments are mandatory

Syllabus for B.E. Semester IV, Open Elective

Course Code: INT 264-1 **Course : Organizational Behavior Development**

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

Course Outcomes :

The students will be able to

1. Conceptualize the components of individual behavior
2. Understand Personality and its importance for organization
3. Apply Perception techniques in organization
4. Improve on learning ability
5. Understand the practicability of communication
6. Understand attitudes and values

Unit 1:

Introduction to Organizational Behavior - Emerging Challenges of OB- Managing Diversity, Changing Demographics of work force, Globalization & Technology, Foundation of Individual Behavior – Personal & Environmental factors, models of Individual Behavior

Unit 2:

Personality - Types – Personality Theories, Freudian Stage, Determinants of Personality, Personality Traits, Personality Tests, Personality &OB

Unit 3:

Perception& Attribution - Importance - Factors Influencing Perception - Interpersonal Perception Types, Perceptual Process, Process of Interpreting, Attribution theory, perception failure, Perception & OB

Unit 4:

Learning-Types of Learning Styles - The Learning Process - Learning Theories –Learning Curve, Learning & OB

Unit 5:

Communication- Significance of Inter Personal Communication, Types of Communication, Barriers for effective communication, factors influencing organizational communication, Transaction Analysis, Johari Window

Unit 6:

Attitudes & Values- components of attitudes, ABC model, foundation of attitude, changing attitudes, Job satisfaction, Values, merging personal and organizational values, attitudes values & OB

Text Books :

1. Aswathapa, Organizational Behavior, PHI Publications.

Reference Books

1. Stephen Robbins, Organizational Behavior, Prentice HallOf India, 9th Edition, 2001.
2. Fred Luthans, Organizational Behavior, Mcgraw Hill Book Co, 1998.

Syllabus for B.E. Semester IV, Open Elective

Course Code: INT 264-2 **Course : Decision Modeling**

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

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

Syllabus for B.E. Semester IV, Open Elective

Course Code: INT264-3 **Course : Six Sigma**

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

Course Outcomes :

Students will be able to:

1) Develop understanding of Quality Management terminology
2) Develop understanding of six sigma concepts for any improvement in a process.
3) Have knowledge of methodology of implementation of six sigma in any industry.
4) Apply statistical quality control tools and techniques.

Syllabus:

Unit 1: 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 2: Six Sigma: Definitions and success stories, six sigma framework, DMAIC – the six sigma improvement process, statistics and six sigma, difference between six sigma and TQM.

Unit 3: Preparing for Deployment: Elements of successful deployment, personal requirements – developing training plan, training need analysis, champions, black belts, and green belts, and focusing on deployment – customer focus, project selection, and QFD.

Unit 4: Six Sigma Tools: Exploratory tools and Analysis tools – Charts, diagrams, Data collection and monitoring tools – primary and secondary data and SPC.

Unit 5: Six Sigma Methodology (DMAIC): Define – objectives, process thinking, process mapping, balanced scorecard, project selection and tracking, Measure –objectives, measurements (discrete vs continuous), measurement as a process, baseline estimation, performance metrics, and measurement system analysis, Analysis – objectives, value stream analysis, analyzing sources of variations, and determining process drivers, Improve – objectives, defining new process, benchmarking, prioritizing and selecting a solution, and corrective action matrix, Control – objectives, more on SPC, visual control, best practices and lessons learned, and documenting process changes.

Unit 6: Six sigma Methodology (DMADV) .Case studies: Selective cases with hands on exercises.

Text Books

"Six Sigma Demystified"- Keller, P. (2005). Tata McGraw-Hill, New Delhi.
"Simplified Six Sigma "- N.Gopalkrishnan (2012) , ,PHI,New Delhi.

Reference Books

"Quality Planning and analysis" - Juran Jata, McGraw Hill.
"Statistical Quality Control" - Eugene L Grant, McGraw-Hill
"Six Sigma Handbook"- Pyzdek, T. (2003). McGraw-Hill, New York.

Syllabus for B.E. Semester IV

Course Code: HUT 259 **Course : Leadership Skills**

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

Course Outcomes :

1. Students will be acquainted with the basic concepts of leadership.
2. Students will learn to work effectively in team as leaders and members.
3. Students will have effective awareness about linkages between leadership and culture.
4. Students will understand the concept and role of digital leadership in contemporary society.
5. Students will understand transformation of society by effective leadership.
6. Students will learn the value of contributing to community development.

Syllabus

Unit I : Introduction to Leadership

Leadership : Definition, classification, features, approaches, traits, distinguishing leadership and management

Unit II : Leading the Team

Steps for formation of team : Team purpose, Power of purpose, creating the team for purpose, Delegation : why people resist delegation of work, how to delegate successfully.

Unit III : Culture and Leadership

Understanding global leadership : Cultures differences in leadership, cultural Intelligence, women in leadership.

Unit IV : Digital Leadership

Influence Building : Influencing and Persuasion techniques, Influence and organizational politics, Connect and influence, Influencing others as a leader.

Unit V : Transformational Leadership

Overview of transformational leadership : Case study : Mohandas Gandhi, Adolf Hitler, Nelson mandela, martin Luther King Junior, Dhirubai Ambani, Henry Ford and Narayana Murthy, Applying leadership theory to all of the above.

Unit VI : Community Leadership

Community Leadership : Importance, need, role of leadership in CSR, case studies (Ratan Tata, Keshub Mahendra, etc)

Reference Books :

1. Christopher F. Achua and Robert N. Lussier *"Effective Leadership by CourseMate"* Cengage India Private Limited; Fifth edition (1 March 2017)
2. Northouse P, (2015) *"Leadership : Theory and Practice"*, Kindle Edition, 8th Edition, Sage Publishing Inc. California.
3. Lencioni. P, (2005) *"Overcoming the Five Dysfucntions of a Team: A Field Guide for Leaders, Managers, and Facilitators"*, Jossey-Bass Publishing house, Francisco.
4. Moran T. R, et al, (2007) *"Managing Cultural Differences: Global Leadership Strategies for the 21st Century", 7*th edition, Butterworth Heinemann Elsevier Inc.
5. Sheninger C. E, (2014) *"Digital Leadership: Changing Paradigms for Changing Times"*, 1st edition, Corwin a Sage company.
6. Seth M., Asudani V. (2018) *"Indian Spiritual Masters and Management Principles"*, Narendra Publication, Nagpur.
7. Blaine H, (2017) *"Principles of transformational Leadership"*, Career Press. Inc, New Jersey.
8. Krile F. J, (2006) *"The Community Leadership Handbook : Framing ideas, Building Relationships, and Mobilizing Resources"*, Paperback, Amazon.

Syllabus for B.E. Semester IV

Course Code: CHT 252 **Course : Environmental Science**
L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 02**

Course Outcomes :

On successful completion of the course, the students

1. Will get full knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual's outlook, so as to perceive our environmental issues correctly, using practical approach based on observations and self learning.
3. Will become conservant with recent waste management techniques such as E-wastes, its recycling and management.
4. Will gain knowledge about the modes for sustainable development, importance of green energy and processes.
5. Will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be adopted, to protect the environment from getting polluted.

Syllabus

Principle of contaminant behavior and recent trends in environmental pollution control

I - Air pollution and its control techniques

Contaminant behavior in the environment, Air pollution due to SOx, NOx, photochemical smog, indoor air pollution

Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle.

factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs)

Techniques to control Air pollution, ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

II : Noise pollution and its control techniques : (2 lectures)

Introduction to noise pollution and its causes

Noise pollution control : Recent advances in noise pollution control and benefits

III : Soil pollution and its control techniques : (5 lectures)

Soil pollution : Soil around us, Soil water characteristics, soil pollution.

Solid waste management: Composting, vermiculture, landfills, hazardous waste treatment, bioremediation

technologies, conventional techniques (land farming, constructed wetlands), and phytoremediation.

Degradation of xenobiotics in environment: Petroleum hydrocarbons, pesticides, heavy metals

IV : Water pollution and its control techniques : (8 lectures)

Major sources of water pollution : Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and tanning, marine pollution, microplastics.

Techniques to control water pollution: Conventional waste water treatment-types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal.

Case studies :

Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills.

V : E - Wastes (2 lectures)

Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

VI : Environment Sustainability : Role of Green technology (5 lectures)

Concept of green technologies, categories, goals and significance, sustainability

Green energy, green chemistry, challenges to green technology, advantage and disadvantages of green processes, Eco mark certification -its importance and implementation

VII - Different government initiatives (2 lectures)

National ambient air quality standard 2009, Swacch bharat abhiyan, National afforestation program and Act - 2016, National river conservation plan and National Ganga river basin authority, Formation of National Green Tribunal.

Books Suggested :

1. Benny joseph, Environmental Studies, McGraw Hill Education (India) Private Limited
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut.
3. P Aarne Vesilind, J. Jeffrey Peirce ad Ruth F. Weiner, Environmental Pollution and Control, Butterworth - Heinemann
4. D. D. Mishra, S. S. Dara, A textbook of Environmental Chemistry and Pollution Control, S. Chand & Company Ltd., Sultan Chand & Company
5. Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer - Verlag Berlin Heidelberg
6. P. T. Anastas & J. C. Warner, Gree Chemistry: Theory & practice, Oxford university Press
7. P. Thangavel & Sridevi, Environmental Sustainability: Role of Green technologies, Spreinger publications.

Syllabus for B.E. Semester IV, Honors Specialization

Course Code: INTH41 **Course : Industry 4.0**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcome:-

The students should be able to

1. Understand the drivers and enablers of Industry 4.0
2. Appreciate the smartness in Smart Factories, Smart cities, smart products and smart services
3. Able to outline the various systems used in a manufacturing plant and their role in an Industry 4.0 world
4. Appreciate the power of Cloud Computing in a networked economy
5. Understand the opportunities, challenges brought about by Industry 4.0 and how organisations and individuals should prepare to reap the benefits

Syllabus

Unit I: History

Industrialization and Industrial revolutions, Industry 1.0, Industry 2.0, Industry3.0, Integration of modern technologies with industrial processes. Drivers, Enablers, Compelling Forces and Challenges for Industry 4.0, Comparison of Industry 4.0 Factory and Today's Factory

Unit II: Cyber Physical Systems

Introduction, Sensing and Actuation, Communication and Networking, Next Generation Sensors and Collaborative Platform, Introduction to Arduino Raspberry Pi and other IOT development boards, Product Life Cycle Management,

Unit III: Internet Of Things

Introduction of Iota, Industrial Iota, Business model with IIoT, APPLICATIONS OF IOT like Digital Manufacturing, Smart Factories, Smart cities, Smart Housing, Smart products and Smart services, Smart Logistics, Robotic Automation and Collaborative Robots, Augmented Reality and Virtual Reality.

Unit IV: Data Analytics

Introduction, Big Data Analytics and Software Defined Network, Machine Learning and Data Science, Programming for data analytics, Data Center Networks. Inventory management and Quality control.

Unit V: Cloud Computing

Introduction, the role of cloud computing in IoT, Fog computing and Cloud computing, Cyber-security, Security in IIoT systems.

Unit VI: Current Scenario

Industrial engineering in Industry 4.0 paradigm, Industry 4.0 Drivers and Industrial Engineer, Shift and change in the responsibilities of IE in smart/connected factories. Case studies on simulation and virtual plant modeling with real time inputs.

Text Books

1. Industry 4.0 : Managing the Digital Transformation: Alp Ustundag, Emre Cevikcan Springer

Reference Book

1. The fourth Industrial Revolution:- Kalus Schwab: Penguin paperback

Syllabus for B.E. Semester V, Honors Specialization

Course Code: INTH51 **Course : Soft Computing Methods**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcomes :

After completing this course, students will be able to learn:

1. Artificial neural networks and its applications.
2. Fuzzy logic and its applications.
3. Solving optimization problems using GAs and Hybrid algorithms.
4. Applications of Soft computing to solve problems in varieties of application domains.

Syllabus

Unit I: Introduction to Soft Computing

Concept of computing systems, "Soft" computing versus "Hard" computing, Characteristics of Soft computing; Fuzzy Computing, Neural Computing, Genetic Algorithms, Associative Memory, Adaptive Resonance Theory, Classification ,Clustering, Bayesian Networks, Probabilistic reasoning, applications of soft computing.

Unit II : Fundamentals of Neural Networks & Feed Forward Networks

Basic Concept of Neural Networks, Human Brain, Models of an Artificial Neuron, Learning Methods, Neural Networks Architectures, Single Layer Feed Forward Neural Network: The Perceptron Model, Multilayer Feed Forward Neural Network: Architecture of a Back-Propagation Network (BPN), The Solution, Back propagation Learning, Selection of various Parameters in BPN. Application of Back Propagation Networks in Pattern Recognition & Image Processing

Unit III : Fuzzy logic & Systems

Introduction to Fuzzy logic, Fuzzy sets and membership functions, Operations on Fuzzy sets, Fuzzy relations, rules, propositions, implications and inferences; Defuzzification techniques; Fuzzy logic controller design; Some applications of Fuzzy logic.

Unit IV : Genetic Algorithms &Hybrid Systems

Concept of "Genetics" and "Evolution" and its application to probabilistic search techniques; Basic GA framework and different GA architectures; GA operators: Encoding, Crossover, Selection, Mutation, etc; Solving single-objective optimization problems using GAs; Sequential Hybrid Systems, Auxiliary Hybrid Systems, Embedded Hybrid Systems, Neuro-Fuzzy Hybrid Systems,Neuro-Genetic Hybrid Systems, Fuzzy-Genetic Hybrid System.

Text Books:

1. Introduction to Artificial Neural Systems – J.M. Zurada, Jaico Publishers
2. Neural Networks, Fuzzy Logic & Genetic Algorithms: Synthesis & Applications – S. Rajasekaran, G.A. Vijayalakshmi Pai, July 2011, PHI, New Delhi.
3. Genetic Algorithms by David E. Gold Berg, Pearson Education India, 2006.
4. Neural Networks & Fuzzy Sytems- Kosko.B., PHI, Delhi,1994.

Reference Books:

1. Artificial Neural Networks – Dr. B. Yagananarayana, 1999, PHI, New Delhi.
2. An introduction to Genetic Algorithms – Mitchell Melanie, MIT Press, 1998
3. Fuzzy Sets, Uncertainty and Information- Klir G.J. & Folger. T. A., PHI, Delhi, 1993.

Syllabus for B.E. Semester VI, Honors Specialization

Course Code: INTH61 **Course : Taguchi Methods for Experimentation**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcome:-

After completing this course, students will be able to learn:

1. Application of Taguchi methods for experimentation
2. Design of experiments
3. Determining significant variables
4. Determining loss function

Syllabus

Unit I : Introduction to Taguchi's Approach

Quality Through Product and Process Optimization, Design of Experiments—The Conventional Approach and The Taguchi Approach, Taguchi Philosophy, Concept of The Loss Function Experiment Design Strategy, Analysis of Results, Areas of Application, Measurement of Quality by Taguchi's Strategy, Taguchi Quality Strategy, Selecting Design, Parameters for Reduced Variation, Common Terminology of Taguchi methods

Unit II : Working Mechanics of the Taguchi Design of Experiments

Formulas for Experiment Layout, Basic Methodology, Designing the Experiment, Designing with More Than Three Variables, Designs with Interaction, Designs with Mixed Factor Levels, Dummy Treatment (Column Degrading), Combination Design, Designing Experiments to Reduce Variability, Robust Design Strategy, S/N Ratio—A Smarter Way to Analyze Multiple Sample Results, Two-Step Optimizations, Robust Designs Against Multiple Noises, Design and Analysis Summary

Unit III : Analysis of Variance (ANOVA)

The Role of ANOVA, ANOVA Terms, Notations, And Development, One-Way ANOVA, OneFactor Two-Level Experiments (One-Way ANOVA), Two-Way ANOVA, Experiments withReplications, Standard Analysis with Single and Multiple Runs, Application of S/N Ratio

Unit IV : Taguchi's Loss function& Application

Derivation of Loss Function, Average Loss Function for Product Population, Application ofLoss Function Concepts, Approach for Performance Improvement, Brainstorming—An Integral Part of the Taguchi Philosophy, Taguchi Case Studies.

Text Books:

1. "A Primer on TheTaguchi Method" by Ranjit K. Roy, Copyright © 2010 Society of Manufacturing Engineers, Michigan, Second edition, ISBN 13: 978-0-87263-864-8
2. "Applied Design of Experiments and Taguchi Methods", by K. Krishnaiah and P.Shahabudeen, PHI Learning Private Limited, New Delhi.

Reference Books:

1. Taguchi's Quality Engineering Handbook - Genichi Taguchi, Subir Chowdhury, Yuin Wu, ISBN: 978-0-471-41334-9

Syllabus for B.E. Semester VII, Honors Specialization

Course Code: INTH71 **Course : Supply Chain Optimization**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcomes :

1. To give students an understanding that the problems and issues within the respective fields of logistics are invariably complex, and require clear reasoning and analysis, in order to derive an appropriate course of action.
2. To incorporate and learn the critical elements of Logistics and Supply Chain Management processes
3. To give students an appreciation that the process by which appropriate decisions are made often requires not only technical competencies from those individuals involved, but also requires them to possess competencies of a more managerial nature; and vice versa.
4. To equip students with the required depth and balance of technical and managerial competencies such that they will be able to function successfully in their chosen field.
5. Overall, to give a frame of reference for logistics and supply chain management - to give knowledge of the functions of the logistics and supply chain systems - to give knowledge of the relations of the logistics and supply chain systems to its environment - to give knowledge of the management and the operations.
6. To treat the subject in depth by emphasizing on the advanced quantitative models and methods in logistics and supply chain management and its practical aspects and the latest developments in the field.

Unit I :

Introduction to Logistics and Supply Chain Management, Inventory Management, Inventory aggregation Models, Dynamic Lot sizing Methods, Multi-Echelon Inventory models, Aggregate Inventory system and Limit

Unit II :

Transportation Network Models, Notion of Graphs, Minimal Spanning Tree, Shortest Path Algorithms, Maximal Flow Problems, Multistage Transshipment and Transportation Problems, Set covering and Set Partitioning Problems, Traveling Salesman Algorithms, Advanced Vehicle Routing Problem Heuristics, Scheduling Algorithms-Deficit function Approach and Linking Algorithms.

Unit III :

Inventory Management: Inventory aggregation Models, Dynamic Lot sizing Methods, Multi- Echelon Inventory models, Aggregate Inventory system and LIMIT.

Unit IV:

Risk Analysis in Supply Chain, Measuring transit risks, supply risks, delivering risks, Risk Pooling strategies.

Unit V : Warehousing Decisions and Facilities Location in a Supply Chain Network.

Unit VI: Demand Management and Forecasting in a Supply Chain.

Text Book:-

1. Simulation of Supply Chain Optimization: Caroline Thierry Wiley

Reference Book :-

1. Supply Chain Optimization: Joseph Genues, Panos.M.Pardos Springer

Syllabus for B.E. Semester VIII, Honors Specialization

Course Code: INTH81-1 **Course : Business Analytics**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcome:-

The students at the end of this course will be able to

1. Understand data categorization, data pre-processing, variables
2. Carry out data analysis/statistical analysis using R.
3. Carry out data analysis with R commands
4. Effectively visualize the data
5. Understand, and practice Machine learning approaches and Artificial Intelligence and its application in data analytics

Syllabus

Unit I

Data Definitions, variables and overview of Big data Elements, Variables, and Data categorization, Levels of Measurement, Big data overview, data pre-processing, concepts of supervised and unsupervised learning. Introduction to statistical learning and R-Programming.

Unit-II

R for Data Analytics- 1 Introduction to Basics, the basic data types in R and variables, Input and Output Vectors: Analyze data using vectors. Create, name and select elements from vectors. Matrices: work with matrices in R. basic computations of Matrices using R, Factors: categorical data in factors. Create, subset and compare categorical data.
R for Data Analytics- 2

Unit-III

Data Frames: usage of Data frames, create and order Data frames Lists: use of list to store components of different types. Basic Graphics: R's packages graphics and data visualizations. Descriptive Statistics using R: Basic statistics: mean, median, standard deviation, variance, correlation, and covariance, Measures of central tendency, Measures of location of dispersions, Practice and analysis with R

Unit-IV

Data Analysis Techniques and Tools Basic analysis techniques, Statistical hypothesis generation and testing, Chi-Square test, t-Test, Analysis of variance, Correlation analysis, Regression analysis, Classification techniques, clustering, Introduction to data analytics tools like TABLEAU, POWERBI, RAPIDMINER, WEKA etc.

Unit-V

Machine Learning & AI Basics of Machine Learning & AI, Introduction to Machine Learning with respect to Linear Regression Logistics regression and neural networks, Brief review of AI history, artificial intelligence and its applications in data sciences

Text Books:-

1. Data Analytics : Anil Maheshwari; MC Graw Hill Publication
2. Data Science and Analytics:- V. K. Jain : Khanna Publications

Reference Book :

Data Mining and Analytics :-Daniel T. Larose, Chantal .T.Larose Wiely Eastern

Syllabus for B.E. Semester VIII, Honors Specialization

Course Code: INTH81-2 **Course : Strategic Information Management System**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcomes :

The students at the end of this course will be able to

1. Realize the importance of having a Management Information System as a strategic tool in a given business enterprise
2. To leverage the IT infrastructure as a growth carrier for a given business model
3. To develop a Collaborative Commerce and Customer Relationship Management for sustainable competitive advantage.
4. To evolve an effective decision support system (DSS) to guide the decision making and forecast the effect of those decisions

Syllabus

Unit-I Introduction to Management Information System for strategic advantage, Contemporary Approaches to Information Systems, Role of Information Systems in Organization

Unit-II Different Types of Systems, Relationship of System to one another, Systems from a functional Perspective, Enterprise Systems, Supply Chain Management and Collaborative Commerce, Customer Relationship Management for sustainable competitive advantage, Decision Making in Information Systems, Business-Level Strategy and the Value Chain Model

Unit-III Customer Centered Retailing, Business-to-Business Electronic Commerce, Intranet Support Electronic Business, Management Challenges and Opportunities, Ethical and Social Issues

Unit-IV Managing Hardware and Software Assets, Database Approach to Data Management, Database Trends, Telecommunications and Networks, Internet

Unit-V Organizational Learning and Knowledge Management, Knowledge Work Systems, Artificial Intelligence, Decision-Support System (DSS), Group Decision-Support System (GDSS), Executive Support in the Enterprise (ES),

Unit-VI Building Information System: Linking Information Systems to the Business Plan, Systems Development, Establishing Organizational Information Requirement, Business Process Reengineering and Process Improvement, Change Management ERP: Introduction, ERP Legacy, ERP's element and sub elements, Need of having ERP, ERP Implementation, ERP Vendors

Text Books:

1. Management Information System – Lucey T., Honts, 1987
2. Information Systems for Modern Management - New Delhi, Prentice-Hall India, 1983

Syllabus for B.E. Semester IV, Minors Specialization

Course Code: INTM41 **Course : Methods Engineering**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcomes :

At the end of this course the students will be able to

1. Carry out systematic investigation of existing way of doing work to effect improvement
2. Select 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

Unit I

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. Method Study

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

Unit II

Recording Techniques, Recording Techniques, process Charts symbols, outlines process chart, flow process charts, multiple activity chart, two hand process chart, SIMO chart, travel chart, Flow diagram, string diagram. Critical evaluation Phase, Develop, Define and Install Step.

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-Time Study Objective of work measurement, work measurement techniques, time study, time study equipment, Principles 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. Factors affecting the rate of working. Allowances: Types of allowances, standard time estimation.

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.

Syllabus for B.E. Semester V, Minors Specialization

Course Code: INTM51-1 **Course : Material Management**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcome:-

Students shall be able to

1. Describe the concept, functions, objectives and importance of material management function in an organization.
2. Describe the purchasing, store management aspects.
3. Define inventory management in industries.
4. Describe vendor management and supplier selection methods.
5. Apply materials management concepts in different industries

Unit I: Introduction to Materials Management

Objectives, scope and functions of Materials Management, Cost involved, integrated materials management approach, Linkages of materials management department, role of material management techniques in material productivity improvement.

Unit II: Materials planning and Purchasing

Objectives, Functions,material requirement planning (MRP-I), manufacturing resource planning(MRP-II),Centralized and Decentralized purchasing, make or buy decision, purchase policy and procedures, Negotiation in purchasing, Purchasing of Capital equipment.

Unit III: Store Management

Objectives of storekeeping, Functions of storekeeper, store location, layout of stores, Codification, return and issue of material, indent on stores,Material management using KANBAN, stores accounting.

Unit IV: Inventory Models

Deterministic models, Inventory models for shortages, inventory models with price breaks, multi-item Deterministic models, Stochastic inventory models, Selective inventory control models.

Unit V: Vendor development and evaluation

Supplier selection, Application of multi-criteria decision making (MCDM) techniques in supplier selection like Analytic hierarchy process (AHP), Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS), Preference Ranking Organization Method for Enrichment Evaluations (PROMETHEE) etc

Unit VI: Industrial Application

Lean materials management, Various industrial application of materials management, softwares used for materials management, challenges of materials management.

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

Syllabus for B.E. Semester V, Minors Specialization

Course Code: INTM51-2 **Course :-Production Planning and Control**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcomes :

Students shall be able to

1. understand the various important features and functions of PPC
2. understand demand forecasting and its models
3. understand capacity planning and develop different aggregate plans
4. understand material requirement planning and inventory control models
5. understand scheduling and sequencing in production

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

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)

Syllabus for B.E. Semester VI, Minors Specialization

Course Code: INTM61 **Course : Operations Research**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcome:-

The expected learning outcome is that the students will be able to:

1. Convert given situation to mathematical form and determine optimal settings.
2. Use sequential optimization approach to find optimal setting in many real life situations.
3. Manage projects for minimum total cost and smooth level of resources.
4. Make decisions related to age of replacement of equipments
5. Develop simulation of real life system to analyze and optimize system concerned.

Unit I:

Introduction to OR & Basic OR Models, Definition Characteristics and limitations of OR linear programming solutions of LPP by graphical methods and simplex method. Sensitivity analysis & formulation of Dual of LPP

Unit II:

Assignment Model, Travelling Salesman Problem by branch and bound method, Transshipment model, Transportation Model

Unit III:

Dynamic programming structure and characteristics of Dynamic programming application of Dynamic programming to resource allocation

Unit IV:

Project Management: Drawing of Network, CPM & PERT, probability of completion of project, cost analysis, Allocation and updating of Networks.

Unit V:

Replacement Models: Concept of equivalence, Interest Rate, Present worth, economic evaluations of Alternatives, Group replacement models.

Unit VI:

Inventory control models, Simulation, concepts and its application in inventory control, and in waiting line situations (queuing situations) and other applications.

Text Books:

1. Operation Research Heera & Gupta S Chand Publications
2. Operation Research JK Sharma, McMillian Publications
3. Operation Research Askhedkar & Kulkarni, Dhanpat Rai Publications

Reference Books:

1. Operation Research, Hamdy Taha, Prentice Hall
2. Operation Research Liberman, McGraw Hill Publications
3. Operation Research by S D Sharma, Kedarnath Ramnath & Co.
4. Operation Research by V K Kapoor, S.Chand Publications
5. Operations Research: Models and Methods by Paul A. Jensen and Jonathan F. Bard, John Wiley and Sons.

Syllabus for B.E. Semester VII, Minors Specialization

Course Code: INTM71 **Course :-Quality Engineering & Management**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcomes :

Students shall be able to

1. Understand and identify different parameters related to product and service quality
2. Make use of quality control tools for process improvement.
3. Make use of different techniques for product quality improvement.
4. Develop skills for applying quality strategy in companies.

Unit I:

Introduction to Quality Management- Evolution of Quality Management ,Strategic Quality management, Concepts of Product and Service Quality, Cost of Quality, Quality circles

Unit II :

Process Quality improvement , Introduction to Process Quality, Graphical and statistical techniques for Process Quality, Improvement Graphical tools for data representation, 7 QC tools.

Unit III:

Sampling, The need for Sampling, Types , sampling distributions, Control charts, types, Control charts for variables and attributes, Process capability .

Unit IV:

Total Quality Management, Lean and JIT Quality Philosophy, Kaizen, Total Productive maintenance, ISO 9001.

Unit V:

Product Quality Improvement, Quality function Deployment, Concept, Applications of QFD, Quality Standards and Business Excellence models, Software Quality Management .Six sigma.

Unit VI:

Service Quality Management, Software Quality Management, Quality Strategy for Indian Companies.

Text Book:

1. Quality Management, Kanishka Bedi, Oxford Publications.
2. Quality Management, K Shridhara Bhat, Himalaya Publications House.

Reference Book:

Quality planning analysis- Juran, Tata McGraw Hill

Syllabus for B.E. Semester VIII, Minors Specialization

Course Code: INTM81 **Course : Project Engineering & Management**

L: 4 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits: 04**

Course Outcome:-

At the end of this course the students will be able to

1. Make a proper project charter.
2. Plan and schedule a project activity
3. Demonstrate the ability to understand and use human resources and contracts project team
4. Evaluate the project performance
5. Ability to prepare the project audit report

Introduction and concepts of project management life cycle, Establishing project scope time cost and Performance goals, organizing human resources and contracting, organizing systems and procedures for project implementation, project direction, coordination, control and evaluation. Benefits of project evaluation, limitations of project evaluation, limitations and methods of project evaluation, Project Management Performance, Management Information System, Project Management Tools

Text Books:

1. Project Management: David Cleveland. Lewis Ireland, Tata McGraw-Hill.
2. Project Management: S. Chaudhary Tata McGraw Hill.
3. Guide to Project Management: Harold Kenzer Tata McGrawHill

Reference Book:

1. Project Management: Jack Gido, James Clements; Cengage Learning.

SHRI RAMDEOBABA SARVAJANIK SAMITI
RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT
NAGPUR
ESTD - 1984
श्रेष्ठम् तंत्र शिक्षणम्