FACULTY OF ENGINEERING & TECHNOLOGY

MECHANICAL ENGINEERING

Syllabus Structure for

B.E. (Mechanical Engineering) w.e.f. Academic Year 2017-2018

(CGPA)

SOLAPUR UNIVERSITY, SOLAPUR

Faculty of Engineering & Technology

Credit System Structure of B.E (Mechanical Engineering) wef 2017-18

Semester I: Theory Courses

Sr. No.	Name of Theory Course	Hrs./week				Credits	Examination Scheme			
		L	T	P	D		ISE	ESE	ICA	Total
1	Automatic Control Engineering	3	-	-	-	3	30	70	-	100
2	Operations Research	3	-	-	-	3	30	70	-	100
3	Refrigeration and Air Conditioning	3	-	-	-	3	30	70	-	100
4	Professional Elective - 3	3	-	-	-	3	30	70	-	100
5	Free Elective - I	3	-	-	-	3	30	70	-	100
	Sub Total	**15**	**-**	**-**	**-**	**15**	**150**	**350**	**-**	**500**

Semester I: Laboratory / Tutorial Courses

Sr. No.	Name of Laboratory / Tutorial Course	Hrs./week				Credits	Examination Scheme				
		L	T	P	D		ISE	ESE		ICA	Total
								POE	OE		
1	Automatic Control Engineering	-	-	2	-	1	-	-	-	25	25
2	Operations Research	-	-	2	-	1	-	-	-	25	25
3	Refrigeration and Air Conditioning	-	-	2	-	1	-	-	25	25	50
4	Professional Elective - 3	-	-	2	-	1	-	-	25	25	50
5	Free Elective - I	-	2	-	-	1	-	-	-	25	25
6	Industrial Training	-	-	1	-	1	-	-	25	50	75
7	Project Work– I	-	-	4	-	2	-	-	-	50	50
	Sub Total	-	-	-	-	8	-	-	75	225	300
	Grand Total	**15**	**02**	**13**		**23**	**150**	**425**		**225**	**800**

Abbreviations: *L - Lectures, P –Practical, T - Tutorial, ISE - In Semester Examination, ESE - End Semester Examination (University Examination for Theory & / POE & / Oral), ICA - Internal Continuous Assessment.*

Professional Elective-3: Finite Element Methods, Automobile Engineering, Process Engineering

Free Elective –I: Industrial Robotics, Sugar Engineering, Textile Engineering, and Entrepreneurship Development

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Semester II: Theory Courses

Sr. No.	*Name of Theory Course*	*Hrs./week*				*Credits*	*Examination Scheme*			
		L	T	P	**D**		ISE	ESE	ICA	Total
1	Industrial and Quality Management	3	-	-	-	3	30	70	-	100
2	Industrial Engineering	3	-	-	-	3	30	70	-	100
3	Professional Elective - 4	3	-	-	-	3	30	70	-	100
4	Free Elective - II	3	-	-	-	3	30	70	-	100
	Sub Total	**12**	**-**	**-**	**-**	**12**	**120**	**280**	**-**	**400**

Semester II: Laboratory / Tutorial Course

Sr. No.	*Name of Laboratory / Tutorial Course*	*Hrs./week*				*Credits*	*Examination Scheme*				
		L	*T*	*P*	**D**		*ISE*	*ESE*		*ICA*	*Total*
								POE	*OE*		
1	Industrial and Quality Management	-	-	2	-	1	-	-	-	25	25
2	Industrial Engineering	-	-	2	-	1	-	-	-	25	25
3	Professional Elective - 4	-	-	2	-	1	-	-	25	25	50
4	Free Elective - II	-	2	-	-	1	-	-	25	25	50
5	Project Work – II	-	-	8	-	4	-	-	100	100	200
6	General Proficiency	2	-	-	-	2	-	-	-	50	50
	Sub Total	**2**	**2**	**14**	**-**	**10**	**-**	**150**			**400**
	Grand Total	**14**	**2**	**14**	**-**	**22**	**120**	**430**		**250**	**800**

Abbreviations: *L - Lectures, P –Practical, T - Tutorial, ISE - In Semester Examination, ESE - End Semester Examination (University Examination for Theory & / POE & / Oral), ICA - Internal Continuous Assessment.*

Professional Elective-4: Mechatronics, Computational Fluid Dynamics, Production and Operation Management

Free Elective –II: Software Engineering & cyber security, Agro Machine Engineering, Plastic Engineering and Economics for Engineers

Note :

1. Batch size for the practical /tutorial shall be of 15 students. On forming the batches, if the strength of remaining students exceeds 07, then a new batch shall be formed..

2. Project group for B.E. (Mechanical) Sem. I and Sem. II shall not be of more than **four** students.

3. Practical / Tutorial load indicates the load per batch.

4. ICA assessment shall be a continuous process based on the performance of student in assignment, class test, quizzes, homework, interaction during theory and laboratory session, hand written lab book/ hand written journal, sheet drawing, subject seminar presentation etc. as applicable.

5. For Elective -: To offer a particular subject as an Elective, minimum 15 students should opt for the same. Appropriate Electives Subjects may be added when required.

Semester-I

1. Automatic Control Engineering

Teaching Scheme:	*Examination scheme:*
Lectures: 3 Hrs/week	ISE-30 Marks
	ESE-70 Marks
Practical: 2 Hrs/week	ICA: 25 marks

Course Objectives: 1) To make the students aware of basic mathematical analysis techniques used for Automatic control systems.
2) To make use of the software MATLAB to solve simple problems in control Engg. as a part of Term-Work.

Section - I

UNIT (1) Need for control, manual and automatic control, Open loop and closed loop (feedback) control systems, modern control systems. (3)

UNIT (2) Representation of control components: Mechanical – helical spring, viscous damper, torsional spring and damper, Electrical – resistor, inductor, capacitor, series and parallel electric circuit and mech. System, grounded chair representation. Analogs – direct and inverse analogs for mechanical, thermal and fluid systems. (5)

UNIT (3) Representation of control systems: Linearization of non-linear functions, linearization of operating curves, hydraulic amplifier, servomotor, jet pipe amplifier, speed control of AC and DC motors. (5)

UNIT (4) Block diagram algebra: general representation of a feedback control system, transfer functions, rules of block dia. algebra, reduction of block dia. to obtain closed loop transfer function. (4)

UNIT (5) Steady state operation: Steady state analysis for general block dia. for a control system, steady state characteristics, equilibrium in a system. (3)

Section - II

UNIT (6) Transient Response: Transient response and steady state analysis of unit, step input, general operational representation for a differential equation of control system, distinct, repeated and complex conjugate zeros, general form of transient response, Routh's stability criterion for a control system. (3)

UNIT (7) Modes of control: ON/OFF, proportional (P), Integral (I), Derivative (D) and P+I, P+D, P+I+D controllers (No numerical treatment). (3)

UNIT (8) Root locus method: Significance of Root locus, angle and magnitude conditions, breakaway points, angles of departure and arrival, construction of Root locus using general rules and steps. (6)

UNIT (9) Bode Plots: Magnitude and Phase angle plots, standard form of open loop T.F. $G(j\omega)\,H(j\omega)$, Bode plots for standard factors of $G(j\omega)\,H(j\omega)$,steps to sketch Bode plots for following factors :System gain K, Poles & zeroes at the origin, simple poles &simple zeroes, frequency response specifications, calculation of Gain Margin and Phase margin from Bode plots. (5)

UNIT (10) State space methods: State space representation for control system by direct, parallel, series and general programming, matrix from representation, computer diagrams. (3)

TERM WORK

Any **six** of the following to be completed.

1. An experiment on DC/AC motor speed control
2. An experiment to demonstrate various modes of control: P, P+I, P+D & P+I+D.
3. Assignment on linearization of nonlinear functions and operating curves.
4. Assignment on reduction of block diagrams of control systems using block diagram algebra.
5. Assignment on 'Root Locus method'
6. Assignment on 'Bode Plots.
7. Assignment on 'State space methods'

• Every assignment must include a few theory questions and a variety of problems

• Software 'MATLAB' must be used to solve some problems in assignment numbers No.5 to No.7.

TEXT BOOKS

1. Automatic control Engineering: F.H.Raven., McGraw Hill International editions, New Delhi, Fifth edition.

2. Control Systems: U.A. Bakshi and V.U. Bakshi, Technical Publications, Pune, Fifth revised edition – 2007.

REFERENCE BOOKS

1. Modern Control Engineering: K.Ogata, Prentice Hall of India Pvt. Ltd., NewDelhi., Fourth edition.
2. Process Control: C. Johnson, Prentice Hall of India Pvt. Ltd., 1996.
3. Closed loop control systems: S.C.Goyal and U.A.Bakshi, Technical Publications, Pune, 2002.
4. Feedback Control systems: Bhide, Satyanarayana and Jalgoankar, Technova Publishers, Pune
5. Automatic control systems, B.C. Kuo, Prentice Hall of India Ltd.

2. Operations Research

Teaching Scheme:	***Examination scheme:***
Lectures: 3 Hrs/week	ISE-30
	ESE-70 Marks
Practical: 2 Hrs/week.	ICA-25 marks

Course objective:

1. Study of quantitative techniques in management decision making and its applications by using mathematical models.
2. Create awareness about preparation of Project Plan.

Course outcomes:

Student should be able to -

1. Apply various optimization techniques to industrial applications.
2. Develop a project plan for the industry or organization.

Section I

1. Introduction: 02 hrs.

History and development of OR, Applications, methodology in operation research, O.R. models and their applications

2. Linear Programming Problems: 07 hrs.

Introduction, Formulation of problem, Graphical solution, Simplex method, Big M method, Two phase method, Duality in LPP, Sensitivity analysis under different situation (No numerical problems).

3. Assignment Model: 03 hrs.

Mathematical statement, Methods to solve balanced and unbalanced assignment problems, Maximization problems, Assignment with restrictions, Traveling salesman problem.

4. Transportation Model: 05 hrs.

Mathematical formulation, methods to obtain initial basic feasible solution (IBFS), NWCR matrix minima method and VAM, conditions for testing optimality, MODI method for testing optimality solution of balanced and unbalanced problems, Degeneracy and its resolution.

5. Dynamic Programming : 03 hrs.

Introduction, Bellman's principle of optimality, shortest route (stage coach) problem, maximization problem (cargo loading problem)

Section II

6. Games Theory: **04 hrs.**

Introduction, Minimax and maximin principle, Solution of zero sum two persons games – Saddle point algebraic method, Dominance properties, Graphical method

7. Decision Theory: **04 hrs.**

Introduction, Pay off table, Opportunity loss or regret table, Decisions under uncertainty, Laplace Criterion, Maximin or minmax principle, maximax or minimax principle, Hurwicz principle, Decisions under risk – maximum likelihood criteria, Expectation principle, Expected opportunity loss or expected regret, decision trees.

8. Replacement Model: **03 hrs.**

Replacement problem, Replacement model for items whose maintenance cost increases with time (money value constant) and with change in money value, Selection of best machine, Replacement of items that fail suddenly, Individual and group replacement policies.

9. Inventory control: **04 hrs.**

Introduction, Classification of inventory, costs associated with inventory, Deterministic Inventory models- economic lot size model with instantaneous replenishment with or without shortages ,quantity discount model

10. Project Management techniques - CPM/ PERT **05 hrs.**

Fundamentals of CPM / PERT networks; CPM – construction of networks, critical path, forward and backward pass, floats & their significance.

PERT – Time Estimates, Construction of Networks, Probability of completing projects by scheduled date.

Term Work:

1. Minimum six assignments based on Numerical Problem Solving on above syllabus.
2. One Case Study on above mentioned topics in the syllabus.

Books Recommended

Text Books:

1. Hamdy Taha, “Operations Research – An Introduction”, 7th edition PHI (2003)
2. S. D. Sharma, “Operation Research”, Kedarnath and Rannalt Pub.
3. Hira and Gupta, “Operation Research”, S. Chand and Co.

Reference books:

1. Operations Research by Hillier and Lieberman TMGH
2. Swarop Kanti Gupta P.K. & Manmohan- OR Sultan Chand & Sons, New Delhi
3. Shrinath L.S.: PERT & CPM –Affiliate East West Press
4. R. Panneerselvam, “Operations Research”, PHI (2002).

3. Refrigeration and Air Conditioning

Teaching Scheme:
Lectures: 3 Hrs. / Week

Practical: 2 Hrs. / Week

Examination Scheme:
ISE-30 Marks

ESE-70 Marks

ICA- 25 marks

Oral Exam. 25Marks

Course objective:

1. To Study basic refrigeration cycles and air refrigeration systems.
2. To study different refrigerants and multi pressure refrigeration systems
3. To Study Psychometric properties of air and human comfort conditions
4. To study and design of air conditioning systems

Course outcomes:

At the end of course a student can be able to

1. Analyze basic refrigeration cycles and air refrigeration systems
2. Select proper refrigerant and appropriate refrigeration system based on application
3. Define and estimate psychometric properties
4. Estimate cooling and heating load calculations and design air conditioning system for different applications.

Section – I

1. a)Basic Refrigeration Cycles:

Refrigeration, Units of Refrigeration, Reversed Carnot cycle, Bell-Colemon cycle, Types of Vapour Compression Cycles, Calculations & performance of above cycles, Actual vapour compression cycle. (Numerical Treatment) (7 hrs)

b) Air Refrigeration systems for Air Craft Refrigeration:

Necessity of air cooling for air craft, Simple system, Boot strap system, Regenerative system, Reduced ambient system (Descriptive Treatment) (3hrs)

2. Multi pressure systems:

Introduction, Multistage compression, Flash gas removal, flash inter cooling, complete multistage compression system, Multi evaporator systems (Descriptive Treatment) (3 hrs)

3. Refrigerants:

Classification, Desirable properties, Nomenclature of refrigerants, Selection of refrigerant, Secondary refrigerants, Effect on ozone depletion & Global warming, Total equivalent warming impact (TEWI), Alternative refrigerants, Nan refrigerant (Descriptive Treatment) (3hrs)

4. Vapour Absorption System:

Simple aqua-ammonia vapour absorption system, Practical aqua-ammonia vapour absorption system, Comparison between vapour absorption & vapour compression systems, Lithium Bromide absorption refrigeration systems, Electrolux refrigerator. (Descriptive Treatment) . (4hrs)

Section – II

5. Psychrometry

Moist air as a working substance, Psychrometry properties of air, Use of psychometric tables & charts, Processes, Combinations & calculations, ADP, Coil condition line, Sensible heat factor, Bypass factor, Air washer &it's applications.(Numerical Treatment) (7 hrs)

6. Heating & Cooling Load Calculation:

Representation of actual air conditioning process by layouts & on Psychometric charts, Load analysis RSHF, GSHF, Enumeration & brief explanation of the factors forming the load on refrigeration & air conditioning system (Numerical Treatment) (6hrs)

7. Comfort Conditions & Air Distribution System:

Thermal exchange between human body & environment, Factors affecting comfort, effective temperature comfort chart, Ventilation requirements.

Duct classification, duct material, duct construction, duct design, Methods for duct design, determination of duct size, losses in duct (Theoretical Treatment) (4hrs)

8. Introduction to Cryogenics:

Introduction, Limitation of VCRS For production of low temp., Cascade refrigeration, Linde system for liquefaction of air, production of low temperature by adiabatic demagnetization of paramagnetic salt. (Theoretical Treatment) (3hrs)

Term Work

Group I (Study, Demonstration & minimum four assignment on following topics)

01. Study of Refrigeration methods
02. Study of Refrigeration Equipments
03. Study of Refrigeration systems – domestic refrigerator, Split air conditioning, Ice plant, Deep freezer etc.
04. Study of food preservation, Methods of food freezing
05. Study of charging, leak testing of refrigeration systems
06. Study of non conventional refrigeration systems

Group II (Minimum three experiments on following list)

01. Trial on Refrigeration primer / bench
02. Trial on Air conditioning tutor
03. Trial on mini ice plant
04. Trial on Vapour Absorption system
05. Trial on Heat Pump

Group III

1. Visit to refrigeration plant or Central Air conditioning plan
2. Performance evaluation of any one trial of Group-II by using MATLAB/C Programming

Text Books:

01. 'Refrigeration & Air Conditioning' by C.P. Arora
02. 'Refrigeration & Air Conditioning' by Arora & Domkundwar
03. 'Refrigeration and Air-conditioning' by Khurmi R.S.,Gupta

Reference Books:

01. 'Principle of Refrigeration' by Roy J Dossat
02. 'Air Conditioning Applications & design' by W.P. Jones
03. 'Refrigeration & Air Conditioning' by Stocker

Professional Elective -3
4.1 Finite Element Analysis

Teaching Scheme	Examination Scheme
Theory- 3 Hrs. / Week	**ISE-**30 Marks
	ESE-70 Marks
Practical- 2 Hrs./ week	**ICE** - 25 Marks
	Oral Exam - 25 Marks

Course Objectives

- Understand the use of variational formulation and method of weighted residuals in solving field problems.
- Apply direct method to formulate equations for elements
- Under take structural and thermal analysis projects for research and industry.
- Understand the latest trends in Mechatronics and their applications.

Course Outcomes

- Solve boundary value problems using variational calculus and WR methods.
- Formulate stiffness matrices for simple 1D, 2D and 3D elements.
- Solve 1D, 2D and 3D problems using FEA techniques.
- Solve 1D, 2D and 3D problems in software.

Section I

Unit 1: FEA fundamentals (4 hrs.)
Basic ideas in a finite element solution, brief, history, General FEA procedure, applications of FEM, other computational techniques such as FDM, BEM, FVM and their applications.

Unit 2: Approximate Solution to differential elements (4 hrs.)
Variational calculus, Methods of weighted residuals collocation, least squares, Galerkin and Modified Galerkin method, Boundary conditions and general comments.
(Numerical Exercises)

Unit 3: Finite element formulation of trusses and beams (4 hrs.)
Interpolation functions 1D elements, shape functions, formulation of system equations for 2D and 3D trusses and beam elements, calculation of stresses and strains.
(Derivations and Numerical Examples)

Unit 4: Finite element formulation for 2D elements (4 hrs.)
Interpolation functions for 2D elements shape functions for 2D elements, LST, CST, linear quadrilateral element.
(Derivations and Numerical Exercises)

Section II

Unit 5: Finite Element Formulation for 3D elements (4 hrs.)
Interpolation functions for 3D elements, shape functions, formulation of system equations, calculation of stresses and strains.
(Derivations and Numerical Exercises)

Unit 6: Natural Coordinates and Higher order Elements (4 hrs.)
Shape functions in Natural coordinates, derivation of shape functions of 1D, 2D and 3D elements in natural coordinates, Lagrangian polynomials, Isoparametric elements, mapping and transformation in higher order elements, Jacobian.
(Derivations and Numerical Exercises)

Unit 7: Nonlinear and Dynamic FEA (4 hrs.)
Nonlinear elasticity problems: Material, geometric and boundary condition non linearity. Dynamic Problems: Modal Analysis, transient response analysis, harmonic analysis, spectrum analysis, transient thermal analysis.

Unit 8: FEM and Computers (4 hrs.)
Preprocessing, Solvers, Post Processing, Commercial finite element software, model validity, mesh design & refinement, element distortion.

Term work

1) One assignment with numerical exercises on variational formulation.
2) One assignment with numerical exercises on method of weighted residuals formulation.
3) One software assignment on 1D problem.
4) One software assignment on 2D problem.
5) One software assignment on 3D problem.
6) One software assignment on non-linearity problems.
7) One assignment on Natural Coordinates and Isoperimetric formulation
8) One assignment on FEA applications and future developments.
9) One theory assignment on Mechatronics applications.

Recommended Books

Title	**Author**	**Publisher**
Concepts and Applications of FEA	Cook, Malkaus, Plesha, Witt	Wiley
A first course in FEA	Darryl Logan	Cengage
Finite Element Methods	U.S Dixit	Cengage
Textbook of Finite Element Analysis	P. Sheshu	PHI
Fundamentals of Finite Element Analysis	Hutton	McGraw Hill
Introduction to Finite Elements in Engineering	Chandrupatla & Belegundu	PHI
Finite Element analysis	M.J Fagan	

4.2 Automobile Engineering

Teaching Scheme	Examination Scheme
Lecturers: 3 Hrs/ Week	**ISE-30 Marks**
	ESE-70 Marks
Practical's: 2 Hrs/ Week	**ICA-** 25 Marks
	Oral: 25 Marks

Objectives

1. Study basic principles of actual automobile systems
2. Study important systems in an automobile
3. Study recent and modern trends in automobile sector
4. To make students aware about the entrepreneurial opportunities in automobile engineering field.

Outcomes: Learner will be able to…

1. Demonstrate & explain various systems in an automobile
2. Describe importance and features of different elements like axle, differential, brakes, steering, suspension, wheel balancing etc.
3. Explain principle of operation, construction and applications of various sensors used in modern automobile

Section – I

1. Introduction to Automobiles: **04**

Broad classification of Automobiles. Major Components and their functions. Types of vehicle layouts, Front engine rear wheel drive, Front engine front wheel drive, Rear engine rear wheel drive, All wheel drive**,** specifications of vehicles. Types of bodies, Body construction and materials, and safety devices.

2. Performance of Automobiles: **05**

Resistance to vehicle motion, Air, Rolling and Gradient resistance, Acceleration, Grade ability and draw bar pull, Traction and Tractive effort, Distribution of weight, Power required for vehicle propulsion, Selection of gear ratio, Rear axle ratio. (Numerical)

3. Transmission System: **08**

Requirements of transmission system, Automobile clutch- requirements, types & functions, Single plate, Multi-plate, Centrifugal, Electromagnetic & Fluid flywheel. Types of automotive gearboxes, Working of sliding mesh, Constant mesh and Synchromesh gearbox, Overdrive, Principle of operation of automatic transmission, Torque converter, Epicyclical gear trains, Propeller shaft, Universal and slip joint, Final drive and its types, Differential, Construction and types of rear axles, Introduction to wheels and tyres.

4. Automobile Electrical Systems: **03**

Automotive batteries, automotive lighting system. Starting system, charging system, Electric horn, Electric fuel Gauge- thermostatic & balancing coil type, Wiper & side indicator circuit, electric Speedo meter.

Section – II

5. Steering System: **06**

Function of steering, Steering system layout, Automotive steering mechanism- Ackerman and Davis, Types of steering gear boxes, Condition for true rolling, Steering geometry-Camber, Caster, King pin inclination, Included angle, Toe-in and Toe-out, Wheel alignment, Slip angle, Under steer & over steer, Types and working of power steering,. . (Numerical)

6. Braking System: **06**

Function of automotive brake system, Types of braking mechanism, internal expanding & Disc brake, Mechanical, Hydraulic & Air brake system, power brakes, Anti lock braking, Calculation of braking force required, stopping distance and dynamic weight transfer.(Numerical)

7. Suspension Systems: **05**

Suspension requirements, Sprung and Un sprung mass, Types of automotive suspension systems. Conventional and Independent, Shock absorber, Types of springs, Hotch- kiss and Torque tube drive, Reaction members-Radius rod, Stabilizer bar, Air suspension system.

8. Modern Trends: **03**

Engine electronic control modules, Introduction to Sensors and actuators used in automobile controls, Electronic Control Unit, traction control devices, fuel cells Hybrid vehicles-Electrical vehicle, solar vehicles.

Term Work

Minimum **six** experiments from Group A and **two** experiment from Group B are to be performed

Group A.

1. Study and demonstration of four wheeler chassis layout. Two-wheel & four wheel drive layouts.
2. Study and Demonstration of working of single plate automobile clutch.
3. Study and demonstration of synchromesh gearbox.
4. Study and demonstration of final drive and differential.
5. Study and demonstration of working Hydraulic braking system.
6. Study and demonstration of front wheel steering geometry and steering mechanism.
7. Study and demonstration of suspension system of a four-wheeler.
8. Study and demonstration of battery and electrical starting system
9. Study and demonstration of (a) Electric horn. (b) Electric fuel Gauge. (c) Flasher unit. (d) Wiper circuit

Group B.

1. Experiment on wheel balancing & front wheel alignment.
2. Visit to servicing station for study of vehicle maintenance, repairs and report.
3. A case study presentation and report covering recent trends in automobiles.

Books Recommended

Text books-

1. Kripal Singh - Automobile Engineering – Standard publisher.
2. Automobile Mechanics -.N. K. Giri
3. Automobile Electrical Equipment -P. S. Kohali

Reference Books:

1. K. Newton and W. Seeds, T.K. Garrett,Motor Vehicle, Elsevier publications
2. Hans Hermann Braess, Ulrich Seiffen, handbook of Automotive Engineering, SAE Publications
3. William H. Crouse. Automotive Mechanics - Tata McGraw Hill Publishing House
4. Joseph Heitner, Automotive Mechanics -C.B.S Publishers And Distributors
5. SAE Manuals and Standard
8. Narang G. B. S - Automobile Engineering - S. Chand and Company Ltd.
9. Singh Kripal - Automobile Engineering –Standard publisher

4.3 Process Engineering

Teaching Scheme:
Lecture- 3 hour/ Week

Practical- 2 hour/ Week

Examination scheme:
ISE-30 Marks
ESE-70 Marks
ICA- 25 marks
Oral Exam-25 Marks

Course objectives

1. To prepare the student for the knowledge of process planning decisions.
2. To prepare the student to design & develop an optimum process for a given component in a given situation.
3. To prepare the student to compare the processes on the basis of cost and processing time.

Course outcomes

1. Students will be able to prepare process plan for a given component for job production.
2. Students will be able to prepare process plan for a given component for batch production.
3. Students will be able to prepare process plan and tool layout for a given component for mass production.
4. Students will be able to compare two processes on the basis of cost and processing time.

Section I

1. **Introduction** (8)
   a. Manufacturing system, Input & Output of manufacturing system, characteristics of manufacturing system.
   b. Categories of manufacturing system.
   c. Manufacturing Engineering.
   d. Position of product & process Engineering Department in organization.
   e. Function of product & process Engineering.
   f. Documents released by product & process engineering department.
   g. Part print analysis & details of different steps involved in part print analysis.

2. **Process planning fundamentals** (8)
   a. Aims & objectives, Design & manufacturing cycle
   b. Process planning activities.
   c. Route sheets, operation list, tooting list, list of cutting parameters, process chart symbols.
   d. Input & output of process planning, process planning & production planning.
   e. Process planning methods.
   f. General guidelines for manual process planning, advantage & limitations.
   g. Basic process planning terminology- process, operation & cut.
   h. Dimensional control and geometrical control for the job

3. **Drawing interpretation** (4)
   a. Aims & objectives, Engineering drawing.
   b. Interchangeability, standardization, selective assembly.
   c. Process tolerance, tolerance stacks- types, effects.
   d. Methods to control the tolerance stack

Section II

4. **Feasibility study & selection of sequence of operation.** (6)
   a. Technical, economical & managerial aspects.
   b. Procedure to study feasibility.
   c. Classification of operations.
   d. Factors deciding the sequence, combining & eliminating the operation.
   e. Factors affecting method selection.
   f. Study of alternative methods.

5. **Selection of equipments & Selection of tooling** (6)
   a. Factors in equipments selection – Technical & operational factors, economic & managements consideration.
   b. Various sources of information.
   c. Selection criteria for GPM'S, SPM'S for processing.
   d. Factors in tool selection, constraints in tool selection, operating requirements for tool selection.
   e. Technical specification for standard cutting tool & gauges required Various machining operations.

6. **Preparation of process sheet for machining of components for job, batch & mass production**. (8)
   a. Drawing interpretation.
   b. Process m/c selection & sequencing of process & operations.
   c. Tooling selection, setting correct cutting parameters, selecting proper work holding devices, process pictures, symbols, process pictures for operations.
   d. Selection of proper Inspection method required.
   e. Documenting process plan.
   f. Costing the process plan.
   g. Process bench marking.

Term work

1. Process plan for processing of component on job basis. (2 Exercises)
2. Process plan for processing of a component on batch basis. (2 Exercises)
3. Process plan for processing of a component on mass basis. (2 Exercises)
   (These exercises shall include the components requiring processing on at least 3 machines)

Process sheet shall include -

a. Sequence of operation including m/c selected, holding method, machining data for each set up, time estimate.
b. Specification of gauges & inspection equipments.
c. ISO or any commercial Specification of each tool.

4. Process pictures for various operations for a given component. (2 exercises)
5. Industrial visit to study process planning of component & its report.

Text Books

1. Process planning : Peter Scallen (BH publication)
2. Process Engineering for manufacturing – Eary & Johnson.

Reference Books

1. A textbook of Production Engineering – P.C Sharma (Millenium editor).
2. Standard Manual of ISO, QS, TS etc.
3. Manufacturing catalogues for cutting tools & Inspection equipments.

Free Elective –I

5.1 Industrial Robotics

Teaching Scheme:	Examination Scheme:
Lecture-3 Hrs. / Week	**ISE**-30 Marks
	ESE-70 Marks
Tutorial- 2 hours /week	**ICA**-25 Marks

Course Objectives

- Understand the use of sensors, actuators and controllers in various robotic applications
- Apply robotics technical expertise to solving industry-related problems.
- Under take complex robotic automation projects for research and industry.
- Understand the latest trends in robotics and their applications.

Course Outcomes

- Solve forward and inverse kinematic equations for robot motion.
- Interface common sensors and actuators to robots
- Implement software for control of robots
- Implement simulation models in MatLab and ADAMS

Section I

Unit 1: Introduction to Robotics (3-4 hrs.)
Automation and Robots, Robot Classification, Robot Specifications, Historical perspective, current scenario and future roadmap.

Unit 2: Robot Drives and Peripherals (3-4 hrs.)
Sensors in robotics, tactile sensors, proximity sensors, vision sensors, DC and AC motors, stepper motors. DC motor and AC motor control, feedback, robot peripherals and end effectors.

Unit 3: Forward and Inverse Kinematics (4 hrs.)
Forward kinematics: Coordinate frames, transformations, arm equation.
Inverse Kinematics: Tool Configuration, inverse kinematics of three axis, four axis and five axis robots. *(Numerical on forward and inverse kinematics)*

Unit 4: Differential motion and dynamics (4 hrs.)
Jacobian Matrix, Singularities, induced torque and forces, Lagrange's Equation, Dynamic models of two-axis planar robots. *(Numerical on Jacobean)*

Section II

Unit 5: Robot Control and programming (3-4 hrs.)
The control problem, state equations, Liapunov's method, transfer function linear feedback, PID control, robot programming languages, RRS.

Unit 6: Robot Vision (4 hrs.)

Image processing fundamentals: Edge detection, shape analysis, segmentation, object identification, template matching, cameras, camera specification and selection, camera calibration.

Unit 7: Wheeled Robots (4hrs.)

Fundamentals of electric propulsion, two, three and multi wheeled robots, tracked robots, slip modeling, wheeled robots on uneven terrain, kinematics, dynamics and stability of wheeled robots, applications as UGVs.

Unit 8: Robotic Applications (3-4 hrs.)

Welding applications, painting applications, material transfer, assembly applications, UGVs and AGVs, robot work cells, military robots.

Term work

1) One MatLab assignment in forward kinematics.
2) One MatLab assignment on inverse kinematics.
3) One assignment on dynamics.
4) One MatLab assignment on robot control
5) One practical assignment on robot control using software.
6) One practical assignment of Matlab and ADAMS simulation of wheeled robots.
7) One practical assignment which includes building small robotic systems which microprocessor receives input from sensors and controls robot motion.
8) One theory assignment on Robot Applications
9) One MatLab assignment on Image Processing.

Text Books

Title	Author	Publisher
Robotics Fundamental Concepts and Analysis	Ashitava Ghosal	Oxford
Industrial Robotics	Graser	Industrial Press

Reference Books

Title	Author	Publisher
Fundamentals of Robotics	Robert Schilling	Prentice Hall India
Foundation of Robotics	Yoshikawa	MIT Press
Industrial Robotics	Graser	Industrial Press
Robot Vision	Horn	MIT Press
Industrial Robotics	Groover	Tata McGraw Hill

5.2 Sugar Engineering

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 Hrs. / Week	**ISE**-30 Marks
	ESE-70 Marks
Tutorial: 2 hours /week	**ICA**-25 Marks

Course Objectives:

i. To prepare the students for knowing the basic nomenclature related to Sugar and sugarcane.
ii. To familiarize the students with concepts of various concept of mechanical Engineering such as Design Construction and Working for various equipments, chemical processing of sugar manufacturing.
iii. To prepare the students to understand the opportunities in Sugar Industry for Mechanical Engineers.

Course Outcomes:

By the completion of the course, students must be able to:

i. Understand the nomenclature used in Sugar Engineering
ii. Demonstrate the knowledge of various mechanical equipments/machinery and chemical processing of Sugar Industry.
iii. Understand mechanical engineering concepts related to Sugar industry

Section I

1. Process of Sugar Manufacture in short. Cane unloader - **Cane handling** -Feeding table - Power required Slope of table Chain breaking strength, sprocket **Main cane carrier**- Objective, Length –(horizontal length .Inclined length .total length),Speed of cane carrier, Capacity of cane carrier, Slope, Width of carrier, Speed of carrier, Power required, Quantity of cane carrier, Width of carrier, Maintenance part ,Splitting of carrier, Belt type carrier. Cane preparation –Objective, Preparation index- bulk density method, sieving method, Leaching, method, judging by eye. Cane kicker or equalizer. Cane knives. A Fibrizer anvil plate, hammers..Shredder **[5]**

2. Juice extraction from cane, maceration and imbibitions, use of cold and hot water, maceration schemes and mill sanitation. Measurement and weighing of juice – Measuring tanks level meters, weighing machines – hand operated semi-automatic and systems – equipment details and operation**.** **[5]**

3. Juice heaters, heat, exchangers, tubular and plate type and their operation-Single and double heat valves utilization of effect steam economy, dynamic juice heater, Vapour Line Juice Heater. **[5]**

4. Evaporation – Study and operation of different types of multiple effect, vapour cell/pre evaporators, vapour bleeding system, catchalls, scale formation and their removal, factors effecting efficiency of evaporation, method of working, removal of condensate and incondensable gases, brix testing devices, automatic juice level regulator, Causes of entrainment, catch-alls and material of constructions. Recent advances in chemical cleaning and antiscalents. L.T.V.R.F.E., L.T.V.F.F.E. **[5]**

Section II

5. **Crystallization AND Vacuum pan**

   Theory of crystallization, Crystallization zones. Graining – Graining & Graining methods, details about graining method, advantages and disadvantages of graining, techniques in conducting graining. Construction of vacuum pan, types of pan, speed of circulation, comments, heating surface to volume ratio, pan boiling techniques, different boiling schemes. Procedure of making slurry, formula for size of slurry, hardening of grain, methods of preparation of slurry. False grain &conglomerates-Formation of false grain &conglomerates, causes of formation false grain &conglomerates [**5]**

6. **Centrifugal machines**

   Different type of centrifugal machines, batch and continuous type, Construction & working of each type, Factors influences on time of curing. Centrifugal force. Centrifugation theory- Meaning and fundamental calculation regarding centrifugal and their performance study for Fully automatic recycling self discharging centrifugal machine 3 speed cycle, 4speed cycle, Advantages and disadvantages of batch / continuous centrifugal machine. **[5]**

7. **Sugar Drying and cooling**

   Various parts regarding drying and cooling, rotary dryer, multitray grosshopper ,fluidized bed hopper. Sugar Grader – Types of grader, dilution indicator, keeping quality factor safety factor. Sugar Dust collection system –Advantages and significance of dust collector, mechanism types. Sugar Godown – Location , stalking of sugar bags. **[5]**

8. **Industrial waste treatment,**

   Treatment of Sugar Factory and distillery effluents, Primary and secondary methods of effluent treatment, measures to reduce volume and load of effluent by good housekeeping and their re-use. Air pollution control – Control measures for stack gases, SO2, CO2 and sugar dust. **[5]**

Reference Books:

1. Manufacture and refining of raw cane sugar by Baikow, V.E.,(1982-II Edition),Elsevier Publishing Co.
2. Hand book of cane sugar technology by Mathur, R.B.L.,(1986-II) ,Oxford & IBH Publishing Co.
3. Unit operation s in cane sugar production by Payne, J.H., (1988-II0 Elsevier Publishing Co.
4. Cane Sugar Handbook by Chen,J.C.P.,91985-11TH Edition),Wiley Inter Science.
5. Principles of Sugar Technology Vol.-I by Pieter Honig(1953-Ist) Elsevier Publishing Co.
6. Principles of sugar technology Vol.-II by Pieter Honig(1959-Ist) Elsevier Publishing Co.
7. Hand book of Cane Sugar engineering by E.Hugot.,(1986-IIIrd) Elsevier Publishing Co.
8. Cane Sugar Manufacturing in India by D.P. Kulkarni
9. Manufacture of Sugar from Sugar Cane by C.G.M. Park

Term Work:

1. One Industrial visit to observe the machinery, equipment, instruments, layout etc and report of visit to be submitted.
2. Five written assignments based on above syllabus.

5.3 Textile Engineering

Teaching Scheme:	**Examination Scheme:**
Lecture: 3 Hrs. / Week	**ISE**-30 Marks
	ESE-70 Marks
Tutorial: 2 hours /week	**ICA**-25 Marks

Course Objectives:

1. To prepare the students for knowing the basic classification and nomenclature related to textiles.
2. To familiarize the students with concepts of yarn formation, fabric formation, chemical processing of textiles.
3. To prepare the students to understand the opportunities in Textile Industry for Mechanical Engineers.

Course Outcomes:

By the completion of the course, students must be able to:

1. Understand the nomenclature used in textiles
2. Demonstrate the knowledge of yarn formation, fabric formation, and chemical processing of textiles.
3. Understand mechanical engineering concepts related to textile industry

Section -I

1. **General Textile Technology** **(4)**
   Introduction to textiles – textile elements defined – different types of fibers with respect to geometry and substrate: regular, tribal, dope-dyed etc. - textile institute's classification of textile fibers – Introduction to count systems – conversion within and between different count systems - physical and chemical properties of textile fibers.

2. **Yarn Formation** **(8)**
   Introduction to Ginning, Opening, Bale Management, Mixing and Blending, Scutcher, Blow room, Carding, Drafting, Spinning, Post – Spinning, Twist less Spinning and Texturing Operations

3. **Fabric Formation & Processing of Textiles** **(4)**
   Yarn Preparatory methods - Warp and Weft, Hand loom, Dobby Loom, Jacquard Looms, Knitting,
4. **Chemical Processing of Textiles** **(4)**
   Desizing, Scouring, Bleaching, Dyeing, Printing and Finishing

Section -II

5. **Mechanics of Textile Machinery** **(8)**
   Introduction – equations of motion – motion in a circle – transmission of motion by wheel gearing –Belt drives –Determination of speed ratio in planetary mechanisms – applications in textile industry – stepped pulleys – designing method – applications in textile industry –study on breaks and clutches – applications of clutch and break in textile production. Construction of cams and tappets – heart shaped, 3 leaved – plain, Twill tappets

6. **Textile Machinery Erection and Maintenance** **(8)**
   Design of machine foundation, vibration dampers. Erection of machines – hoisting equipments, overhead cranes. Objectives of maintenance – different types of maintenance-Advantages of routine and preventive maintenance. Lubrication – objectives – methods of lubrication – precautions – different lubricants used in textile industry – maintenance of various types of bearings, wheels.

7. **Advances in Textiles** **(4)**
   Shuttle less looms – Rapier, Air jet. Water jet. Non Wovens,

Text Books:

1. Fiber to Fabric by B. P. Carbomann, Tata Mc Graw Hill Publications
2. Textile Mathematics Vol. I, II & III. J.E. Booth, The Textile Institute, Manchester
3. Improved Engineering Maintenance – V. J. Thikker, CBS Publishers

Reference Books:

1. Spun Yarn Technology by Venkata Subramani, Mahajan Publications
2. Plain weaving motion by K.T. Aswani, Mahajan Publications
3. Technology of textile processing, textile fibers – V. A. Shenoi, Sevat publications
4. Spinning Textile Machinery Maintenance – SITRA, Coimbatore
5. Weaving Textile Machinery Maintenance – BTRA, Mumbai

Term Work:

1. Five written assignments based on above syllabus

5.4 Entrepreneurship Development

Teaching Scheme:	Examination Scheme:
Lecture: 3 Hrs. / Week	**ISE**-30 Marks
	ESE-70 Marks
Tutorial: 2 hours /week	**ICA**-25 Marks

Course Objectives:

i. To expose students to the entrepreneurial culture so as to prepare them to set up and manage their own small units.
ii. To acquaint them with the challenges faced by the entrepreneur
iii. To make the students aware about various government schemes for SMEs

Course Outcomes:

Students will be able to

i. Avail various government facilities required to set-up small unit.
ii. Prepare a project report for setting a small manufacturing or service unit.
iii. Find the solutions for problems face by SMEs.

SECTION-I

Unit I. Entrepreneurship: Concept, meaning and definition of entrepreneur and entrepreneurship. Evolution of Entrepreneurship, Corporate entrepreneurship • Importance and significance of growth of entrepreneurial activity. • Concept of entrepreneur. • Characteristics and qualities of entrepreneurs • Classification and types of entrepreneurs. (10)

Unit II. Entrepreneurship Development:

Factors influencing entrepreneurial development and motivation. • Role of culture in entrepreneurial development. • Entrepreneurial development programme (EDP), Managing the problems faced by entrepreneurs such as managerial problems, marketing problems, financial problems, technological problems, etc. • Options available to entrepreneurs, -ancillarisation, franchising and outsourcing. Cases on takeover, mergers and acquisitions in India and at global level. (10)

SECTION-II

Unit III. Entrepreneurial Project Development: • Idea generation – sources and methods • Identification and classification of ideas. • Environmental Scanning and SWOT analysis • Preparation of project plan –Points to be considered • Components of an ideal business plan – market plan, financial plan, operational plan, and HR plan. • Project formulation –project report significance and contents • Project appraisal –Aspects and methods : (a) Economic oriented appraisal (b) Financial appraisal (c) Market oriented appraisal • Technological feasibility • Managerial competency (10)

Unit IV. Small and Medium Enterprises : • Meaning and definition (evolution) • Role and importance • Policies governing SMEs • Organisational structure • Steps in setting up a small unit • SME funding. Requirements of capital (fixed and working), Factors determining capital requirements, Importance of fixed and working capital, Working capital management, Sources of finance for SME's, Taxation benefits • SIDBI and SISI– Their role in the development of SMEs • Marketing mechanism in SMEs. • Export potential of SMEs • Problems of SMEs and prospects • Turnaround strategies for SMEs (10)

Term Work:

i. One compulsory assignment of preparation of project report for setting up a small manufacturing or service unit
ii. Five assignments based on the above syllabus which will include case studies on successful entrepreneurs and failed entrepreneurs.

Text Books

1. Small scale industries and entrepreneurship, Dr. Vasant Desai, Himalayan Publishing House
2. Management of small scale industries, J.C. Saboo, Megha Biyani, Himalayan Publishing House

References Books

1. Dynamics of entrepreneurial development and Management. Dr. Vasant Desai, Himalayan Publishing House
2. Corporate Entrepreneurship – Paul Burns
3. Entrepreneurship in the New Millenium – KutatkoHodgetts.
4. Entrepreneurship. Rajeev Roy- Oxford University Press
5. Entrepreneurship. Alpana Trehan- Dream Tech Press

6. Industrial Training

Teaching Scheme:	**Examination Scheme:**
Practical: 1 Hour / week	**ICA:** 50 Marks
	Oral Exam: 25 Marks

Course Objectives:

1. To make the students aware of Industrial culture & Organizational setup.
2. To create awareness about technical report writing among the student.

Procedure for Assessment of Industrial Training done by student

- Every student should prepare a report of training done (minimum 15 days) in a prescribed format before end of Part I Semester.
- Format of the report will be decided by the concerned guide.
- The report shall be comprehensive and presented in duplicate, typed on a standard A4 size sheet and bound.
- Every student should give presentation to project guide on industrial Training Report.
- The University oral examination will be based on the term work.
- Guidelines for conducting vocational training practical's

7. Project Work - I

Teaching Scheme	**Examination Scheme**
Practical: 4 Hrs/ Week	**ICA**: 50 Marks

Course Objectives:

1. Application of the knowledge gained to practical situations.
2. Develop the technical problem solving ability.

Guidelines for Project content & Mark Distribution:	**Marks**
a. Work diary and weekly reporting	20
b. Synopsis	10
c. Progress report submission and presentation	20

Project Term Work:

The term work under project submitted by students shall include:

a. Work diary and weekly reporting:

Work Diary maintained by group and countersigned by the guide weekly. The contents of work diary shall reflect the efforts taken by project group for

1. Searching suitable project work
2. Brief report preferably on journals/ research or conference papers/ books or literature surveyed to select and bring out the project.
3. Brief report of feasibility studies carried to implement the conclusion.
4. Rough Sketches/ Design Calculations, etc.

b. Synopsis:

The group should submit the synopsis (of 4-5 pages) in following form.

2. Title of Project
3. Names of Students
4. Name of Guide
5. Proposed work (Must indicate the scope of the work & weekly plan up to March end)
6. Approximate Expenditure (if any)

The synopsis shall be signed by the each student in the group, approved by the guide and endorsed by the Head of the Department.

c. Progress report submission and presentation:

The group has to give a power point presentation in front of the faculty of department on the progress completed till end of first semester along with the progress report.

Semester-II

1. Industrial & Quality Management

Teaching Scheme:

Lecturers: 3 Hrs/ Week

Practical: 2 Hrs/ Week

Examination Scheme:

ISE-30 Marks

ESE -70 Marks

ICA- 25 Marks

Course Objective:

1. To give the students an overview of the general functions of Management applicable to industrial & other organizations
2. To give insight to the philosophy & techniques of quality management applicable to industry

Course Outcome:

Students will be able to –

1. Demonstrate various management functions.
2. Apply statistical tools to industrial / organizational problems.

Section I

Industrial Management

Unit1. Introduction to Management, Planning: 05

Nature & purpose of Management. System approach to Management, Function of Managers, Social responsibility & Ethics in Managing. Planning: Meaning, Types of plans, steps in planning, planning process, decision making.

Unit 2.Organising and Staffing: 06

Organizing: Nature & purpose of organizing, Organization structure, Span & levels, Departmentation , Authority delegation, decentralization. Staffing: Definition, Human resource management & selection, Performance appraisal, Training & development.

Unit 3.Leading and Controlling: 06

Leading: Human factors in managing, Motivation, Theories, 'Carrot & Stick', Maslow's theory, Hierarchy of needs, leadership, styles, communication: process. Types- oral, written & nonverbal. Controlling: Process of controlling, control techniques.

Unit 4.Introduction to Basic Departments in Industrial Organization: 03

Production /Operations Management, Marketing Management, Financial Management: Role, Nature and Functions of each department.

Section II

Quality Management

Unit 5. Introduction to Quality: 03

Definition of Quality, Elements of quality, quality specifications. Factors affecting quality of design & quality of conformance, quality control, quality costs.

Unit 6. Total Quality Management: 07

Quality Gurus, Customer satisfaction, continuous process improvement, employee involvement, supplier partnership, Tools of quality control: Check sheets, graphs, Pareto analysis, cause & effect diagram, Scatter diagram, control charts.

Unit 7. Statistical Process Control: 06

Introduction to SPC, Control charts for variable & attributes, interpretation & applications of X,R,P & C charts, Process capability. Acceptance sampling, Sampling plans- types single & double, Operating characteristic curve, Producer & consumer risks. (Numerical treatment only on P & C charts and on sampling plans)

Unit 8. Introduction to Various Techniques and Tools: 04

Benchmarking, Quality Management Systems, Environmental Management System, Quality function deployment, Six Sigma, FMEA, Taguchi's Quality Engineering, etc.

Term Work

Minimum 8 assignments based on each topic out of which 2 case studies related to industry / establishments.

Assignment should include seminar, visit report, survey, analysis & numerical problems, etc.

Text Books Recommended

1. Essentials of Management – Koontz Weihrich By TMH
2. Principles of Management & Administration – D. Chandra Bose. PHI
3. Statistical Quality Control – M. Mahajan By DhanpatRai & Co.
4. Total Quality Management – Besterfield & Others PHI

Reference Books Recommended

1. Principles of Management – Tripathy, Reddy

2. Industrial Engineering

Teaching Scheme:	**Examination Scheme:**
Lecturers: 3 Hrs/ Week	**ISE-**30 Marks
	ESE-70 Marks
Practical: 2 Hrs/ Week	**ICA-** 25 Marks

Course Objectives:

To acquire knowledge of work study and techniques for improving overall productivity and performance.

Course Outcomes:

Students will be able to:

1. Analyze & measure productivity.
2. Perform method study and work measurement etc.
3. Develop improved method of working/process for manufacturing /service sector.

Section - I

Chapter – 1 Introduction to Industrial Engineering

Definitions and meaning of I.E., contribution by F.W. Taylor, Gilbreth, objectives of I.E. Productivity - Factors affecting productivity and ways to improve productivity.

Work Study – Definitions, objectives, Importance of work study procedure, Relation of work study with – work Simplification, Human Relation. (4)

Chapter – 2 Method Study

Definition, objective, Scope of method study, Basic procedure symbols and recording of facts, Charting conventions, Charts – Operation process chart, Flow process chart, Multiple activity chart, Two handed process chart, Diagrams – Flow and string diagram, travel chart Templets and models, Micro motion study. Therbligs simo chart, Critical examination and selection, Implementation method (8)

Chapter – 3 Ergonomics and Industrial Safety

Definition, Man Machine system, Types of display, types of control, manual material handling, Anthropometry, Design of work place and working conditions, ILO Norms.

Definition of accident, Cause of accident, Prevention of accident, safety measures factor acts, minimum wages act, Employers state Insurance act. (6)

Section – II

Chapter – 4 Work Measurements

Definition, objective and techniques of work measurement, time study, stop watch method, performance rating, allowance, relaxation interference contingency, policy, calculation of standard time, work sampling its need and procedure, predetermined motion time study(PMTS). (6)

Chapter – 5 Facility Locations and Plant Layout

a) Factors affecting site selection:

- Intangible factors for facility location, tangible factor for facility location, advantages and disadvantages of facility location in urban and rural areas.

b) Plant Layout:

- Characterization of an efficient layout objectives of plant layout, principles of plant layout, procedure in planning layout, types of plant, layout product/line layout, process/functional layout, fixed position/static layout, cellular/Group Technology layout, selection of material handling equipment . (6)

Chapter – 6 Job Evolutions and Merit Rating

Job evolution: objectives, advantages and procedure, job analysis, job description, job specification, methods of evolution. Merit rating: Objectives And Method of Merit rating. (6)

Term Work:

Any Six assignment based on productivity, time study, method study, layout.

Books Recommended:

1. Industrial engineering and Production management by Martand Telsang. (S. Chand)
2. Engineering management by A. K. Gupta (S. Chand)
3. Industrial Engineering and Management by O. P. Khanna.
4. Introduction to work study by ILO. (Universal Publication)
5. Work Study by O. P. Khanna. (Dhanpat Rai and Sons)

Professional Elective-4

3.1 Mechatronics

Teaching Scheme	Examination Scheme
Theory: 3 Hours / week	**ISE**-30 Marks
	ESE-70 Marks
Practical: 2 Hours / week	**ICA**- 25 Marks
	Oral Exam : 25 Marks

Course Objectives:

- Understand the use of sensors, actuators and controllers in various products and processes.
- Apply Mechatronics Engineering technical expertise to solving industry-related problems.
- Under take complex Mechatronics projects for research and industry.
- Understand the latest trends in Mechatronics and their applications.

Course Outcomes:

- Develop state transition diagrams for control of physical systems
- Interface common sensors and actuators to PCs or microcontrollers
- Implement software for control of Mechatronics systems
- Implement control using PLCs.

Section I

Unit 1: Introduction to Mechatronics **(4 hrs.)**

Basic Definition, Key elements of Mechatronics, Historical Perspective, Examples of Mechatronics Systems: Car Engine Management, Automatic Camera, Washing machine control, Antilock braking system, Humanoid robot.

Unit 2: Sensors and Actuators **(7 hrs.)**

Sensors: Classification, Principle of Operation & Characteristics, Linear and rotational sensors, acceleration sensors, Force sensors, Torque Sensors, Flow Sensors, Temperature Sensors, Distance Sensors, Optical Sensors, Ultrasonic Sensors , Selection criteria. Applications: Sensors for Condition Monitoring, Micro sensors. *(Numerical Exercises on sensor characteristics)*

Actuators: Classification of Actuators, DC Motors, AC Motors, Stepper Motors, Switches, Solenoids, Piezoelectric Actuators, Micro motors

Unit 3: System Interfacing and Data Acquisition **(5 hrs.)**

Data Acquisition, ADC and DAC, OPAMP, Signal Conditioning, Signal Processing, Computer Based Instrumentation, Data Recording and Logging.

(Numerical Exercises on amplifiers and ADC/DAC)

Unit 4: Microcontrollers **(4 hrs.)**

Introduction to 8085 microprocessor, 8085 architecture, microcontrollers, the 8051 microcontroller, architecture, interfacing sensors and actuators with 8051 microcontroller, real time instrumentation.

Section 2

Unit 5: Control with Programmable Logic Controllers **(6 hrs.)**

PLC architecture, I/O Processing, Ladder Diagrams, Internal Relays, Jump and Call, Timers, Counters, Shift Registers and Data Handling, Programs for temperature control, sequencing etc. *(Exercises on Ladder Diagrams)*

Unit 6: Interfacing and Communications **(5 hrs.)**

Terminology: Serial and Parallel communications, bit and baud rate, protocols, data flow, handshaking, signal transmission

TIA/EIA Serial Standards (RS 232, RS422, RS485), IEEE 488 General Purpose Interface bus. Computer Networks, OSI model, LAN, WAN, MAN, CAN bus, PROFI bus and SCADA.

Unit 7: Artificial Intelligence and Mechatronics **(5hrs.)**

Fundamentals of AI, Fuzzy logic, Fuzzy Process, Fuzzy Applications, Neural Networks and its applications, Genetic Algorithms and their applications.

Unit 8: Mechatronics Applications **(4 hrs.)**

MEMS based applications, Robotics, Automotive Systems, Industrial Automation and Control.

Term work

1) One practical assignment on interfacing sensors with microcontrollers.
2) One practical assignment on dc motor control using microcontrollers.
3) One practical assignment of stepper motor control using microcontrollers.
4) One practical assignment which includes building small Mechatronics systems which microprocessor receives input from sensors and controls actuators.
5) One theory assignment on PLC ladder programming.
6) One practical assignment on interfacing sensors and actuators with PLC.
7) One theory assignment on communication systems.
8) One Mat Lab assignment on AI.
9) One theory assignment on Mechatronics applications.

Text Books

Title	Author	Publisher
The Mechatronics Handbook	Robert H. Bishop	CRC Press
Mechatronics	W. Bolton	Pearson Education
The 8051 microcontroller and Embedded Systems"	Mazidi	Prentice Hall
Programmable Logic Controllers"	W. Bolton	Elsevier

Reference Books

Title	Author	Publisher
Introduction to PLC	Gary Dumming	Delmar Publications
Mechatronics System Design	Devdas Shetty, Richard A.Kolk, Brooks/Cole	Cengage Learning
Mechatronics: Integrated Technology for Intelligent Machines	A.Smaili, F.Mrad	Oxford University Press
Mechatronics: Integrated Mechanical Electronic Systems	KP Ramchandran, GK Vijayraghavan, MS Balasundaram	Wiley
Advanced Mechatronics	Dan Neculescu	World Scientific
Introduction to 8085	R Gaonkar	

3.2 Computational Fluid Dynamics

Teaching Scheme:
Lectures: 3 Lectures / weeks

Practical: 2 Hours / week

Examination Scheme:
ISE-30Marks
ESE-70 Marks
ICA: 25 Marks
Oral Exam: 25 Marks

Course Objectives:

1. Study of basic concepts of Computational Fluid Dynamics.
2. Application of CFD in heat transfer & fluid flow problems.

Course Outcomes:

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

1. Formulate and solve computational problems arising in the flow of fluids.
2. Assess the accuracy of numerical solutions by comparison to known solutions of simple test problems and by mesh refinement studies.
3. Use and develop flow simulation software for the most important classes of flows in engineering and science.

Section – I

1. Introduction to CFD, Steps in CFD, Advantages, Disadvantages and Applications of CFD Governing equations continuity, Momentum equation, Energy equation **.** **06**

2. Boundary conditions-classification, initial & boundary value problems-finite difference schemes-forward, central & backward difference, four basics of finite volume schemes, Implicit & explicit approaches. **04**

3. FDM for steady one-dimensional and two-dimensional heat conduction equation in steady state, simple problems, Transient one-dimensional heat conduction equation **05**

4. 1D heat transfer and 2D Transient problems, Finite Volume formulation, Uniform & non-uniform Grids, Numerical Errors, (Simple Numerical Treatment) Grid Independence test. **05**

Section – II

5. Governing Equations, Stream Function – Vorticity method, Determination of pressure for viscous flow, SIMPLE Procedure of Patankar & Spalding, Computation of Boundary layer flow, Finite difference approach, Unstructured Grids for Viscous Flows.

06

6. Steady One-Dimensional & Two-Dimensional Convection – Diffusion, Unsteady one dimensional and 2D Convection –Diffusion,, Unsteady two-dimensional convection – Diffusion

07

7. Turbulence, Effect of Turbulence and Reynolds time averaged Navier Stokes Equation, Algebraic Models – One equation model, K- ε Models, K-W model. **03**

8. Simple CFD Techniques

Introduction, Lax-wendoff technique, Mac Cormackls techniques, Relaxation technique, alternating direction Implicit Techniques, introduction to different plots of computer graphics **04**

TERM WORK

(A) Study of Appropriate Commercial CFD Software for (Any 3)

1. Steady state conduction in fluids
2. Steady state convection in fluids
3. Analysis of Aerofoil
4. Condensation and boiling heat transfer
5. Analysis of Venturimeter for Velocity and pressure variation

(B) Any Six Theoretical Assignments based on unit 1 to 8

TEXT BOOKS:

1. H.K. Versteeg & W.Malalalsekara, An introduction to CFD, The Finite Volume Method, Addition Wesley Longman ltdal heat transfer fluid flow, Hemisphere publishing
2. Ghoshdasdidar, P.S., "Computer Simulation of flow & heat transfer "Tata McGrow- Hill Publishing Company ltd., 1998.
3. Subas, V.Patankar "Numerical Heat Transfer & Fluid Flow" 1980.

REFERENCE BOOKS:

1. Taylor, C and Hughes, J.B. "Finite Element Programming of the Navier Stock Equation" Pineridge Press Ltd., U.K.
2. John D Anderson, Computational Fluid Dynamics, the basics with Applications, Springer
3. Muralidhar, K., and Sundararajan, T., " Computational Fluid Flow & Heat Transfer ", Narosa Publishing house, New Delhi,1995

3.3 Production and Operation Management

Teaching Scheme:
Lectures: 3 Lectures / weeks

Practical: 2 Hours / week

Examination Scheme:
ISE-30Marks
ESE-70 Marks
ICA: 25 Marks
Oral Exam: 25 Marks

Course Objectives:

1. To provide knowledge to the student about the principles of production and operation management.
2. To expose the student to the techniques used to solve the problems related to production management.

Course Objectives:

Students will be able to:

1. Apply the principles and techniques used in production management.
2. Solve the problems related to production.

Section - I

Chapter – 1 Introduction to Production and Operation Management

Definitions, objectives, Scope and History of Production Management, Manufacturing system and their types. (2)

Chapter – 2 Forecasting

Need, types of Forecasting, Statistical method, Moving average method, exponential smoothing method, Least square method, Regression and Co-relation method. (6)

Chapter – 3 Capacity Planning

Concept, measurement and measures of capacity factor affecting, capacity planning procedure, Aggregate planning, Investment decision and replacement analysis. (4)

Chapter – 4 Production Planning and Control

Objectives, Functions, Difference, Co-ordination of PPC with other Department, Routing Scheduling, Loading and Sequencing, Line balancing, Production Control – Dispatching, Function and documents, Follow up, Evolution. (6)

Section – II

Chapter – 5 Inventory Management

Inventory concepts, objectives, types of Inventory, different costs of Inventory, EOQ model, Economic batch quantity (EBQ) model, Inventory control techniques, ABC analysis MRP, Fixed period and fixed quantity system. (6)

Chapter – 6 Plant Maintenance

Definition, Need, Importance, Functions, scope and organization of maintenance department Types of maintenance- preventive, break down and TPM, Reliability and life testing. (6)

Chapter – 7 Value Engineering and Value Analysis

Definition, objectives and use of value analysis, reason of unnecessary cost, value analysis procedure, phases of value analysis. (3)

Chapter – 8 Advance manufacturing System

Just- in Time (JIT), Kanban System, KAYZAY, Zero defect, six sigma. Computer aided production management system. (3)

Term Work:

Minimum eight case studies or assignments based on all topics.

Books Recommended:

6. Industrial engineering and Production management by Martand Telsang. (S. Chand)
7. Elements of Production Planning and Control by Samuel. (Universal Pub.)
8. Modern Production/Operation Management by Buffa Sarin. (Wiley)
9. Industrial Engineering and Management by O. P. Khanna.
10. Production and Operation Management by M. E. Thukaram Rao. (New Age International Pub)

Free Elective –II
4.1 Software Engineering & Cyber Security

Teaching Scheme:
Lectures: 3 Lectures / weeks

Tutorial: 2 Hours / week

Examination Scheme:
ISE-*30 Marks*
ESE-*70 Marks*
ICA- 25 Marks
Oral Exam: 25 Marks

Course Objectives:

The Course should enable the student

1. To be acquainted with the software Project development life cycle models.
2. To design and develop correct and robust software products.
3. To analyze business requirements pertaining to software development.
4. To be acquainted with Cyber security norms.

Course Outcomes:

At the end of the course

1. a student will be able to select a proper software life cycle model for design and development.
2. a student will be able to prepare a prototype model
3. a student will be able to focus on the fundamentals of developing a Software Project.
4. a student will be able to get Software Requirement Specification from client, analyze, design and estimate the cost of development of a Software Project.
5. a student will be acquainted with the Cyber security norms

SECTION-I

Unit 1: Introduction to Software Engineering (6Hrs.)

Software Development Life Cycle, Life cycle models : Water fall model, Spiral model, Prototype model, Agile process model. Software Requirement Analysis and Specification: Value of Good SRS, Requirement Process, Requirements specification.

Unit 2: Design and Planning a software Project (10 Hrs.)

Design Concepts: Coupling, Cohesion, Open Closed Principle, Function-Oriented Design, Object Oriented Design, Detailed Design, Verification, Metrics. Planning a Software Project**:** Effort estimation, Project Schedule and Staffing ,Quality planning: Quality Concepts, Qualitative quality management planning. CMM project management process, Risk Management Planning, Project Monitoring Plan, Detailed Scheduling.

Unit 3: Agile Project Management and Testing (6Hrs.)

Introduction to APM, Implementation, Iterative Project Management Life Cycle, Adaptive Project Management Life Cycle, Adaptive & Integrating the APM toolkit. Testing Concepts , Testing Process , Black-Box Testing, White-Box Testing, Object Oriented Software testing methods, Functional testing, Unit testing, System testing, User satisfaction testing.

SECTION-II

Unit 4: Introduction to Computer Security (8 Hrs)

Definition, Threats to security, Government requirements, Information Protection and Access Controls, Computer security efforts, Standards, Computer Security mandates and legislation, Privacy considerations, International security activity. Secure System Planning and administration, Introduction to the orange book, Security policy requirements, accountability, assurance and documentation requirements, Network Security, The Red book and Government network evaluations.

Unit 5: Information security policies and procedures: (4Hrs)

Corporate policies- Tier 1, Tier 2 and Tier3 policies -process management-planning and preparation-developing policies-asset classification policy-developing standards.

Unit 6: Information security:: (8Hrs)

Fundamentals-Employee responsibilities- information classification-Information handling-Tools of information security- Information processing-secure program administration. Organizational and Human Security: Adoption of Information Security Management Standards, Human Factors in Security- Role of information security professionals.

Text Books-

1. Pankaj Jalote's Software Engineering, A Precise Approach(Wiley Precise Textbook, WILEY INDIA)
2. An Integrated Approach to Software Engineering- 3rdedition: Pankaj Jalote (Narosa Publishers)
3. Debby Russell and Sr. G.T Gangemi, "Computer Security Basics (Paperback)", 2ndEdition,O' Reilly Media, 2006.

References Books:

1. Effective Project Management Traditional,Agile,Extreme ,Robert K. Wysocki WILEY INDIA,6th edition
2. Ian Sommerville,software engineering, pearson education Asia, 6th edition
3. Software Engineering Fundamentals –Ali Behforooz and Frederick j. Hudson (Oxford University Press) . Thomas R. Peltier, "Information Security policies and procedures: A Practitioner'sReference", 2nd Edition Prentice Hall, 2004.
4. Kenneth J. Knapp, "Cyber Security and Global Information Assurance: Threat Analysis and Response Solutions", IGI Global, 2009.
5. Thomas R Peltier, Justin Peltier and John blackley, "Information Security Fundamentals", 2nd Edition, Prentice Hall, 1996
6. Jonathan Rosenoer, "Cyber law: the Law of the Internet", Springer-verlag, 1997
7. James Graham, "Cyber Security Essentials" Averbach Publication T & F Group.

Term Work:

In Tutorial Session, Students of Different Batches should be assigned Different Case Studies to Design & Implement products.

4.2 Agro Machine Engineering

Teaching Scheme:
Lectures: 3 Lectures / weeks

Tutorial: 2 Hours / week

Examination Scheme:
ISE-30 Marks
ESE-70 Marks
ICA- 25 Marks
Oral Exam: 25 Marks

Course objectives:

1. To explore various agro machinery related operations such as ploughing, harrowing, threshing etc.
2. To learn the working mechanisms of different agro machines.
3. To make the student to know about design aspects of different agro machines.

Course outcomes:

After completion of this course, a student will be able to

1. Distinguish between various agro operations such as ploughing, harrowing, threshing etc.
2. Select and design mechanism for various agro machines

Section - I

1. Introduction **(4 Hr)**

Present Status and Scope, bottle necks of farm mechanization and mechanization policy. Dynamic soil properties affecting soil tool interaction. Atterberg, soil and metal friction

2. Primary Tillage Equipments **(6 Hr)**

Force analysis of tillage tools and their measurement. Mould board plough - animal and power operated, types and construction, working principles. Accessories of M.B. plough forces acting on mould board bottom. Disc ploughs, types and construction, soil reaction and draft of disk ploughs, and special tillage implements such as rotavators sub-soiler, paddy puddler.

3. Secondary Tillage Equipment **(5 Hr)**

Disc harrow types and construction. Selection of disk harrow. Forces acting on disk harrows and there analysis

4. Hitching Implements **(5 Hr)**

Virtual and real hitching for single point, single axis and double hitch implements.
Yokes and harness for draught animals and mechanics of hitching.

Section – II

5. Sowing Planting and Fertilizer Application Equipment **(6 Hr)**

Construction and working principles of seeding, planting and fertilizer application equipment seed and fertilizer metering devices, furrow openers and covering devices calibration, field adjustment and operations

6. Inter-culture Equipment (4 Hr)

Cultivators, sweeps and shovels, types and uses, rotary hoes, nodders, classification of weeders according to power sources.

7. Plant Protection Equipment (5 Hr)

Plant protection equipments, types construction and working principle. Selection of equipment for spraying and dusting, characteristics of equipment.

8. Harvesting, Threshing and Specialized Crop Equipment (5 Hr)

Classification, construction and working principles of reapers, mowers, combine harvesters and power threshers.

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Term Work:

Any six assignments on

1. Different farm operations and familiarization with farm machines and equipment.
2. Different animal and tractor drawn mould board ploughs and their evaluation.
3. Different type of disc ploughs and their evaluation.
4. Blade, drag and power harrows.
5. Different type of harrows.
6. Different type of sub-soiling equipment
7. Paddy and potato planters, sugarcane planters.
8. Equipment for maize, cotton, sugarcane, root crops and horticultural crops

TEXT BOOKS

1. Jain S.C. and Grace Philip, “Farm Machinery: An approach”, Standard Publisher and distributor, Delhi
2. Srivastava, A.K. Carroll E. Georing and Roger P.Rohrbach "Engineering Principles of Agricultural Machinery", ASAE Publication, 1993.

REFERENCE BOOKS

1. Roy Bainer, Kepner R.A. and Berger, E.L. "Principles of Farm Machinery", John Wiley and Sons, 3rd Ed., 1978.
2. Smith. H.P. and Pearson, "Farm Machinery and Equipment", Tata McGraw Hill Pub. Co. Ltd.,1964.
3. Lal, Radhey and Dutta, A.C. "Agricultural Engineering through solved examples".

4.3 Plastic Engineering

Teaching Scheme:
Lectures: 3 Lectures / weeks

Tutorial: 2 Hours / week

Examination Scheme:
ISE-30 Marks
ESE-70 Marks
ICA- 25 Marks
Oral Exam: 25 Marks

OBJECTIVES

1. To understand the mechanism of polymerization, techniques of polymerization and the significance of different molecular weight averages.
2. To provide the depth knowledge about different kinds of plastic materials based on their structure and properties.
3. To make the students familiar about properties and processing of plastics and use it for different applications.

OUTCOMES

At the end of the course, the student should be able to

1. Select the plastic materials for particular end user application
2. Predict the structure and properties of different kind of plastic material
3. Know the processing of different plastic material based on the end user requirement.

Section I

Unit –I Introduction to Plastics **4**

Definition and Classification of Plastic Materials, Properties of plastics, applications, Testing methods for plastics, additives in plastics, Monomers & Polymers, Polymerization - Types of Polymerization.

Unit –II Processing of Plastics **6**

Injection moulding, Extrusion moulding, sheet forming processes calendaring, Blow moulding, Processing of thermosetting plastics, compression moulding, Transfer moulding, rotational moulding.

UNIT III Welding of Plastics **4**

Hot gas welding, hot tool welding, High frequency induction welding, nuclear welding, Intra-red welding.

UNIT IV Design of Plastic Parts **6**

Tolerances of molded plastics parts, allowances in plastics, Design corners, undercuts, curing time, ribs, minimum wall thickness, design of inserts, cores mould materials,

Section II

UNIT V Design of compression and transfer molds **6**

a) Design and main parts of compression mould, standard insert mould body, design of loading chamber, design of punch, ejectors, stripper guided pin.
b) Technology of transfer mould, types, main parts, automation in transfer mould.

Unit VI Injection Mould Design **6**

Injection mould design, Single, multi cavity, semi-automatic and automatic moulds.
Types of injection mould, detailed structure and working. Feed system, Temperature control system, Ejection System, application.

UNIT VII Cooling of plastic injection mould **5**

Determining the heat quantity dissipated with cooling, heat dissipation with natural cooling, mean temperature, thermal resistance of mold body, summery of dimension and construction of correct cooling system.

UNIT VIII Introduction of advanced Plastics **3**

Introduction to composite plastics, Introduction of polymer degradation and biodegradable plastics, advanced application like Agriculture, Packaging, Building, Transport, Electrical, Electronics, Medical and Furniture

Term Work-

1. Injection mould design for simple component 2 Turns
2. Design of Blow Mould 2 Turns
3. Design of Compression mould 2 Turns
4. Two Case studies for mould manufacturing 2 Turns
5. Visit to Plastic industry (Thermo sets & Thermo Plasts)

Books -

1. J.A.Brydson, “Plastics Materials”, Butter worth Heinemann Oxford,1999
2. Schwartz & good man “Plastics materials and processing”
3. Irwin rubin “Hand book of Plastic Materials and technology”
7. Fred W. Billmeyer, JR., “Text Book of Polymer Science”, John Wiley & Sons,Singapore,1994.

4.4 Economics for Engineers

Teaching Scheme:
Lectures: 3 Lectures / weeks

Tutorial: 2 Hours / week

Examination Scheme:
ISE-30 Marks
ESE-70 Marks
ICA- 25 Marks
Oral Exam: 25 Marks

Course Objectives:

1. To create the awareness of various economic concepts and its relationship in engineering.
2. To appraise the various investment proposals through economic comparisons methods.
3. To apply economical analysis techniques to solve engineering problems

Course Outcomes:

At the end of the course student will be able to:

1. Understand the concepts of economics and its impact on industrial development.
2. Demonstrate the decision making abilities based on economic methods to appraise alternatives
3. Apply economical analytical techniques to solve engineering problems

Section-I

Unit I: Definition of Economics, Economic laws. Meaning of Demand, Law of demand, Meaning of production and factors of production; Economies of scale. Supply and Law of Supply, Role of Demand& Supply in Price Determination. Concept of Engineering Economics, Types of Efficiency, Definition and Scope of Engineering Economics.

Unit II: Various concepts of cost - Fixed cost, variable cost, average cost, marginal cost, total cost etc. Marginal Revenue, Sunk Cost, Opportunity Cost, Break-Even Analysis, Profit/Volume Ratio (P/V Ratio).

Unit III: Time value of money, Interest Formulas and their applications. Bases for Comparison of Alternatives. Present worth method, Future worth method, Annual Equivalent method, Rate of Return method, Net Present Value

Section-II

Unit IV: Elementary economic analysis, Introduction, Applications to Material Selection for a Product/Substitution of Raw Material, Design Selection for a Product, Process Planning/Process Modification. Make or Buy Decisions.

Unit V: Replacement and Maintenance Analysis: Introduction, Types of Maintenance, Types of Replacement Problem, Determination of Economic Life of an Asset, Replacement of Existing Asset with a New Asset, Capital Recovery with Return. Effect of Inflation.

Unit VI: Project life cycle management- selection, cash flow analysis, cost-benefit analysis, cost- effectiveness analysis, risk management and resource management.

Term Work

1. Six assignments based on above syllabus

Text Books:

1. Fundamentals of Engineering Economics- Pravin Kumar, Wiley India
2. Principles of Engineering Economic Analysis-John A. White, Kenneth E. Case, David B. Pratt, Wiley India, 5th edition.

Reference books:

1. Managerial Economics – Analysis**,** Problems and Cases, P.L. Mehta, Sultan Chand Sons
2. Managerial Economics – Varshney and Maheshwari, Sultan Chand and Sons, New Delhi.
3. Managerial Economics – D.M.Mithani
4. Liberalisation and Globalisation of Indian Economy – K.R. Gupta
5. Indian Economy – Ruddar Datt and K.P.M Sundhara
6. Financial Management- M. Y. Khan and P. K. Jain- McGraw. Hills

5. Project Work – II

Teaching Scheme:

Practical's: 8 Hrs/ Week

Examination Scheme:

ICA- 100 Marks

Oral Exam: 100 Marks

Guidelines for Project contents & mark distribution:

a) Work diary and weekly reporting	20
b) Project Report	40
c) Presentation	40

Project Report:

Project report should be of 25 to 50 pages (More pages can be used if needed). For standardization of the project reports the following format should be strictly followed.

1. Page size: Trimmed A4
2. Top Margin: 1.00 Inches
3. Bottom Margin: 1.32 Inches
4. Left Margin: 1.5 Inches
5. Right Margin: 1.0 Inches
6. Para Text: Times New Roman 12 point font
7. Line Spacing: 1.5 Lines
8. Page Numbers: Right aligned at footer, font 12 point Times New Roman
9. Headings: New Times Roman, 14 point, Boldface
10. Certificate:

    All students should attach standard format of Certificate as described by the Department. Certificate should be awarded to batch and not individual student Certificate should have signatures of Guide, Principal, and External Examiner. Entire Report has to be segmented chapter wise as per the requirement.

11. Index of Report:
    - i) Title Sheet
    - ii) Certificate from Guide/ College
    - iii) Acknowledgement
    - iv) Abstract (Brief content of the work)
    - v) List of Figures
    - vi) List of Table

1. Introduction (History, Importance of Project Area, Problem identification, Objective of the Project)
2. Literature Review
3. Design/ Experimentation/ Fabrication/ Production/ Actual work carried out for the same.
4. Observation/ Analysis/ Findings/Results
5. Discussion on Results and Conclusion

References:

12. References or Bibliography: References should have the following format

For Books: "Title of Book"; Authors; Publisher; Edition;

For Papers: Authors, Year of Publication, "Title of Paper"; Conference Details/ General Details; Page No.

b) Presentation:

The group has to prepare a power point presentation on project report, project and present it in front of the faculty of department along with the demonstration of the project. One copy of the report should be submitted to Institute/ Department, One copy to Guide and one copy should remain with each student of the project group.

(Sample Format for Project Work Diary):

Project Progress Sheet

Activity Week: Date from…… to……..

Description of the Work Performed by the student:

(Literature Survey /Design/ Drawings /Purchase/ Manufacturing / Testing/Data Collection/Analysis/Algorithm/Flowchart/Simulation)

……

Space for Drawings:

Constraint / Problem Found:

……

……

……

Activity to be carried out in next week:

……

……

Remarks by the Guide/ Co-Guide:

……

……

……

Date: Sign of Guide/Co-Guide:

6. General Proficiency

Teaching Scheme: 2 Hours /week. **ICA-** 50 Marks

Purpose: - To develop presentation skills, communication skills (oral & written) & to make the student ready to decide his/her career.

1.	Resume and letter writing – Definition of resume, Types of resumes, Basic hints for writing resume. Letter writing – Job Application Letter Writing, acceptance letter, email writing, SMS writing (formal and informal), awareness about social media.	2
2.	Writing Skills– Importance of Writing, Written Vs Spoken Language, Formal and Informal Styles of writing, Resources for improving writing, Grammar and Usage, Vocabulary Building, SWOT analysis,	4
3.	Oral Skills – Group Discussion – Introduction and Practice Interview techniques- Definition of interview, Purpose of interview, Guidelines for facing interviews, Self evaluation/analysis for interviews. Organizing and Attending Meetings, Negotiation Skills.	3
4.	Introduction to Soft Skills– Attitude, Self-Confidence, Leadership Qualities, Emotional Quotient, Effective Time Management Skills, Surviving Stress, Overcoming Failure, Professional Ethics, Interpersonal Skills.	3
5.	Adapting to corporate life– Corporate Etiquette – Grooming and Dressing	2
6.	Information about various opportunities in technical & non-technical postgraduate courses, entrance examinations etc. e.g. GATE, CET/CAT, GRE-TOEFL, M.E/M.TECH, IES, UPSC, MPSC.	2
7.	Information about job opportunities (technical/administration) & nature of work and its importance in different sectors like Government jobs, Private jobs, Various departments in any company, jobs in IT/Software sector, private consultancy entrepreneur, entrepreneurship.	2
8.	Introduction to various techniques like Speed mathematics / Vedic mathematics for use in competitive examinations.	2

Assignments:

1. Resume writing.
2. Job application letter writing
3. Group discussion -- should be conducted by making different groups considering the recent issues & evaluation should be done by the teacher, writing minutes of group discussion.
4. Mock Interviews and analysis report.
5. Student should analyze himself/herself with respect to his/her strength & weaknesses, opportunities & threats. Use of things like past experience, achievements, failures, feedback from others for SWOT analysis should be made, evaluation report.
6. Report on one of the career opportunities (based on topic 7 & 8)
7. Student should prepare one report of 10 to 12 pages about any recent technological changes/ recent products & should submit and present seminar on the same
8. Writing project proposal for starting small scale industry.

Books:

1. 'How to write first class letters', Lee Sue Baugh, Viva Books Pvt.Ltd, NTC Publishing group.
2. 'Strengthen your writing', V.R.Narayanaswami, Orient Longman Pvt. Ltd.
3. 'Business Communications', M. Balasubrahmanian, Kalyani Publishers, New Delhi-Ludhiyana.
4. 'Communicative Competence in Business English', Brian Robinson, Vidya S. Netrakanti, Dr. Hari V. Shintre, Orient Longman Ltd.
5. 'A Guide to Technical Communication', James Sherlock, Allyn & Bacon Inc.
6. 'Effective Letters in Business', Robert L. Shurter, Tata McGraw Hill Pub., New Delhi.
7. 'Vikas Book of General English' Chaudhri Harish Chandra, Dalip Singh, Vani Educational Books.
8. First things first by Stephan Covey
9. Vedic Mathematics by Swami Saraswati
10. Vedic Mathematics by Grover
11. Every ones guide to effective writing by Jayakaran, Apple Publishing

Internet, Technical, Business Magazines, News papers should be other sources for references.